Apache Solr Reference Guide

Covering Apache Solr 5.1

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Apache Solr Reference Guide

This reference guide describes Apache Solr, the open source solution for search. You can download Apache Solr from the Solr website at http://lucene.apache.org/solr/.

This Guide contains the following sections:
Getting Started: This section guides you through the installation and setup of Solr.

Using the Solr Administration User Interface: This section introduces the Solr Web-based user interface. From your browser you can view configuration files, submit queries, view logfile settings and Java environment settings, and monitor and control distributed configurations.

Documents, Fields, and Schema Design: This section describes how Solr organizes its data for indexing. It explains how a Solr schema defines the fields and field types which Solr uses to organize data within the document files it indexes.

Understanding Analyzers, Tokenizers, and Filters: This section explains how Solr prepares text for indexing and searching. Analyzers parse text and produce a stream of tokens, lexical units used for indexing and searching. Tokenizers break field data down into tokens. Filters perform other transformational or selective work on token streams.

Indexing and Basic Data Operations: This section describes the indexing process and basic index operations, such as commit, optimize, and rollback.
Searching: This section presents an overview of the search process in Solr. It describes the main components used in searches, including request handlers, query parsers, and response writers. It lists the query parameters that can be passed to Solr, and it describes features such as boosting and faceting, which can be used to fine-tune search results.

The Well-Configured Solr Instance: This section discusses performance tuning for Solr. It begins with an overview of the `solrconfig.xml` file, then tells you how to configure cores with `solr.xml`, how to configure the Lucene index writer, and more.

Managing Solr: This section discusses important topics for running and monitoring Solr. Other topics include how to back up a Solr instance, and how to run Solr with Java Management Extensions (JMX).

SolrCloud: This section describes the newest and most exciting of Solr's new features, SolrCloud, which provides comprehensive distributed capabilities.

Legacy Scaling and Distribution: This section tells you how to grow a Solr distribution by dividing a large index into sections called shards, which are then distributed across multiple servers, or by replicating a single index across multiple services.

Client APIs: This section tells you how to access Solr through various client APIs, including JavaScript, JSON, and Ruby.

About This Guide

This guide describes all of the important features and functions of Apache Solr. It is free to download from http://lucene.apache.org/solr/.

Designed to provide high-level documentation, this guide is intended to be more encyclopedic and less of a cookbook. It is structured to address a broad spectrum of needs, ranging from new developers getting started to well-experienced developers extending their application or troubleshooting. It will be of use at any point in the application life cycle, for whenever you need authoritative information about Solr.

The material as presented assumes that you are familiar with some basic search concepts and that you can read XML. It does not assume that you are a Java programmer, although knowledge of Java is helpful when working directly with Lucene or when developing custom extensions to a Lucene/Solr installation.

Special Inline Notes

Special notes are included throughout these pages.

Note Type	Look & Description
Information	ⓘ Notes with a blue background are used for information that is important for you to know.
Notes	⚠ Yellow notes are further clarifications of important points to keep in mind while using Solr.
Tip	✓ Notes with a green background are Helpful Tips.
Warning	❗ Notes with a red background are warning messages.

Hosts and Port Examples

The default port when running Solr is 8983. The samples, URLs and screenshots in this guide may show different ports, because the port number that Solr uses is configurable. If you have not customized your installation of Solr, please make sure that you use port 8983 when following the examples, or configure your own installation to use the port numbers shown in the examples. For information about configuring port numbers, see Managing Solr.

Similarly, URL examples use 'localhost' throughout; if you are accessing Solr from a location remote to the server hosting Solr, replace 'localhost' with the proper domain or IP where Solr is running.

Paths

Path information is given relative to `solr.home`, which is the location under the main Solr installation where Solr's collections and their `conf` and `data` directories are stored. When running the various examples mentioned through out this tutorial (i.e., `bin/solr -e techproducts`) the `solr.home` will be a sub directory of `example/` created for you automatically.

Getting Started

Solr makes it easy for programmers to develop sophisticated, high-performance search applications with advanced features such as faceting (arranging search results in columns with numerical counts of key terms). Solr builds on another open source search technology: Lucene, a Java library that provides indexing and search technology, as well as spellchecking, hit highlighting and advanced analysis/tokenization capabilities. Both Solr and Lucene are managed by the Apache Software Foundation (www.apache.org).

The Lucene search library currently ranks among the top 15 open source projects and is one of the top 5 Apache projects, with installations at over 4,000 companies. Lucene/Solr downloads have grown nearly ten times over the past three years, with a current run-rate of over 6,000 downloads a day. The Solr search server, which provides application builders a ready-to-use search platform on top of the Lucene search library, is the fastest growing Lucene sub-project. Apache Lucene/Solr offers an attractive alternative to the proprietary licensed search and discovery software vendors.

This section helps you get Solr up and running quickly, and introduces you to the basic Solr architecture and features. It covers the following topics:

Installing Solr: A walkthrough of the Solr installation process.

Running Solr: An introduction to running Solr. Includes information on starting up the servers, adding documents, and running queries.

A Quick Overview: A high-level overview of how Solr works.

A Step Closer: An introduction to Solr's home directory and configuration options.

Solr Start Script Reference: a complete reference of all of the commands and options available with the bin/solr script.

Installing Solr

This section describes how to install Solr. You can install Solr in any system where a suitable Java Runtime Environment (JRE) is available, as detailed below. Currently this includes Linux, OS X, and Microsoft Windows. The instructions in this section should work for any platform, with a few exceptions for Windows as noted.

Got Java?

You will need the Java Runtime Environment (JRE) version 1.7 or higher. At a command line, check your Java version like this:

```
$ java -version
java version "1.7.0_55"
Java(TM) SE Runtime Environment (build 1.7.0_55-b13)
Java HotSpot(TM) 64-Bit Server VM (build 24.55-b03, mixed mode)
```

The output will vary, but you need to make sure you have version 1.7 or higher. If you don't have the required version, or if the java command is not found, download and install the latest version from Oracle at http://www.oracle.com/technetwork/java/javase/downloads/index.html.

Installing Solr

Solr is available from the Solr website at http://lucene.apache.org/solr/.

For Linux/Unix/OSX systems, download the `.tgz` file. For Microsoft Windows systems, download the `.zip` file. When getting started, all you need to do is extract the Solr distribution archive to a directory of your choosing. When you're ready to setup Solr for a production environment, please refer to the instructions provided on the Taking Solr to Production page. To keep things simple for now, extract the Solr distribution archive to your local home directory, for instance on Linux, do:

```
$ cd ~/
$ tar zxf solr-5.0.0.tgz
```

Once extracted, you are now ready to run Solr using the instructions provided in the Running Solr section.

Running Solr

This section describes how to run Solr with an example schema, how to add documents, and how to run queries.

Start the Server

If you didn't start Solr after installing it, you can start it by running `bin/solr` from the Solr directory.

```
$ bin/solr start
```

If you are running Windows, you can start Solr by running `bin\solr.cmd` instead.

```
bin\solr.cmd start
```

This will start Solr in the background, listening on port 8983.

When you start Solr in the background, the script will wait to make sure Solr starts correctly before returning to the command line prompt.

The `bin/solr` and `bin\solr.cmd` scripts allow you to customize how you start Solr. Let's work through a few examples of using the `bin/solr` script (if you're running Solr on Windows, the `bin\solr.cmd` works the same as what is shown in the examples below):

Solr Script Options

The `bin/solr` script has several options.

Script Help

To see how to use the `bin/solr` script, execute:

```
$ bin/solr -help
```

For specific usage instructions for the **start** command, do:

```
$ bin/solr start -help
```

Start Solr in the Foreground

Since Solr is a server, it is more common to run it in the background, especially on Unix/Linux. However, to start Solr in the foreground, simply do:

```
$ bin/solr start -f
```

If you are running windows, you can run:

```
bin\solr.cmd start -f
```

Start Solr with a Different Port

To change the port Solr listens on, you can use the `-p` parameter when starting, such as:

```
$ bin/solr start -p 8984
```

Stop Solr

When running Solr in the foreground (using -f), then you can stop it using `Ctrl-c`. However, when running in the background, you should use the **stop** command, such as:

```
$ bin/solr stop -p 8983
```

The stop command requires you to specify the port Solr is listening on or you can use the `-all` parameter to stop all running Solr instances.

Start Solr with a Specific Example Configuration

Solr also provides a number of useful examples to help you learn about key features. You can launch the examples using the `-e` flag. For instance, to launch the "techproducts" example, you would do:

```
$ bin/solr -e techproducts
```

Currently, the available examples you can run are: techproducts, dih, schemaless, and cloud. See the section Running with Example Configurations for details on each example.

> ⓘ **Getting Started with SolrCloud**
> Running the `cloud` example starts Solr in SolrCloud mode. For more information on starting Solr in cloud mode, see the section Getting Started with SolrCloud.

Check if Solr is Running

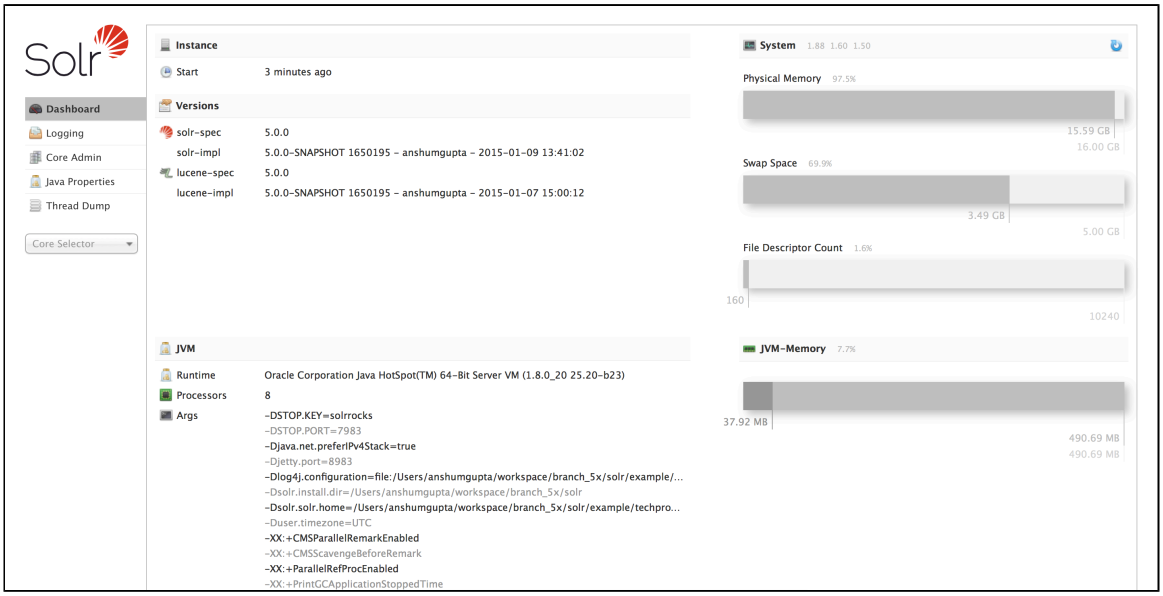
If you're not sure if Solr is running locally, you can use the status command:

```
$ bin/solr status
```

This will search for running Solr instances on your computer and then gather basic information about them, such as the version and memory usage.

That's it! Solr is running. If you need convincing, use a Web browser to see the Admin Console.

`http://localhost:8983/solr/`



Instance

Start 3 minutes ago

Versions

solr-spec 5.0.0
solr-impl 5.0.0-SNAPSHOT 1650195 - anshumgupta - 2015-01-09 13:41:02
lucene-spec 5.0.0
lucene-impl 5.0.0-SNAPSHOT 1650195 - anshumgupta - 2015-01-07 15:00:12

JVM

Runtime Oracle Corporation Java HotSpot(TM) 64-Bit Server VM (1.8.0_20 25.20-b23)
Processors 8
Args -DSTOP.KEY=solrrocks
-DSTOP.PORT=7983
-Djava.net.preferIPv4Stack=true
-Djetty.port=8983
-Dlog4j.configuration=file:/Users/anshumgupta/workspace/branch_5x/solr/example/...
-Dsolr.install.dir=/Users/anshumgupta/workspace/branch_5x/solr
-Dsolr.solr.home=/Users/anshumgupta/workspace/branch_5x/solr/example/techpro...
-Duser.timezone=UTC
-XX:+CMSParallelRemarkEnabled
-XX:+CMSScavengeBeforeRemark
-XX:+ParallelRefProcEnabled
-XX:+PrintGCApplicationStoppedTime

The Solr Admin interface.

If Solr is not running, your browser will complain that it cannot connect to the server. Check your port number and try again.

Create a Core

If you did not start Solr with an example configuration, you would need to create a core in order to be able to index and search. You can do so by running:

```
$ bin/solr create -c <name>
```

This will create a core that uses a data-driven schema which tries to guess the correct field type when you add documents to the index.

To see all available options for creating a new core, execute:

```
$ bin/solr create -help
```

Add Documents

Solr is built to find documents that match queries. Solr's schema provides an idea of how content is structured (more on the schema later), but without documents there is nothing to find. Solr needs input before it can do much.

You may want to add a few sample documents before trying to index your own content. The Solr installation comes with different types of example documents located under the sub-directories of the `example/` directory of your installation.

In the `bin/` directory is the post script, a command line tool which can be used to index different types of documents. Do not worry too much about the details for now. The Indexing and Basic Data Operations section has all the details on indexing.

To see some information about the usage of `bin/post`, use the `-help` option.

`bin/post` can post various types of content to Solr, including files in Solr's native XML and JSON formats, CSV files, a directory tree of rich documents, or even a simple short web crawl. See the examples at the end of \`bin/post -help\` for various commands to easily get started posting your content into Solr.

Go ahead and add all the documents in some example XML files:

```
$ bin/post -c gettingstarted example/exampledocs/*.xml
SimplePostTool version 5.0.0
Posting files to [base] url http://localhost:8983/solr/gettingstarted/update...
Entering auto mode. File endings considered are
xml,json,csv,pdf,doc,docx,ppt,pptx,xls,xlsx,odt,odp,ods,ott,otp,ots,rtf,htm,html,txt
,log
POSTing file gb18030-example.xml (application/xml) to [base]
POSTing file hd.xml (application/xml) to [base]
POSTing file ipod_other.xml (application/xml) to [base]
POSTing file ipod_video.xml (application/xml) to [base]
POSTing file manufacturers.xml (application/xml) to [base]
POSTing file mem.xml (application/xml) to [base]
POSTing file money.xml (application/xml) to [base]
POSTing file monitor.xml (application/xml) to [base]
POSTing file monitor2.xml (application/xml) to [base]
POSTing file mp500.xml (application/xml) to [base]
POSTing file sd500.xml (application/xml) to [base]
POSTing file solr.xml (application/xml) to [base]
POSTing file utf8-example.xml (application/xml) to [base]
POSTing file vidcard.xml (application/xml) to [base]
14 files indexed.
COMMITting Solr index changes to http://localhost:8983/solr/gettingstarted/update...
Time spent: 0:00:00.153
```

That's it! Solr has indexed the documents contained in those files.

Ask Questions

Now that you have indexed documents, you can perform queries. The simplest way is by building a URL that includes the query parameters. This is exactly the same as building any other HTTP URL.

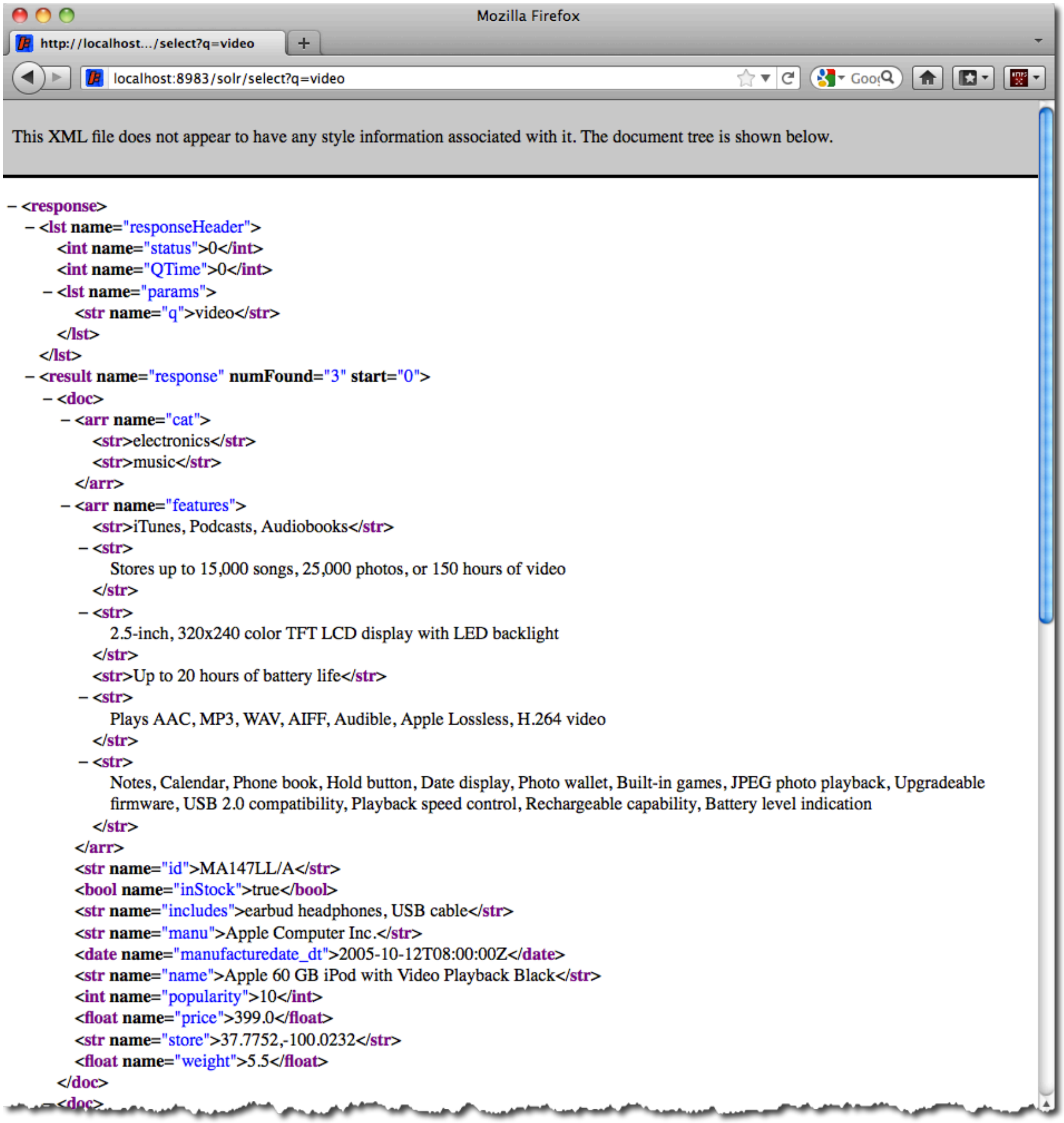
For example, the following query searches all document fields for "video":

`http://localhost:8983/solr/gettingstarted/select?q=video`

Notice how the URL includes the host name (`localhost`), the port number where the server is listening (`8983`), the application name (`solr`), the request handler for queries (`select`), and finally, the query itself (`q=video`).

The results are contained in an XML document, which you can examine directly by clicking on the link above. The document contains two parts. The first part is the `responseHeader`, which contains information about the response itself. The main part of the reply is in the result tag, which contains one or more doc tags, each of which contains fields from documents that match the query. You can use standard XML transformation techniques to mold Solr's results into a form that is suitable for displaying to users. Alternatively, Solr can output the results in JSON, PHP, Ruby and even user-defined formats.

Just in case you are not running Solr as you read, the following screen shot shows the result of a query (the next example, actually) as viewed in Mozilla Firefox. The top-level response contains a `lst` named `responseHeader` and a result named response. Inside result, you can see the three docs that represent the search results.


Mozilla Firefox
http://localhost.../select?q=video
localhost:8983/solr/select?q=video
Goo

This XML file does not appear to have any style information associated with it. The document tree is shown below.

```
– <response>
  – <lst name="responseHeader">
      <int name="status">0</int>
      <int name="QTime">0</int>
    – <lst name="params">
        <str name="q">video</str>
      </lst>
    </lst>
  – <result name="response" numFound="3" start="0">
    – <doc>
      – <arr name="cat">
          <str>electronics</str>
          <str>music</str>
        </arr>
      – <arr name="features">
          <str>iTunes, Podcasts, Audiobooks</str>
        – <str>
            Stores up to 15,000 songs, 25,000 photos, or 150 hours of video
          </str>
        – <str>
            2.5-inch, 320x240 color TFT LCD display with LED backlight
          </str>
          <str>Up to 20 hours of battery life</str>
        – <str>
            Plays AAC, MP3, WAV, AIFF, Audible, Apple Lossless, H.264 video
          </str>
        – <str>
            Notes, Calendar, Phone book, Hold button, Date display, Photo wallet, Built-in games, JPEG photo playback, Upgradeable
            firmware, USB 2.0 compatibility, Playback speed control, Rechargeable capability, Battery level indication
          </str>
        </arr>
        <str name="id">MA147LL/A</str>
        <bool name="inStock">true</bool>
        <str name="includes">earbud headphones, USB cable</str>
        <str name="manu">Apple Computer Inc.</str>
        <date name="manufacturedate_dt">2005-10-12T08:00:00Z</date>
        <str name="name">Apple 60 GB iPod with Video Playback Black</str>
        <int name="popularity">10</int>
        <float name="price">399.0</float>
        <str name="store">37.7752,-100.0232</str>
        <float name="weight">5.5</float>
      </doc>
    – <doc>
```

An XML response to a query.

Once you have mastered the basic idea of a query, it is easy to add enhancements to explore the query syntax. This one is the same as before but the results only contain the ID, name, and price for each returned document. If you don't specify which fields you want, all of them are returned.

```
http://localhost:8983/solr/gettingstarted/select?q=video&fl=id,name,price
```

Here is another example which searches for "black" in the `name` field only. If you do not tell Solr which field to search, it will search default fields, as specified in the schema.

```
http://localhost:8983/solr/gettingstarted/select?q=name:black
```

You can provide ranges for fields. The following query finds every document whose price is between $0 and $400.

```
http://localhost:8983/solr/gettingstarted/select?q=price:[0%20TO%20400]&fl=id,name
,price
```

Faceted browsing is one of Solr's key features. It allows users to narrow search results in ways that are meaningful to your application. For example, a shopping site could provide facets to narrow search results by manufacturer or price.

Faceting information is returned as a third part of Solr's query response. To get a taste of this power, take a look at the following query. It adds `facet=true` and `facet.field=cat`.

```
http://localhost:8983/solr/gettingstarted/select?q=price:[0%20TO%20400]&fl=id,name
,price&facet=true&facet.field=cat
```

In addition to the familiar `responseHeader` and response from Solr, a `facet_counts` element is also present. Here is a view with the `responseHeader` and response collapsed so you can see the faceting information clearly.

An XML Response with faceting

```
<response>
<lst name="responseHeader">
...
</lst>
<result name="response" numFound="9" start="0">
  <doc>
    <str name="id">SOLR1000</str>
    <str name="name">Solr, the Enterprise Search Server</str>
    <float name="price">0.0</float></doc>
...
</result>
<lst name="facet_counts">
  <lst name="facet_queries"/>
  <lst name="facet_fields">
    <lst name="cat">
      <int name="electronics">6</int>
      <int name="memory">3</int>
      <int name="search">2</int>
      <int name="software">2</int>
      <int name="camera">1</int>
      <int name="copier">1</int>
      <int name="multifunction printer">1</int>
      <int name="music">1</int>
      <int name="printer">1</int>
      <int name="scanner">1</int>
      <int name="connector">0</int>
      <int name="currency">0</int>
      <int name="graphics card">0</int>
      <int name="hard drive">0</int>
      <int name="monitor">0</int>
    </lst>
  </lst>
  <lst name="facet_dates"/>
  <lst name="facet_ranges"/>
</lst>
</response>
```

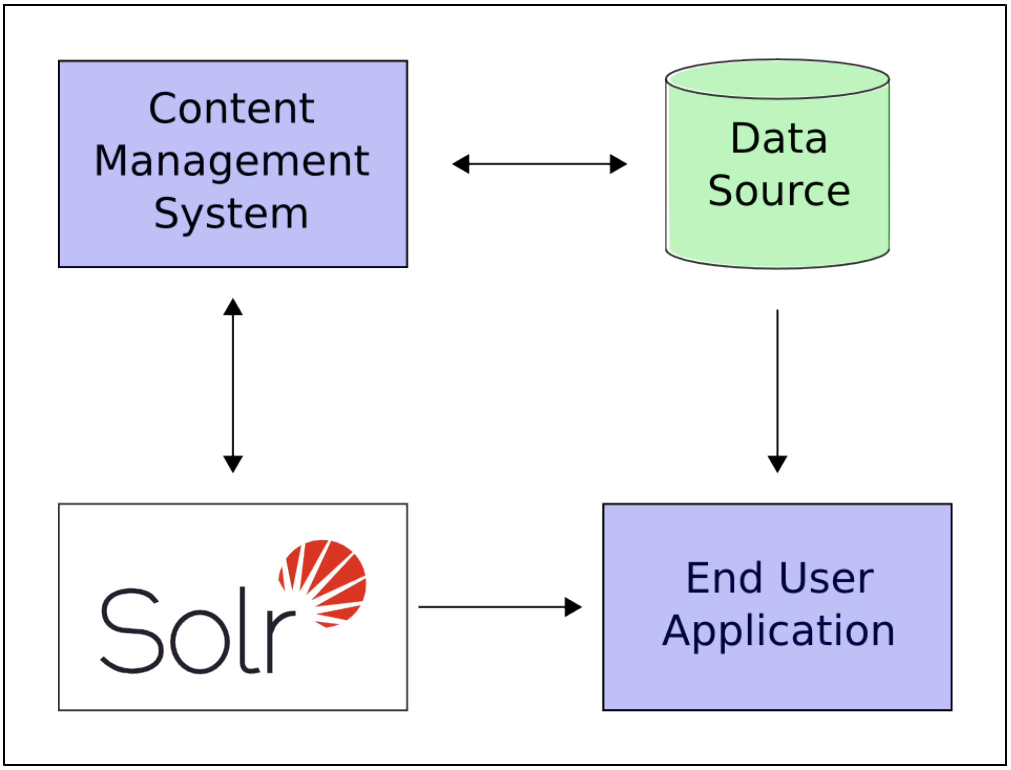
The facet information shows how many of the query results have each possible value of the `cat` field. You could easily use this information to provide users with a quick way to narrow their query results. You can filter results by adding one or more filter queries to the Solr request. Here is a request further constraining the request to documents with a category of "software".

`http://localhost:8983/solr/gettingstarted/select?q=price:0%20TO%20400&fl=id,name,price&facet=true&facet.field=cat&fq=cat:software`

A Quick Overview

Having had some fun with Solr, you will now learn about all the cool things it can do.

Here is a example of how Solr might be integrated into an application:



In the scenario above, Solr runs along side other server applications. For example, an online store application would provide a user interface, a shopping cart, and a way to make purchases for end users; while an inventory management application would allow store employees to edit product information. The product metadata would be kept in some kind of database, as well as in Solr.

Solr makes it easy to add the capability to search through the online store through the following steps:

1. Define a *schema*. The schema tells Solr about the contents of documents it will be indexing. In the online store example, the schema would define fields for the product name, description, price, manufacturer, and so on. Solr's schema is powerful and flexible and allows you to tailor Solr's behavior to your application. See Documents, Fields, and Schema Design for all the details.
2. Deploy Solr to your application server.
3. Feed Solr the document for which your users will search.
4. Expose search functionality in your application.

Because Solr is based on open standards, it is highly extensible. Solr queries are RESTful, which means, in essence, that a query is a simple HTTP request URL and the response is a structured document: mainly XML, but it could also be JSON, CSV, or some other format. This means that a wide variety of clients will be able to use Solr, from other web applications to browser clients, rich client applications, and mobile devices. Any platform capable of HTTP can talk to Solr. See Client APIs for details on client APIs.

Solr is based on the Apache Lucene project, a high-performance, full-featured search engine. Solr offers support for the simplest keyword searching through to complex queries on multiple fields and faceted search results. Searching has more information about searching and queries.

If Solr's capabilities are not impressive enough, its ability to handle very high-volume applications should do the trick.

A relatively common scenario is that you have so much data, or so many queries, that a single Solr server is unable to handle your entire workload. In this case, you can scale up the capabilities of your application using So lrCloud to better distribute the data, and the processing of requests, across many servers. Multiple options can be mixed and matched depending on the type of scalability you need.

For example: "Sharding" is a scaling technique in which a collection is split into multiple logical pieces called "shards" in in order to scale up the number of documents in a collection beyond what could physically fit on a single server. Incoming queries are distributed to every shard in the collection, which respond with merged results. Another technique available is to increase the "Replication Factor" of your collection, which allows you to add servers with additional copies of your collection to handle higher concurrent query load by spreading the requests around to multiple machines. Sharding and Replication are not mutually exclusive, and together make Solr an extremely powerful and scalable platform.

Best of all, this talk about high-volume applications is not just hypothetical: some of the famous Internet sites that use Solr today are Macy's, EBay, and Zappo's.

For more information, take a look at https://wiki.apache.org/solr/PublicServers.

A Step Closer

You already have some idea of Solr's schema. This section describes Solr's home directory and other configuration options.

When Solr runs in an application server, it needs access to a home directory. The home directory contains important configuration information and is the place where Solr will store its index. The layout of the home directory will look a little different when you are running Solr in standalone mode vs when you are running in SolrCloud mode.

The crucial parts of the Solr home directory are shown in these examples:

Standalone Mode

```
<solr-home-directory>/
   solr.xml
   core_name1/
      core.properties
      conf/
         solrconfig.xml
         schema.xml
      data/
   core_name2/
      core.properties
      conf/
         solrconfig.xml
         schema.xml
      data/
```

SolrCloud Mode

```
<solr-home-directory>/
   solr.xml
   core_name1/
      core.properties
      data/
   core_name2/
      core.properties
      data/
```

You may see other files, but the main ones you need to know are:

- `solr.xml` specifies configuration options for your Solr server instance. For more information on `solr.xml` see Solr Cores and solr.xml.
- Per Solr Core:
    - `core.properties` defines specific properties for each core such as its name, the collection the core belongs to, the location of the schema, and other parameters. For more details on `core.properties`, see the section Defining core.properties.
    - `solrconfig.xml` controls high-level behavior. You can, for example, specify an alternate location for the data directory. For more information on `solrconfig.xml`, see Configuring solrconfig.xml.
    - `schema.xml` describes the documents you will ask Solr to index. Inside `schema.xml`, you define a document as a collection of fields. You get to define both the field types and the fields themselves. Field type definitions are powerful and include information about how Solr processes incoming field values and query values. For more information on `schema.xml`, see Documents, Fields, and Schema Design.
    - `data/` The directory containing the low level index files.

Note that the SolrCloud example does not include a `conf` directory for each Solr Core (so there is no `solrconfig.xml` or `schema.xml`). This is because the configuration files usually found in the `conf` directory are stored in ZooKeeper so they can be propagated across the cluster.

If you are using SolrCloud with the embedded ZooKeeper instance, you may also see `zoo.cfg` and `zoo.data` which are ZooKeeper configuration and data files. However, if you are running your own ZooKeeper ensemble, you would supply your own ZooKeeper configuration file when you start it and the copies in Solr would be unused. For more information about ZooKeeper and SolrCloud, see the section SolrCloud.

Solr Start Script Reference

Solr includes a script known as "`bin/solr`" that allows you to start and stop Solr, create and delete collections or cores, and check the status of Solr and configured shards. You can find the script in the `bin/` directory of your Solr installation. The `bin/solr` script makes Solr easier to work with by providing simple commands and options to quickly accomplish common goals.

In this section, the headings below correspond to available commands. For each command, the available options are described with examples.

More examples of bin/solr in use are available throughout the Solr Reference Guide, but particularly in the sections Running Solr and Getting Started with SolrCloud.

Starting and Stopping

Start and Restart

The start command starts Solr. The restart command allows you to restart Solr while it is already running or if it has been stopped already.

The start and restart commands have several options to allow you to run in SolrCloud mode, use an example configuration set, start with a hostname or port that is not the default and point to a local ZooKeeper ensemble.

`bin/solr start [options]`

`bin/solr start -help`

`bin/solr restart [options]`

`bin/solr restart -help`

When using the restart command, you must pass all of the parameters you initially passed when you started Solr. Behind the scenes, a stop request is initiated, so Solr will be stopped before being started again. If no nodes are already running, restart will skip the step to stop and proceed to starting Solr.

Available Parameters

The bin/solr script provides many options to allow you to customize the server in common ways, such as changing the listening port. However, most of the defaults are adequate for most Solr installations, especially when just getting started.

Parameter	Description	Example
-a "<string>"	Start Solr with additional JVM parameters, such as those starting with -X. If you are passing JVM parameters that begin with "-D", you can omit the -a option.	`bin/solr start -a "-Xdebug -Xrunjdwp:transport=dt_socket, server=y,suspend=n,address=1044"`

-cloud	Start Solr in SolrCloud mode, which will also launch the embedded ZooKeeper instance included with Solr. This option can be shortened to simply `-c`. If you are already running a ZooKeeper ensemble that you want to use instead of the embedded (single-node) ZooKeeper, you should also pass the -z parameter. For more details, see the section SolrCloud Mode below.	`bin/solr start -c`
-d <dir>	Define a server directory, defaults to `server` (as in, `$SOLR_HOME/server`). It is uncommon to override this option. When running multiple instances of Solr on the same host, it is more common to use the same server directory for each instance and use a unique Solr home directory using the -s option.	`bin/solr start -d newServerDir`
-e <name>	Start Solr with an example configuration. These examples are provided to help you get started faster with Solr generally, or just try a specific feature. The available options are: • cloud • techproducts • dih • schemaless See the section Running with Example Configurations below for more details on the example configurations.	`bin/solr start -e schemaless`
-f	Start Solr in the foreground; you cannot use this option when running examples with the -e option.	`bin/solr start -f`
-h <hostname>	Start Solr with the defined hostname. If this is not specified, 'localhost' will be assumed.	`bin/solr start -h search.mysolr.com`

-m <memory>	Start Solr with the defined value as the min (-Xms) and max (-Xmx) heap size for the JVM.	`bin/solr start -m 1g`
-noprompt	Start Solr and suppress any prompts that may be seen with another option. This would have the side effect of accepting all defaults implicitly. For example, when using the "cloud" example, an interactive session guides you through several options for your SolrCloud cluster. If you want to accept all of the defaults, you can simply add the -noprompt option to your request.	`bin/solr start -e cloud -noprompt`
-p <port>	Start Solr on the defined port. If this is not specified, '8983' will be used.	`bin/solr start -p 8655`
-s <dir>	Sets the solr.solr.home system property; Solr will create core directories under this directory. This allows you to run multiple Solr instances on the same host while reusing the same server directory set using the -d parameter. If set, the specified directory should contain a solr.xml file. The default value is `server/solr`. This parameter is ignored when running examples (-e), as the solr.solr.home depends on which example is run.	`bin/solr start -s newHome`
-V	Start Solr with verbose messages from the start script.	`bin/solr start -V`
-z <zkHost>	Start Solr with the defined ZooKeeper connection string. This option is only used with the -c option, to start Solr in SolrCloud mode. If this option is not provided, Solr will start the embedded ZooKeeper instance and use that instance for SolrCloud operations.	`bin/solr start -c -z server1:2181,server2:2181`

To emphasize how the default settings work take a moment to understand that the following commands are equivalent:

```
bin/solr start
```

```
bin/solr start -h localhost -p 8983 -d server -s solr -m 512m
```

It is not necessary to define all of the options when starting if the defaults are fine for your needs.

Setting Java System Properties

The bin/solr script will pass any additional parameters that begin with -D to the JVM, which allows you to set arbitrary Java system properties. For example, to set the auto soft-commit frequency to 3 seconds, you can do:

```
bin/solr start -Dsolr.autoSoftCommit.maxTime=3000
```

SolrCloud Mode

The -c and -cloud options are equivalent:

```
bin/solr start -c
```

```
bin/solr start -cloud
```

If you specify a ZooKeeper connection string, such as `-z 192.168.1.4:2181`, then Solr will connect to ZooKeeper and join the cluster. If you do not specify the -z option when starting Solr in cloud mode, then Solr will launch an embedded ZooKeeper server listening on the Solr port + 1000, i.e., if Solr is running on port 8983, then the embedded ZooKeeper will be listening on port 9983.

IMPORTANT: If your ZooKeeper connection string uses a chroot, such as `localhost:2181/solr`, then you need to bootstrap the /solr znode before launching SolrCloud using the bin/solr script. To do this, you need to use the `zkcli.sh` script shipped with Solr, such as:

```
server/scripts/cloud-scripts/zkcli.sh -zkhost localhost:2181/solr -cmd bootstrap
-solrhome server/solr
```

When starting in SolrCloud mode, the interactive script session will prompt you to choose a configset to use.

For more information about starting Solr in SolrCloud mode, see also the section Getting Started with SolrCloud.

Running with Example Configurations

```
bin/solr start -e <name>
```

The example configurations allow you to get started quickly with a configuration that mirrors what you hope to accomplish with Solr. The following examples are provided:

- **cloud**: This example starts a 1-4 node SolrCloud cluster on a single machine. When chosen, an interactive session will start to guide you through options to select the number of nodes for your example cluster, the ports to use, and name of the collection to be created.
- **techproducts**: This example starts Solr in standalone mode with a schema designed for the sample documents included in the `$SOLR_HOME/example/exampledocs` directory. The configset used does not have SolrCloud or schemaless modes enabled, so fields must be explicitly defined in `schema.xml`in order for documents including those fields to be added to the index. The configset used can be found in `$SOLR_HOME/server/solr/configsets/sample_techproducts_configs`.
- **dih**: This example starts Solr in standalone mode with the DataImportHandler (DIH) enabled and several example `dataconfig.xml` files pre-configured for different types of data supported with DIH (such as, database contents, email, RSS feeds, etc.). For more information about DIH, see the section Uploading Structured Data Store Data with the Data Import Handler.
- **schemaless**: This example starts Solr in standalone mode using a managed schema, as described in the section Managed Schema Definition in SolrConfig, and provides a very minimal pre-defined schema. Solr

will run in Schemaless Mode with this configuration, where Solr will create fields in the schema on the fly and will guess field types used in incoming documents. The configset used can be found in `$SOLR_HOME/server/solr/configsets/data_driven_schema_configs`.

Note: The run-in-foreground option (-f) does not work with the -e option since the script needs to perform additional tasks after starting the Solr server.

Status

The status command displays basic JSON-formatted information for any Solr nodes found running on the local system. The status command uses the SOLR_PID_DIR environment variable to locate Solr process ID files to find running Solr instances; the SOLR_PID_DIR variable defaults to the bin directory.

`bin/solr status`

The output will include a status of each node of the cluster, as in this example:

```
Found 2 Solr nodes:

Solr process 39920 running on port 7574
{
  "solr_home":"/Applications/Solr/solr-5.0.0/example/cloud/node2/solr/",
  "version":"5.0.0 1658469 - anshumgupta - 2015-02-09 09:54:36",
  "startTime":"2015-02-10T17:19:54.739Z",
  "uptime":"1 days, 23 hours, 55 minutes, 48 seconds",
  "memory":"77.2 MB (%15.7) of 490.7 MB",
  "cloud":{
    "ZooKeeper":"localhost:9865",
    "liveNodes":"2",
    "collections":"2"}}

Solr process 39827 running on port 8865
{
  "solr_home":"/Applications/Solr/solr-5.0.0/example/cloud/node1/solr/",
  "version":"5.0.0 1658469 - anshumgupta - 2015-02-09 09:54:36",
  "startTime":"2015-02-10T17:19:49.057Z",
  "uptime":"1 days, 23 hours, 55 minutes, 54 seconds",
  "memory":"94.2 MB (%19.2) of 490.7 MB",
  "cloud":{
    "ZooKeeper":"localhost:9865",
    "liveNodes":"2",
    "collections":"2"}}
```

Stop

The stop command sends a STOP request to a running Solr node, which allows it to shutdown gracefully. The command will wait up to 5 seconds for Solr to stop gracefully and then will forcefully kill the process (kill -9).

`bin/solr stop [options]`

`bin/solr stop -help`

Available Parameters

Parameter	Description	Example

-p <port>	Stop Solr running on the given port. If you are running more than one instance, or are running in SolrCloud mode, you either need to specify the ports in separate requests or use the -all option.	`bin/solr stop -p 8983`
-all	Stop all running Solr instances that have a valid PID.	`bin/solr stop -all`
-k <key>	Stop key used to protect from stopping Solr inadvertently; default is "solrrocks".	`bin/solr stop -k solrrocks`

Healthcheck

The healthcheck command generates a JSON-formatted health report for a collection when running in SolrCloud mode. The health report provides information about the state of every replica for all shards in a collection, including the number of committed documents and its current state.

```
bin/solr healthcheck [options]
```

```
bin/solr healthcheck -help
```

Available Parameters

Parameter	Description	Example
-c <collection>	Name of the collection to run a healthcheck against (required).	`bin/solr healthcheck -c gettingstarted`
-z <zkhost>	ZooKeeper connection string, defaults to localhost:9983. If you are running Solr on a port other than 8983, you will have to specify the ZooKeeper connection string. By default, this will be the Solr port + 1000.	`bin/solr healthcheck -z localhost:2181`

Below is an example healthcheck request and response using a non-standard ZooKeeper connect string, with 2 nodes running:

```
$ bin/solr healthcheck -c gettingstarted -z localhost:9865

{
  "collection":"gettingstarted",
  "status":"healthy",
  "numDocs":0,
  "numShards":2,
  "shards":[
    {
      "shard":"shard1",
      "status":"healthy",
      "replicas":[
        {
          "name":"core_node1",
          "url":"http://10.0.1.10:8865/solr/gettingstarted_shard1_replica2/",
          "numDocs":0,
          "status":"active",
          "uptime":"2 days, 1 hours, 18 minutes, 48 seconds",
          "memory":"25.6 MB (%5.2) of 490.7 MB",
          "leader":true},
        {
          "name":"core_node4",
          "url":"http://10.0.1.10:7574/solr/gettingstarted_shard1_replica1/",
          "numDocs":0,
          "status":"active",
          "uptime":"2 days, 1 hours, 18 minutes, 42 seconds",
          "memory":"95.3 MB (%19.4) of 490.7 MB"}]},
    {
      "shard":"shard2",
      "status":"healthy",
      "replicas":[
        {
          "name":"core_node2",
          "url":"http://10.0.1.10:8865/solr/gettingstarted_shard2_replica2/",
          "numDocs":0,
          "status":"active",
          "uptime":"2 days, 1 hours, 18 minutes, 48 seconds",
          "memory":"25.8 MB (%5.3) of 490.7 MB"},
        {
          "name":"core_node3",
          "url":"http://10.0.1.10:7574/solr/gettingstarted_shard2_replica1/",
          "numDocs":0,
          "status":"active",
          "uptime":"2 days, 1 hours, 18 minutes, 42 seconds",
          "memory":"95.4 MB (%19.4) of 490.7 MB",
          "leader":true}]}]}
```

Collections and Cores

The bin/solr script can also help you create new collections (in SolrCloud mode) or cores (in standalone mode), or delete collections.

Create

The create command detects the mode that Solr is running in (standalone or SolrCloud) and then creates a core or collection depending on the mode.

`bin/solr create options`

`bin/solr create -help`

Available Parameters

Parameter	Description	Example
-c <name>	Name of the core or collection to create (required).	`bin/solr create -c mycollection`
-d <confdir>	The configuration directory. This defaults to `data_driven_schema_configs`. See the section Configuration Directories and SolrCloud below for more details about this option when running in SolrCloud mode.	`bin/solr create -d basic_configs`
-n <configName>	The configuration name. This defaults to the same name as the core or collection.	`bin/solr create -n basic`
-p <port>	Port of a local Solr instance to send the create command to; by default the script tries to detect the port by looking for running Solr instances. This option is useful if you are running multiple standalone Solr instances on the same host, thus requiring you to be specific about which instance to create the core in.	`bin/solr create -p 8983`
-s <shards> -shards	Number of shards to split a collection into, default is 1; only applies when Solr is running in SolrCloud mode.	`bin/solr create -s 2`
-rf <replicas> -replicationFactor	Number of copies of each document in the collection. The default is 1 (no replication).	`bin/solr -rf 2`

Configuration Directories and SolrCloud

Before creating a collection in SolrCloud, the configuration directory used by the collection must be uploaded to ZooKeeper. The create command supports several use cases for how collections and configuration directories work. The main decision you need to make is whether a configuration directory in ZooKeeper should be shared across multiple collections. Let's work through a few examples to illustrate how configuration directories work in SolrCloud.

First, if you don't provide the `-d` or `-n` options, then the default configuration (`$SOLR_HOME/server/solr/configsets/data_driven_schema_configs/conf`) is uploaded to ZooKeeper using the same name as the collection. For example, the following command will result in the **data_driven_schema_configs** configuration being uploaded to `/configs/contacts` in ZooKeeper: `bin/solr create -c contacts`. If you create another collection, by doing `bin/solr create -c contacts2`, then another copy of the `data_driven_sch` `ema_configs` directory will be uploaded to ZooKeeper under `/configs/contacts2`. Any changes you make to the configuration for the contacts collection will not affect the contacts2 collection. Put simply, the default behavior creates a unique copy of the configuration directory for each collection you create.

You can override the name given to the configuration directory in ZooKeeper by using the `-n` option. For instance, the command `bin/solr create -c logs -d basic_configs -n basic` will upload the `server/solr/configsets/basic_configs/conf` directory to ZooKeeper as `/configs/basic`.

Notice that we used the `-d` option to specify a different configuration than the default. Solr provides several built-in configurations under `server/solr/configsets`. However you can also provide the path to your own configuration directory using the `-d` option. For instance, the command `bin/solr create -c mycoll -d /tmp/myconfigs`, will upload `/tmp/myconfigs` into ZooKeeper under `/configs/mycoll` . To reiterate, the configuration directory is named after the collection unless you override it using the `-n` option.

Other collections can share the same configuration by specifying the name of the shared configuration using the `-n` option. For instance, the following command will create a new collection that shares the basic configuration created previously: `bin/solr create -c logs2 -n basic`.

Data-driven schema and shared configurations

The data_driven_schema_configs schema can mutate as data is indexed. Consequently, we recommend that you do not share data-driven configurations between collections unless you are certain that all collections should inherit the changes made when indexing data into one of the collections.

Delete

The delete command detects the mode that Solr is running in (standalone or SolrCloud) and then deletes the specified core (standalone) or collection (SolrCloud) as appropriate.

```
bin/solr delete [options]
```

```
bin/solr delete -help
```

If running in SolrCloud mode, the delete command checks if the configuration directory used by the collection you are deleting is being used by other collections. If not, then the configuration directory is also deleted from ZooKeeper. For example, if you created a collection by doing `bin/solr create -c contacts`, then the delete command `bin/solr delete -c contacts` will check to see if the `/configs/contacts` configuration directory is being used by any other collections. If not, then the `/configs/contacts` directory is removed from ZooKeeper.

Available Parameters

Parameter	Description	Example
-c <name>	Name of the core / collection to delete (required).	`bin/solr delete -c mycoll`
-deleteConfig <true|false>	Delete the configuration directory from ZooKeeper. The default is true. If the configuration directory is being used by another collection, then it will not be deleted even if you pass -deleteConfig true.	`bin/solr delete -deleteConfig false`

-p <port>	The port of a local Solr instance to send the delete command to. By default the script tries to detect the port by looking for running Solr instances. This option is useful if you are running multiple standalone Solr instances on the same host, thus requiring you to be specific about which instance to delete the core from.	`bin/solr delete -p 8983`

Upgrading Solr

If you are already using Solr 5.0, Solr 5.1 should not present any major problems. However, you should review the `CHANGES.txt` file found in your Solr package for changes and updates that may effect your existing implementation.

Upgrading from 5.0.x

- `SolrClient` query functions now declare themselves as throwing `IOException` in addition to `SolrServerException`, to bring them in line with the update functions.
- `SolrRequest.process()` is now final. Subclasses should instead be parameterized by their corresponding `SolrResponse` type, and implement `createResponse()`.
- The signature of `SolrDispatchFilter.createCoreContainer()` has changed to take `(String,Properties)` arguments.
- Deprecated the `'lib'` option added to `create-requesthandler` as part of SOLR-6801 in 5.0 release. Please use the `add-runtimelib` command.
- Tika's runtime dependency of 'jhighlight' was removed as the latter was found to contain some LGPL-only code. Until that's resolved by Tika, you can download the jar yourself and place it under `contrib/extraction/lib`.
- The `_text` catch-all field in `data_driven_schema_configs` has been renamed to `_text_`.

Upgrading from Older Versions of Solr

Users upgrading from older versions are strongly encouraged to consult `CHANGES.txt` for the details of *all* cha nges since the version they are upgrading from

For users upgrading from Solr 4.x, a summary of the significant changes can be found in the Major Changes from Solr 4 to Solr 5 section.

Using the Solr Administration User Interface

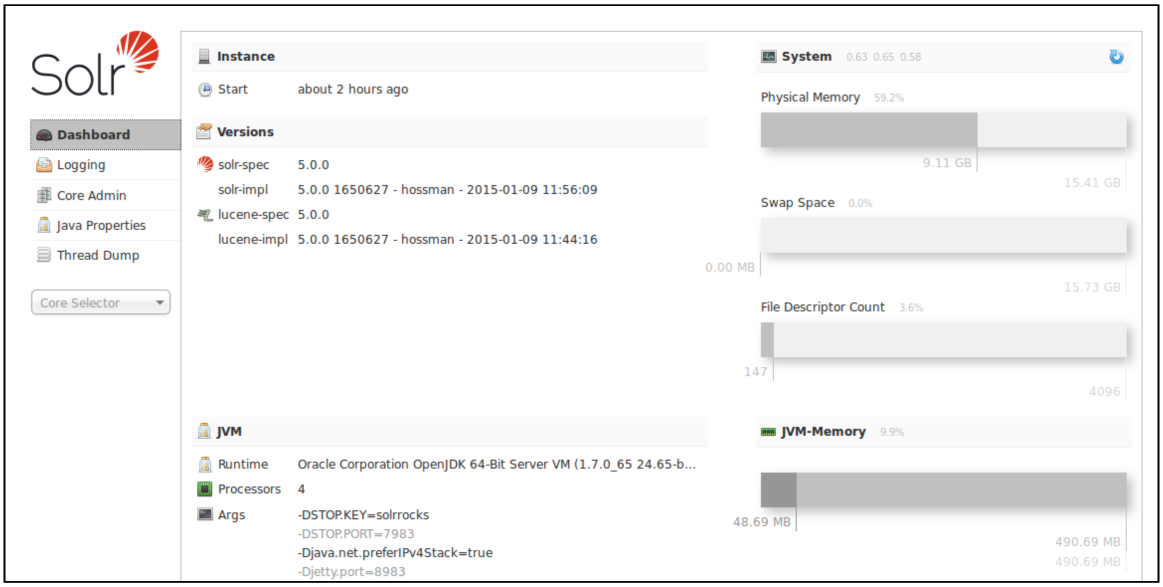
This section discusses the Solr Administration User Interface ("Admin UI").

The Overview of the Solr Admin UI explains the basic features of the user interface, what's on the initial Admin UI page, and how to configure the interface. In addition, there are pages describing each screen of the Admin UI:

- **Getting Assistance** shows you how to get more information about the UI.
- **Logging** explains the various logging levels available and how to invoke them.
- **Cloud Screens** display information about nodes when running in SolrCloud mode.
- **Core Admin** explains how to get management information about each core.
- **Java Properties** shows the Java information about each core.
- **Thread Dump** lets you see detailed information about each thread, along with state information.
- **Core-Specific Tools** is a section explaining additional screens available for each named core.
  - Analysis - lets you analyze the data found in specific fields.
  - Dataimport - shows you information about the current status of the Data Import Handler.
  - Documents - provides a simple form allowing you to execute various Solr indexing commands directly from the browser.
  - Files - shows the current core configuration files such as `solrconfig.xml` and `schema.xml`.
  - Ping - lets you ping a named core and determine whether the core is active.
  - Plugins/Stats - shows statistics for plugins and other installed components.
  - Query - lets you submit a structured query about various elements of a core.
  - Replication - shows you the current replication status for the core, and lets you enable/disable replication.
  - Schema Browser - displays schema data in a browser window.
  - Segments Info - Provides a visualization of the underlying Lucene index segments.

Overview of the Solr Admin UI

Solr features a Web interface that makes it easy for Solr administrators and programmers to view Solr configuration details, run queries and analyze document fields in order to fine-tune a Solr configuration and access online documentation and other help.



Start about 2 hours ago

solr-spec	5.0.0
solr-impl	5.0.0 1650627 - hossman - 2015-01-09 11:56:09
lucene-spec	5.0.0
lucene-impl	5.0.0 1650627 - hossman - 2015-01-09 11:44:16

Runtime	Oracle Corporation OpenJDK 64-Bit Server VM (1.7.0_65 24.65-b...
Processors	4
Args	-DSTOP.KEY=solrrocks -DSTOP.PORT=7983 -Djava.net.preferIPv4Stack=true -Djetty.port=8983

Accessing the URL `http://hostname:8983/solr/` will show the main dashboard, which is divided into two parts.

A left-side of the screen is a menu under the Solr logo that provides the navigation through the screens of the UI. The first set of links are for system-level information and configuration and provide access to Logging, Core Admin and Java Properties, among other things. At the end of this information is a list of Solr cores configured for this instance. Clicking on a core name shows a secondary menu of information and configuration options for the core specifically. Items in this list include the Schema, Config, Plugins, and an ability to perform Queries on indexed data.

The center of the screen shows the detail of the option selected. This may include a sub-navigation for the option or text or graphical representation of the requested data. See the sections in this guide for each screen for more details.

Under the covers, the Solr Admin UI re-uses the same HTTP APIs available to all clients to access Solr-related data to drive an external interface.

> ✓ The path to the Solr Admin UI given above is `http://hostname:port/solr`, which redirects to `http://hostname:port/solr/#/` in the current version. A convenience redirect is also supported, so simply accessing the Admin UI at `http://hostname:port/` will also redirect to `http://hostname:port/solr/#/`.

Configuring the Admin UI in `solrconfig.xml`

You can configure the Solr Admin UI by editing the file `solrconfig.xml`.

The `<admin>` block in the `solrconfig.xml` file determines the default query to be displayed in the Query section of the core-specific pages. The default is `*:*`, which is to find all documents. In this example, we have changed the default to the term `solr`.

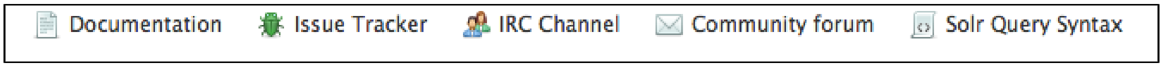
```
<admin>
    <defaultQuery>solr</defaultQuery>
</admin>
```

Related Topics

- Configuring solrconfig.xml

Getting Assistance

At the bottom of each screen of the Admin UI is a set of links that can be used to get more assistance with configuring and using Solr.



Assistance icons

These icons include the following links.

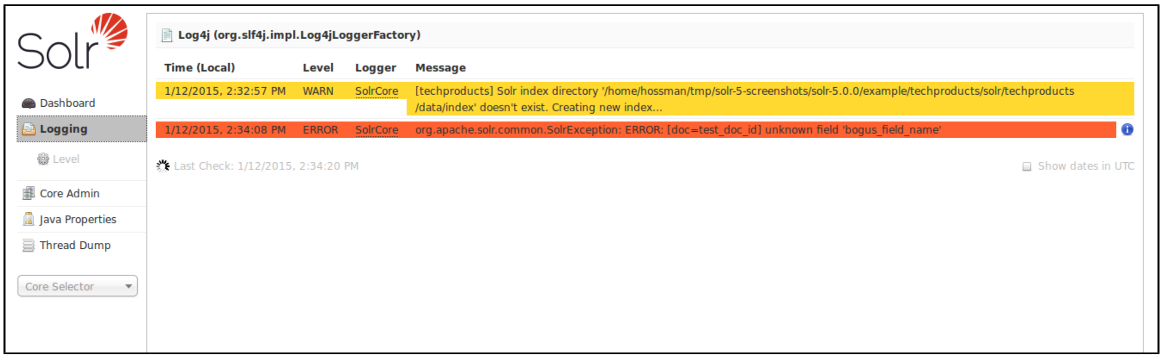
Link	Description
Documentation	Navigates to the Apache Solr documentation hosted on http://lucene.apache.org/solr/.
Issue Tracker	Navigates to the JIRA issue tracking server for the Apache Solr project. This server resides at http://issues.apache.org/jira/browse/SOLR.
IRC Channel	Navigates to an Apache Wiki page describing how to join Solr's IRClive-chat room: https://wiki.apache.org/solr/IRCChannels.
Community forum	Navigates to the Apache Solr web page http://lucene.apache.org/solr/resources.html#community which has further information about ways to engage.
Solr Query Syntax	Navigates to the section "Query Syntax and Parsing" in this reference guide.

These links cannot be modified without editing the `admin.html` in the `solr.war` that contains the Admin UI files.

Logging

The Logging page shows messages from Solr's log files.

When you click the link for "Logging", a page similar to the one below will be displayed:



Log4j (org.slf4j.impl.Log4jLoggerFactory)

Time (Local)	Level	Logger	Message
1/12/2015, 2:32:57 PM	WARN	SolrCore	[techproducts] Solr index directory '/home/hossman/tmp/solr-5-screenshots/solr-5.0.0/example/techproducts/solr/techproducts /data/index' doesn't exist. Creating new index...
1/12/2015, 2:34:08 PM	ERROR	SolrCore	org.apache.solr.common.SolrException: ERROR: [doc=test_doc_id] unknown field 'bogus_field_name'

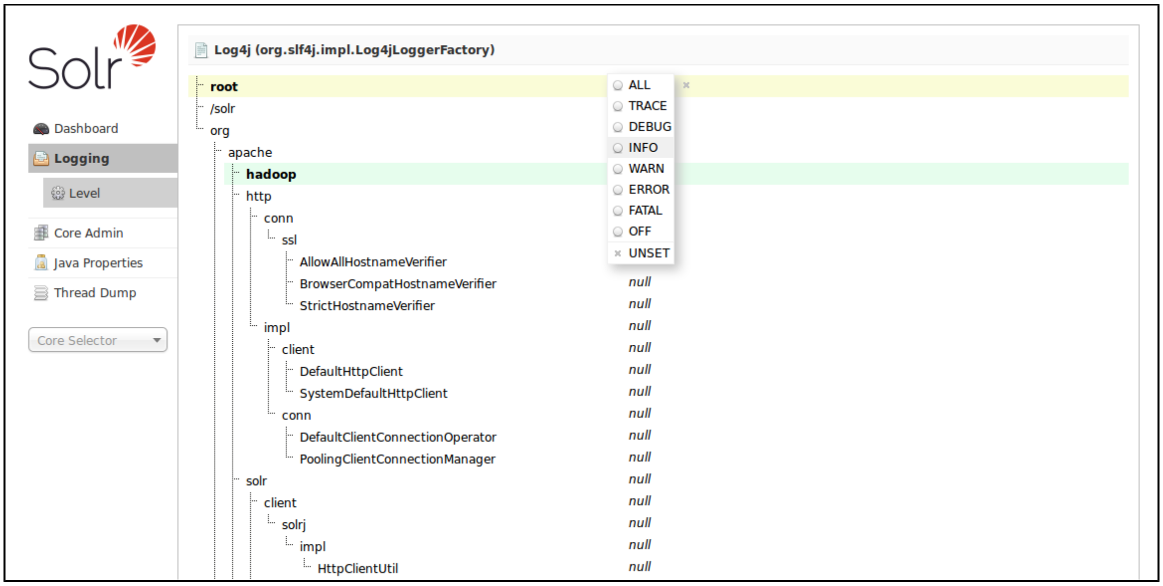
Last Check: 1/12/2015, 2:34:20 PM

□ Show dates in UTC

The Main Logging Screen, including an example of an error due to a bad document sent by a client

While this example shows logged messages for only one core, if you have multiple cores in a single instance, they will each be listed, with the level for each.

Selecting a Logging Level



Log4j (org.slf4j.impl.Log4jLoggerFactory)

```
root
/solr
org
  apache
    hadoop
    http
      conn
        ssl
          AllowAllHostnameVerifier                null
          BrowserCompatHostnameVerifier           null
          StrictHostnameVerifier                  null
      impl                                        null
        client                                    null
          DefaultHttpClient                       null
          SystemDefaultHttpClient                 null
        conn                                      null
          DefaultClientConnectionOperator         null
          PoolingClientConnectionManager          null
    solr                                          null
      client                                      null
        solrj                                     null
          impl                                    null
            HttpClientUtil                        null
```

When you select the **Level** link on the left, you see the hierarchy of classpaths and classnames for your instance. A row highlighted in yellow indicates that the class has logging capabilities. Click on a highlighted row, and a menu will appear to allow you to change the log level for that class. Characters in boldface indicate that the class will not be affected by level changes to root.

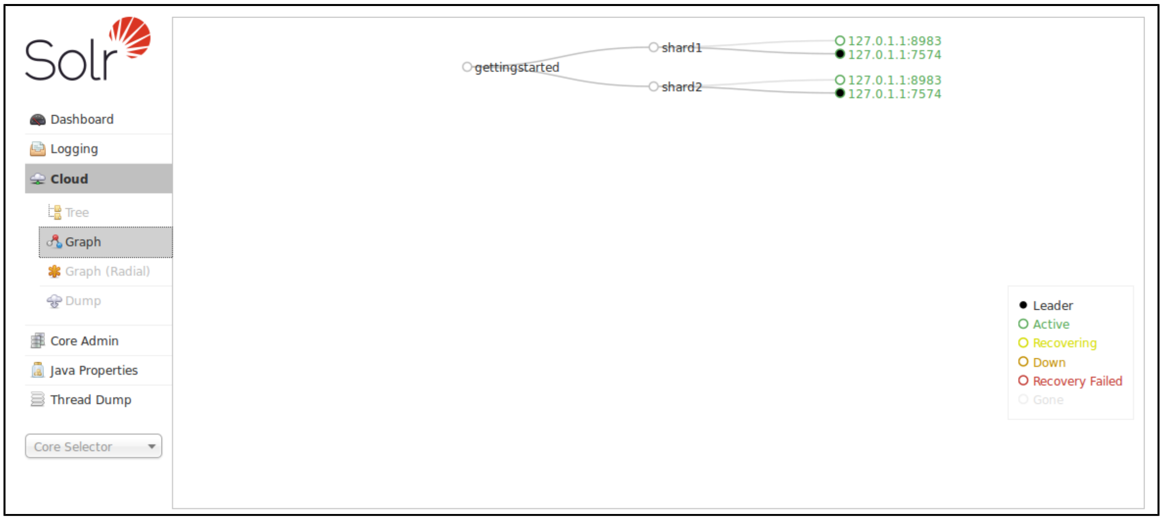
For an explanation of the various logging levels, see Configuring Logging.

Cloud Screens

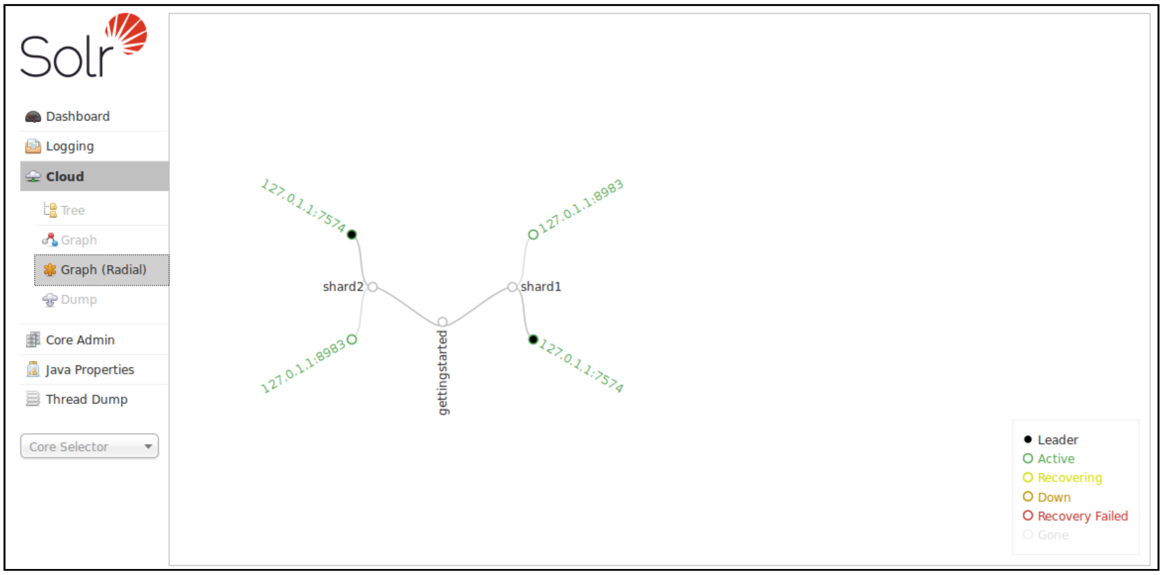
When running in SolrCloud mode, an option will appear in the Admin UI between Logging and Core Admin for Cloud. It's not possible at the current time to manage the nodes of the SolrCloud cluster from the Admin UI, but you can view them and open the Solr Admin UI on each node to view the status and statistics for the node and each core on each node.

Only Visible When using SolrCloud
The "Cloud" menu option is only available on Solr instances running in SolrCloud mode. Single node or master/slave replication instances of Solr will not display this option.

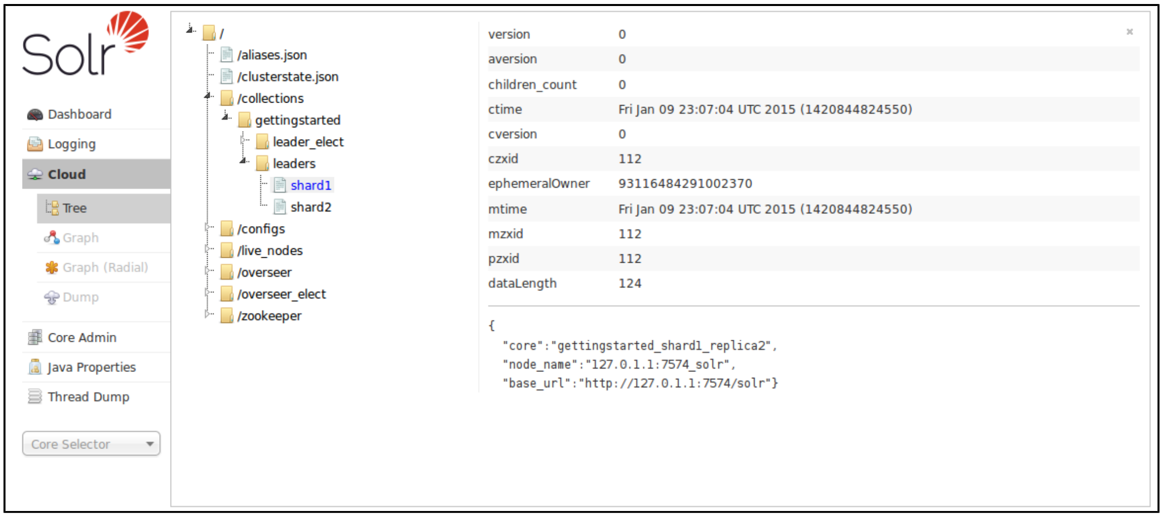
Click on the Cloud option in the left-hand navigation, and a small sub-menu appears with options called "Tree", "Graph", "Graph (Radial)" and "Dump". The default view ("Graph") shows a graph of each collection, the shards that make up those collections, and the addresses of each replica for each shard. This example shows the very simple two-node, two-shard, two-replica cluster you can get running the "`bin/solr -e cloud`" example:



The "Graph (Radial)" option provides a different visual view of each node. Using the same example cluster, the radial graph view looks like:



The "Tree" option shows a directory structure of the files in ZooKeeper, including `clusterstate.json`, configuration files, and other status and information files. In this example, we show the leader definition for "shard1" in the "gettingstarted" collection:



version	0
aversion	0
children_count	0
ctime	Fri Jan 09 23:07:04 UTC 2015 (1420844824550)
cversion	0
czxid	112
ephemeralOwner	93116484291002370
mtime	Fri Jan 09 23:07:04 UTC 2015 (1420844824550)
mzxid	112
pzxid	112
dataLength	124

```
{
  "core":"gettingstarted_shard1_replica2",
  "node_name":"127.0.1.1:7574_solr",
  "base_url":"http://127.0.1.1:7574/solr"}
```

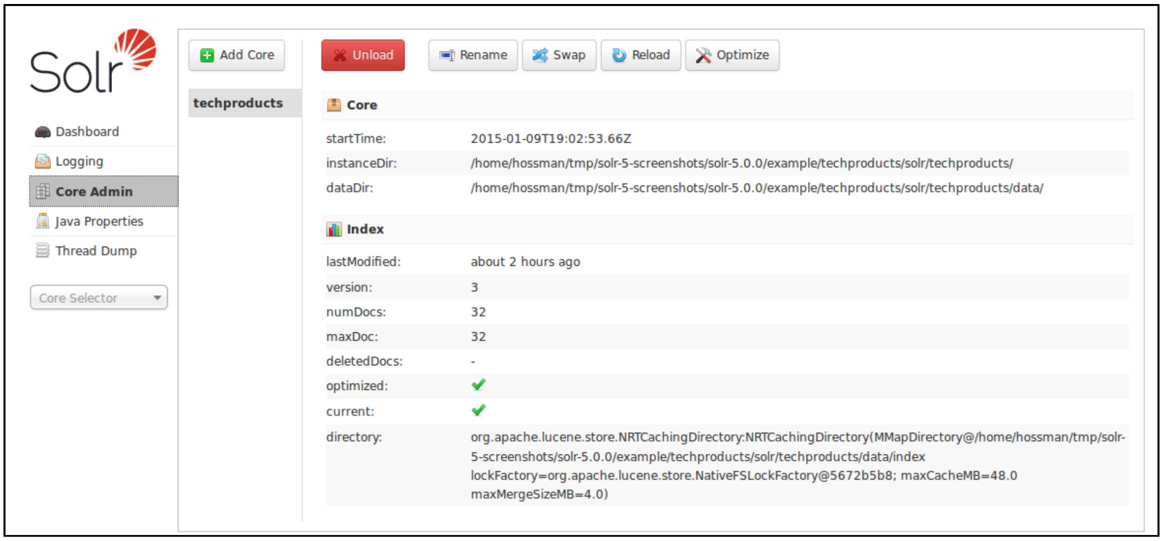
The final option is "Dump", which allows you to download an XML file with all the ZooKeeper configuration files.

Core Admin

The Core Admin screen lets you manage your cores.

The buttons at the top of the screen let you add a new core, unload the core displayed, rename the currently displayed core, swap the existing core with one that you specify in a drop-down box, reload the current core, and optimize the current core.

The main display and available actions correspond to the commands used with the CoreAdminHandler, but provide another way of working with your cores.



Core

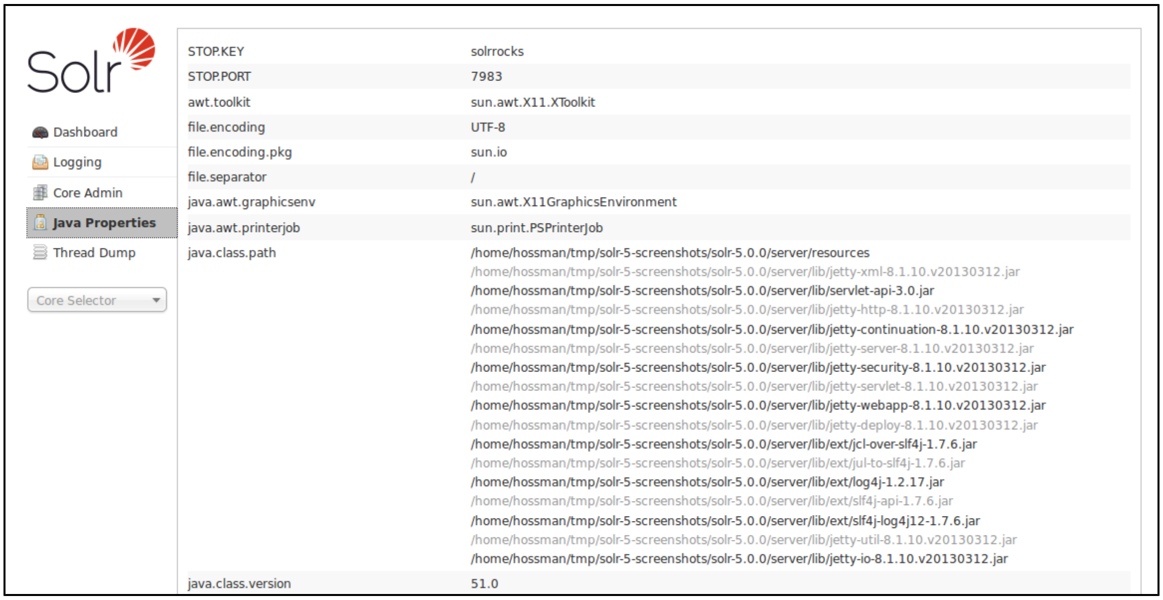
startTime:	2015-01-09T19:02:53.66Z
instanceDir:	/home/hossman/tmp/solr-5-screenshots/solr-5.0.0/example/techproducts/solr/techproducts/
dataDir:	/home/hossman/tmp/solr-5-screenshots/solr-5.0.0/example/techproducts/solr/techproducts/data/

Index

lastModified:	about 2 hours ago
version:	3
numDocs:	32
maxDoc:	32
deletedDocs:	-
optimized:	✓
current:	✓
directory:	org.apache.lucene.store.NRTCachingDirectory:NRTCachingDirectory(MMapDirectory@/home/hossman/tmp/solr-5-screenshots/solr-5.0.0/example/techproducts/solr/techproducts/data/index lockFactory=org.apache.lucene.store.NativeFSLockFactory@5672b5b8; maxCacheMB=48.0 maxMergeSizeMB=4.0)

Java Properties

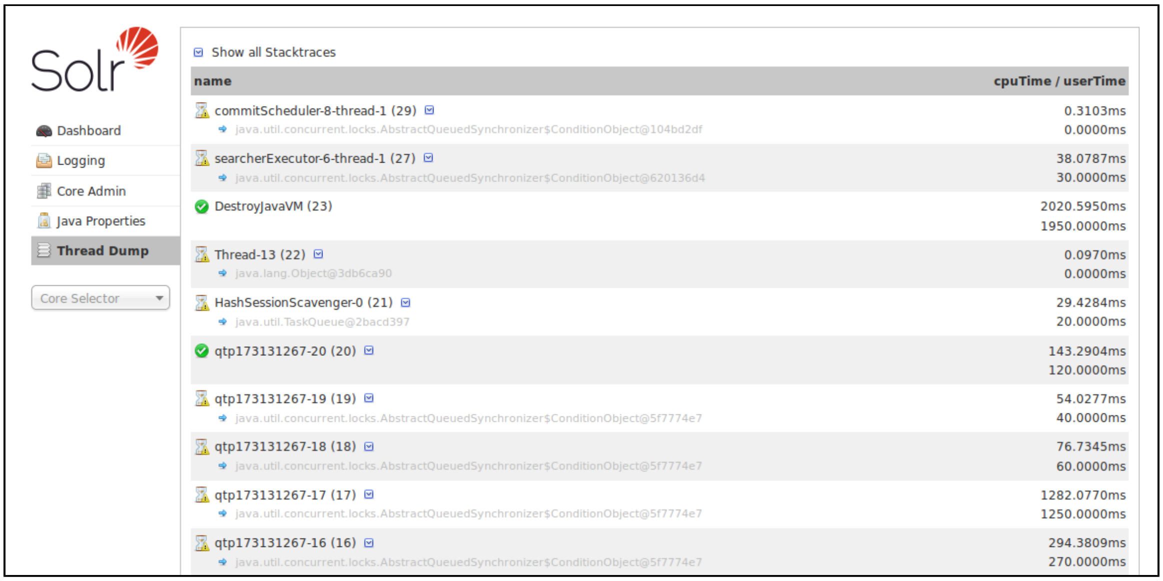
The Java Properties screen provides easy access to one of the most essential components of a top-performing Solr systems With the Java Properties screen, you can see all the properties of the JVM running Solr, including the class paths, file encodings, JVM memory settings, operating system, and more.



STOP.KEY	solrrocks
STOP.PORT	7983
awt.toolkit	sun.awt.X11.XToolkit
file.encoding	UTF-8
file.encoding.pkg	sun.io
file.separator	/
java.awt.graphicsenv	sun.awt.X11GraphicsEnvironment
java.awt.printerjob	sun.print.PSPrinterJob
java.class.path	/home/hossman/tmp/solr-5-screenshots/solr-5.0.0/server/resources /home/hossman/tmp/solr-5-screenshots/solr-5.0.0/server/lib/jetty-xml-8.1.10.v20130312.jar /home/hossman/tmp/solr-5-screenshots/solr-5.0.0/server/lib/servlet-api-3.0.jar /home/hossman/tmp/solr-5-screenshots/solr-5.0.0/server/lib/jetty-http-8.1.10.v20130312.jar /home/hossman/tmp/solr-5-screenshots/solr-5.0.0/server/lib/jetty-continuation-8.1.10.v20130312.jar /home/hossman/tmp/solr-5-screenshots/solr-5.0.0/server/lib/jetty-server-8.1.10.v20130312.jar /home/hossman/tmp/solr-5-screenshots/solr-5.0.0/server/lib/jetty-security-8.1.10.v20130312.jar /home/hossman/tmp/solr-5-screenshots/solr-5.0.0/server/lib/jetty-servlet-8.1.10.v20130312.jar /home/hossman/tmp/solr-5-screenshots/solr-5.0.0/server/lib/jetty-webapp-8.1.10.v20130312.jar /home/hossman/tmp/solr-5-screenshots/solr-5.0.0/server/lib/jetty-deploy-8.1.10.v20130312.jar /home/hossman/tmp/solr-5-screenshots/solr-5.0.0/server/lib/ext/jcl-over-slf4j-1.7.6.jar /home/hossman/tmp/solr-5-screenshots/solr-5.0.0/server/lib/ext/jul-to-slf4j-1.7.6.jar /home/hossman/tmp/solr-5-screenshots/solr-5.0.0/server/lib/ext/log4j-1.2.17.jar /home/hossman/tmp/solr-5-screenshots/solr-5.0.0/server/lib/ext/slf4j-api-1.7.6.jar /home/hossman/tmp/solr-5-screenshots/solr-5.0.0/server/lib/ext/slf4j-log4j12-1.7.6.jar /home/hossman/tmp/solr-5-screenshots/solr-5.0.0/server/lib/jetty-util-8.1.10.v20130312.jar /home/hossman/tmp/solr-5-screenshots/solr-5.0.0/server/lib/jetty-io-8.1.10.v20130312.jar
java.class.version	51.0

Thread Dump

The Thread Dump screen lets you inspect the currently active threads on your server. Each thread is listed and access to the stacktraces is available where applicable. Icons to the left indicate the state of the thread: for example, threads with a green check-mark in a green circle are in a "RUNNABLE" state. On the right of the thread name, a down-arrow means you can expand to see the stacktrace for that thread.



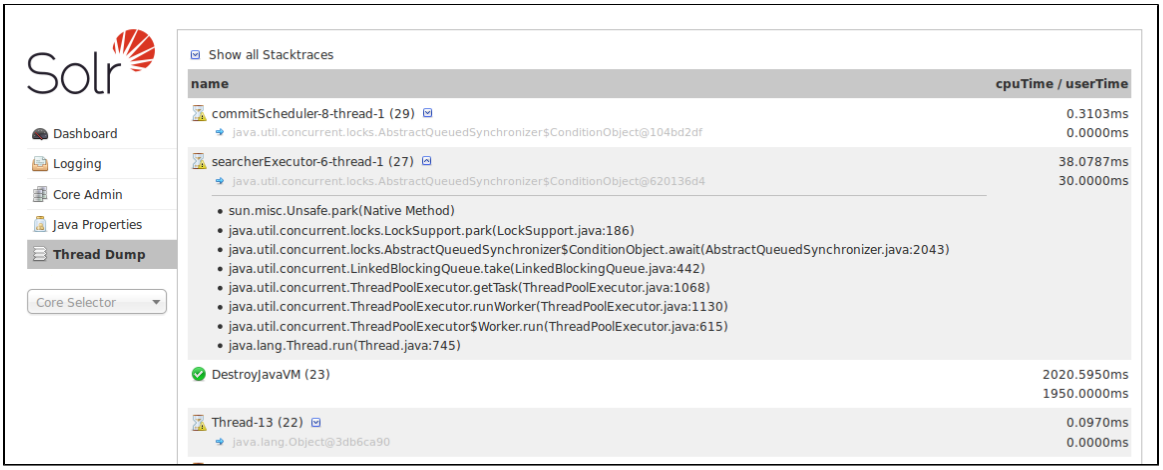
name	cpuTime / userTime
commitScheduler-8-thread-1 (29) java.util.concurrent.locks.AbstractQueuedSynchronizer$ConditionObject@104bd2df	0.3103ms 0.0000ms
searcherExecutor-6-thread-1 (27) java.util.concurrent.locks.AbstractQueuedSynchronizer$ConditionObject@620136d4	38.0787ms 30.0000ms
✓ DestroyJavaVM (23)	2020.5950ms 1950.0000ms
Thread-13 (22) java.lang.Object@3db6ca90	0.0970ms 0.0000ms
HashSessionScavenger-0 (21) java.util.TaskQueue@2bacd397	29.4284ms 20.0000ms
✓ qtp173131267-20 (20)	143.2904ms 120.0000ms
qtp173131267-19 (19) java.util.concurrent.locks.AbstractQueuedSynchronizer$ConditionObject@5f7774e7	54.0277ms 40.0000ms
qtp173131267-18 (18) java.util.concurrent.locks.AbstractQueuedSynchronizer$ConditionObject@5f7774e7	76.7345ms 60.0000ms
qtp173131267-17 (17) java.util.concurrent.locks.AbstractQueuedSynchronizer$ConditionObject@5f7774e7	1282.0770ms 1250.0000ms
qtp173131267-16 (16) java.util.concurrent.locks.AbstractQueuedSynchronizer$ConditionObject@5f7774e7	294.3809ms 270.0000ms

When you move your cursor over a thread name, a box floats over the name with the state for that thread. Thread states can be:

State	Meaning
NEW	A thread that has not yet started.
RUNNABLE	A thread executing in the Java virtual machine.
BLOCKED	A thread that is blocked waiting for a monitor lock.

WAITING	A thread that is waiting indefinitely for another thread to perform a particular action.
TIMED_WAITING	A thread that is waiting for another thread to perform an action for up to a specified waiting time.
TERMINATED	A thread that has exited.

When you click on one of the threads that can be expanded, you'll see the stacktrace, as in the example below:



name	cpuTime / userTime
commitScheduler-8-thread-1 (29) java.util.concurrent.locks.AbstractQueuedSynchronizer$ConditionObject@104bd2df	0.3103ms 0.0000ms
searcherExecutor-6-thread-1 (27) java.util.concurrent.locks.AbstractQueuedSynchronizer$ConditionObject@620136d4	38.0787ms 30.0000ms
DestroyJavaVM (23)	2020.5950ms 1950.0000ms
Thread-13 (22) java.lang.Object@3db6ca90	0.0970ms 0.0000ms

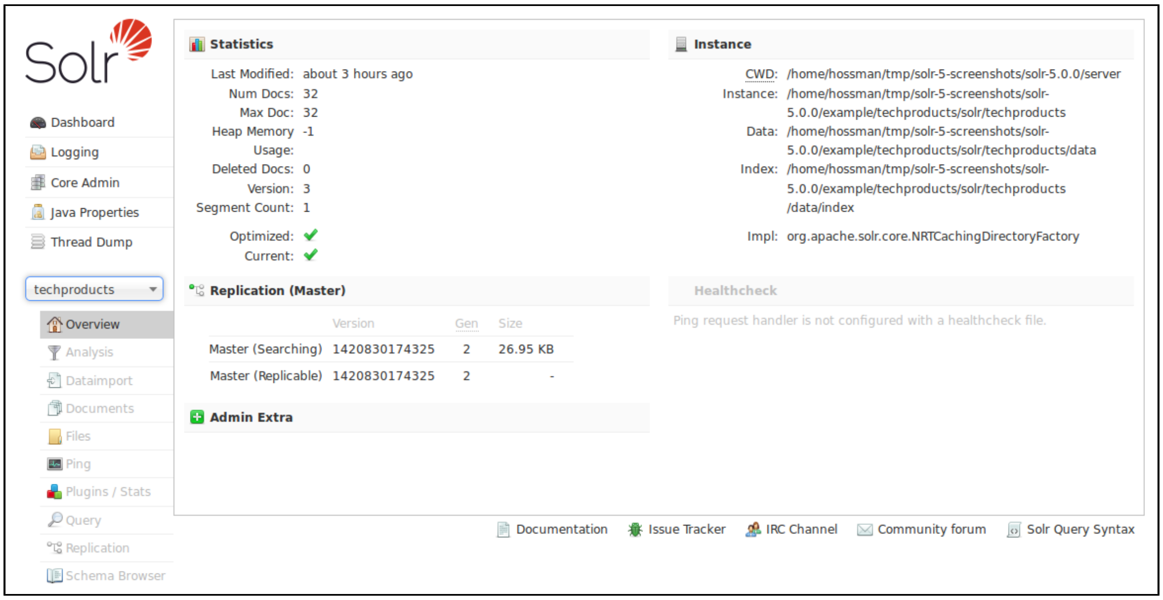
```
• sun.misc.Unsafe.park(Native Method)
• java.util.concurrent.locks.LockSupport.park(LockSupport.java:186)
• java.util.concurrent.locks.AbstractQueuedSynchronizer$ConditionObject.await(AbstractQueuedSynchronizer.java:2043)
• java.util.concurrent.LinkedBlockingQueue.take(LinkedBlockingQueue.java:442)
• java.util.concurrent.ThreadPoolExecutor.getTask(ThreadPoolExecutor.java:1068)
• java.util.concurrent.ThreadPoolExecutor.runWorker(ThreadPoolExecutor.java:1130)
• java.util.concurrent.ThreadPoolExecutor$Worker.run(ThreadPoolExecutor.java:615)
• java.lang.Thread.run(Thread.java:745)
```

Inspecting a thread

You can also check the **Show all Stacktraces** button to automatically enable expansion for all threads.

Core-Specific Tools

In the left-hand navigation bar, you will see a pull-down menu titled "Core Selector". Clicking on the menu will show a list of Solr cores, with a search box that can be used to find a specific core (handy if you have a lot of cores). When you select a core, a secondary menu opens under the core name with the administration options available for that particular core.



Statistics

Last Modified: about 3 hours ago
Num Docs: 32
Max Doc: 32
Heap Memory Usage: -1
Deleted Docs: 0
Version: 3
Segment Count: 1
Optimized: ✓
Current: ✓

Instance

CWD: /home/hossman/tmp/solr-5-screenshots/solr-5.0.0/server
Instance: /home/hossman/tmp/solr-5-screenshots/solr-5.0.0/example/techproducts/solr/techproducts
Data: /home/hossman/tmp/solr-5-screenshots/solr-5.0.0/example/techproducts/solr/techproducts/data
Index: /home/hossman/tmp/solr-5-screenshots/solr-5.0.0/example/techproducts/solr/techproducts/data/index
Impl: org.apache.solr.core.NRTCachingDirectoryFactory

Replication (Master)

	Version	Gen	Size
Master (Searching)	1420830174325	2	26.95 KB
Master (Replicable)	1420830174325	2	-

Healthcheck

Ping request handler is not configured with a healthcheck file.

After selecting the core, the central part of the screen shows Statistics and other information about the core you chose. You can define a file called `admin-extra.html` that includes links or other information you would like to display in the "Admin Extra" part of this main screen.

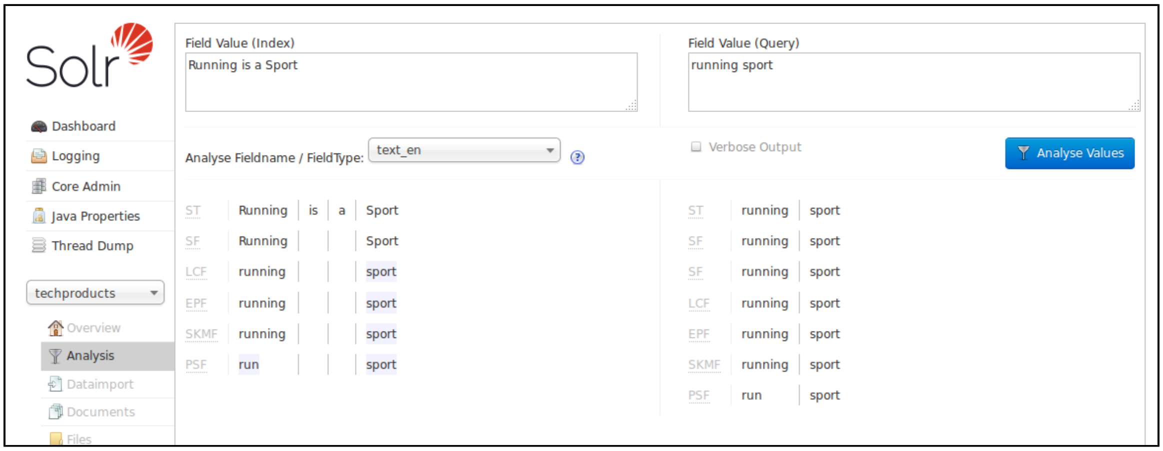
On the left side, under the core name, are links to other screens that display information or provide options for the specific core chosen. The core-specific options are listed below, with a link to the section of this Guide to find out more:

- Analysis - lets you analyze the data found in specific fields.
- Dataimport - shows you information about the current status of the Data Import Handler.
- Documents - provides a simple form allowing you to execute various Solr indexing commands directly from the browser.
- Files - shows the current core configuration files such as `solrconfig.xml` and `schema.xml`.
- Ping - lets you ping a named core and determine whether the core is active.
- Plugins/Stats - shows statistics for plugins and other installed components.
- Query - lets you submit a structured query about various elements of a core.
- Replication - shows you the current replication status for the core, and lets you enable/disable replication.
- Schema Browser - displays schema data in a browser window.
- Segments Info - Provides a visualization of the underlying Lucene index segments.

Analysis Screen

The Analysis screen lets you inspect how data will be handled according to the field, field type and dynamic rule configurations found in `schema.xml`. You can analyze how content would be handled during indexing or during query processing and view the results separately or at the same time. Ideally, you would want content to be handled consistently, and this screen allows you to validate the settings in the field type or field analysis chains.

Enter content in one or both boxes at the top of the screen, and then choose the field or field type definitions to use for analysis.



Field Value (Index): Running is a Sport

Field Value (Query): running sport

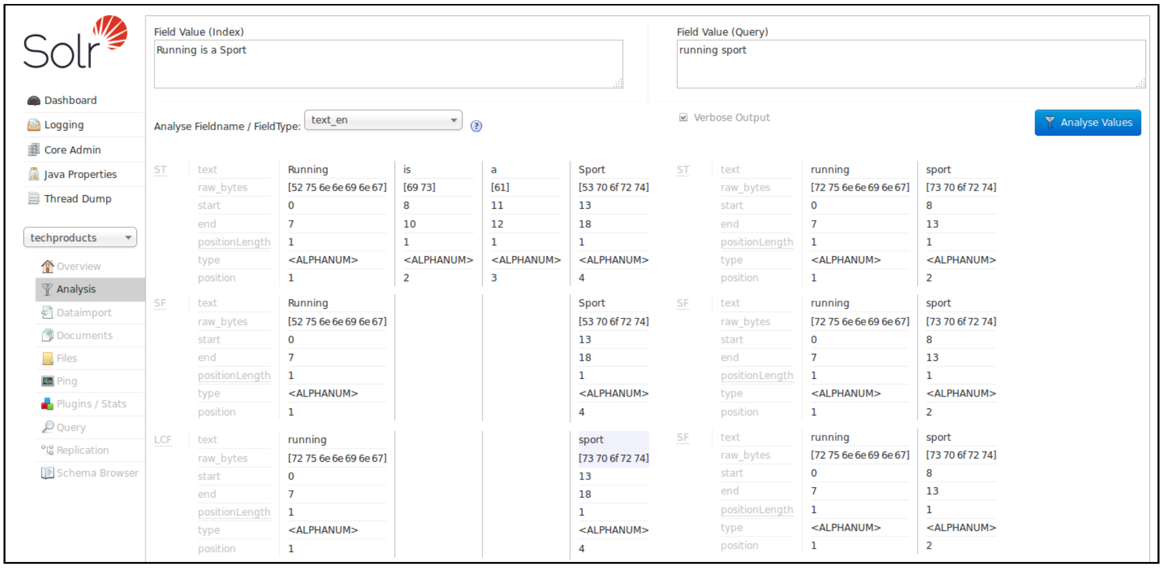
Analyse Fieldname / FieldType: text_en

☐ Verbose Output

ST	Running	is	a	Sport
SF	Running			Sport
LCF	running			sport
EPF	running			sport
SKMF	running			sport
PSF	run			sport

ST	running	sport
SF	running	sport
SF	running	sport
LCF	running	sport
EPF	running	sport
SKMF	running	sport
PSF	run	sport

If you click the **Verbose Output** check box, you see more information, including transformations to the input (such as, convert to lower case, strip extra characters, etc.) and the bytes, type and detailed position information. The information displayed will vary depending on the settings of the field or field type. Each step of the process is displayed in a separate section, with an abbreviation for the tokenizer or filter that is applied in that step. Hover or click on the abbreviation, and you'll see the name and path of the tokenizer or filter.



Field Value (Index): Running is a Sport

Field Value (Query): running sport

Analyse Fieldname / FieldType: text_en

☑ Verbose Output

ST	text	Running	is	a	Sport
	raw_bytes	[52 75 6e 6e 69 6e 67]	[69 73]	[61]	[53 70 6f 72 74]
	start	0	8	11	13
	end	7	10	12	18
	positionLength	1	1	1	1
	type	<ALPHANUM>	<ALPHANUM>	<ALPHANUM>	<ALPHANUM>
	position	1	2	3	4
SF	text	Running			Sport
	raw_bytes	[52 75 6e 6e 69 6e 67]			[53 70 6f 72 74]
	start	0			13
	end	7			18
	positionLength	1			1
	type	<ALPHANUM>			<ALPHANUM>
	position	1			4
LCF	text	running			sport
	raw_bytes	[72 75 6e 6e 69 6e 67]			[73 70 6f 72 74]
	start	0			13
	end	7			18
	positionLength	1			1
	type	<ALPHANUM>			<ALPHANUM>
	position	1			4

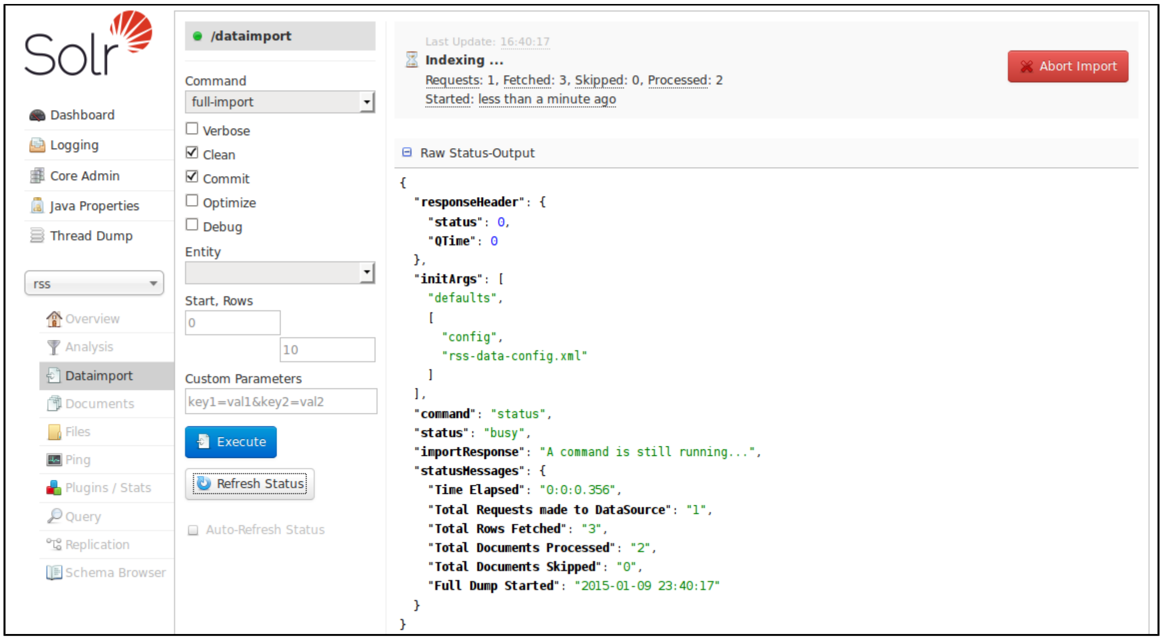
ST	text	running	sport
	raw_bytes	[72 75 6e 6e 69 6e 67]	[73 70 6f 72 74]
	start	0	8
	end	7	13
	positionLength	1	1
	type	<ALPHANUM>	<ALPHANUM>
	position	1	2
SF	text	running	sport
	raw_bytes	[72 75 6e 6e 69 6e 67]	[73 70 6f 72 74]
	start	0	8
	end	7	13
	positionLength	1	1
	type	<ALPHANUM>	<ALPHANUM>
	position	1	2
SF	text	running	sport
	raw_bytes	[72 75 6e 6e 69 6e 67]	[73 70 6f 72 74]
	start	0	8
	end	7	13
	positionLength	1	1
	type	<ALPHANUM>	<ALPHANUM>
	position	1	2

In example screenshot above, several transformations are applied to the input "Running is a sport." The words "is" and "a" have been removed and the word "running" has been changed to its basic form, "run". This is because we are using the field type `text_en` in this scenario, which is configured to remove stop words (small words that usually do not provide a great deal of context) and "stem" terms when possible to find more possible matches (this is particularly helpful with plural forms of words). If you click the question mark next to the **Analyze Fieldname/Field Type** pull-down menu, the Schema Browser window will open, showing you the settings for the field specified.

The section Understanding Analyzers, Tokenizers, and Filters describes in detail what each option is and how it may transform your data and the section Running Your Analyzer has specific examples for using the Analysis screen.

Dataimport Screen

The Dataimport screen shows the configuration of the DataImportHandler (DIH) and allows you start, and monitor the status of, import commands as defined by the options selected on the screen and defined in the configuration file.



Command: full-import

□ Verbose
☑ Clean
☑ Commit
□ Optimize
□ Debug

Entity:

Start, Rows: 0 10

Custom Parameters: key1=val1&key2=val2

□ Auto-Refresh Status

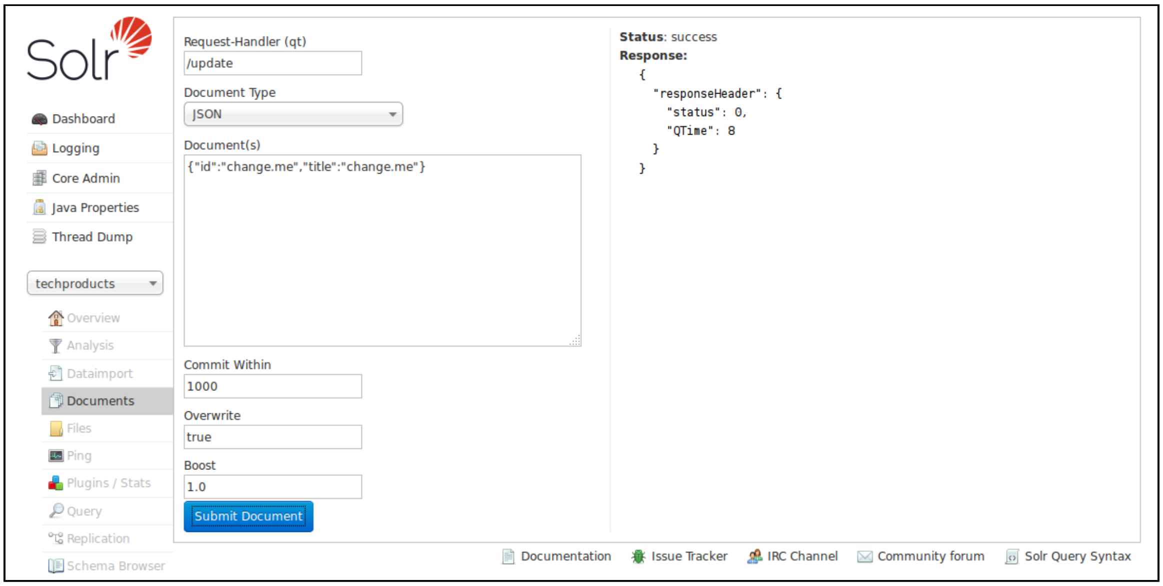
Last Update: 16:40:17
Indexing ...
Requests: 1, Fetched: 3, Skipped: 0, Processed: 2
Started: less than a minute ago

```
{
  "responseHeader": {
    "status": 0,
    "QTime": 0
  },
  "initArgs": [
    "defaults",
    [
      "config",
      "rss-data-config.xml"
    ]
  ],
  "command": "status",
  "status": "busy",
  "importResponse": "A command is still running...",
  "statusMessages": {
    "Time Elapsed": "0:0:0.356",
    "Total Requests made to DataSource": "1",
    "Total Rows Fetched": "3",
    "Total Documents Processed": "2",
    "Total Documents Skipped": "0",
    "Full Dump Started": "2015-01-09 23:40:17"
  }
}
```

This screen also lets you adjust various options to control how the data is imported to Solr, and view the data import configuration file that controls the import. For more information about data importing with DIH, see the section on Uploading Structured Data Store Data with the Data Import Handler.

Documents Screen

The Documents screen provides a simple form allowing you to execute various Solr indexing commands in a variety of formats directly from the browser.



Request-Handler (qt): /update

Document Type: JSON

Document(s): {"id":"change.me","title":"change.me"}

Commit Within: 1000

Overwrite: true

Boost: 1.0

Status: success
Response:

```
{
  "responseHeader": {
    "status": 0,
    "QTime": 8
  }
}
```

The screen allows you to:

- Copy documents in JSON, CSV or XML and submit them to the index
- Upload documents (in JSON, CSV or XML)
- Construct documents by selecting fields and field values

The first step is to define the RequestHandler to use (aka, 'qt'). By default `/update` will be defined. To use Solr Cell, for example, change the request handler to `/update/extract`.

Then choose the Document Type to define the type of document to load. The remaining parameters will change depending on the document type selected.

JSON

When using the JSON document type, the functionality is similar to using a requestHandler on the command line. Instead of putting the documents in a curl command, they can instead be input into the Document entry box. The document structure should still be in proper JSON format.

Then you can choose when documents should be added to the index (Commit Within), whether existing documents should be overwritten with incoming documents with the same id (if this is not **true**, then the incoming documents will be dropped), and, finally, if a document boost should be applied.

This option will only add or overwrite documents to the index; for other update tasks, see the Solr Command opti on.

CSV

When using the CSV document type, the functionality is similar to using a requestHandler on the command line. Instead of putting the documents in a curl command, they can instead be input into the Document entry box. The document structure should still be in proper CSV format, with columns delimited and one row per document.

Then you can choose when documents should be added to the index (Commit Within), and whether existing documents should be overwritten with incoming documents with the same id (if this is not **true**, then the incoming documents will be dropped).

Document Builder

The Document Builder provides a wizard-like interface to enter fields of a document

File Upload

The File Upload option allows choosing a prepared file and uploading it. If using only `/update` for the Request-Handler option, you will be limited to XML, CSV, and JSON.

However, to use the ExtractingRequestHandler (aka Solr Cell), you can modify the Request-Handler to `/update/extract`. You must have this defined in your `solrconfig.xml` file, with your desired defaults. You should also update the `&literal.id` shown in the Extracting Req. Handler Params so the file chosen is given a unique id.

Then you can choose when documents should be added to the index (Commit Within), and whether existing documents should be overwritten with incoming documents with the same id (if this is not **true**, then the incoming documents will be dropped).

Solr Command

The Solr Command option allows you use XML or JSON to perform specific actions on documents, such as defining documents to be added or deleted, updating only certain fields of documents, or commit and optimize commands on the index.

The documents should be structured as they would be if using `/update` on the command line.

XML

When using the XML document type, the functionality is similar to using a requestHandler on the command line. Instead of putting the documents in a curl command, they can instead be input into the Document entry box. The document structure should still be in proper Solr XML format, with each document separated by `<doc>` tags and each field defined.

Then you can choose when documents should be added to the index (Commit Within), and whether existing documents should be overwritten with incoming documents with the same id (if this is not **true**, then the incoming documents will be dropped).

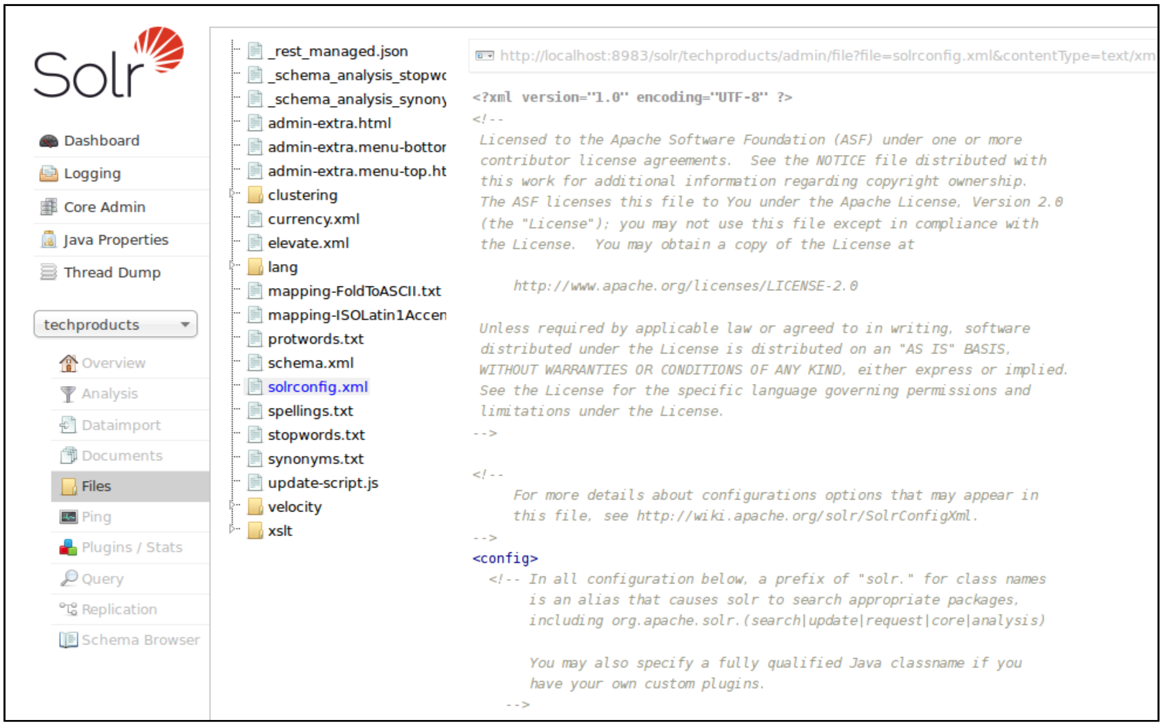
This option will only add or overwrite documents to the index; for other update tasks, see the Solr Command option.

Related Topics

- Uploading Data with Index Handlers
- Uploading Data with Solr Cell using Apache Tika

Files Screen

The Files screen lets you browse & view the various configuration files (such `solrconfig.xml` and `schema.xml`) for the core you selected.



http://localhost:8983/solr/techproducts/admin/file?file=solrconfig.xml&contentType=text/xm

```
<?xml version="1.0" encoding="UTF-8" ?>
<!--
 Licensed to the Apache Software Foundation (ASF) under one or more
 contributor license agreements.  See the NOTICE file distributed with
 this work for additional information regarding copyright ownership.
 The ASF licenses this file to You under the Apache License, Version 2.0
 (the "License"); you may not use this file except in compliance with
 the License.  You may obtain a copy of the License at

     http://www.apache.org/licenses/LICENSE-2.0

 Unless required by applicable law or agreed to in writing, software
 distributed under the License is distributed on an "AS IS" BASIS,
 WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 See the License for the specific language governing permissions and
 limitations under the License.
-->

<!--
     For more details about configurations options that may appear in
     this file, see http://wiki.apache.org/solr/SolrConfigXml.
-->
<config>
  <!-- In all configuration below, a prefix of "solr." for class names
       is an alias that causes solr to search appropriate packages,
       including org.apache.solr.(search|update|request|core|analysis)

       You may also specify a fully qualified Java classname if you
       have your own custom plugins.
    -->
```

While the `solrconfig.xml` defines the behaviour of Solr as it indexes content and responds to queries, the `schema.xml` allows you to define the types of data in your content (field types), the fields your documents will be broken into, and any dynamic fields that should be generated based on patterns of field names in the incoming documents. Any other configuration files are used depending on how they are referenced in either `solrconfig.xml` or `schema.xml`.

Configuration files cannot be edited with this screen, so a text editor of some kind must be used.

This screen is related to the Schema Browser Screen, in that they both can display information from the schema, but the Schema Browser provides a way to drill into the analysis chain and displays linkages between field types, fields, and dynamic field rules.

Many of the options defined in `solrconfig.xml` and `schema.xml` are described throughout the rest of this Guide. In particular, you will want to review these sections:

- Indexing and Basic Data Operations
- Searching
- The Well-Configured Solr Instance
- Documents, Fields, and Schema Design

Ping

Choosing Ping under a core name issues a `ping` request to check whether a server is up.

Ping is configured using a `requestHandler` in the `solrconfig.xml` file:

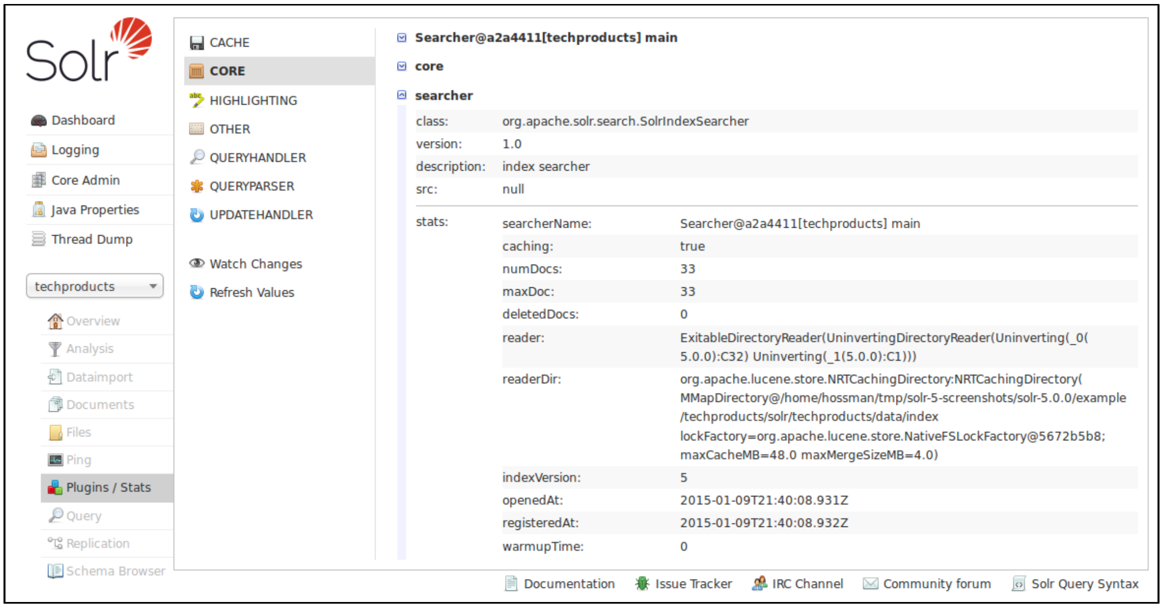
```
<!-- ping/healthcheck -->
  <requestHandler name="/admin/ping" class="solr.PingRequestHandler">
    <lst name="invariants">
      <str name="q">solrpingquery</str>
    </lst>
    <lst name="defaults">
      <str name="echoParams">all</str>
    </lst>
    <!-- An optional feature of the PingRequestHandler is to configure the
         handler with a "healthcheckFile" which can be used to enable/disable
         the PingRequestHandler.
         relative paths are resolved against the data dir
      -->
    <!-- <str name="healthcheckFile">server-enabled.txt</str> -->
  </requestHandler>
```

The Ping option doesn't open a page, but the status of the request can be seen on the core overview page shown when clicking on a collection name. The length of time the request has taken is displayed next to the Ping option, in milliseconds.

Plugins & Stats Screen

The Plugins screen shows information and statistics about Solr's status and performance. You can find information about the performance of Solr's caches, the state of Solr's searchers, and the configuration of searchHandlers and requestHandlers.

Choose an area of interest on the right, and then drill down into more specifics by clicking on one of the names that appear in the central part of the window. In this example, we've chosen to look at the Searcher stats, from the Core area:



Searcher@a2a4411[techproducts] main

core

searcher

class:	org.apache.solr.search.SolrIndexSearcher
version:	1.0
description:	index searcher
src:	null

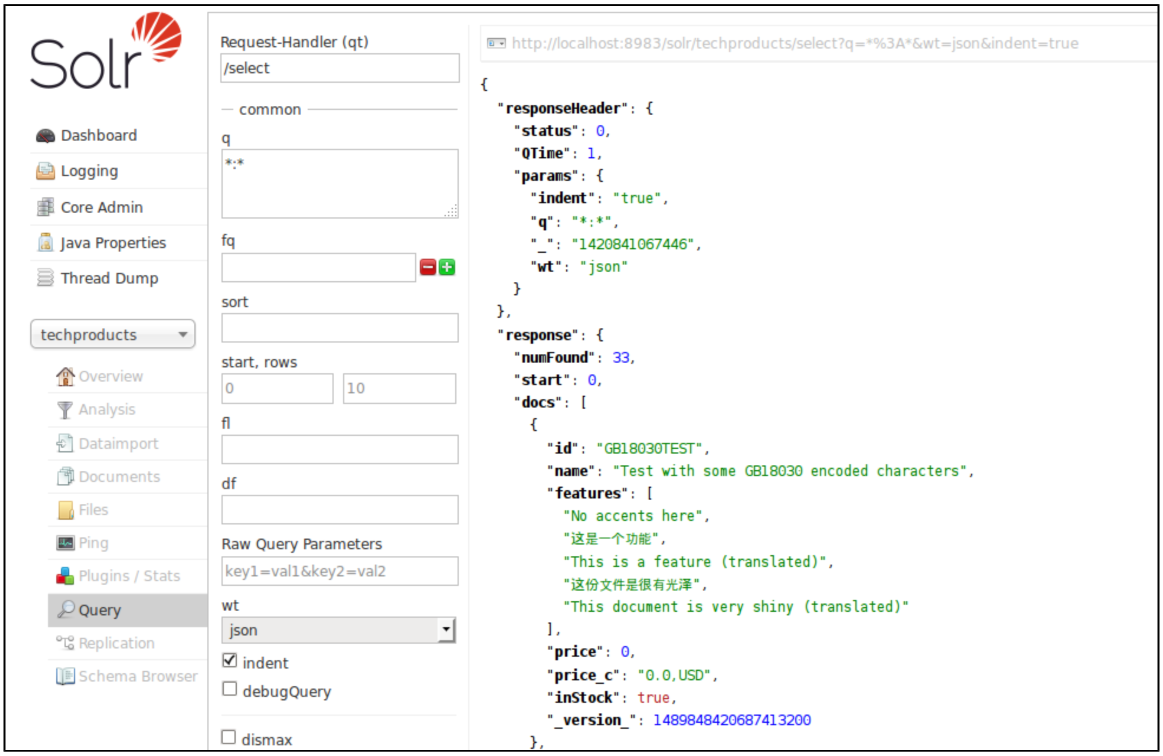
stats:		
	searcherName:	Searcher@a2a4411[techproducts] main
	caching:	true
	numDocs:	33
	maxDoc:	33
	deletedDocs:	0
	reader:	ExitableDirectoryReader(UninvertingDirectoryReader(Uninverting(_0(5.0.0):C32) Uninverting(_1(5.0.0):C1)))
	readerDir:	org.apache.lucene.store.NRTCachingDirectory:NRTCachingDirectory(MMapDirectory@/home/hossman/tmp/solr-5-screenshots/solr-5.0.0/example /techproducts/solr/techproducts/data/index lockFactory=org.apache.lucene.store.NativeFSLockFactory@5672b5b8; maxCacheMB=48.0 maxMergeSizeMB=4.0)
	indexVersion:	5
	openedAt:	2015-01-09T21:40:08.931Z
	registeredAt:	2015-01-09T21:40:08.932Z
	warmupTime:	0

Searcher Statistics

The display is a snapshot taken when the page is loaded. You can get updated status by choosing to either **Watch Changes** or **Refresh Values**. Watching the changes will highlight those areas that have changed, while refreshing the values will reload the page with updated information.

Query Screen

You can use **Query**, shown under the name of each core, to submit a search query to a Solr server and analyze the results. In the example in the screenshot, a query has been submitted, and the screen shows the query results sent to the browser as JSON.



Request-Handler (qt): /select

q: *:*

fq:

sort:

start, rows: 0 10

fl:

df:

Raw Query Parameters: key1=val1&key2=val2

wt: json

☑ indent

□ debugQuery

□ dismax

http://localhost:8983/solr/techproducts/select?q=*%3A*&wt=json&indent=true

```
{
  "responseHeader": {
    "status": 0,
    "QTime": 1,
    "params": {
      "indent": "true",
      "q": "*:*",
      "_": "1420841067446",
      "wt": "json"
    }
  },
  "response": {
    "numFound": 33,
    "start": 0,
    "docs": [
      {
        "id": "GB18030TEST",
        "name": "Test with some GB18030 encoded characters",
        "features": [
          "No accents here",
          "这是一个功能",
          "This is a feature (translated)",
          "这份文件是很有光泽",
          "This document is very shiny (translated)"
        ],
        "price": 0,
        "price_c": "0.0,USD",
        "inStock": true,
        "_version_": 1489848420687413200
      },
```

The query was sent to a core named "techproducts". We used Solr's default query for this screen (as defined in s olrconfig.xml), which is `*:*`. This query will find all records in the index for this core. We kept the other defaults, but the table below explains these options, which are also covered in detail in later parts of this Guide.

The response is shown to the right of the form. Requests to Solr are simply HTTP requests, and the query submitted is shown in light type above the results; if you click on this it will open a new browser window with just this request and response (without the rest of the Solr Admin UI). The rest of the response is shown in JSON, which is part of the request (see the `wt=json` part at the end).

The response has at least two sections, but may have several more depending on the options chosen. The two sections it always has are the `responseHeader` and the `response`. The `responseHeader` includes the status of the search (`status`), the processing time (`QTime`), and the parameters (`params`) that were used to process the query.

The `response` includes the documents that matched the query, in `doc` sub-sections. The fields return depend on the parameters of the query (and the defaults of the request handler used). The number of results is also included in this section.

This screen allows you to experiment with different query options, and inspect how your documents were indexed. The query parameters available on the form are some basic options that most users want to have available, but there are dozens more available which could be simply added to the basic request by hand (if opened in a browser). The table below explains the parameters available:

Field	Description
Request-handler (qt)	Specifies the query handler for the request. If a query handler is not specified, Solr processes the response with the standard query handler.
q	The query event. See Searching for an explanation of this parameter.
fq	The filter queries. See Common Query Parameters for more information on this parameter.
sort	Sorts the response to a query in either ascending or descending order based on the response's score or another specified characteristic.
start, rows	`start` is the offset into the query result starting at which documents should be returned. The default value is 0, meaning that the query should return results starting with the first document that matches. This field accepts the same syntax as the start query parameter, which is described in Searching. `rows` is the number of rows to return.
fl	Defines the fields to return for each document. You can explicitly list the stored fields, functions, and doc transformers you want to have returned by separating them with either a comma or a space.
wt	Specifies the Response Writer to be used to format the query response. Defaults to XML if not specified.
indent	Click this button to request that the Response Writer use indentation to make the responses more readable.
debugQuery	Click this button to augment the query response with debugging information, including "explain info" for each document returned. This debugging information is intended to be intelligible to the administrator or programmer.

dismax	Click this button to enable the Dismax query parser. See The DisMax Query Parser for further information.
edismax	Click this button to enable the Extended query parser. See The Extended DisMax Query Parser for further information.
hl	Click this button to enable highlighting in the query response. See Highlighting for more information.
facet	Enables faceting, the arrangement of search results into categories based on indexed terms. See Faceting for more information.
spatial	Click to enable using location data for use in spatial or geospatial searches. See Spatial Search for more information.
spellcheck	Click this button to enable the Spellchecker, which provides inline query suggestions based on other, similar, terms. See Spell Checking for more information.

Related Topics

- Searching

Replication Screen

The Replication screen shows you the current replication state for the named core you have specified. SolrCloud has supplanted much of this functionality, but if you are still using Master-Slave index replication, you can use this screen to:

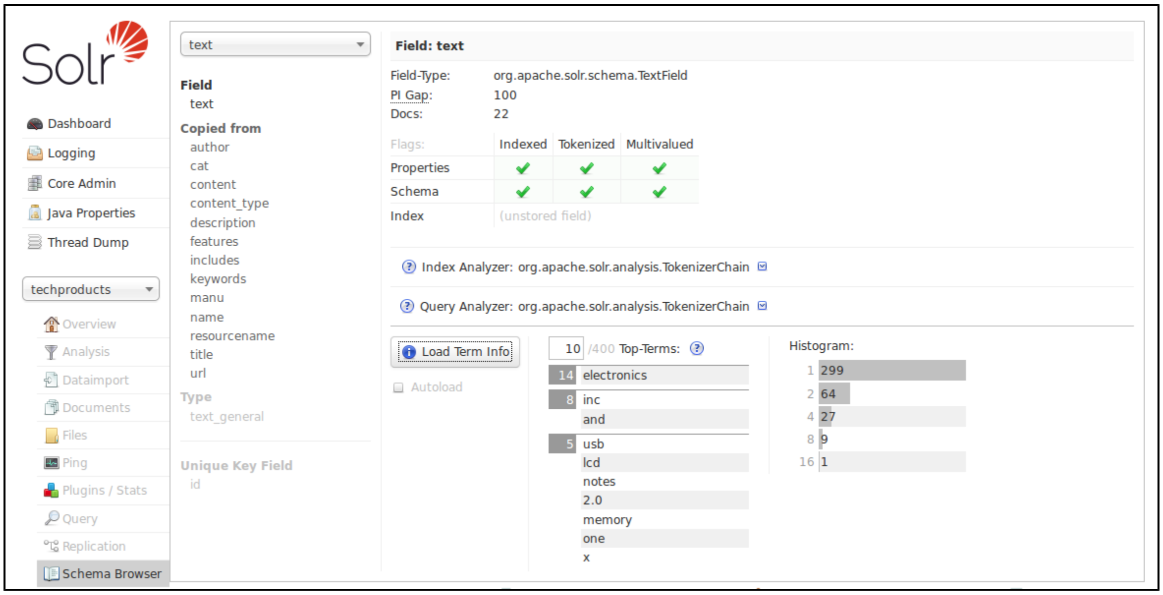
1. View the replicatable index state. (on a master node)
2. View the current replication status (on a slave node)
3. Disable replication. (on a master node)

> ⚠ **Caution When Using SolrCloud**
> When using SolrCloud, do not attempt to disable replication via this screen.

More details on how to configure replication is available in the section called Index Replication.

Schema Browser Screen

The Schema Browser screen lets you see schema data in a browser window. If you have accessed this window from the Analysis screen, it will be opened to a specific field, dynamic field rule or field type. If there is nothing chosen, use the pull-down menu to choose the field or field type.



Field
text

Copied from
author
cat
content
content_type
description
features
includes
keywords
manu
name
resourcename
title
url

Type
text_general

Unique Key Field
id

Field: text

Field-Type: org.apache.solr.schema.TextField
PI Gap: 100
Docs: 22

Flags:	Indexed	Tokenized	Multivalued
Properties	✓	✓	✓
Schema	✓	✓	✓
Index	(unstored field)		

Index Analyzer: org.apache.solr.analysis.TokenizerChain

Query Analyzer: org.apache.solr.analysis.TokenizerChain

Load Term Info

□ Autoload

10 /400 Top-Terms:

14	electronics
8	inc
	and
5	usb
	lcd
	notes
	2.0
	memory
	one
	x

Histogram:

1	299
2	64
4	27
8	9
16	1

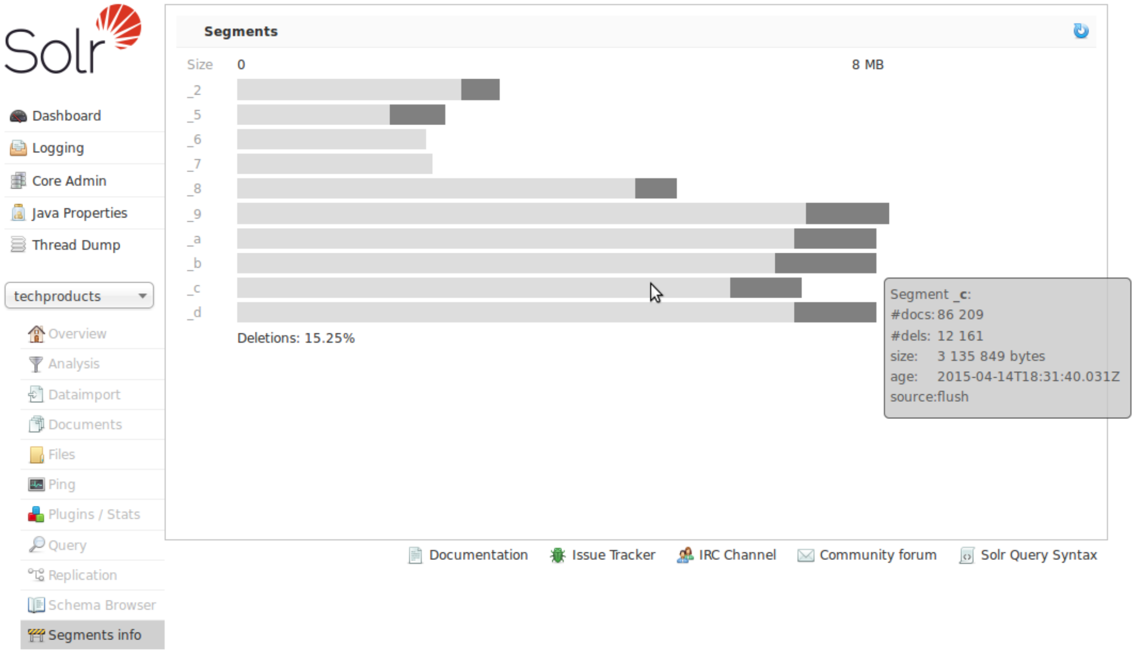
The screen provides a great deal of useful information about each particular field. In the example above, we have chosen the `text` field. On the right side of the center window, we see the field name, and a list of fields that populate this field because they are defined to be copied to the `text` field. Click on one of those field names, and you can see the definitions for that field. We can also see the field type, which would allow us to inspect the type definitions as well.

In the left part of the center window, we see the field type again, and the defined properties for the field. We can also see how many documents have populated this field. Then we see the analyzer used for indexing and query processing. Click the icon to the left of either of those, and you'll see the definitions for the tokenizers and/or filters that are used. The output of these processes is the information you see when testing how content is handled for a particular field with the Analysis Screen.

Under the analyzer information is a button to **Load Term Info**. Clicking that button will show the top *N* terms that are in the index for that field. Click on a term, and you will be taken to the Query Screen to see the results of a query of that term in that field. If you want to always see the term information for a field, choose **Autoload** and it will always appear when there are terms for a field. A histogram shows the number of terms with a given frequency in the field.

Segments Info

The Segments Info screen lets you see a visualization of the various segments in the underlying Lucene index, with information about the size of each segment – both bytes and in number of documents – as well as other basic metadata about those segments, notably the number of deleted documents.



Deletions: 15.25%

Segment _c:
#docs: 86 209
#dels: 12 161
size: 3 135 849 bytes
age: 2015-04-14T18:31:40.031Z
source:flush

This information may be useful for people to help make decisions about the optimal merge settings for their data.

Documents, Fields, and Schema Design

This section discusses how Solr organizes its data into documents and fields, as well as how to work with the Solr schema file, `schema.xml`. It includes the following topics:

Overview of Documents, Fields, and Schema Design: An introduction to the concepts covered in this section.

Solr Field Types: Detailed information about field types in Solr, including the field types in the default Solr schema.

Defining Fields: Describes how to define fields in Solr.

Copying Fields: Describes how to populate fields with data copied from another field.

Dynamic Fields: Information about using dynamic fields in order to catch and index fields that do not exactly conform to other field definitions in your schema.

Schema API: Use curl commands to read various parts of a schema or create new fields and copyField rules.

Other Schema Elements: Describes other important elements in the Solr schema.

Putting the Pieces Together: A higher-level view of the Solr schema and how its elements work together.

DocValues: Describes how to create a docValues index for faster lookups.

Schemaless Mode: Automatically add previously unknown schema fields using value-based field type guessing.

Overview of Documents, Fields, and Schema Design

The fundamental premise of Solr is simple. You give it a lot of information, then later you can ask it questions and find the piece of information you want. The part where you feed in all the information is called *indexing* or *up dating*. When you ask a question, it's called a *query*.

One way to understand how Solr works is to think of a loose-leaf book of recipes. Every time you add a recipe to the book, you update the index at the back. You list each ingredient and the page number of the recipe you just added. Suppose you add one hundred recipes. Using the index, you can very quickly find all the recipes that use garbanzo beans, or artichokes, or coffee, as an ingredient. Using the index is much faster than looking through each recipe one by one. Imagine a book of one thousand recipes, or one million.

Solr allows you to build an index with many different fields, or types of entries. The example above shows how to build an index with just one field, `ingredients`. You could have other fields in the index for the recipe's cooking style, like `Asian`, `Cajun`, or `vegan`, and you could have an index field for preparation times. Solr can answer questions like "What Cajun-style recipes that have blood oranges as an ingredient can be prepared in fewer than 30 minutes?"

The schema is the place where you tell Solr how it should build indexes from input documents.

How Solr Sees the World

Solr's basic unit of information is a *document*, which is a set of data that describes something. A recipe document would contain the ingredients, the instructions, the preparation time, the cooking time, the tools needed, and so on. A document about a person, for example, might contain the person's name, biography, favorite color, and shoe size. A document about a book could contain the title, author, year of publication, number of pages, and so on.

In the Solr universe, documents are composed of *fields*, which are more specific pieces of information. Shoe size could be a field. First name and last name could be fields.

Fields can contain different kinds of data. A name field, for example, is text (character data). A shoe size field might be a floating point number so that it could contain values like 6 and 9.5. Obviously, the definition of fields is flexible (you could define a shoe size field as a text field rather than a floating point number, for example), but if you define your fields correctly, Solr will be able to interpret them correctly and your users will get better results when they perform a query.

You can tell Solr about the kind of data a field contains by specifying its *field type*. The field type tells Solr how to interpret the field and how it can be queried.

When you add a document, Solr takes the information in the document's fields and adds that information to an index. When you perform a query, Solr can quickly consult the index and return the matching documents.

Field Analysis

Field analysis tells Solr what to do with incoming data when building an index. A more accurate name for this process would be *processing* or even *digestion*, but the official name is *analysis*.

Consider, for example, a biography field in a person document. Every word of the biography must be indexed so that you can quickly find people whose lives have had anything to do with ketchup, or dragonflies, or cryptography.

However, a biography will likely contains lots of words you don't care about and don't want clogging up your index—words like "the", "a", "to", and so forth. Furthermore, suppose the biography contains the word "Ketchup", capitalized at the beginning of a sentence. If a user makes a query for "ketchup", you want Solr to tell you about the person even though the biography contains the capitalized word.

The solution to both these problems is field analysis. For the biography field, you can tell Solr how to break apart the biography into words. You can tell Solr that you want to make all the words lower case, and you can tell Solr to remove accents marks.

Field analysis is an important part of a field type. Understanding Analyzers, Tokenizers, and Filters is a detailed description of field analysis.

Solr Field Types

The field type defines how Solr should interpret data in a field and how the field can be queried. There are many field types included with Solr by default, and they can also be defined locally.

Topics covered in this section:

- Field Type Definitions and Properties
- Field Types Included with Solr
- Working with Currencies and Exchange Rates
- Working with Dates
- Working with Enum Fields
- Working with External Files and Processes
- Field Properties by Use Case

Related Topics

- SchemaXML-DataTypes
- FieldType Javadoc

Field Type Definitions and Properties

A field type definition can include four types of information:

- The name of the field type (mandatory)
- An implementation class name (mandatory)
- If the field type is `TextField`, a description of the field analysis for the field type
- Field type properties - depending on the implementation class, some properties may be mandatory.

Field Type Definitions in `schema.xml`

Field types are defined in `schema.xml`. Each field type is defined between `fieldType` elements. They can optionally be grouped within a `types` element. Here is an example of a field type definition for a type called `text_general`:

```
<fieldType name="text_general" class="solr.TextField" positionIncrementGap="100">
  <analyzer type="index">
    <tokenizer class="solr.StandardTokenizerFactory"/>
    <filter class="solr.StopFilterFactory" ignoreCase="true" words="stopwords.txt"
/>
    <!-- in this example, we will only use synonyms at query time
    <filter class="solr.SynonymFilterFactory" synonyms="index_synonyms.txt"
ignoreCase="true" expand="false"/>
    -->
    <filter class="solr.LowerCaseFilterFactory"/>
  </analyzer>
  <analyzer type="query">
    <tokenizer class="solr.StandardTokenizerFactory"/>
    <filter class="solr.StopFilterFactory" ignoreCase="true" words="stopwords.txt"
/>
    <filter class="solr.SynonymFilterFactory" synonyms="synonyms.txt"
ignoreCase="true" expand="true"/>
    <filter class="solr.LowerCaseFilterFactory"/>
  </analyzer>
</fieldType>
```

The first line in the example above contains the field type name, `text_general`, and the name of the implementing class, `solr.TextField`. The rest of the definition is about field analysis, described in Understanding Analyzers, Tokenizers, and Filters.

The implementing class is responsible for making sure the field is handled correctly. In the class names in `schema.xml`, the string `solr` is shorthand for `org.apache.solr.schema` or `org.apache.solr.analysis`. Therefore, `solr.TextField` is really `org.apache.solr.schema.TextField.`.

Field Type Properties

The field type `class` determines most of the behavior of a field type, but optional properties can also be defined. For example, the following definition of a date field type defines two properties, `sortMissingLast` and `omitNo` `rms`.

```
<fieldType name="date" class="solr.TrieDateField"
           sortMissingLast="true" omitNorms="true"/>
```

The properties that can be specified for a given field type fall into three major categories:

- Properties specific to the field type's class.
- General Properties Solr supports for any field type.
- Field Default Properties that can be specified on the field type that will be inherited by fields that use this type instead of the default behavior.

General Properties

Property	Description	Values
name	The name of the fieldType. This value gets used in field definitions, in the "type" attribute. It is strongly recommended that names consist of alphanumeric or underscore characters only and not start with a digit. This is not currently strictly enforced.	
class	The class name that gets used to store and index the data for this type. Note that you may prefix included class names with "solr." and Solr will automatically figure out which packages to search for the class - so "solr.TextField" will work. If you are using a third-party class, you will probably need to have a fully qualified class name. The fully qualified equivalent for "solr.TextField" is "org.apache.solr.schema.TextField".	
positionIncrementGap	For multivalued fields, specifies a distance between multiple values, which prevents spurious phrase matches	integer
autoGeneratePhraseQueries	For text fields. If true, Solr automatically generates phrase queries for adjacent terms. If false, terms must be enclosed in double-quotes to be treated as phrases.	true or false
docValuesFormat	Defines a custom `DocValuesFormat` to use for fields of this type. This requires that a schema-aware codec, such as the `SchemaCodecFactory` has been configured in solrconfig.xml.	n/a
postingsFormat	Defines a custom `PostingsFormat` to use for fields of this type. This requires that a schema-aware codec, such as the `SchemaCodecFactory` has been configured in solrconfig.xml.	n/a

Lucene index back-compatibility is only supported for the default codec. If you choose to customize the `postingsFormat` or `docValuesFormat` in your schema.xml, upgrading to a future version of Solr may require you to either switch back to the default codec and optimize your index to rewrite it into the default codec before upgrading, or re-build your entire index from scratch after upgrading.

Field Default Properties

Property	Description	Values
indexed	If true, the value of the field can be used in queries to retrieve matching documents	true or false
stored	If true, the actual value of the field can be retrieved by queries	true or false
docValues	If true, the value of the field will be put in a column-oriented DocValues structure	true or false
sortMissingFirst sortMissingLast	Control the placement of documents when a sort field is not present. As of Solr 3.5, these work for all numeric fields, including Trie and date fields.	true or false
multiValued	If true, indicates that a single document might contain multiple values for this field type	true or false
omitNorms	If true, omits the norms associated with this field (this disables length normalization and index-time boosting for the field, and saves some memory). Defaults to true for all primitive (non-analyzed) field types, such as int, float, data, bool, and string. Only full-text fields or fields that need an index-time boost need norms.	true or false
omitTermFreqAndPositions	If true, omits term frequency, positions, and payloads from postings for this field. This can be a performance boost for fields that don't require that information. It also reduces the storage space required for the index. Queries that rely on position that are issued on a field with this option will silently fail to find documents. This property defaults to true for all fields that are not text fields.	true or false
omitPositions	Similar to `omitTermFreqAndPositions` but preserves term frequency information	true or false
termVectors termPositions termOffsets termPayloads	These options instruct Solr to maintain full term vectors for each document, optionally including position, offset and payload information for each term occurrence in those vectors. These can be used to accelerate highlighting and other ancillary functionality, but impose a substantial cost in terms of index size. They are not necessary for typical uses of Solr.	true or false
required	Instructs Solr to reject any attempts to add a document which does not have a value for this field. This property defaults to false.	true or false

Field Types Included with Solr

The following table lists the field types that are available in Solr. The `org.apache.solr.schema` package includes all the classes listed in this table.

Class	Description
BinaryField	Binary data.

BoolField	Contains either true or false. Values of "1", "t", or "T" in the first character are interpreted as true. Any other values in the first character are interpreted as false.
CollationField	Supports Unicode collation for sorting and range queries. ICUCollationField is a better choice if you can use ICU4J. See the section Unicode Collation.
CurrencyField	Supports currencies and exchange rates. See the section Working with Currencies and Exchange Rates.
DateRangeField	Supports indexing date ranges, to include point in time date instances as well (single-millisecond durations). See the section Working with Dates. Consider using this even if it's just for date instances, particularly when the queries typically fall on UTC year/month/day/hour etc. boundaries.
ExternalFileField	Pulls values from a file on disk. See the section Working with External Files and Processes.
EnumField	Allows defining an enumerated set of values which may not be easily sorted by either alphabetic or numeric order (such as a list of severities, for example). This field type takes a configuration file, which lists the proper order of the field values. See the section Working with Enum Fields for more information.
ICUCollationField	Supports Unicode collation for sorting and range queries. See the section Unicode Collation.
LatLonType	Spatial Search: a latitude/longitude coordinate pair. The latitude is specified first in the pair.
PointType	Spatial Search: An arbitrary n-dimensional point, useful for searching sources such as blueprints or CAD drawings.
PreAnalyzedField	Provides a way to send to Solr serialized token streams, optionally with independent stored values of a field, and have this information stored and indexed without any additional text processing. Useful if you want to submit field content that was already processed by some existing external text processing pipeline (e.g. tokenized, annotated, stemmed, inserted synonyms, etc.), while using all the rich attributes that Lucene's `TokenStream` provides via token attributes.
RandomSortField	Does not contain a value. Queries that sort on this field type will return results in random order. Use a dynamic field to use this feature.
SpatialRecursivePrefixTreeFieldType	(RPT for short) Spatial Search: Accepts latitude comma longitude strings or other shapes in WKT format.
StrField	String (UTF-8 encoded string or Unicode).
TextField	Text, usually multiple words or tokens.

TrieDateField	Date field. Represents a point in time with millisecond precision. See the section Working with Dates. `precisionStep="0"` enables efficient date sorting and minimizes index size; `precisionStep="8"` (the default) enables efficient range queries.
TrieDoubleField	Double field (64-bit IEEE floating point). `precisionStep="0"` enables efficient numeric sorting and minimizes index size; `precisionStep="8"` (the default) enables efficient range queries.
TrieField	If this field type is used, a "type" attribute must also be specified, valid values are: `integer`, `long`, `float`, `double`, `date`. Using this field is the same as using any of the Trie fields. `precisionStep="0"` enables efficient numeric sorting and minimizes index size; `precisionStep="8"` (the default) enables efficient range queries.
TrieFloatField	Floating point field (32-bit IEEE floating point). `precisionStep="0"` enables efficient numeric sorting and minimizes index size; `precisionStep="8"` (the default) enables efficient range queries.
TrieIntField	Integer field (32-bit signed integer). `precisionStep="0"` enables efficient numeric sorting and minimizes index size; `precisionStep="8"` (the default) enables efficient range queries.
TrieLongField	Long field (64-bit signed integer). `precisionStep="0"` enables efficient numeric sorting and minimizes index size; `precisionStep="8"` (the default) enables efficient range queries.
UUIDField	Universally Unique Identifier (UUID). Pass in a value of "NEW" and Solr will create a new UUID. **Note**: configuring a UUIDField instance with a default value of "NEW" is not advisable for most users when using SolrCloud (and not possible if the UUID value is configured as the unique key field) since the result will be that each replica of each document will get a unique UUID value. Using UUIDUpdateProcessorFactory to generate UUID values when documents are added is recommended instead.

The `MultiTermAwareComponent` has been added to relevant `solr.TextField` entries in `schema.xml` (e.g. , wildcards, regex, prefix, range, etc.) to allow automatic lowercasing for multi-term queries.

Further, you can optionally specify a multi-term analyzer in field types in your schema: `<analyzer type="multiterm">`; if you don't do this, `analyzer` will process the fields according to their specific attributes.

Working with Currencies and Exchange Rates

The `currency` FieldType provides support for monetary values to Solr/Lucene with query-time currency conversion and exchange rates. The following features are supported:

- Point queries
- Range queries
- Function range queries

- Sorting
- Currency parsing by either currency code or symbol
- Symmetric & asymmetric exchange rates (asymmetric exchange rates are useful if there are fees associated with exchanging the currency)

Configuring Currencies

The `currency` field type is defined in `schema.xml`. This is the default configuration of this type:

```
<fieldType name="currency" class="solr.CurrencyField" precisionStep="8"
           defaultCurrency="USD" currencyConfig="currency.xml" />
```

In this example, we have defined the name and class of the field type, and defined the `defaultCurrency` as "USD", for U.S. Dollars. We have also defined a `currencyConfig` to use a file called "currency.xml". This is a file of exchange rates between our default currency to other currencies. There is an alternate implementation that would allow regular downloading of currency data. See Exchange Rates below for more.

At indexing time, money fields can be indexed in a native currency. For example, if a product on an e-commerce site is listed in Euros, indexing the price field as "1000,EUR" will index it appropriately. The price should be separated from the currency by a comma, and the price must be encoded with a floating point value (a decimal point).

During query processing, range and point queries are both supported.

Exchange Rates

You configure exchange rates by specifying a provider. Natively, two provider types are supported: `FileExchangeRateProvider` or `OpenExchangeRatesOrgProvider`.

FileExchangeRateProvider

This provider requires you to provide a file of exchange rates. It is the default, meaning that to use this provider you only need to specify the file path and name as a value for `currencyConfig` in the definition for this type.

There is a sample `currency.xml` file included with Solr, found in the same directory as the `schema.xml` file. Here is a small snippet from this file:

```
<currencyConfig version="1.0">
  <rates>
    <!-- Updated from http://www.exchangerate.com/ at 2011-09-27 -->
    <rate from="USD" to="ARS" rate="4.333871" comment="ARGENTINA Peso" />
    <rate from="USD" to="AUD" rate="1.025768" comment="AUSTRALIA Dollar" />
    <rate from="USD" to="EUR" rate="0.743676" comment="European Euro" />
    <rate from="USD" to="CAD" rate="1.030815" comment="CANADA Dollar" />

    <!-- Cross-rates for some common currencies -->
    <rate from="EUR" to="GBP" rate="0.869914" />
    <rate from="EUR" to="NOK" rate="7.800095" />
    <rate from="GBP" to="NOK" rate="8.966508" />

    <!-- Asymmetrical rates -->
    <rate from="EUR" to="USD" rate="0.5" />
  </rates>
</currencyConfig>
```

OpenExchangeRatesOrgProvider

You can configure Solr to download exchange rates from OpenExchangeRates.Org, with updates rates between USD and 158 currencies hourly. These rates are symmetrical only.

In this case, you need to specify the `providerClass` in the definitions for the field type. Here is an example:

```
<fieldType name="currency" class="solr.CurrencyField" precisionStep="8"
           providerClass="solr.OpenExchangeRatesOrgProvider"
           refreshInterval="60"

ratesFileLocation="http://www.openexchangerates.org/api/latest.json?app_id=yourPerso
nalAppIdKey"/>
```

The `refreshInterval` is minutes, so the above example will download the newest rates every 60 minutes.

Working with Dates

Date Formatting

Solr's `TrieDateField` (and deprecated `DateField`) represents a point in time with millisecond precision. The format used is a restricted form of the canonical representation of `dateTime` in the XML Schema specification:

`YYYY-MM-DDThh:mm:ssZ`

- YYYY is the year.
- `MM` is the month.
- `DD` is the day of the month.
- hh is the hour of the day as on a 24-hour clock.
- `mm` is minutes.
- `ss` is seconds.
- Z is a literal 'Z' character indicating that this string representation of the date is in UTC

Note that no time zone can be specified; the String representations of dates is always expressed in Coordinated Universal Time (UTC). Here is an example value:

`1972-05-20T17:33:18Z`

You can optionally include fractional seconds if you wish, although any precision beyond milliseconds will be ignored. Here are examples value with sub-seconds include:

- `1972-05-20T17:33:18.772Z`
- `1972-05-20T17:33:18.77Z`
- `1972-05-20T17:33:18.7Z`

Date Range Formatting

Solr's `DateRangeField` supports the same point in time date syntax described above (with *date math* described below) and more to express date ranges. One class of examples is truncated dates, which represent the entire date span to the precision indicated. The other class uses the range syntax (`[ TO ]`). Here are some examples:

- `2000-11` – The entire month of November, 2000.
- `2000-11T13` – Likewise but for the 13th hour of the day (1pm-2pm).
- `-0009` – The year 10 BC. A 0 in the year position is 0 AD, and is also considered 1 BC.
- `[2000-11-01 TO 2014-12-01]` – The specified date range at a day resolution.
- `[2014 TO 2014-12-01]` – From the start of 2014 till the end of the first day of December.
- `[* TO 2014-12-01]` – From the earliest representable time thru till the end of 2014-12-01.

Limitations: The range syntax doesn't support embedded date math. If you specify a date instance supported by TrieDateField with date math truncating it, like `NOW/DAY`, you still get the first millisecond of that day, not the entire day's range. Exclusive ranges (using `{` & `}`) work in queries but not for indexing ranges.

Date Math

Solr's date field types also supports *date math* expressions, which makes it easy to create times relative to fixed moments in time, include the current time which can be represented using the special value of "`NOW`".

Date Math Syntax

Date math expressions consist either adding some quantity of time in a specified unit, or rounding the current time by a specified unit. expressions can be chained and are evaluated left to right.

For example: this represents a point in time two months from now:

`NOW+2MONTHS`

This is one day ago:

`NOW-1DAY`

A slash is used to indicate rounding. This represents the beginning of the current hour:

`NOW/HOUR`

The following example computes (with millisecond precision) the point in time six months and three days into the future and then rounds that time to the beginning of that day:

`NOW+6MONTHS+3DAYS/DAY`

Note that while date math is most commonly used relative to `NOW` it can be applied to any fixed moment in time as well:

`1972-05-20T17:33:18.772Z+6MONTHS+3DAYS/DAY`

Request Parameters That Affect Date Math

`NOW`

The `NOW` parameter is used internally by Solr to ensure consistent date math expression parsing across multiple nodes in a distributed request. But it can be specified to instruct Solr to use an arbitrary moment in time (past or future) to override for all situations where the the special value of "`NOW`" would impact date math expressions.

It must be specified as a (long valued) milliseconds since epoch

Example:

`q=solr&fq=start_date:[* TO NOW]&NOW=1384387200000`

`TZ`

By default, all date math expressions are evaluated relative to the UTC TimeZone, but the `TZ` parameter can be specified to override this behaviour, by forcing all date based addition and rounding to be relative to the specified time zone.

For example, the following request will use range faceting to facet over the current month, "per day" relative UTC:

```
http://localhost:8983/solr/my_collection/select?q=*:*&facet.range=my_date_field&face
t=true&facet.range.start=NOW/MONTH&facet.range.end=NOW/MONTH%2B1MONTH&facet.range.ga
p=%2B1DAY
```

```
<int name="2013-11-01T00:00:00Z">0</int>
<int name="2013-11-02T00:00:00Z">0</int>
<int name="2013-11-03T00:00:00Z">0</int>
<int name="2013-11-04T00:00:00Z">0</int>
<int name="2013-11-05T00:00:00Z">0</int>
<int name="2013-11-06T00:00:00Z">0</int>
<int name="2013-11-07T00:00:00Z">0</int>
...
```

While in this example, the "days" will be computed relative to the specified time zone - including any applicable Daylight Savings Time adjustments:

```
http://localhost:8983/solr/my_collection/select?q=*:*&facet.range=my_date_field&face
t=true&facet.range.start=NOW/MONTH&facet.range.end=NOW/MONTH%2B1MONTH&facet.range.ga
p=%2B1DAY&TZ=America/Los_Angeles
```

```
<int name="2013-11-01T07:00:00Z">0</int>
<int name="2013-11-02T07:00:00Z">0</int>
<int name="2013-11-03T07:00:00Z">0</int>
<int name="2013-11-04T08:00:00Z">0</int>
<int name="2013-11-05T08:00:00Z">0</int>
<int name="2013-11-06T08:00:00Z">0</int>
<int name="2013-11-07T08:00:00Z">0</int>
...
```

More DateRangeField Details

`DateRangeField` is almost a drop-in replacement for places where `TrieDateField` is used. The only difference is that Solr's XML or SolrJ response formats will expose the stored data as a String instead of a Date. The underlying index data for this field will be a bit larger. Queries that align to units of time a second on up should be faster than TrieDateField, especially if it's in UTC. But the main point of DateRangeField as it's name suggests is to allow indexing date ranges. To do that, simply supply strings in the format shown above. It also supports specifying 3 different relational predicates between the indexed data, and the query range: `Intersects` (default), `Contains`, `Within`. You can specify the predicate by querying using the `op` local-params parameter like so:

```
fq={!field f=dateRange op=Contains}[2013 TO 2018]
```

In that example, it would find documents with indexed ranges that *contain* (or equals) the range 2013 thru 2018. Multi-valued overlapping indexed ranges in a document are effectively coalesced.

Working with Enum Fields

The EnumField type allows defining a field whose values are a closed set, and the sort order is pre-determined but is not alphabetic nor numeric. Examples of this are severity lists, or risk definitions.

Defining an EnumField in `schema.xml`

The EnumField type definition is quite simple, as in this example defining field types for "priorityLevel" and "riskLevel" enumerations:

```
<fieldType name="priorityLevel" class="solr.EnumField" enumsConfig="enumsConfig.xml"
enumName="severity"/>
<fieldType name="riskLevel"     class="solr.EnumField" enumsConfig="enumsConfig.xml"
enumName="risk"    />
```

Besides the `name` and the `class`, which are common to all field types, this type also takes two additional parameters:

- `enumsConfig`: the name of a configuration file that contains the `<enum/>` list of field values and their order that you wish to use with this field type. If a path to the file is not defined specified, the file should be in the `conf` directory for the collection.
- `enumName`: the name of the specific enumeration in the `enumsConfig` file to use for this type.

Defining the EnumField configuration file

The file named with the `enumsConfig` parameter can contain multiple enumeration value lists with different names if there are multiple uses for enumerations in your Solr schema.

In this example, there are two value lists defined. Each list is between `enum` opening and closing tags:

```
<?xml version="1.0" ?>
<enumsConfig>
  <enum name="priority">
    <value>Not Available</value>
    <value>Low</value>
    <value>Medium</value>
    <value>High</value>
    <value>Urgent</value>
  </enum>
  <enum name="risk">
    <value>Unknown</value>
    <value>Very Low</value>
    <value>Low</value>
    <value>Medium</value>
    <value>High</value>
    <value>Critical</value>
  </enum>
</enumsConfig>
```

> **Changing Values**
> You cannot change the order, or remove, existing values in an `<enum/>` without reindexing.
>
> You can however add new values to the end.

Working with External Files and Processes

The `ExternalFileField` Type

The `ExternalFileField` type makes it possible to specify the values for a field in a file outside the Solr index. For such a field, the file contains mappings from a key field to the field value. Another way to think of this is that, instead of specifying the field in documents as they are indexed, Solr finds values for this field in the external file.

> External fields are not searchable. They can be used only for function queries or display. For more information on function queries, see the section on Function Queries.

The `ExternalFileField` type is handy for cases where you want to update a particular field in many documents more often than you want to update the rest of the documents. For example, suppose you have implemented a document rank based on the number of views. You might want to update the rank of all the documents daily or hourly, while the rest of the contents of the documents might be updated much less frequently. Without `ExternalFileField`, you would need to update each document just to change the rank. Using `ExternalFileField` is much more efficient because all document values for a particular field are stored in an external file that can be updated as frequently as you wish.

In `schema.xml`, the definition of this field type might look like this:

```
<fieldType name="entryRankFile" keyField="pkId" defVal="0" stored="false"
indexed="false" class="solr.ExternalFileField" valType="pfloat"/>
```

The `keyField` attribute defines the key that will be defined in the external file. It is usually the unique key for the index, but it doesn't need to be as long as the `keyField` can be used to identify documents in the index. A `defVal` defines a default value that will be used if there is no entry in the external file for a particular document.

The `valType` attribute specifies the actual type of values that will be found in the file. The type specified must be either a float field type, so valid values for this attribute are `pfloat`, `float` or `tfloat`. This attribute can be omitted.

Format of the External File

The file itself is located in Solr's index directory, which by default is `$SOLR_HOME/data`. The name of the file should be external_*fieldname* or external_*fieldname*.*. For the example above, then, the file could be named `external_entryRankFile` or `external_entryRankFile.txt`.

> If any files using the name pattern `.*` (such as `.txt`) appear, the last (after being sorted by name) will be used and previous versions will be deleted. This behavior supports implementations on systems where one may not be able to overwrite a file (for example, on Windows, if the file is in use).

The file contains entries that map a key field, on the left of the equals sign, to a value, on the right. Here are a few example entries:

```
doc33=1.414
doc34=3.14159
doc40=42
```

The keys listed in this file do not need to be unique. The file does not need to be sorted, but Solr will be able to perform the lookup faster if it is.

Reloading an External File

It's possible to define an event listener to reload an external file when either a searcher is reloaded or when a new searcher is started. See the section Query-Related Listeners for more information, but a sample definition in `solrconfig.xml` might look like this:

```
<listener event="newSearcher"
class="org.apache.solr.schema.ExternalFileFieldReloader"/>
<listener event="firstSearcher"
class="org.apache.solr.schema.ExternalFileFieldReloader"/>
```

Pre-Analyzing a Field Type

The `PreAnalyzedField` type provides a way to send to Solr serialized token streams, optionally with independent stored values of a field, and have this information stored and indexed without any additional text processing applied in Solr. This is useful if user wants to submit field content that was already processed by some existing external text processing pipeline (e.g., it has been tokenized, annotated, stemmed, synonyms inserted, etc.), while using all the rich attributes that Lucene's TokenStream provides (per-token attributes).

The serialization format is pluggable using implementations of PreAnalyzedParser interface. There are two out-of-the-box implementations:

- JsonPreAnalyzedParser: as the name suggests, it parses content that uses JSON to represent field's content. This is the default parser to use if the field type is not configured otherwise.
- SimplePreAnalyzedParser: uses a simple strict plain text format, which in some situations may be easier to create than JSON.

There is only one configuration parameter, `parserImpl`. The value of this parameter should be a fully qualified class name of a class that implements PreAnalyzedParser interface. The default value of this parameter is `org.apache.solr.schema.JsonPreAnalyzedParser`.

Field Properties by Use Case

Here is a summary of common use cases, and the attributes the fields or field types should have to support the case. An entry of true or false in the table indicates that the option must be set to the given value for the use case to function correctly. If no entry is provided, the setting of that attribute has no impact on the case.

Use Case	indexed	stored	multiValued	omitNorms	termVectors	termPositions	docValues
search within field	true						
retrieve contents		true					
use as unique key	true		false				
sort on field	true[7]		false	true [1]			true[7]
use field boosts [5]				false			
document boosts affect searches within field				false			
highlighting	true [4]	true			true[2]	true [3]	
faceting [5]	true[7]						true[7]
add multiple values, maintaining order			true				
field length affects doc score				false			
MoreLikeThis [5]					true [6]		

Notes:

[1] Recommended but not necessary.
[2] Will be used if present, but not necessary.
[3] (if termVectors=true)
[4] A tokenizer must be defined for the field, but it doesn't need to be indexed.
[5] Described in Understanding Analyzers, Tokenizers, and Filters.
[6] Term vectors are not mandatory here. If not true, then a stored field is analyzed. So term vectors are recommended, but only required if `stored=false`.
[7] Either `indexed` or `docValues` must be true, but both are not required. DocValues can be more efficient in many cases.

Defining Fields

Fields are defined in the fields element of `schema.xml`. Once you have the field types set up, defining the fields themselves is simple.

Example

The following example defines a field named `price` with a type named `float` and a default value of `0.0`; the `indexed` and `stored` properties are explicitly set to `true`, while any other properties specified on the `float` field type are inherited.

```
<field name="price" type="float" default="0.0" indexed="true" stored="true"/>
```

Field Properties

Property	Description
name	The name of the field. Field names should consist of alphanumeric or underscore characters only and not start with a digit. This is not currently strictly enforced, but other field names will not have first class support from all components and back compatibility is not guaranteed. Names with both leading and trailing underscores (e.g. `_version_`) are reserved. Every field must have a `name`.
type	The name of the `fieldType` for this field. This will be found in the "`name`" attribute on the `fieldType` definition. Every field must have a `type`.
default	A default value that will be added automatically to any document that does not have a value in this field when it is indexed. If this property is not specified, there is no default.

Optional Field Type Override Properties

Fields can have the same options as field types. The field type options serve as defaults which can be overridden by options defined per field. Included below is the table of field type properties from the section Field Type Definitions and Properties:

Property	Description	Values
indexed	If true, the value of the field can be used in queries to retrieve matching documents	true or false

stored	If true, the actual value of the field can be retrieved by queries	true or false
docValues	If true, the value of the field will be put in a column-oriented DocValues structure	true or false
sortMissingFirst sortMissingLast	Control the placement of documents when a sort field is not present. As of Solr 3.5, these work for all numeric fields, including Trie and date fields.	true or false
multiValued	If true, indicates that a single document might contain multiple values for this field type	true or false
omitNorms	If true, omits the norms associated with this field (this disables length normalization and index-time boosting for the field, and saves some memory). Defaults to true for all primitive (non-analyzed) field types, such as int, float, data, bool, and string. Only full-text fields or fields that need an index-time boost need norms.	true or false
omitTermFreqAndPositions	If true, omits term frequency, positions, and payloads from postings for this field. This can be a performance boost for fields that don't require that information. It also reduces the storage space required for the index. Queries that rely on position that are issued on a field with this option will silently fail to find documents. This property defaults to true for all fields that are not text fields.	true or false
omitPositions	Similar to `omitTermFreqAndPositions` but preserves term frequency information	true or false
termVectors termPositions termOffsets termPayloads	These options instruct Solr to maintain full term vectors for each document, optionally including position, offset and payload information for each term occurrence in those vectors. These can be used to accelerate highlighting and other ancillary functionality, but impose a substantial cost in terms of index size. They are not necessary for typical uses of Solr.	true or false
required	Instructs Solr to reject any attempts to add a document which does not have a value for this field. This property defaults to false.	true or false

Related Topics

- SchemaXML-Fields
- Field Options by Use Case

Copying Fields

You might want to interpret some document fields in more than one way. Solr has a mechanism for making copies of fields so that you can apply several distinct field types to a single piece of incoming information.

The name of the field you want to copy is the *source*, and the name of the copy is the *destination*. In `schema.xml`, it's very simple to make copies of fields:

```
<copyField source="cat" dest="text" maxChars="30000" />
```

If the `text` destination field has data of its own in the input documents, the contents of the `cat` field will be added as additional values – just as if all of the values had originally been specified by the client. Remember to configure your fields as `multivalued="true"` if they will ultimately get multiple values (either from a multivalued source, or multiple `copyField` directives, etc...)

The `maxChars` parameter, an `int` parameter, establishes an upper limit for the number of characters to be copied from the source value when constructing the value added to the destination field. This limit is useful for situations in which you want to copy some data from the source field, but also control the size of index files.

Both the source and the destination of `copyField` can contain either leading or trailing asterisks, which will match anything. For example, the following line will copy the contents of all incoming fields that match the wildcard pattern `*_t` to the text field.:

```
<copyField source="*_t" dest="text" maxChars="25000" />
```

> ⚠ The `copyField` command can use a wildcard (*) character in the `dest` parameter only if the `source` parameter contains one as well. `copyField` uses the matching glob from the source field for the `dest` field name into which the source content is copied.

Related Topics

- SchemaXML-Copy Fields

Dynamic Fields

Dynamic fields allow Solr to index fields that you did not explicitly define in your schema. This is useful if you discover you have forgotten to define one or more fields. Dynamic fields can make your application less brittle by providing some flexibility in the documents you can add to Solr.

A dynamic field is just like a regular field except it has a name with a wildcard in it. When you are indexing documents, a field that does not match any explicitly defined fields can be matched with a dynamic field.

For example, suppose your schema includes a dynamic field with a name of `*_i`. If you attempt to index a document with a `cost_i` field, but no explicit `cost_i` field is defined in the schema, then the `cost_i` field will have the field type and analysis defined for `*_i`.

Like regular fields, dynamic fields have a name, a field type, and options.

```
<dynamicField name="*_i" type="int" indexed="true"  stored="true"/>
```

It is recommended that you include basic dynamic field mappings (like that shown above) in your `schema.xml`. The mappings can be very useful.

Related Topics

- SchemaXML-Dynamic Fields

Other Schema Elements

This section describes several other important elements of `schema.xml`.

Unique Key

The `uniqueKey` element specifies which field is a unique identifier for documents. Although `uniqueKey` is not required, it is nearly always warranted by your application design. For example, `uniqueKey` should be used if you will ever update a document in the index.

You can define the unique key field by naming it:

```
<uniqueKey>id</uniqueKey>
```

Schema defaults and `copyFields` cannot be used to populate the `uniqueKey` field. You also can't use `UUIDUpdateProcessorFactory` to have `uniqueKey` values generated automatically.

Further, the operation will fail if the `uniqueKey` field is used, but is multivalued (or inherits the multivalueness from the `fieldtype`). However, `uniqueKey` will continue to work, as long as the field is properly used.

Default Search Field

If you are using the Lucene query parser, queries that don't specify a field name will use the defaultSearchField. The DisMax and Extended DisMax query parsers will also fallback to this if `qf` is not specified.

> ⓘ Use of the `defaultSearchField` element is deprecated in Solr versions 3.6 and higher. Instead, you should use the `df` request parameter. At some point, the `defaultSearchField` element may be removed.

For more information about query parsers, see the section on Query Syntax and Parsing.

Query Parser Default Operator

In queries with multiple terms, Solr can either return results where all conditions are met or where one or more conditions are met. The *operator* controls this behavior. An operator of AND means that all conditions must be fulfilled, while an operator of OR means that one or more conditions must be true.

In `schema.xml`, the `solrQueryParser` element controls what operator is used if an operator is not specified in the query. The default operator setting only applies to the Lucene query parser, not the DisMax or Extended DisMax query parsers, which internally hard-code their operators to OR.

> ⓘ The query parser default operator parameter has been deprecated in Solr versions 3.6 and higher. You are instead encouraged to specify the query parser `q.op` parameter in your request handler.

Similarity

Similarity is a Lucene class used to score a document in searching.

A global `<similarity>` declaration can be used to specify a custom similarity implementation that you want Solr to use when dealing with your index. A similarity can be specified either by referring directly to the name of a class with a no-argument constructor:

```
<similarity class="solr.DefaultSimilarityFactory"/>
```

or by referencing a `SimilarityFactory` implementation, which may take optional initialization parameters:

```
<similarity class="solr.DFRSimilarityFactory">
  <str name="basicModel">P</str>
  <str name="afterEffect">L</str>
  <str name="normalization">H2</str>
  <float name="c">7</float>
</similarity>
```

A special `SchemaSimilarityFactory` is available, which allows individual field types to be configured with a similarity to override the default behavior:

```
<similarity class="solr.SchemaSimilarityFactory"/>
<fieldType name="text_ib">
   <analyzer/>
   <similarity class="solr.IBSimilarityFactory">
      <str name="distribution">SPL</str>
      <str name="lambda">DF</str>
      <str name="normalization">H2</str>
   </similarity>
</fieldType>
```

If a field type does not have an explicitly configured similarity factory, then a `DefaultSimilarity` instance is used.

This examples above show `DFRSimilarityFactory` (divergence from random) and `IBSimilarityFactory` (using the Information-Based model), but there are several similarity implementations that can be used such as the `SweetSpotSimilarityFactory`, `BM25SimilarityFactory`, etc.... For details, see the Solr Javadocs for the similarity factories.

Related Topics

- SchemaXML-Miscellaneous Settings
- UniqueKey

Schema API

The Schema API provides read and write access to the Solr schema for each collection (or core, when using standalone Solr). Read access to all schema elements is supported. Fields, dynamic fields, field types and copyField rules may be added, removed or replaced. Future Solr releases will extend write access to allow more schema elements to be modified.

> ⚠ **Re-index after schema modifications!**
> If you modify your schema, you will likely need to re-index all documents. If you do not, you may lose access to documents, or not be able to interpret them properly, e.g. after replacing a field type.

To enable schema modification with this API, the schema will need to be managed and mutable. See the section

Managed Schema Definition in SolrConfig for more information.

The API allows two output modes for all calls: JSON or XML. When requesting the complete schema, there is another output mode which is XML modeled after the schema.xml file itself.

When modifying the schema with the API, a core reload will automatically occur in order for the changes to be available immediately.

The base address for the API is `http://<host>:<port>/solr/<collection_name>`. If for example you run Solr's "`cloud`" example (via the `bin/solr` command shown below), which creates a "`gettingstarted`" collection, then the base URL (as in all the sample URLs in this section) would be: `http://localhost:8983/solr/gettingstarted` .

```
bin/solr -e cloud -noprompt
```

API Entry Points

`/schema`: retrieve the schema, or modify the schema to add, remove, or replace fields, dynamic fields, copy fields, or field types
`/schema/fields`: retrieve information about all defined fields or a specific named field

`/schema/dynamicfields`: retrieve information about all dynamic field rules or a specific named dynamic rule
`/schema/fieldtypes`: retrieve information about all field types or a specific field type
`/schema/copyfields`: retrieve information about copy fields
`/schema/name`: retrieve the schema name
`/schema/version`: retrieve the schema version
`/schema/uniquekey`: retrieve the defined uniqueKey
`/schema/similarity`: retrieve the global similarity definition
`/schema/solrqueryparser/defaultoperator`: retrieve the default operator

Modify the Schema

`POST /collection/schema`

To add, remove or replace fields, dynamic field rules, copy field rules, or new field types, you can send a POST request to the `/collection/schema/` endpoint with a sequence of commands to perform the requested actions. The following commands are supported:

- `add-field`: add a new field with parameters you provide.
- `delete-field`: delete a field.
- `replace-field`: replace an existing field with one that is differently configured.

- `add-dynamic-field`: add a new dynamic field rule with parameters you provide.
- `delete-dynamic-field`: delete a dynamic field rule.
- `replace-dynamic-field`: replace an existing dynamic field rule with one that is differently configured.

- `add-field-type`: add a new field type with parameters you provide.
- `delete-field-type`: delete a field type.
- `replace-field-type`: replace an existing field type with one that is differently configured.

- `add-copy-field`: add a new copy field rule.
- `delete-copy-field`: delete a copy field rule.

These commands can be issued in separate POST requests or in the same POST request. Commands are executed in the order in which they are specified.

In each case, the response will include the status and the time to process the request, but will not include the entire schema.

When modifying the schema with the REST API, a core reload will automatically occur in order for the changes to be available immediately.

Add a New Field

The `add-field` command adds a new field definition to your schema. If a field with the same name exists an error is thrown.

All of the properties available when defining a field with manual `schema.xml` edits can be passed via the API. These request attributes are described in detail in the section Defining Fields.

For example, to define a new stored field named "sell-by", of type "tdate", you would POST the following request:

```
curl -X POST -H 'Content-type:application/json' --data-binary '{
  "add-field":{
     "name":"sell-by",
     "type":"tdate",
     "stored":true }
}' http://localhost:8983/solr/gettingstarted/schema
```

Delete a Field

The `delete-field` command removes a field definition from your schema. If the field does not exist in the schema, or if the field is the source or destination of a copy field rule, an error is thrown.

For example, to delete a field named "sell-by", you would POST the following request:

```
curl -X POST -H 'Content-type:application/json' --data-binary '{
  "delete-field" : { "name":"sell-by" }
}' http://localhost:8983/solr/gettingstarted/schema
```

Replace a Field

The `replace-field` command replaces a field's definition. Note that you must supply the full definition for a field - this command will **not** partially modify a field's definition. If the field does not exist in the schema an error is thrown.

All of the properties available when defining a field with manual `schema.xml` edits can be passed via the API. These request attributes are described in detail in the section Defining Fields.

For example, to replace the definition of an existing field "sell-by", to make it be of type "date" and to not be stored, you would POST the following request:

```
curl -X POST -H 'Content-type:application/json' --data-binary '{
  "replace-field":{
     "name":"sell-by",
     "type":"date",
     "stored":false }
}' http://localhost:8983/solr/gettingstarted/schema
```

Add a Dynamic Field Rule

The `add-dynamic-field` command adds a new dynamic field rule to your schema.

All of the properties available when editing `schema.xml` can be passed with the POST request. The section Dynamic Fields has details on all of the attributes that can be defined for a dynamic field rule.

For example, to create a new dynamic field rule where all incoming fields ending with "_s" would be stored and have field type "string", you can POST a request like this:

```
curl -X POST -H 'Content-type:application/json' --data-binary '{
  "add-dynamic-field":{
     "name":"*_s",
     "type":"string",
     "stored":true }
}' http://localhost:8983/solr/gettingstarted/schema
```

Delete a Dynamic Field Rule

The `delete-dynamic-field` command deletes a dynamic field rule from your schema. If the dynamic field rule does not exist in the schema, or if the schema contains a copy field rule with a target or destination that matches only this dynamic field rule, an error is thrown.

For example, to delete a dynamic field rule matching "*_s", you can POST a request like this:

```
curl -X POST -H 'Content-type:application/json' --data-binary '{
  "delete-dynamic-field":{ "name":"*_s" }
}' http://localhost:8983/solr/gettingstarted/schema
```

Replace a Dynamic Field Rule

The `replace-dynamic-field` command replaces a dynamic field rule in your schema. Note that you must supply the full definition for a dynamic field rule - this command will **not** partially modify a dynamic field rule's definition. If the dynamic field rule does not exist in the schema an error is thrown.

All of the properties available when editing `schema.xml` can be passed with the POST request. The section Dynamic Fields has details on all of the attributes that can be defined for a dynamic field rule.

For example, to replace the definition of the "*_s" dynamic field rule with one where the field type is "text_general" and it's not stored, you can POST a request like this:

```
curl -X POST -H 'Content-type:application/json' --data-binary '{
  "replace-dynamic-field":{
     "name":"*_s",
     "type":"text_general",
     "stored":false }
}' http://localhost:8983/solr/gettingstarted/schema
```

Add a New Field Type

The `add-field-type` command adds a new field type to your schema.

All of the field type properties available when editing `schema.xml` by hand are available for use in a POST request. The structure of the command is a json mapping of the standard field type definition, including the name, class, index and query analyzer definitions, etc. Details of all of the available options are described in the section Solr Field Types.

For example, to create a new field type named "myNewTxtField", you can POST a request as follows:

```
curl -X POST -H 'Content-type:application/json' --data-binary '{
  "add-field-type" : {
     "name":"myNewTxtField",
     "class":"solr.TextField",
     "positionIncrementGap":"100",
     "analyzer" : {
        "charFilters":[{
           "class":"solr.PatternReplaceCharFilterFactory",
           "replacement":"$1$1",
           "pattern":"([a-zA-Z])\\\\1+" }],
        "tokenizer":{
           "class":"solr.WhitespaceTokenizerFactory" },
        "filters":[{
           "class":"solr.WordDelimiterFilterFactory",
           "preserveOriginal":"0" }]}}
}' http://localhost:8983/solr/gettingstarted/schema
```

Note in this example that we have only defined a single analyzer section that will apply to index analysis and query analysis. If we wanted to define separate analysis, we would replace the `analyzer` section in the above example with separate sections for `indexAnalyzer` and `queryAnalyzer`. As in this example:

```
curl -X POST -H 'Content-type:application/json' --data-binary '{
  "add-field-type":{
     "name":"myNewTextField",
     "class":"solr.TextField",
     "indexAnalyzer":{
        "tokenizer":{
           "class":"solr.PathHierarchyTokenizerFactory",
           "delimiter":"/" }},
     "queryAnalyzer":{
        "tokenizer":{
           "class":"solr.KeywordTokenizerFactory" }}}
}' http://localhost:8983/solr/gettingstarted/schema
```

Delete a Field Type

The `delete-field-type` command removes a field type from your schema. If the field type does not exist in the schema, or if any field or dynamic field rule in the schema uses the field type, an error is thrown.

For example, to delete the field type named "myNewTxtField", you can make a POST request as follows:

```
curl -X POST -H 'Content-type:application/json' --data-binary '{
  "delete-field-type":{ "name":"myNewTxtField" }
}' http://localhost:8983/solr/gettingstarted/schema
```

Replace a Field Type

The `replace-field-type` command replaces a field type in your schema. Note that you must supply the full definition for a field type - this command will **not** partially modify a field type's definition. If the field type does not exist in the schema an error is thrown.

All of the field type properties available when editing `schema.xml` by hand are available for use in a POST request. The structure of the command is a json mapping of the standard field type definition, including the name, class, index and query analyzer definitions, etc. Details of all of the available options are described in the section Solr Field Types.

For example, to replace the definition of a field type named "myNewTxtField", you can make a POST request as follows:

```
curl -X POST -H 'Content-type:application/json' --data-binary '{
  "replace-field-type":{
     "name":"myNewTxtField",
     "class":"solr.TextField",
     "positionIncrementGap":"100",
     "analyzer":{
        "tokenizer":{
           "class":"solr.StandardTokenizerFactory" }}}
}' http://localhost:8983/solr/gettingstarted/schema
```

Add a New Copy Field Rule

The `add-copy-field` command adds a new copy field rule to your schema.

The attributes supported by the command are the same as when creating copy field rules by manually editing the `schema.xml`, as below:

Name	Required	Description
source	Yes	The source field.
dest	Yes	A field or an array of fields to which the source field will be copied.
maxChars	No	The upper limit for the number of characters to be copied. The section Copying Fields has more details.

For example, to define a rule to copy the field "shelf" to the "location" and "catchall" fields, you would POST the following request:

```
curl -X POST -H 'Content-type:application/json' --data-binary '{
  "add-copy-field":{
     "source":"shelf",
     "dest":[ "location", "catchall" ]}
}' http://localhost:8983/solr/gettingstarted/schema
```

Delete a Copy Field Rule

The `delete-copy-field` command deletes a copy field rule from your schema. If the copy field rule does not exist in the schema an error is thrown.

The `source` and `dest` attributes are required by this command.

For example, to delete a rule to copy the field "shelf" to the "location" field, you would POST the following request:

```
curl -X POST -H 'Content-type:application/json' --data-binary '{
  "delete-copy-field":{ "source":"shelf", "dest":"location" }
}' http://localhost:8983/solr/gettingstarted/schema
```

Multiple Commands in a Single POST

It is possible to perform one or more add requests in a single command. The API is transactional and all commands in a single call either succeed or fail together.

The commands are executed in the order in which they are specified. This means that if you want to create a new field type and in the same request use the field type on a new field, the section of the request that creates the field type must come before the section that creates the new field. Similarly, since a field must exist for it to be used in a copy field rule, a request to add a field must come before a request for the field to be used as either the source or the destination for a copy field rule.

The syntax for making multiple requests supports several approaches. First, the commands can simply be made serially, as in this request to create a new field type and then a field that uses that type:

```
curl -X POST -H 'Content-type:application/json' --data-binary '{
  "add-field-type":{
     "name":"myNewTxtField",
     "class":"solr.TextField",
     "positionIncrementGap":"100",
     "analyzer":{
        "charFilters":[{
           "class":"solr.PatternReplaceCharFilterFactory",
           "replacement":"$1$1",
           "pattern":"([a-zA-Z])\\\\1+" }],
        "tokenizer":{
           "class":"solr.WhitespaceTokenizerFactory" },
        "filters":[{
           "class":"solr.WordDelimiterFilterFactory",
           "preserveOriginal":"0" }]}},
   "add-field" : {
      "name":"sell-by",
      "type":"myNewTxtField",
      "stored":true }
}' http://localhost:8983/solr/gettingstarted/schema
```

Or, the same command can be repeated, as in this example:

```
curl -X POST -H 'Content-type:application/json' --data-binary '{
  "add-field":{
     "name":"shelf",
     "type":"myNewTxtField",
     "stored":true },
  "add-field":{
     "name":"location",
     "type":"myNewTxtField",
     "stored":true },
  "add-copy-field":{
     "source":"shelf",
      "dest":[ "location", "catchall" ]}
}' http://localhost:8983/solr/gettingstarted/schema
```

Finally, repeated commands can be sent as an array:

```
curl -X POST -H 'Content-type:application/json' --data-binary '{
  "add-field":[
     { "name":"shelf",
       "type":"myNewTxtField",
       "stored":true },
     { "name":"location",
       "type":"myNewTxtField",
       "stored":true }]
}' http://localhost:8983/solr/gettingstarted/schema
```

Schema Changes among Replicas

When running in SolrCloud mode, changes made to the schema on one node will propagate to all replicas in the collection. You can pass the **updateTimeoutSecs** parameter with your request to set the number of seconds to wait until all replicas confirm they applied the schema updates. This helps your client application be more robust in that you can be sure that all replicas have a given schema change within a defined amount of time. If agreement is not reached by all replicas in the specified time, then the request fails and the error message will include information about which replicas had trouble. In most cases, the only option is to re-try the change after waiting a brief amount of time. If the problem persists, then you'll likely need to investigate the server logs on the replicas that had trouble applying the changes. If you do not supply an **updateTimeoutSecs** parameter, the default behavior is for the receiving node to return immediately after persisting the updates to ZooKeeper. All other replicas will apply the updates asynchronously. Consequently, without supplying a timeout, your client application cannot be sure that all replicas have applied the changes.

Retrieve Schema Information

The following endpoints allow you to read how your schema has been defined. You can GET the entire schema, or only portions of it as needed.

To modify the schema, see the previous section Modify the Schema.

Retrieve the Entire Schema

`GET /collection/schema`

INPUT

Path Parameters

Key	Description
collection	The collection (or core) name.

Query Parameters

The query parameters should be added to the API request after '?'.

Key	Type	Required	Default	Description
wt	string	No	json	Defines the format of the response. The options are **json**, **xml** or **schema.xml**. If not specified, JSON will be returned by default.

OUTPUT

Output Content

The output will include all fields, field types, dynamic rules and copy field rules, in the format requested (JSON or XML). The schema name and version are also included.

EXAMPLES

Get the entire schema in JSON.

```
curl http://localhost:8983/solr/gettingstarted/schema?wt=json
```

```
{
  "responseHeader":{
    "status":0,
    "QTime":5},
  "schema":{
    "name":"example",
    "version":1.5,
    "uniqueKey":"id",
    "fieldTypes":[{
        "name":"alphaOnlySort",
        "class":"solr.TextField",
        "sortMissingLast":true,
        "omitNorms":true,
        "analyzer":{
          "tokenizer":{
            "class":"solr.KeywordTokenizerFactory"},
          "filters":[{
              "class":"solr.LowerCaseFilterFactory"},
            {
              "class":"solr.TrimFilterFactory"},
            {
              "class":"solr.PatternReplaceFilterFactory",
              "replace":"all",
              "replacement":"",
              "pattern":"([^a-z])"}]}},
...
    "fields":[{
        "name":"_version_",
        "type":"long",
        "indexed":true,
        "stored":true},
      {
        "name":"author",
        "type":"text_general",
        "indexed":true,
        "stored":true},
      {
        "name":"cat",
        "type":"string",
        "multiValued":true,
        "indexed":true,
        "stored":true},
...
    "copyFields":[{
        "source":"author",
        "dest":"text"},
      {
        "source":"cat",
        "dest":"text"},
      {
        "source":"content",
        "dest":"text"},
...
      {
        "source":"author",
        "dest":"author_s"}]}}
```

Get the entire schema in XML.

```
curl http://localhost:8983/solr/gettingstarted/schema?wt=xml
```

```
<response>
<lst name="responseHeader">
  <int name="status">0</int>
  <int name="QTime">5</int>
</lst>
<lst name="schema">
  <str name="name">example</str>
  <float name="version">1.5</float>
  <str name="uniqueKey">id</str>
  <arr name="fieldTypes">
    <lst>
      <str name="name">alphaOnlySort</str>
      <str name="class">solr.TextField</str>
      <bool name="sortMissingLast">true</bool>
      <bool name="omitNorms">true</bool>
      <lst name="analyzer">
        <lst name="tokenizer">
          <str name="class">solr.KeywordTokenizerFactory</str>
        </lst>
        <arr name="filters">
          <lst>
            <str name="class">solr.LowerCaseFilterFactory</str>
          </lst>
          <lst>
            <str name="class">solr.TrimFilterFactory</str>
          </lst>
          <lst>
            <str name="class">solr.PatternReplaceFilterFactory</str>
            <str name="replace">all</str>
            <str name="replacement"/>
            <str name="pattern">([^a-z])</str>
          </lst>
        </arr>
      </lst>
    </lst>
...
    <lst>
      <str name="source">author</str>
      <str name="dest">author_s</str>
    </lst>
  </arr>
</lst>
</response>
```

Get the entire schema in "schema.xml" format.

```
curl http://localhost:8983/solr/gettingstarted/schema?wt=schema.xml
```

```
<schema name="example" version="1.5">
  <uniqueKey>id</uniqueKey>
  <types>
    <fieldType name="alphaOnlySort" class="solr.TextField" sortMissingLast="true"
omitNorms="true">
      <analyzer>
        <tokenizer class="solr.KeywordTokenizerFactory"/>
        <filter class="solr.LowerCaseFilterFactory"/>
        <filter class="solr.TrimFilterFactory"/>
        <filter class="solr.PatternReplaceFilterFactory" replace="all"
replacement="" pattern="([^a-z])"/>
      </analyzer>
    </fieldType>
...
  <copyField source="url" dest="text"/>
  <copyField source="price" dest="price_c"/>
  <copyField source="author" dest="author_s"/>
</schema>
```

List Fields

GET */collection*/schema/fields

GET */collection*/schema/fields/*fieldname*

INPUT

Path Parameters

Key	Description
collection	The collection (or core) name.
fieldname	The specific fieldname (if limiting request to a single field).

Query Parameters

The query parameters can be added to the API request after a '?'.

Key	Type	Required	Default	Description
wt	string	No	json	Defines the format of the response. The options are **json** or **xml**. If not specified, JSON will be returned by default.

OUTPUT

Output Content

The output will include each field and any defined configuration for each field. The defined configuration can vary for each field, but will minimally include the field `name`, the `type`, if it is `indexed` and if it is `stored`. If `multiValued` is defined as either true or false (most likely true), that will also be shown. See the section Defining Fields for more information about each parameter.

EXAMPLES

Get a list of all fields.

```
curl http://localhost:8983/solr/gettingstarted/schema/fields?wt=json
```

The sample output below has been truncated to only show a few fields.

```
{
    "fields": [
        {
            "indexed": true,
            "name": "_version_",
            "stored": true,
            "type": "long"
        },
        {
            "indexed": true,
            "name": "author",
            "stored": true,
            "type": "text_general"
        },
        {
            "indexed": true,
            "multiValued": true,
            "name": "cat",
            "stored": true,
            "type": "string"
        },
...
    ],
    "responseHeader": {
        "QTime": 1,
        "status": 0
    }
}
```

List Dynamic Fields

GET /*collection*/schema/dynamicfields

GET /*collection*/schema/dynamicfields/*name*

INPUT

Path Parameters

Key	Description
collection	The collection (or core) name.
name	The name of the dynamic field rule (if limiting request to a single dynamic field rule).

Query Parameters

The query parameters can be added to the API request after a '?'.

Key	Type	Required	Default	Description

wt	string	No	json	Defines the format of the response. The options are **json** or **xml**. If not specified, JSON will be returned by default.

OUTPUT

Output Content

The output will include each dynamic field rule and the defined configuration for each rule. The defined configuration can vary for each rule, but will minimally include the dynamic field `name`, the `type`, if it is `indexed` and if it is `stored`. See the section Dynamic Fields for more information about each parameter.

EXAMPLES

Get a list of all dynamic field declarations:

```
curl http://localhost:8983/solr/gettingstarted/schema/dynamicfields?wt=json
```

The sample output below has been truncated.

```
{
    "dynamicFields": [
        {
            "indexed": true,
            "name": "*_coordinate",
            "stored": false,
            "type": "tdouble"
        },
        {
            "multiValued": true,
            "name": "ignored_*",
            "type": "ignored"
        },
        {
            "name": "random_*",
            "type": "random"
        },
        {
            "indexed": true,
            "multiValued": true,
            "name": "attr_*",
            "stored": true,
            "type": "text_general"
        },
        {
            "indexed": true,
            "multiValued": true,
            "name": "*_txt",
            "stored": true,
            "type": "text_general"
        }
...
    ],
    "responseHeader": {
        "QTime": 1,
        "status": 0
    }
}
```

List Field Types

`GET /collection/schema/fieldtypes`

`GET /collection/schema/fieldtypes/name`

INPUT

Path Parameters

Key	Description
collection	The collection (or core) name.
name	The name of the field type (if limiting request to a single field type).

Query Parameters

The query parameters can be added to the API request after a '?'.

Key	Type	Required	Default	Description
wt	string	No	json	Defines the format of the response. The options are **json** or **xml**. If not specified, JSON will be returned by default.

OUTPUT

Output Content

The output will include each field type and any defined configuration for the type. The defined configuration can vary for each type, but will minimally include the field type `name` and the `class`. If query or index analyzers, tokenizers, or filters are defined, those will also be shown with other defined parameters. See the section Solr Field Types for more information about how to configure various types of fields.

EXAMPLES

Get a list of all field types.

```
curl http://localhost:8983/solr/gettingstarted/schema/fieldtypes?wt=json
```

The sample output below has been truncated to show a few different field types from different parts of the list.

```
{
    "fieldTypes": [
        {
            "analyzer": {
                "class": "solr.TokenizerChain",
                "filters": [
                    {
                        "class": "solr.LowerCaseFilterFactory"
                    },
                    {
                        "class": "solr.TrimFilterFactory"
                    },
                    {
                        "class": "solr.PatternReplaceFilterFactory",
                        "pattern": "([^a-z])",
                        "replace": "all",
                        "replacement": ""
                    }
                ],
                "tokenizer": {
                    "class": "solr.KeywordTokenizerFactory"
                }
            },
            "class": "solr.TextField",
            "dynamicFields": [],
            "fields": [],
            "name": "alphaOnlySort",
            "omitNorms": true,
            "sortMissingLast": true
        },
...
        {
            "class": "solr.TrieFloatField",
            "dynamicFields": [
                "*_fs",
                "*_f"
            ],
            "fields": [
                "price",
                "weight"
            ],
            "name": "float",
            "positionIncrementGap": "0",
            "precisionStep": "0"
        },
...
}
```

List Copy Fields

`GET /collection/schema/copyfields`

INPUT

Path Parameters

Key	Description
collection	The collection (or core) name.

Query Parameters

The query parameters can be added to the API request after a '?'.

Key	Type	Required	Default	Description
wt	string	No	json	Defines the format of the response. The options are **json** or **xml**. If not specified, JSON will be returned by default.

OUTPUT

Output Content

The output will include the `source` and `dest`ination of each copy field rule defined in `schema.xml`. For more information about copying fields, see the section Copying Fields.

EXAMPLES

Get a list of all copyfields.

```
curl http://localhost:8983/solr/gettingstarted/schema/copyfields?wt=json
```

The sample output below has been truncated to the first few copy definitions.

```
{
    "copyFields": [
        {
            "dest": "text",
            "source": "author"
        },
        {
            "dest": "text",
            "source": "cat"
        },
        {
            "dest": "text",
            "source": "content"
        },
        {
            "dest": "text",
            "source": "content_type"
        },
...
    ],
    "responseHeader": {
        "QTime": 3,
        "status": 0
    }
}
```

Show Schema Name

`GET /collection/schema/name`

INPUT

Path Parameters

Key	Description
collection	The collection (or core) name.

Query Parameters

The query parameters can be added to the API request after a '?'.

Key	Type	Required	Default	Description
wt	string	No	json	Defines the format of the response. The options are **json** or **xml**. If not specified, JSON will be returned by default.

OUTPUT

Output Content
The output will be simply the name given to the schema.

EXAMPLES

Get the schema name.

```
curl http://localhost:8983/solr/gettingstarted/schema/name?wt=json
```

```
{
  "responseHeader":{
    "status":0,
    "QTime":1},
  "name":"example"}
```

Show the Schema Version

`GET /collection/schema/version`

INPUT

Path Parameters

Key	Description
collection	The collection (or core) name.

Query Parameters

The query parameters can be added to the API request after a '?'.

Key	Type	Required	Default	Description

wt	string	No	json	Defines the format of the response. The options are **json** or **xml**. If not specified, JSON will be returned by default.

OUTPUT

Output Content

The output will simply be the schema version in use.

EXAMPLES

Get the schema version

```
curl http://localhost:8983/solr/gettingstarted/schema/version?wt=json
```

```
{
  "responseHeader":{
    "status":0,
    "QTime":2},
  "version":1.5}
```

List UniqueKey

GET /*collection*/schema/uniquekey

INPUT

Path Parameters

Key	Description
collection	The collection (or core) name.

Query Parameters

The query parameters can be added to the API request after a '?'.

Key	Type	Required	Default	Description
wt	string	No	json	Defines the format of the response. The options are **json** or **xml**. If not specified, JSON will be returned by default.

OUTPUT

Output Content

The output will include simply the field name that is defined as the uniqueKey for the index.

EXAMPLES

List the uniqueKey.

```
curl http://localhost:8983/solr/gettingstarted/schema/uniquekey?wt=json
```

```
{
  "responseHeader":{
    "status":0,
    "QTime":2},
  "uniqueKey":"id"}
```

Show Global Similarity

GET */collection*/schema/similarity

INPUT

Path Parameters

Key	Description
collection	The collection (or core) name.

Query Parameters

The query parameters can be added to the API request after a '?'.

Key	Type	Required	Default	Description
wt	string	No	json	Defines the format of the response. The options are **json** or **xml**. If not specified, JSON will be returned by default.

OUTPUT

Output Content

The output will include the class name of the global similarity defined (if any).

EXAMPLES

Get the similarity implementation.

```
curl http://localhost:8983/solr/gettingstarted/schema/similarity?wt=json
```

```
{
  "responseHeader":{
    "status":0,
    "QTime":1},
  "similarity":{
    "class":"org.apache.solr.search.similarities.DefaultSimilarityFactory"}}
```

Get the Default Query Operator

`GET /collection/schema/solrqueryparser/defaultoperator`

INPUT

Path Parameters

Key	Description
collection	The collection (or core) name.

Query Parameters

The query parameters can be added to the API request after a '?'.

Key	Type	Required	Default	Description
wt	string	No	json	Defines the format of the response. The options are **json** or **xml**. If not specified, JSON will be returned by default.

OUTPUT

Output Content

The output will include simply the default operator if none is defined by the user.

EXAMPLES

Get the default operator.

```
curl
http://localhost:8983/solr/gettingstarted/schema/solrqueryparser/defaultoperator?wt=
json
```

```
{
  "responseHeader":{
    "status":0,
    "QTime":2},
  "defaultOperator":"OR"}
```

Manage Resource Data

The Managed Resources REST API provides a mechanism for any Solr plugin to expose resources that should support CRUD (Create, Read, Update, Delete) operations. Depending on what Field Types and Analyzers are configured in your Schema, additional `/schema/` REST API paths may exist. See the Managed Resources section for more information and examples.

Putting the Pieces Together

At the highest level, `schema.xml` is structured as follows. This example is not real XML, but it gives you an idea of the structure of the file.

```
<schema>
  <types>
  <fields>
  <uniqueKey>
  <copyField>
</schema>
```

Obviously, most of the excitement is in `types` and `fields`, where the field types and the actual field definitions live. These are supplemented by `copyFields`. The `uniqueKey` must always be defined. In older Solr versions you would find `defaultSearchField` and `solrQueryParser` tags as well, but although these still work they are deprecated and discouraged, see Other Schema Elements.

> **Types and fields are optional tags**
> Note that the `types` and `fields` sections are optional, meaning you are free to mix `field`, `dynamiField`, `copyField` and `fieldType` definitions on the top level. This allows for a more logical grouping of related tags in your schema.

Choosing Appropriate Numeric Types

For general numeric needs, use `TrieIntField`, `TrieLongField`, `TrieFloatField`, and `TrieDoubleField` with `precisionStep="0"`.

If you expect users to make frequent range queries on numeric types, use the default `precisionStep` (by not specifying it) or specify it as `precisionStep="8"` (which is the default). This offers faster speed for range queries at the expense of increasing index size.

Working With Text

Handling text properly will make your users happy by providing them with the best possible results for text searches.

One technique is using a text field as a catch-all for keyword searching. Most users are not sophisticated about their searches and the most common search is likely to be a simple keyword search. You can use `copyField` to take a variety of fields and funnel them all into a single text field for keyword searches. In the schema.xml file for the "`techproducts`" example included with Solr, `copyField` declarations are used to dump the contents of `cat`, `name`, `manu`, `features`, and `includes` into a single field, `text`. In addition, it could be a good idea to copy `ID` into `text` in case users wanted to search for a particular product by passing its product number to a keyword search.

Another technique is using `copyField` to use the same field in different ways. Suppose you have a field that is a list of authors, like this:

`Schildt, Herbert; Wolpert, Lewis; Davies, P.`

For searching by author, you could tokenize the field, convert to lower case, and strip out punctuation:

`schildt / herbert / wolpert / lewis / davies / p`

For sorting, just use an untokenized field, converted to lower case, with punctuation stripped:

`schildt herbert wolpert lewis davies p`

Finally, for faceting, use the primary author only via a `StringField`:

`Schildt, Herbert`

Related Topics

- SchemaXML

DocValues

DocValues are a way of recording field values internally that is more efficient for some purposes, such as sorting and faceting, then traditional indexing.

Why DocValues?

The standard way that Solr builds the index is with an *inverted index*. This style builds a list of terms found in all the documents in the index and next to each term is a list of documents that the term appears in (as well as how many times the term appears in that document). This makes search very fast - since users search by terms, having a ready list of term-to-document values makes the query process faster.

For other features that we now commonly associate with search, such as sorting, faceting, and highlighting, this approach is not very efficient. The faceting engine, for example, must look up each term that appears in each document that will make up the result set and pull the document IDs in order to build the facet list. In Solr, this is maintained in memory, and can be slow to load (depending on the number of documents, terms, etc.).

In Lucene 4.0, a new approach was introduced. DocValue fields are now column-oriented fields with a document-to-value mapping built at index time. This approach promises to relieve some of the memory requirements of the fieldCache and make lookups for faceting, sorting, and grouping much faster.

How to Use DocValues

To use docValues, you only need to enable it for a field that you will use it with. As with all schema design, you need to define a field type and then define fields of that type with docValues enabled. All of these actions are done in `schema.xml`.

Enabling a field for docValues only requires adding `docValues="true"` to the field (or field type) definition, as in this example from the `schema.xml` of Solr's `sample_techproducts_configs` config set:

```
<field name="manu_exact" type="string" indexed="false" stored="false"
docValues="true" />
```

> ⚠ If you have already indexed data into your Solr index, you will need to completely re-index your content after changing your field definitions in `schema.xml` in order to successfully use docValues.

DocValues are only available for specific field types. The types chosen determine the underlying Lucene docValue type that will be used. The available Solr field types are:

- `StrField` and `UUIDField`.
    - If the field is single-valued (i.e., multi-valued is false), Lucene will use the SORTED type.
    - If the field is multi-valued, Lucene will use the SORTED_SET type.

- Any `Trie*` numeric fields and `EnumField`.
  - If the field is single-valued (i.e., multi-valued is false), Lucene will use the NUMERIC type.
  - If the field is multi-valued, Lucene will use the SORTED_SET type.

These Lucene types are related to how the values are sorted and stored.

There is an additional configuration option available, which is to modify the `docValuesFormat` used by the field type. The default implementation employs a mixture of loading some things into memory and keeping some on disk. In some cases, however, you may choose to specify an alternative DocValuesFormat implementation. For example, you could choose to keep everything in memory by specifying `docValuesFormat="Memory"` on a field type:

```
<fieldType name="string_in_mem_dv" class="solr.StrField" docValues="true"
docValuesFormat="Memory" />
```

Please note that the `docValuesFormat` option may change in future releases.

> Lucene index back-compatibility is only supported for the default codec. If you choose to customize the `docValuesFormat` in your schema.xml, upgrading to a future version of Solr may require you to either switch back to the default codec and optimize your index to rewrite it into the default codec before upgrading, or re-build your entire index from scratch after upgrading.

Schemaless Mode

Schemaless Mode is a set of Solr features that, when used together, allow users to rapidly construct an effective schema by simply indexing sample data, without having to manually edit the schema. These Solr features, all specified in `solrconfig.xml`, are:

1. Managed schema: Schema modifications are made through Solr APIs rather than manual edits - see Managed Schema Definition in SolrConfig.
2. Field value class guessing: Previously unseen fields are run through a cascading set of value-based parsers, which guess the Java class of field values - parsers for Boolean, Integer, Long, Float, Double, and Date are currently available.
3. Automatic schema field addition, based on field value class(es): Previously unseen fields are added to the schema, based on field value Java classes, which are mapped to schema field types - see Solr Field Types.

Using the Schemaless Example

The three features of schemaless mode are pre-configured in the `data_driven_schema_configs` config set in the Solr distribution. To start an example instance of Solr using these configs, run the following command:

```
bin/solr start -e schemaless
```

This will launch a Solr server, and automatically create a collection (named "`gettingstarted`") that contains only three fields in the initial schema: `id`, `_version_`, and `_text_`.

You can use the `/schema/fields` Schema API to confirm this: `curl http://localhost:8983/solr/gettingstarted/schema/fields` will output:

```
{
  "responseHeader":{
    "status":0,
    "QTime":1},
  "fields":[{
      "name":"_text_",
      "type":"text_general",
      "multiValued":true,
      "indexed":true,
      "stored":false},
    {
      "name":"_version_",
      "type":"long",
      "indexed":true,
      "stored":true},
    {
      "name":"id",
      "type":"string",
      "multiValued":false,
      "indexed":true,
      "required":true,
      "stored":true,
      "uniqueKey":true}]}
```

Because the `data_driven_schema_configs` config set includes a `copyField` directive that causes all content to be indexed in a predefined "catch-all" `_text_` field, to enable single-field search that includes all fields' content, the index will be larger than it would be without the `copyField`. When you nail down your schema, consider removing the `_text_` field and the corresponding `copyField` directive if you don't need it.

Configuring Schemaless Mode

As described above, there are three configuration elements that need to be in place to use Solr in schemaless mode. In the `data_driven_schema_configs` config set included with Solr these are already configured. If, however, you would like to implement schemaless on your own, you should make the following changes.

Enable Managed Schema

As described in the section Managed Schema Definition in SolrConfig, changing the `schemaFactory` will allow the schema to be modified by the Schema API. Your `solrconfig.xml` should have a section like the one below (and the ClassicIndexSchemaFactory should be commented out or removed).

```
   <schemaFactory class="ManagedIndexSchemaFactory">
    <bool name="mutable">true</bool>
    <str name="managedSchemaResourceName">managed-schema</str>
  </schemaFactory>
```

Define an UpdateRequestProcessorChain

The UpdateRequestProcessorChain allows Solr to guess field types, and you can define the default field type classes to use. To start, you should define it as follows (see the javadoc links below for update processor factory documentation):

```
<updateRequestProcessorChain name="add-unknown-fields-to-the-schema">
  <!-- UUIDUpdateProcessorFactory will generate an id if none is present in the
incoming document -->
  <processor class="solr.UUIDUpdateProcessorFactory" />
  <processor class="solr.LogUpdateProcessorFactory"/>
  <processor class="solr.DistributedUpdateProcessorFactory"/>
  <processor class="solr.RemoveBlankFieldUpdateProcessorFactory"/>
  <processor class="solr.FieldNameMutatingUpdateProcessorFactory">
    <str name="pattern">[^\w-\.]</str>
    <str name="replacement">_</str>
  </processor>
  <processor class="solr.ParseBooleanFieldUpdateProcessorFactory"/>
  <processor class="solr.ParseLongFieldUpdateProcessorFactory"/>
  <processor class="solr.ParseDoubleFieldUpdateProcessorFactory"/>
  <processor class="solr.ParseDateFieldUpdateProcessorFactory">
    <arr name="format">
      <str>yyyy-MM-dd'T'HH:mm:ss.SSSZ</str>
      <str>yyyy-MM-dd'T'HH:mm:ss,SSSZ</str>
      <str>yyyy-MM-dd'T'HH:mm:ss.SSS</str>
      <str>yyyy-MM-dd'T'HH:mm:ss,SSS</str>
      <str>yyyy-MM-dd'T'HH:mm:ssZ</str>
      <str>yyyy-MM-dd'T'HH:mm:ss</str>
      <str>yyyy-MM-dd'T'HH:mmZ</str>
      <str>yyyy-MM-dd'T'HH:mm</str>
      <str>yyyy-MM-dd HH:mm:ss.SSSZ</str>
      <str>yyyy-MM-dd HH:mm:ss,SSSZ</str>
      <str>yyyy-MM-dd HH:mm:ss.SSS</str>
      <str>yyyy-MM-dd HH:mm:ss,SSS</str>
      <str>yyyy-MM-dd HH:mm:ssZ</str>
      <str>yyyy-MM-dd HH:mm:ss</str>
      <str>yyyy-MM-dd HH:mmZ</str>
      <str>yyyy-MM-dd HH:mm</str>
      <str>yyyy-MM-dd</str>
    </arr>
  </processor>
  <processor class="solr.AddSchemaFieldsUpdateProcessorFactory">
    <str name="defaultFieldType">strings</str>
    <lst name="typeMapping">
      <str name="valueClass">java.lang.Boolean</str>
      <str name="fieldType">booleans</str>
    </lst>
    <lst name="typeMapping">
      <str name="valueClass">java.util.Date</str>
      <str name="fieldType">tdates</str>
    </lst>
    <lst name="typeMapping">
      <str name="valueClass">java.lang.Long</str>
      <str name="valueClass">java.lang.Integer</str>
      <str name="fieldType">tlongs</str>
    </lst>
    <lst name="typeMapping">
      <str name="valueClass">java.lang.Number</str>
      <str name="fieldType">tdoubles</str>
    </lst>
  </processor>
  <processor class="solr.RunUpdateProcessorFactory"/>
</updateRequestProcessorChain>
```

Javadocs for update processor factories mentioned above:

- UUIDUpdateProcessorFactory
- RemoveBlankFieldUpdateProcessorFactory
- FieldNameMutatingUpdateProcessorFactory
- ParseBooleanFieldUpdateProcessorFactory
- ParseLongFieldUpdateProcessorFactory
- ParseDoubleFieldUpdateProcessorFactory
- ParseDateFieldUpdateProcessorFactory
- AddSchemaFieldsUpdateProcessorFactory

Make the UpdateRequestProcessorChain the Default for the UpdateRequestHandler

Once the UpdateRequestProcessorChain has been defined, you must instruct your UpdateRequestHandlers to use it when working with index updates (i.e., adding, removing, replacing documents). Here is an example using InitParams to set the defaults on all `/update` request handlers:

```
<initParams path="/update/**">
    <lst name="defaults">
      <str name="update.chain">add-unknown-fields-to-the-schema</str>
    </lst>
  </initParams>
```

⚠ After each of these changes have been made, Solr should be restarted (or, you can reload the cores to load the new `solrconfig.xml` definitions).

Examples of Indexed Documents

Once the schemaless mode has been enabled (whether you configured it manually or are using `data_driven_schema_configs`), documents that include fields that are not defined in your schema should be added to the index, and the new fields added to the schema.

For example, adding a CSV document will cause its fields that are not in the schema to be added, with fieldTypes based on values:

```
curl "http://localhost:8983/solr/gettingstarted/update?commit=true" -H
"Content-type:application/csv" -d '
id,Artist,Album,Released,Rating,FromDistributor,Sold
44C,Old Shews,Mead for Walking,1988-08-13,0.01,14,0'
```

Output indicating success:

```
<response>
  <lst name="responseHeader"><int name="status">0</int><int
name="QTime">106</int></lst>
</response>
```

The fields now in the schema (output from `curl http://localhost:8983/solr/gettingstarted/schema/fields`):

```
{
  "responseHeader":{
    "status":0,
    "QTime":1},
  "fields":[{
      "name":"Album",
      "type":"strings"},      // Field value guessed as String -> strings fieldType
    {
      "name":"Artist",
      "type":"strings"},      // Field value guessed as String -> strings fieldType
    {
      "name":"FromDistributor",
      "type":"tlongs"},       // Field value guessed as Long -> tlongs fieldType
    {
      "name":"Rating",
      "type":"tdoubles"},     // Field value guessed as Double -> tdoubles fieldType
    {
      "name":"Released",
      "type":"tdates"},       // Field value guessed as Date -> tdates fieldType
    {
      "name":"Sold",
      "type":"tlongs"},       // Field value guessed as Long -> tlongs fieldType
    {
      "name":"_text_",
...
    },
    {
      "name":"_version_",
...
    },
    {
      "name":"id",
...
    }]}
```

You Can Still Be Explicit
Even if you want to use schemaless mode for most fields, you can still use the Schema API to pre-emptively create some fields, with explicit types, before you index documents that use them.

Internally, the Schema REST API and the Schemaless Update Processors both use the same Managed Schema functionality.

Once a field has been added to the schema, its field type is fixed. As a consequence, adding documents with field value(s) that conflict with the previously guessed field type will fail. For example, after adding the above document, the "`Sold`" field has the fieldType `tlongs`, but the document below has a non-integral decimal value in this field:

```
curl "http://localhost:8983/solr/gettingstarted/update?commit=true" -H
"Content-type:application/csv" -d '
id,Description,Sold
19F,Cassettes by the pound,4.93'
```

This document will fail, as shown in this output:

```
<response>
  <lst name="responseHeader">
    <int name="status">400</int>
    <int name="QTime">7</int>
  </lst>
  <lst name="error">
    <str name="msg">ERROR: [doc=19F] Error adding field 'Sold'='4.93' msg=For input string: "4.93"</str>
    <int name="code">400</int>
  </lst>
</response>
```

Understanding Analyzers, Tokenizers, and Filters

The following sections describe how Solr breaks down and works with textual data. There are three main concepts to understand: analyzers, tokenizers, and filters.

Field analyzers are used both during ingestion, when a document is indexed, and at query time. An analyzer examines the text of fields and generates a token stream. Analyzers may be a single class or they may be composed of a series of tokenizer and filter classes.

Tokenizers break field data into lexical units, or *tokens*.

Filters examine a stream of tokens and keep them, transform or discard them, or create new ones. Tokenizers and filters may be combined to form pipelines, or *chains*, where the output of one is input to the next. Such a sequence of tokenizers and filters is called an *analyzer* and the resulting output of an analyzer is used to match query results or build indices.

Using Analyzers, Tokenizers, and Filters

Although the analysis process is used for both indexing and querying, the same analysis process need not be used for both operations. For indexing, you often want to simplify, or normalize, words. For example, setting all letters to lowercase, eliminating punctuation and accents, mapping words to their stems, and so on. Doing so can increase recall because, for example, "ram", "Ram" and "RAM" would all match a query for "ram". To increase query-time precision, a filter could be employed to narrow the matches by, for example, ignoring all-cap acronyms if you're interested in male sheep, but not Random Access Memory.

The tokens output by the analysis process define the values, or *terms*, of that field and are used either to build an index of those terms when a new document is added, or to identify which documents contain the terms you are querying for.

For More Information

These sections will show you how to configure field analyzers and also serves as a reference for the details of configuring each of the available tokenizer and filter classes. It also serves as a guide so that you can configure your own analysis classes if you have special needs that cannot be met with the included filters or tokenizers.

For Analyzers, see:

- Analyzers: Detailed conceptual information about Solr analyzers.
- Running Your Analyzer: Detailed information about testing and running your Solr analyzer.

For Tokenizers, see:

- About Tokenizers: Detailed conceptual information about Solr tokenizers.
- Tokenizers: Information about configuring tokenizers, and about the tokenizer factory classes included in this distribution of Solr.

For Filters, see:

- About Filters: Detailed conceptual information about Solr filters.
- Filter Descriptions: Information about configuring filters, and about the filter factory classes included in this distribution of Solr.
- CharFilterFactories: Information about filters for pre-processing input characters.

To find out how to use Tokenizers and Filters with various languages, see:

- Language Analysis: Information about tokenizers and filters for character set conversion or for use with specific languages.

Analyzers

An analyzer examines the text of fields and generates a token stream. Analyzers are specified as a child of the `<fieldType>` element in the `schema.xml` configuration file (in the same `conf/` directory as `solrconfig.xml`) .

In normal usage, only fields of type `solr.TextField` will specify an analyzer. The simplest way to configure an analyzer is with a single `<analyzer>` element whose class attribute is a fully qualified Java class name. The named class must derive from `org.apache.lucene.analysis.Analyzer`. For example:

```
<fieldType name="nametext" class="solr.TextField">
  <analyzer class="org.apache.lucene.analysis.WhitespaceAnalyzer"/>
</fieldType>
```

In this case a single class, `WhitespaceAnalyzer`, is responsible for analyzing the content of the named text field and emitting the corresponding tokens. For simple cases, such as plain English prose, a single analyzer class like this may be sufficient. But it's often necessary to do more complex analysis of the field content.

Even the most complex analysis requirements can usually be decomposed into a series of discrete, relatively simple processing steps. As you will soon discover, the Solr distribution comes with a large selection of tokenizers and filters that covers most scenarios you are likely to encounter. Setting up an analyzer chain is very straightforward; you specify a simple `<analyzer>` element (no class attribute) with child elements that name factory classes for the tokenizer and filters to use, in the order you want them to run.

For example:

```
<fieldType name="nametext" class="solr.TextField">
  <analyzer>
    <tokenizer class="solr.StandardTokenizerFactory"/>
    <filter class="solr.StandardFilterFactory"/>
    <filter class="solr.LowerCaseFilterFactory"/>
    <filter class="solr.StopFilterFactory"/>
    <filter class="solr.EnglishPorterFilterFactory"/>
  </analyzer>
</fieldType>
```

Note that classes in the `org.apache.solr.analysis` package may be referred to here with the shorthand `solr.` prefix.

In this case, no Analyzer class was specified on the `<analyzer>` element. Rather, a sequence of more specialized classes are wired together and collectively act as the Analyzer for the field. The text of the field is passed to the first item in the list (`solr.StandardTokenizerFactory`), and the tokens that emerge from the last one (`solr.EnglishPorterFilterFactory`) are the terms that are used for indexing or querying any fields that use the "nametext" `fieldType`.

⚠ **Field Values versus Indexed Terms**
The output of an Analyzer affects the *terms* indexed in a given field (and the terms used when parsing queries against those fields) but it has no impact on the *stored* value for the fields. For example: an analyzer might split "Brown Cow" into two indexed terms "brown" and "cow", but the stored value will still be a single String: "Brown Cow"

Analysis Phases

Analysis takes place in two contexts. At index time, when a field is being created, the token stream that results from analysis is added to an index and defines the set of terms (including positions, sizes, and so on) for the field. At query time, the values being searched for are analyzed and the terms that result are matched against those that are stored in the field's index.

In many cases, the same analysis should be applied to both phases. This is desirable when you want to query for exact string matches, possibly with case-insensitivity, for example. In other cases, you may want to apply slightly different analysis steps during indexing than those used at query time.

If you provide a simple `<analyzer>` definition for a field type, as in the examples above, then it will be used for both indexing and queries. If you want distinct analyzers for each phase, you may include two `<analyzer>` definitions distinguished with a type attribute. For example:

```
<fieldType name="nametext" class="solr.TextField">
  <analyzer type="index">
    <tokenizer class="solr.StandardTokenizerFactory"/>
    <filter class="solr.LowerCaseFilterFactory"/>
    <filter class="solr.KeepWordFilterFactory" words="keepwords.txt"/>
    <filter class="solr.SynonymFilterFactory" synonyms="syns.txt"/>
  </analyzer>
  <analyzer type="query">
    <tokenizer class="solr.StandardTokenizerFactory"/>
    <filter class="solr.LowerCaseFilterFactory"/>
  </analyzer>
</fieldType>
```

In this theoretical example, at index time the text is tokenized, the tokens are set to lowercase, any that are not listed in `keepwords.txt` are discarded and those that remain are mapped to alternate values as defined by the synonym rules in the file `syns.txt`. This essentially builds an index from a restricted set of possible values and then normalizes them to values that may not even occur in the original text.

At query time, the only normalization that happens is to convert the query terms to lowercase. The filtering and mapping steps that occur at index time are not applied to the query terms. Queries must then, in this example, be very precise, using only the normalized terms that were stored at index time.

About Tokenizers

The job of a tokenizer is to break up a stream of text into tokens, where each token is (usually) a sub-sequence of the characters in the text. An analyzer is aware of the field it is configured for, but a tokenizer is not. Tokenizers read from a character stream (a Reader) and produce a sequence of Token objects (a TokenStream).

Characters in the input stream may be discarded, such as whitespace or other delimiters. They may also be added to or replaced, such as mapping aliases or abbreviations to normalized forms. A token contains various metadata in addition to its text value, such as the location at which the token occurs in the field. Because a tokenizer may produce tokens that diverge from the input text, you should not assume that the text of the token is the same text that occurs in the field, or that its length is the same as the original text. It's also possible for more than one token to have the same position or refer to the same offset in the original text. Keep this in mind if you use token metadata for things like highlighting search results in the field text.

```
<fieldType name="text" class="solr.TextField">
  <analyzer>
    <tokenizer class="solr.StandardTokenizerFactory"/>
  </analyzer>
</fieldType>
```

The class named in the tokenizer element is not the actual tokenizer, but rather a class that implements the `org.apache.solr.analysis.TokenizerFactory` interface. This factory class will be called upon to create new tokenizer instances as needed. Objects created by the factory must derive from `org.apache.lucene.analysis.TokenStream`, which indicates that they produce sequences of tokens. If the tokenizer produces tokens that are usable as is, it may be the only component of the analyzer. Otherwise, the tokenizer's output tokens will serve as input to the first filter stage in the pipeline.

A `TypeTokenFilterFactory` is available that creates a `TypeTokenFilter` that filters tokens based on their TypeAttribute, which is set in `factory.getStopTypes`.

For a complete list of the available TokenFilters, see the section Tokenizers.

When To use a CharFilter vs. a TokenFilter

There are several pairs of CharFilters and TokenFilters that have related (ie: `MappingCharFilter` and `ASCIIFoldingFilter`) or nearly identical (ie: `PatternReplaceCharFilterFactory` and `PatternReplaceFilterFactory`) functionality and it may not always be obvious which is the best choice.

The decision about which to use depends largely on which Tokenizer you are using, and whether you need to preprocess the stream of characters.

For example, suppose you have a tokenizer such as `StandardTokenizer` and although you are pretty happy with how it works overall, you want to customize how some specific characters behave. You could modify the rules and re-build your own tokenizer with JFlex, but it might be easier to simply map some of the characters before tokenization with a `CharFilter`.

About Filters

Like tokenizers, filters consume input and produce a stream of tokens. Filters also derive from `org.apache.lucene.analysis.TokenStream`. Unlike tokenizers, a filter's input is another TokenStream. The job of a filter is usually easier than that of a tokenizer since in most cases a filter looks at each token in the stream sequentially and decides whether to pass it along, replace it or discard it.

A filter may also do more complex analysis by looking ahead to consider multiple tokens at once, although this is less common. One hypothetical use for such a filter might be to normalize state names that would be tokenized as two words. For example, the single token "california" would be replaced with "CA", while the token pair "rhode" followed by "island" would become the single token "RI".

Because filters consume one `TokenStream` and produce a new `TokenStream`, they can be chained one after another indefinitely. Each filter in the chain in turn processes the tokens produced by its predecessor. The order in which you specify the filters is therefore significant. Typically, the most general filtering is done first, and later filtering stages are more specialized.

```
<fieldType name="text" class="solr.TextField">
  <analyzer>
    <tokenizer class="solr.StandardTokenizerFactory"/>
    <filter class="solr.StandardFilterFactory"/>
    <filter class="solr.LowerCaseFilterFactory"/>
    <filter class="solr.EnglishPorterFilterFactory"/>
  </analyzer>
</fieldType>
```

This example starts with Solr's standard tokenizer, which breaks the field's text into tokens. Those tokens then pass through Solr's standard filter, which removes dots from acronyms, and performs a few other common operations. All the tokens are then set to lowercase, which will facilitate case-insensitive matching at query time.

The last filter in the above example is a stemmer filter that uses the Porter stemming algorithm. A stemmer is basically a set of mapping rules that maps the various forms of a word back to the base, or *stem*, word from which they derive. For example, in English the words "hugs", "hugging" and "hugged" are all forms of the stem word "hug". The stemmer will replace all of these terms with "hug", which is what will be indexed. This means that a query for "hug" will match the term "hugged", but not "huge".

Conversely, applying a stemmer to your query terms will allow queries containing non stem terms, like "hugging", to match documents with different variations of the same stem word, such as "hugged". This works because both the indexer and the query will map to the same stem ("hug").

Word stemming is, obviously, very language specific. Solr includes several language-specific stemmers created by the Snowball generator that are based on the Porter stemming algorithm. The generic Snowball Porter Stemmer Filter can be used to configure any of these language stemmers. Solr also includes a convenience wrapper for the English Snowball stemmer. There are also several purpose-built stemmers for non-English languages. These stemmers are described in Language Analysis.

Tokenizers

You configure the tokenizer for a text field type in `schema.xml` with a `<tokenizer>` element, as a child of `<analyzer>`:

```
<fieldType name="text" class="solr.TextField">
    <analyzer type="index">
        <tokenizer class="solr.StandardTokenizerFactory"/>
        <filter class="solr.StandardFilterFactory"/>
    </analyzer>
</fieldType>
```

The class attribute names a factory class that will instantiate a tokenizer object when needed. Tokenizer factory classes implement the `org.apache.solr.analysis.TokenizerFactory`. A TokenizerFactory's `create()` method accepts a Reader and returns a TokenStream. When Solr creates the tokenizer it passes a Reader object that provides the content of the text field.

Tokenizers discussed in this section:

- Standard Tokenizer

- Classic Tokenizer
- Keyword Tokenizer
- Letter Tokenizer
- Lower Case Tokenizer
- N-Gram Tokenizer
- Edge N-Gram Tokenizer
- ICU Tokenizer
- Path Hierarchy Tokenizer
- Regular Expression Pattern Tokenizer
- UAX29 URL Email Tokenizer
- White Space Tokenizer
- Related Topics

Arguments may be passed to tokenizer factories by setting attributes on the `<tokenizer>` element.

```
<fieldType name="semicolonDelimited" class="solr.TextField">
  <analyzer type="query">
  <tokenizer class="solr.PatternTokenizerFactory" pattern="; "/>
  <analyzer>
</fieldType>
```

The following sections describe the tokenizer factory classes included in this release of Solr.

For more information about Solr's tokenizers, see http://wiki.apache.org/solr/AnalyzersTokenizersTokenFilters.

Standard Tokenizer

This tokenizer splits the text field into tokens, treating whitespace and punctuation as delimiters. Delimiter characters are discarded, with the following exceptions:

- Periods (dots) that are not followed by whitespace are kept as part of the token, including Internet domain names.
- The "@" character is among the set of token-splitting punctuation, so email addresses are **not** preserved as single tokens.

Note that words are split at hyphens.

The Standard Tokenizer supports Unicode standard annex UAX#29 word boundaries with the following token types: `<ALPHANUM>`, `<NUM>`, `<SOUTHEAST_ASIAN>`, `<IDEOGRAPHIC>`, and `<HIRAGANA>`.

Factory class: `solr.StandardTokenizerFactory`

Arguments:

`maxTokenLength`: (integer, default 255) Solr ignores tokens that exceed the number of characters specified by `maxTokenLength`.

Example:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
</analyzer>
```

In: "Please, email john.doe@foo.com by 03-09, re: m37-xq."

Out: "Please", "email", "john.doe", "foo.com", "by", "03", "09", "re", "m37", "xq"

Classic Tokenizer

The Classic Tokenizer preserves the same behavior as the Standard Tokenizer of Solr versions 3.1 and previous. It does not use the Unicode standard annex UAX#29 word boundary rules that the Standard Tokenizer uses. This tokenizer splits the text field into tokens, treating whitespace and punctuation as delimiters. Delimiter characters are discarded, with the following exceptions:

- Periods (dots) that are not followed by whitespace are kept as part of the token.
- Words are split at hyphens, unless there is a number in the word, in which case the token is not split and the numbers and hyphen(s) are preserved.
- Recognizes Internet domain names and email addresses and preserves them as a single token.

Factory class: `solr.ClassicTokenizerFactory`

Arguments:

`maxTokenLength`: (integer, default 255) Solr ignores tokens that exceed the number of characters specified by `maxTokenLength`.

Example:

```
<analyzer>
  <tokenizer class="solr.ClassicTokenizerFactory"/>
</analyzer>
```

In: "Please, email john.doe@foo.com by 03-09, re: m37-xq."

Out: "Please", "email", "john.doe@foo.com", "by", "03-09", "re", "m37-xq"

Keyword Tokenizer

This tokenizer treats the entire text field as a single token.

Factory class: `solr.KeywordTokenizerFactory`

Arguments: None

Example:

```
<analyzer>
  <tokenizer class="solr.KeywordTokenizerFactory"/>
</analyzer>
```

In: "Please, email john.doe@foo.com by 03-09, re: m37-xq."

Out: "Please, email john.doe@foo.com by 03-09, re: m37-xq."

Letter Tokenizer

This tokenizer creates tokens from strings of contiguous letters, discarding all non-letter characters.

Factory class: `solr.LetterTokenizerFactory`

Arguments: None

Example:

```
<analyzer>
  <tokenizer class="solr.LetterTokenizerFactory"/>
</analyzer>
```

In: "I can't."

Out: "I", "can", "t"

Lower Case Tokenizer

Tokenizes the input stream by delimiting at non-letters and then converting all letters to lowercase. Whitespace and non-letters are discarded.

Factory class: `solr.LowerCaseTokenizerFactory`

Arguments: None

Example:

```
<analyzer>
  <tokenizer class="solr.LowerCaseTokenizerFactory"/>
</analyzer>
```

In: "I just **LOVE** my iPhone!"

Out: "i", "just", "love", "my", "iphone"

N-Gram Tokenizer

Reads the field text and generates n-gram tokens of sizes in the given range.

Factory class: `solr.NGramTokenizerFactory`

Arguments:

`minGramSize`: (integer, default 1) The minimum n-gram size, must be > 0.

`maxGramSize`: (integer, default 2) The maximum n-gram size, must be >= `minGramSize`.

Example:

Default behavior. Note that this tokenizer operates over the whole field. It does not break the field at whitespace. As a result, the space character is included in the encoding.

```
<analyzer>
  <tokenizer class="solr.NGramTokenizerFactory"/>
</analyzer>
```

In: "hey man"

Out: "h", "e", "y", " ", "m", "a", "n", "he", "ey", "y ", " m", "ma", "an"

Example:

With an n-gram size range of 4 to 5:

```
<analyzer>
  <tokenizer class="solr.NGramTokenizerFactory" minGramSize="4" maxGramSize="5"/>
</analyzer>
```

In: "bicycle"

Out: "bicy", "bicyc", "icyc", "icycl", "cycl", "cycle", "ycle"

Edge N-Gram Tokenizer

Reads the field text and generates edge n-gram tokens of sizes in the given range.

Factory class: `solr.EdgeNGramTokenizerFactory`

Arguments:

`minGramSize`: (integer, default is 1) The minimum n-gram size, must be > 0.

`maxGramSize`: (integer, default is 1) The maximum n-gram size, must be >= `minGramSize`.

`side`: ("front" or "back", default is "front") Whether to compute the n-grams from the beginning (front) of the text or from the end (back).

Example:

Default behavior (min and max default to 1):

```
<analyzer>
  <tokenizer class="solr.EdgeNGramTokenizerFactory"/>
</analyzer>
```

In: "babaloo"

Out: "b"

Example:

Edge n-gram range of 2 to 5

```
<analyzer>
  <tokenizer class="solr.EdgeNGramTokenizerFactory" minGramSize="2"
maxGramSize="5"/>
</analyzer>
```

In: "babaloo"

Out:"ba", "bab", "baba", "babal"

Example:

Edge n-gram range of 2 to 5, from the back side:

```
<analyzer>
  <tokenizer class="solr.EdgeNGramTokenizerFactory" minGramSize="2" maxGramSize="5"
side="back"/>
</analyzer>
```

In: "babaloo"

Out: "oo", "loo", "aloo", "baloo"

ICU Tokenizer

This tokenizer processes multilingual text and tokenizes it appropriately based on its script attribute.

You can customize this tokenizer's behavior by specifying per-script rule files. To add per-script rules, add a `rulefiles` argument, which should contain a comma-separated list of `code:rulefile` pairs in the following format: four-letter ISO 15924 script code, followed by a colon, then a resource path. For example, to specify rules for Latin (script code "Latn") and Cyrillic (script code "Cyrl"), you would enter `Latn:my.Latin.rules.rbbi,Cyrl:my.Cyrillic.rules.rbbi`.

The default `solr.ICUTokenizerFactory` provides UAX#29 word break rules tokenization (like `solr.StandardTokenizer`), but also includes custom tailorings for Hebrew (specializing handling of double and single quotation marks), and for syllable tokenization for Khmer, Lao, and Myanmar.

Factory class: `solr.ICUTokenizerFactory`

Arguments:

`rulefile`: a comma-separated list of `code:rulefile` pairs in the following format: four-letter ISO 15924 script code, followed by a colon, then a resource path.

Example:

```
<analyzer>
    <!-- no customization -->
    <tokenizer class="solr.ICUTokenizerFactory"/>
  </analyzer>
```

```
<analyzer>
    <tokenizer class="solr.ICUTokenizerFactory"
    rulefiles="Latn:my.Latin.rules.rbbi,Cyrl:my.Cyrillic.rules.rbbi"
  />
  </analyzer>
```

Path Hierarchy Tokenizer

This tokenizer creates synonyms from file path hierarchies.

Factory class: `solr.PathHierarchyTokenizerFactory`

Arguments:

`delimiter`: (character, no default) You can specify the file path delimiter and replace it with a delimiter you provide. This can be useful for working with backslash delimiters.

`replace`: (character, no default) Specifies the delimiter character Solr uses in the tokenized output.

Example:

```
<fieldType name="text_path" class="solr.TextField" positionIncrementGap="100">
  <analyzer>
    <tokenizer class="solr.PathHierarchyTokenizerFactory" delimiter="\"
replace="/"/>
  </analyzer>
</fieldType>
```

In: "c:\usr\local\apache"

Out: "c:", "c:/usr", "c:/usr/local", "c:/usr/local/apache"

Regular Expression Pattern Tokenizer

This tokenizer uses a Java regular expression to break the input text stream into tokens. The expression provided by the pattern argument can be interpreted either as a delimiter that separates tokens, or to match patterns that should be extracted from the text as tokens.

See the Javadocs for `java.util.regex.Pattern` for more information on Java regular expression syntax.

Factory class: `solr.PatternTokenizerFactory`

Arguments:

`pattern`: (Required) The regular expression, as defined by in `java.util.regex.Pattern`.

`group`: (Optional, default -1) Specifies which regex group to extract as the token(s). The value -1 means the regex should be treated as a delimiter that separates tokens. Non-negative group numbers (>= 0) indicate that character sequences matching that regex group should be converted to tokens. Group zero refers to the entire regex, groups greater than zero refer to parenthesized sub-expressions of the regex, counted from left to right.

Example:

A comma separated list. Tokens are separated by a sequence of zero or more spaces, a comma, and zero or more spaces.

```
<analyzer>
  <tokenizer class="solr.PatternTokenizerFactory" pattern="\s*,\s*"/>
</analyzer>
```

In: "fee,fie, foe , fum, foo"

Out: "fee", "fie", "foe", "fum", "foo"

Example:

Extract simple, capitalized words. A sequence of at least one capital letter followed by zero or more letters of either case is extracted as a token.

```
<analyzer>
  <tokenizer class="solr.PatternTokenizerFactory" pattern="[A-Z][A-Za-z]*"
group="0"/>
</analyzer>
```

In: "Hello. My name is Inigo Montoya. You killed my father. Prepare to die."

Out: "Hello", "My", "Inigo", "Montoya", "You", "Prepare"

Example:

Extract part numbers which are preceded by "SKU", "Part" or "Part Number", case sensitive, with an optional semi-colon separator. Part numbers must be all numeric digits, with an optional hyphen. Regex capture groups are numbered by counting left parenthesis from left to right. Group 3 is the subexpression "[0-9-]+", which matches one or more digits or hyphens.

```
<analyzer>
  <tokenizer class="solr.PatternTokenizerFactory"
pattern="(SKU|Part(\sNumber)?):?\s(\[0-9-\]+)" group="3"/>
</analyzer>
```

In: "SKU: 1234, Part Number 5678, Part: 126-987"

Out: "1234", "5678", "126-987"

UAX29 URL Email Tokenizer

This tokenizer splits the text field into tokens, treating whitespace and punctuation as delimiters. Delimiter characters are discarded, with the following exceptions:

- Periods (dots) that are not followed by whitespace are kept as part of the token.
- Words are split at hyphens, unless there is a number in the word, in which case the token is not split and the numbers and hyphen(s) are preserved.
- Recognizes top-level Internet domain names (validated against the white list in the IANA Root Zone Database when the tokenizer was generated); email addresses; `file : //`, `http(s)://`, and `ftp://` addresses; IPv4 and IPv6 addresses; and preserves them as a single token.

The UAX29 URL Email Tokenizer supports Unicode standard annex UAX#29 word boundaries with the following token types: `<ALPHANUM>`, `<NUM>`, `<URL>`, `<EMAIL>`, `<SOUTHEAST_ASIAN>`, `<IDEOGRAPHIC>`, and `<HIRAGANA>`.

Factory class: `solr.UAX29URLEmailTokenizerFactory`

Arguments:

`maxTokenLength`: (integer, default 255) Solr ignores tokens that exceed the number of characters specified by `maxTokenLength`.

Example:

```
<analyzer>
  <tokenizer class="solr.UAX29URLEmailTokenizerFactory"/>
</analyzer>
```

In: "Visit http://accarol.com/contact.htm?from=external&a=10 or e-mail bob.cratchet@accarol.com"

Out: "Visit", "http://accarol.com/contact.htm?from=external&a=10", "or", "e", "mail", "bob.cratchet@accarol.com"

White Space Tokenizer

Simple tokenizer that splits the text stream on whitespace and returns sequences of non-whitespace characters as tokens. Note that any punctuation *will* be included in the tokenization.

Factory class: `solr.WhitespaceTokenizerFactory`

Arguments: None

Example:

```
<analyzer>
  <tokenizer class="solr.WhitespaceTokenizerFactory"/>
</analyzer>
```

In: "To be, or what?"

Out: "To", "be,", "or", "what?"

Related Topics

- TokenizerFactories

Filter Descriptions

You configure each filter with a `<filter>` element in `schema.xml` as a child of `<analyzer>`, following the `<tokenizer>` element. Filter definitions should follow a tokenizer or another filter definition because they take a `TokenStream` as input. For example.

```
<fieldType name="text" class="solr.TextField">
    <analyzer type="index">
        <tokenizer class="solr.StandardTokenizerFactory"/>
        <filter class="solr.LowerCaseFilterFactory"/>...
    </analyzer>
</fieldType>
```

The class attribute names a factory class that will instantiate a filter object as needed. Filter factory classes must implement the `org.apache.solr.analysis.TokenFilterFactory` interface. Like tokenizers, filters are also instances of TokenStream and thus are producers of tokens. Unlike tokenizers, filters also consume tokens from a TokenStream. This allows you to mix and match filters, in any order you prefer, downstream of a tokenizer.

Arguments may be passed to tokenizer factories to modify their behavior by setting attributes on the `<filter>` element. For example:

```
<fieldType name="semicolonDelimited" class="solr.TextField">
  <analyzer type="query">
    <tokenizer class="solr.PatternTokenizerFactory" pattern="; " />
    <filter class="solr.LengthFilterFactory" min="2" max="7"/>
  </analyzer>
</fieldType>
```

The following sections describe the filter factories that are included in this release of Solr.

For more information about Solr's filters, see http://wiki.apache.org/solr/AnalyzersTokenizersTokenFilters.

Filters discussed in this section:

- ASCII Folding Filter
- Beider-Morse Filter
- Classic Filter
- Common Grams Filter
- Collation Key Filter
- Daitch-Mokotoff Soundex Filter
- Double Metaphone Filter
- Edge N-Gram Filter
- English Minimal Stem Filter
- Hunspell Stem Filter
- Hyphenated Words Filter
- ICU Folding Filter
- ICU Normalizer 2 Filter
- ICU Transform Filter
- Keep Words Filter
- KStem Filter
- Length Filter
- Lower Case Filter
- Managed Stop Filter
- Managed Synonym Filter
- N-Gram Filter
- Numeric Payload Token Filter
- Pattern Replace Filter
- Phonetic Filter
- Porter Stem Filter
- Remove Duplicates Token Filter
- Reversed Wildcard Filter
- Shingle Filter
- Snowball Porter Stemmer Filter
- Standard Filter
- Stop Filter
- Suggest Stop Filter
- Synonym Filter
- Token Offset Payload Filter
- Trim Filter
- Type As Payload Filter
- Type Token Filter
- Word Delimiter Filter

- Related Topics

ASCII Folding Filter

This filter converts alphabetic, numeric, and symbolic Unicode characters which are not in the Basic Latin Unicode block (the first 127 ASCII characters) to their ASCII equivalents, if one exists. This filter converts characters from the following Unicode blocks:

- C1 Controls and Latin-1 Supplement (PDF)
- Latin Extended-A (PDF)
- Latin Extended-B (PDF)
- Latin Extended Additional (PDF)
- Latin Extended-C (PDF)
- Latin Extended-D (PDF)
- IPA Extensions (PDF)
- Phonetic Extensions (PDF)
- Phonetic Extensions Supplement (PDF)
- General Punctuation (PDF)
- Superscripts and Subscripts (PDF)
- Enclosed Alphanumerics (PDF)
- Dingbats (PDF)
- Supplemental Punctuation (PDF)
- Alphabetic Presentation Forms (PDF)
- Halfwidth and Fullwidth Forms (PDF)

Factory class: `solr.ASCIIFoldingFilterFactory`

Arguments: None

Example:

```
<analyzer>
  <filter class="solr.ASCIIFoldingFilterFactory"/>
</analyzer>
```

In: "á" (Unicode character 00E1)

Out: "a" (ASCII character 97)

Beider-Morse Filter

Implements the Beider-Morse Phonetic Matching (BMPM) algorithm, which allows identification of similar names, even if they are spelled differently or in different languages. More information about how this works is available in the section on Phonetic Matching.

> ⚠ BeiderMorseFilter changed its behavior in Solr 5.0 (version 3.04 of the BMPM algorithm is implemented, while previous Solr versions implemented BMPM version 3.00 - see http://stevemorse.org/phoneticinfo.htm), so any index built using this filter with earlier versions of Solr will need to be rebuilt.

Factory class: `solr.BeiderMorseFilterFactory`

Arguments:

nameType: Types of names. Valid values are GENERIC, ASHKENAZI, or SEPHARDIC. If not processing Ashkenazi or Sephardic names, use GENERIC.

ruleType: Types of rules to apply. Valid values are APPROX or EXACT.

concat: Defines if multiple possible matches should be combined with a pipe ("|").

languageSet: The language set to use. The value "auto" will allow the Filter to identify the language, or a comma-separated list can be supplied.

Example:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.BeiderMorseFilterFactory" nameType="GENERIC" ruleType="APPROX"

          concat="true" languageSet="auto">
  </filter>
</analyzer>
```

Classic Filter

This filter takes the output of the Classic Tokenizer and strips periods from acronyms and "'s" from possessives.

Factory class: solr.ClassicFilterFactory

Arguments: None

Example:

```
<analyzer>
  <tokenizer class="solr.ClassicTokenizerFactory"/>
  <filter class="solr.ClassicFilterFactory"/>
</analyzer>
```

In: "I.B.M. cat's can't"

Tokenizer to Filter: "I.B.M", "cat's", "can't"

Out: "IBM", "cat", "can't"

Common Grams Filter

This filter creates word shingles by combining common tokens such as stop words with regular tokens. This is useful for creating phrase queries containing common words, such as "the cat." Solr normally ignores stop words in queried phrases, so searching for "the cat" would return all matches for the word "cat."

Factory class: solr.CommonGramsFilterFactory

Arguments:

words: (a common word file in .txt format) Provide the name of a common word file, such as stopwords.txt.

format: (optional) If the stopwords list has been formatted for Snowball, you can specify format="snowball" so Solr can read the stopwords file.

`ignoreCase`: (boolean) If true, the filter ignores the case of words when comparing them to the common word file. The default is false.

Example:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.CommonGramsFilterFactory" words="stopwords.txt"
ignoreCase="true"/>
</analyzer>
```

In: "the Cat"

Tokenizer to Filter: "the", "Cat"

Out: "the_cat"

Collation Key Filter

Collation allows sorting of text in a language-sensitive way. It is usually used for sorting, but can also be used with advanced searches. We've covered this in much more detail in the section on Unicode Collation.

Daitch-Mokotoff Soundex Filter

Implements the Daitch-Mokotoff Soundex algorithm, which allows identification of similar names, even if they are spelled differently. More information about how this works is available in the section on Phonetic Matching.

Factory class: `solr.DaitchMokotoffSoundexFilterFactory`

Arguments:

`inject` : (true/false) If true (the default), then new phonetic tokens are added to the stream. Otherwise, tokens are replaced with the phonetic equivalent. Setting this to false will enable phonetic matching, but the exact spelling of the target word may not match.

Example:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.DaitchMokotoffSoundexFilterFactory" inject="true"/>
</analyzer>
```

Double Metaphone Filter

This filter creates tokens using the `DoubleMetaphone` encoding algorithm from commons-codec. For more information, see the Phonetic Matching section.

Factory class: `solr.DoubleMetaphoneFilterFactory`

Arguments:

`inject`: (true/false) If true (the default), then new phonetic tokens are added to the stream. Otherwise, tokens are replaced with the phonetic equivalent. Setting this to false will enable phonetic matching, but the exact spelling of the target word may not match.

`maxCodeLength`: (integer) The maximum length of the code to be generated.

Example:

Default behavior for inject (true): keep the original token and add phonetic token(s) at the same position.

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.DoubleMetaphoneFilterFactory"/>
</analyzer>
```

In: "four score and Kuczewski"

Tokenizer to Filter: "four"(1), "score"(2), "and"(3), "Kuczewski"(4)

Out: "four"(1), "FR"(1), "score"(2), "SKR"(2), "and"(3), "ANT"(3), "Kuczewski"(4), "KSSK"(4), "KXFS"(4)

The phonetic tokens have a position increment of 0, which indicates that they are at the same position as the token they were derived from (immediately preceding). Note that "Kuczewski" has two encodings, which are added at the same position.

Example:

Discard original token (`inject="false"`).

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.DoubleMetaphoneFilterFactory" inject="false"/>
</analyzer>
```

In: "four score and Kuczewski"

Tokenizer to Filter: "four"(1), "score"(2), "and"(3), "Kuczewski"(4)

Out: "FR"(1), "SKR"(2), "ANT"(3), "KSSK"(4), "KXFS"(4)

Note that "Kuczewski" has two encodings, which are added at the same position.

Edge N-Gram Filter

This filter generates edge n-gram tokens of sizes within the given range.

Factory class: `solr.EdgeNGramFilterFactory`

Arguments:

`minGramSize`: (integer, default 1) The minimum gram size.

`maxGramSize`: (integer, default 1) The maximum gram size.

Example:

Default behavior.

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.EdgeNGramFilterFactory"/>
</analyzer>
```

In: "four score and twenty"

Tokenizer to Filter: "four", "score", "and", "twenty"

Out: "f", "s", "a", "t"

Example:

A range of 1 to 4.

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.EdgeNGramFilterFactory" minGramSize="1" maxGramSize="4"/>
</analyzer>
```

In: "four score"

Tokenizer to Filter: "four", "score"

Out: "f", "fo", "fou", "four", "s", "sc", "sco", "scor"

Example:

A range of 4 to 6.

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.EdgeNGramFilterFactory" minGramSize="4" maxGramSize="6"/>
</analyzer>
```

In: "four score and twenty"

Tokenizer to Filter: "four", "score", "and", "twenty"

Out: "four", "scor", "score", "twen", "twent", "twenty"

English Minimal Stem Filter

This filter stems plural English words to their singular form.

Factory class: `solr.EnglishMinimalStemFilterFactory`

Arguments: None

Example:

```
<analyzer type="index">
  <tokenizer class="solr.StandardTokenizerFactory "/>
  <filter class="solr.EnglishMinimalStemFilterFactory"/>
</analyzer>
```

In: "dogs cats"

Tokenizer to Filter: "dogs", "cats"

Out: "dog", "cat"

Hunspell Stem Filter

The Hunspell Stem Filter provides support for several languages. You must provide the dictionary (`.dic`) and rules (`.aff`) files for each language you wish to use with the Hunspell Stem Filter. You can download those language files here. Be aware that your results will vary widely based on the quality of the provided dictionary and rules files. For example, some languages have only a minimal word list with no morphological information. On the other hand, for languages that have no stemmer but do have an extensive dictionary file, the Hunspell stemmer may be a good choice.

Factory class: `solr.HunspellStemFilterFactory`

Arguments:

`dictionary`: (required) The path of a dictionary file.
`affix`: (required) The path of a rules file.
`ignoreCase`: (boolean) controls whether matching is case sensitive or not. The default is false.
`strictAffixParsing`: (boolean) controls whether the affix parsing is strict or not. If true, an error while reading an affix rule causes a ParseException, otherwise is ignored. The default is true.

Example:

```
<analyzer type="index">
  <tokenizer class="solr.WhitespaceTokenizerFactory"/>
  <filter class="solr.HunspellStemFilterFactory"
    dictionary="en_GB.dic"
    affix="en_GB.aff"
    ignoreCase="true"
    strictAffixParsing="true" />
</analyzer>
```

In: "jump jumping jumped"

Tokenizer to Filter: "jump", "jumping", "jumped"

Out: "jump", "jump", "jump"

Hyphenated Words Filter

This filter reconstructs hyphenated words that have been tokenized as two tokens because of a line break or other intervening whitespace in the field test. If a token ends with a hyphen, it is joined with the following token and the hyphen is discarded. Note that for this filter to work properly, the upstream tokenizer must not remove trailing hyphen characters. This filter is generally only useful at index time.

Factory class: `solr.HyphenatedWordsFilterFactory`

Arguments: None

Example:

```
<analyzer type="index">
  <tokenizer class="solr.WhitespaceTokenizerFactory"/>
  <filter class="solr.HyphenatedWordsFilterFactory"/>
</analyzer>
```

In: "A hyphen- ated word"

Tokenizer to Filter: "A", "hyphen-", "ated", "word"

Out: "A", "hyphenated", "word"

ICU Folding Filter

This filter is a custom Unicode normalization form that applies the foldings specified in Unicode Technical Report 30 in addition to the `NFKC_Casefold` normalization form as described in ICU Normalizer 2 Filter. This filter is a better substitute for the combined behavior of the ASCII Folding Filter, Lower Case Filter, and ICU Normalizer 2 Filter.

To use this filter, see `solr/contrib/analysis-extras/README.txt` for instructions on which jars you need to add to your `solr_home/lib`.

Factory class: `solr.ICUFoldingFilterFactory`

Arguments: None

Example:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.ICUFoldingFilterFactory"/>
</analyzer>
```

For detailed information on this normalization form, see http://www.unicode.org/reports/tr30/tr30-4.html.

ICU Normalizer 2 Filter

This filter factory normalizes text according to one of five Unicode Normalization Forms as described in Unicode Standard Annex #15:

- NFC: (name="nfc" mode="compose") Normalization Form C, canonical decomposition
- NFD: (name="nfc" mode="decompose") Normalization Form D, canonical decomposition, followed by canonical composition
- NFKC: (name="nfkc" mode="compose") Normalization Form KC, compatibility decomposition
- NFKD: (name="nfkc" mode="decompose") Normalization Form KD, compatibility decomposition, followed by canonical composition
- NFKC_Casefold: (name="nfkc_cf" mode="compose") Normalization Form KC, with additional Unicode case folding. Using the ICU Normalizer 2 Filter is a better-performing substitution for the Lower Case Filter and NFKC normalization.

Factory class: `solr.ICUNormalizer2FilterFactory`

Arguments:

`name`: (string) The name of the normalization form; `nfc`, `nfd`, `nfkc`, `nfkd`, `nfkc_cf`

`mode`: (string) The mode of Unicode character composition and decomposition; `compose` or `decompose`

Example:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.ICUNormalizer2FilterFactory" name="nkc_cf" mode="compose"/>
</analyzer>
```

For detailed information about these Unicode Normalization Forms, see http://unicode.org/reports/tr15/.

To use this filter, see `solr/contrib/analysis-extras/README.txt` for instructions on which jars you need to add to your `solr_home/lib`.

ICU Transform Filter

This filter applies ICU Tranforms to text. This filter supports only ICU System Transforms. Custom rule sets are not supported.

Factory class: `solr.ICUTransformFilterFactory`

Arguments:

`id`: (string) The identifier for the ICU System Transform you wish to apply with this filter. For a full list of ICU System Transforms, see http://demo.icu-project.org/icu-bin/translit?TEMPLATE_FILE=data/translit_rule_main.html.

Example:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.ICUTransformFilterFactory" id="Traditional-Simplified"/>
</analyzer>
```

For detailed information about ICU Transforms, see http://userguide.icu-project.org/transforms/general.

To use this filter, see `solr/contrib/analysis-extras/README.txt` for instructions on which jars you need to add to your `solr_home/lib`.

Keep Words Filter

This filter discards all tokens except those that are listed in the given word list. This is the inverse of the Stop Words Filter. This filter can be useful for building specialized indices for a constrained set of terms.

Factory class: `solr.KeepWordFilterFactory`

Arguments:

`words`: (required) Path of a text file containing the list of keep words, one per line. Blank lines and lines that begin with "#" are ignored. This may be an absolute path, or a simple filename in the Solr config directory.

`ignoreCase`: (true/false) If **true** then comparisons are done case-insensitively. If this argument is true, then the words file is assumed to contain only lowercase words. The default is **false**.

`enablePositionIncrements`: if `luceneMatchVersion` is `4.3` or earlier and `enablePositionIncrements="false"`, no position holes will be left by this filter when it removes tokens. **This argument is invalid if `luceneMatchVersion` is `5.0` or later.**

Example:

Where `keepwords.txt` contains:

`happy`

`funny`

`silly`

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.KeepWordFilterFactory" words="keepwords.txt"/>
</analyzer>
```

In: "Happy, sad or funny"

Tokenizer to Filter: "Happy", "sad", "or", "funny"

Out: "funny"

Example:

Same `keepwords.txt`, case insensitive:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.KeepWordFilterFactory" words="keepwords.txt"
ignoreCase="true"/>
</analyzer>
```

In: "Happy, sad or funny"

Tokenizer to Filter: "Happy", "sad", "or", "funny"

Out: "Happy", "funny"

Example:

Using LowerCaseFilterFactory before filtering for keep words, no `ignoreCase` flag.

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.LowerCaseFilterFactory"/>
  <filter class="solr.KeepWordFilterFactory" words="keepwords.txt"/>
</analyzer>
```

In: "Happy, sad or funny"

Tokenizer to Filter: "Happy", "sad", "or", "funny"

Filter to Filter: "happy", "sad", "or", "funny"

Out: "happy", "funny"

KStem Filter

KStem is an alternative to the Porter Stem Filter for developers looking for a less aggressive stemmer. KStem was written by Bob Krovetz, ported to Lucene by Sergio Guzman-Lara (UMASS Amherst). This stemmer is only appropriate for English language text.

Factory class: `solr.KStemFilterFactory`

Arguments: None

Example:

```
<analyzer type="index">
  <tokenizer class="solr.StandardTokenizerFactory "/>
  <filter class="solr.KStemFilterFactory"/>
</analyzer>
```

In: "jump jumping jumped"

Tokenizer to Filter: "jump", "jumping", "jumped"

Out: "jump", "jump", "jump"

Length Filter

This filter passes tokens whose length falls within the min/max limit specified. All other tokens are discarded.

Factory class: `solr.LengthFilterFactory`

Arguments:

`min`: (integer, required) Minimum token length. Tokens shorter than this are discarded.

`max`: (integer, required, must be >= min) Maximum token length. Tokens longer than this are discarded.

`enablePositionIncrements`: if `luceneMatchVersion` is `4.3` or earlier and `enablePositionIncrements="false"`, no position holes will be left by this filter when it removes tokens. **This argument is invalid if `luceneMatchVersion` is `5.0` or later.**

Example:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.LengthFilterFactory" min="3" max="7"/>
</analyzer>
```

In: "turn right at Albuquerque"

Tokenizer to Filter: "turn", "right", "at", "Albuquerque"

Out: "turn", "right"

Lower Case Filter

Converts any uppercase letters in a token to the equivalent lowercase token. All other characters are left unchanged.

Factory class: `solr.LowerCaseFilterFactory`

Arguments: None

Example:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.LowerCaseFilterFactory"/>
</analyzer>
```

In: "Down With CamelCase"

Tokenizer to Filter: "Down", "With", "CamelCase"

Out: "down", "with", "camelcase"

Managed Stop Filter

This is specialized version of the Stop Words Filter Factory that uses a set of stop words that are managed from a REST API.

Arguments:

`managed`: The name that should be used for this set of stop words in the managed REST API.

Example:

With this configuration the set of words is named "english" and can be managed via `/solr/collection_name/schema/analysis/stopwords/english`

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.ManagedStopFilterFactory" managed="english"/>
</analyzer>
```

See Stop Filter for example input/output.

Managed Synonym Filter

This is specialized version of the Synonym Filter Factory that uses a mapping on synonyms that is managed from a REST API.

Arguments:

`managed`: The name that should be used for this mapping on synonyms in the managed REST API.

Example:

With this configuration the set of mappings is named "english" and can be managed via `/solr/collection_name/schema/analysis/synonyms/english`

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.ManagedSynonymFilterFactory" managed="english"/>
</analyzer>
```

See Synonym Filter for example input/output.

N-Gram Filter

Generates n-gram tokens of sizes in the given range. Note that tokens are ordered by position and then by gram size.

Factory class: `solr.NGramFilterFactory`

Arguments:

`minGramSize`: (integer, default 1) The minimum gram size.

`maxGramSize`: (integer, default 2) The maximum gram size.

Example:

Default behavior.

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.NGramFilterFactory"/>
</analyzer>
```

In: "four score"

Tokenizer to Filter: "four", "score"

Out: "f", "o", "u", "r", "fo", "ou", "ur", "s", "c", "o", "r", "e", "sc", "co", "or", "re"

Example:

A range of 1 to 4.

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.NGramFilterFactory" minGramSize="1" maxGramSize="4"/>
</analyzer>
```

In: "four score"

Tokenizer to Filter: "four", "score"

Out: "f", "fo", "fou", "four", "s", "sc", "sco", "scor"

Example:

A range of 3 to 5.

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.NGramFilterFactory" minGramSize="3" maxGramSize="5"/>
</analyzer>
```

In: "four score"

Tokenizer to Filter: "four", "score"

Out: "fou", "four", "our", "sco", "scor", "score", "cor", "core", "ore"

Numeric Payload Token Filter

This filter adds a numeric floating point payload value to tokens that match a given type. Refer to the Javadoc for the `org.apache.lucene.analysis.Token` class for more information about token types and payloads.

Factory class: `solr.NumericPayloadTokenFilterFactory`

Arguments:

`payload`: (required) A floating point value that will be added to all matching tokens.

`typeMatch`: (required) A token type name string. Tokens with a matching type name will have their payload set to the above floating point value.

Example:

```
<analyzer>
  <tokenizer class="solr.WhitespaceTokenizerFactory"/>
  <filter class="solr.NumericPayloadTokenFilterFactory" payload="0.75"
typeMatch="word"/>
</analyzer>
```

In: "bing bang boom"

Tokenizer to Filter: "bing", "bang", "boom"

Out: "bing"[0.75], "bang"[0.75], "boom"[0.75]

Pattern Replace Filter

This filter applies a regular expression to each token and, for those that match, substitutes the given replacement string in place of the matched pattern. Tokens which do not match are passed though unchanged.

Factory class: `solr.PatternReplaceFilterFactory`

Arguments:

`pattern`: (required) The regular expression to test against each token, as per `java.util.regex.Pattern`.

`replacement`: (required) A string to substitute in place of the matched pattern. This string may contain references to capture groups in the regex pattern. See the Javadoc for `java.util.regex.Matcher`.

`replace`: ("all" or "first", default "all") Indicates whether all occurrences of the pattern in the token should be replaced, or only the first.

Example:

Simple string replace:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.PatternReplaceFilterFactory" pattern="cat" replacement="dog"/>
</analyzer>
```

In: "cat concatenate catycat"

Tokenizer to Filter: "cat", "concatenate", "catycat"

Out: "dog", "condogenate", "dogydog"

Example:

String replacement, first occurrence only:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.PatternReplaceFilterFactory" pattern="cat" replacement="dog"
replace="first"/>
</analyzer>
```

In: "cat concatenate catycat"

Tokenizer to Filter: "cat", "concatenate", "catycat"

Out: "dog", "condogenate", "dogycat"

Example:

More complex pattern with capture group reference in the replacement. Tokens that start with non-numeric characters and end with digits will have an underscore inserted before the numbers. Otherwise the token is passed through.

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.PatternReplaceFilterFactory" pattern="(\D+)(\d+)$"
replacement="$1_$2"/>
</analyzer>
```

In: "cat foo1234 9987 blah1234foo"

Tokenizer to Filter: "cat", "foo1234", "9987", "blah1234foo"

Out: "cat", "foo_1234", "9987", "blah1234foo"

Phonetic Filter

This filter creates tokens using one of the phonetic encoding algorithms in the `org.apache.commons.codec.language` package. For more information, see the section on Phonetic Matching.

Factory class: `solr.PhoneticFilterFactory`

Arguments:

`encoder`: (required) The name of the encoder to use. The encoder name must be one of the following (case insensitive): "DoubleMetaphone", "Metaphone", "Soundex", "RefinedSoundex", "Caverphone" (v2.0), "ColognePhonetic", or "Nysiis".

`inject`: (true/false) If true (the default), then new phonetic tokens are added to the stream. Otherwise, tokens are replaced with the phonetic equivalent. Setting this to false will enable phonetic matching, but the exact spelling of the target word may not match.

`maxCodeLength`: (integer) The maximum length of the code to be generated by the Metaphone or Double Metaphone encoders.

Example:

Default behavior for DoubleMetaphone encoding.

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.PhoneticFilterFactory" encoder="DoubleMetaphone"/>
</analyzer>
```

In: "four score and twenty"

Tokenizer to Filter: "four"(1), "score"(2), "and"(3), "twenty"(4)

Out: "four"(1), "FR"(1), "score"(2), "SKR"(2), "and"(3), "ANT"(3), "twenty"(4), "TNT"(4)

The phonetic tokens have a position increment of 0, which indicates that they are at the same position as the token they were derived from (immediately preceding).

Example:

Discard original token.

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.PhoneticFilterFactory" encoder="DoubleMetaphone"
inject="false"/>
</analyzer>
```

In: "four score and twenty"

Tokenizer to Filter: "four"(1), "score"(2), "and"(3), "twenty"(4)

Out: "FR"(1), "SKR"(2), "ANT"(3), "TWNT"(4)

Example:

Default Soundex encoder.

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.PhoneticFilterFactory" encoder="Soundex"/>
</analyzer>
```

In: "four score and twenty"

Tokenizer to Filter: "four"(1), "score"(2), "and"(3), "twenty"(4)

Out: "four"(1), "F600"(1), "score"(2), "S600"(2), "and"(3), "A530"(3), "twenty"(4), "T530"(4)

Porter Stem Filter

This filter applies the Porter Stemming Algorithm for English. The results are similar to using the Snowball Porter Stemmer with the `language="English"` argument. But this stemmer is coded directly in Java and is not based on Snowball. It does not accept a list of protected words and is only appropriate for English language text. However, it has been benchmarked as four times faster than the English Snowball stemmer, so can provide a performance enhancement.

Factory class: `solr.PorterStemFilterFactory`

Arguments: None

Example:

```
<analyzer type="index">
  <tokenizer class="solr.StandardTokenizerFactory "/>
  <filter class="solr.PorterStemFilterFactory"/>
</analyzer>
```

In: "jump jumping jumped"

Tokenizer to Filter: "jump", "jumping", "jumped"

Out: "jump", "jump", "jump"

Remove Duplicates Token Filter

The filter removes duplicate tokens in the stream. Tokens are considered to be duplicates if they have the same text and position values.

Factory class: `solr.RemoveDuplicatesTokenFilterFactory`

Arguments: None

Example:

One example of where `RemoveDuplicatesTokenFilterFactory` is in situations where a synonym file is being used in conjuntion with a stemmer causes some synonyms to be reduced to the same stem. Consider the following entry from a `synonyms.txt` file:

```
 Television, Televisions, TV, TVs
```

When used in the following configuration:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.SynonymFilterFactory" synonyms="synonyms.txt"/>
  <filter class="solr.EnglishMinimalStemFilterFactory"/>
  <filter class="solr.RemoveDuplicatesTokenFilterFactory"/>
</analyzer>
```

In: "Watch TV"

Tokenizer to Synonym Filter: "Watch"(1) "TV"(2)

Synonym Filter to Stem Filter: "Watch"(1) "Television"(2) "Televisions"(2) "TV"(2) "TVs"(2)

Stem Filter to Remove Dups Filter: "Watch"(1) "Television"(2) "Television"(2) "TV"(2) "TV"(2)

Out: "Watch"(1) "Television"(2) "TV"(2)

Reversed Wildcard Filter

This filter reverses tokens to provide faster leading wildcard and prefix queries. Tokens without wildcards are not reversed.

Factory class: `solr.ReveresedWildcardFilterFactory`

Arguments:

`withOriginal` (boolean) If true, the filter produces both original and reversed tokens at the same positions. If false, produces only reversed tokens.

`maxPosAsterisk` (integer, default = 2) The maximum position of the asterisk wildcard ('*') that triggers the reversal of the query term. Terms with asterisks at positions above this value are not reversed.

`maxPosQuestion` (integer, default = 1) The maximum position of the question mark wildcard ('?') that triggers the reversal of query term. To reverse only pure suffix queries (queries with a single leading asterisk), set this to 0 and `maxPosAsterisk` to 1.

`maxFractionAsterisk` (float, default = 0.0) An additional parameter that triggers the reversal if asterisk ('*') position is less than this fraction of the query token length.

`minTrailing` (integer, default = 2) The minimum number of trailing characters in a query token after the last wildcard character. For good performance this should be set to a value larger than 1.

Example:

```
<analyzer type="index">
  <tokenizer class="solr.WhitespaceTokenizerFactory"/>
  <filter class="solr.ReversedWildcardFilterFactory" withOriginal="true"
    maxPosAsterisk="2" maxPosQuestion="1" minTrailing="2" maxFractionAsterisk="0"/>
</analyzer>
```

In: "*foo *bar"

Tokenizer to Filter: "*foo", "*bar"

Out: "oof*", "rab*"

Shingle Filter

This filter constructs shingles, which are token n-grams, from the token stream. It combines runs of tokens into a single token.

Factory class: `solr.ShingleFilterFactory`

Arguments:

`minShingleSize`: (integer, default 2) The minimum number of tokens per shingle.

`maxShingleSize`: (integer, must be >= 2, default 2) The maximum number of tokens per shingle.

`outputUnigrams`: (true/false) If true (the default), then each individual token is also included at its original position.

`outputUnigramsIfNoShingles`: (true/false) If false (the default), then individual tokens will be output if no shingles are possible.

`tokenSeparator`: (string, default is " ") The default string to use when joining adjacent tokens to form a shingle.

Example:

Default behavior.

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.ShingleFilterFactory"/>
</analyzer>
```

In: "To be, or what?"

Tokenizer to Filter: "To"(1), "be"(2), "or"(3), "what"(4)

Out: "To"(1), "To be"(1), "be"(2), "be or"(2), "or"(3), "or what"(3), "what"(4)

Example:

A shingle size of four, do not include original token.

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.ShingleFilterFactory" maxShingleSize="4"
outputUnigrams="false"/>
</analyzer>
```

In: "To be, or not to be."

Tokenizer to Filter: "To"(1), "be"(2), "or"(3), "not"(4), "to"(5), "be"(6)

Out: "To be"(1), "To be or"(1), "To be or not"(1), "be or"(2), "be or not"(2), "be or not to"(2), "or not"(3), "or not to"(3), "or not to be"(3), "not to"(4), "not to be"(4), "to be"(5)

Snowball Porter Stemmer Filter

This filter factory instantiates a language-specific stemmer generated by Snowball. Snowball is a software package that generates pattern-based word stemmers. This type of stemmer is not as accurate as a table-based stemmer, but is faster and less complex. Table-driven stemmers are labor intensive to create and maintain and so are typically commercial products.

Solr contains Snowball stemmers for Armenian, Basque, Catalan, Danish, Dutch, English, Finnish, French, German, Hungarian, Italian, Norwegian, Portuguese, Romanian, Russian, Spanish, Swedish and Turkish. For more information on Snowball, visit http://snowball.tartarus.org/.

`StopFilterFactory`, `CommonGramsFilterFactory`, and `CommonGramsQueryFilterFactory` can optionally read stopwords in Snowball format (specify `format="snowball"` in the configuration of those FilterFactories).

Factory class: `solr.SnowballPorterFilterFactory`

Arguments:

`language`: (default "English") The name of a language, used to select the appropriate Porter stemmer to use. Case is significant. This string is used to select a package name in the "org.tartarus.snowball.ext" class hierarchy.

`protected`: Path of a text file containing a list of protected words, one per line. Protected words will not be stemmed. Blank lines and lines that begin with "#" are ignored. This may be an absolute path, or a simple file name in the Solr config directory.

Example:

Default behavior:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.SnowballPorterFilterFactory"/>
</analyzer>
```

In: "flip flipped flipping"

Tokenizer to Filter: "flip", "flipped", "flipping"

Out: "flip", "flip", "flip"

Example:

French stemmer, English words:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.SnowballPorterFilterFactory" language="French"/>
</analyzer>
```

In: "flip flipped flipping"

Tokenizer to Filter: "flip", "flipped", "flipping"

Out: "flip", "flipped", "flipping"

Example:

Spanish stemmer, Spanish words:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.SnowballPorterFilterFactory" language="Spanish"/>
</analyzer>
```

In: "cante canta"

Tokenizer to Filter: "cante", "canta"

Out: "cant", "cant"

Standard Filter

This filter removes dots from acronyms and the substring "'s" from the end of tokens. This filter depends on the tokens being tagged with the appropriate term-type to recognize acronyms and words with apostrophes.

Factory class: `solr.StandardFilterFactory`

Arguments: None

> ⚠ This filter is no longer operational in Solr when the `luceneMatchVersion` (in `solrconfig.xml`) is higher than "3.1".

Stop Filter

This filter discards, or *stops* analysis of, tokens that are on the given stop words list. A standard stop words list is included in the Solr config directory, named `stopwords.txt`, which is appropriate for typical English language text.

Factory class: `solr.StopFilterFactory`

Arguments:

`words`: (optional) The path to a file that contains a list of stop words, one per line. Blank lines and lines that begin with "#" are ignored. This may be an absolute path, or path relative to the Solr config directory.

`format`: (optional) If the stopwords list has been formatted for Snowball, you can specify `format="snowball"` so Solr can read the stopwords file.

`ignoreCase`: (true/false, default false) Ignore case when testing for stop words. If true, the stop list should contain lowercase words.

`enablePositionIncrements`: if `luceneMatchVersion` is `4.4` or earlier and `enablePositionIncrements="false"`, no position holes will be left by this filter when it removes tokens. **This argument is invalid if `luceneMatchVersion` is `5.0` or later.**

Example:

Case-sensitive matching, capitalized words not stopped. Token positions skip stopped words.

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.StopFilterFactory" words="stopwords.txt"/>
</analyzer>
```

In: "To be or what?"

Tokenizer to Filter: "To"(1), "be"(2), "or"(3), "what"(4)

Out: "To"(1), "what"(4)

Example:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.StopFilterFactory" words="stopwords.txt" ignoreCase="true"/>
</analyzer>
```

In: "To be or what?"

Tokenizer to Filter: "To"(1), "be"(2), "or"(3), "what"(4)

Out: "what"(4)

Suggest Stop Filter

Like Stop Filter, this filter discards, or *stops* analysis of, tokens that are on the given stop words list. Suggest Stop Filter differs from Stop Filter in that it will not remove the last token unless it is followed by a token separator. For example, a query "`find the`" would preserve the '`the`' since it was not followed by a space, punctuation etc., and mark it as a `KEYWORD` so that following filters will not change or remove it. By contrast, a query like "`find the popsicle`" would remove "`the`" as a stopword, since it's followed by a space. When using one of the analyzing suggesters, you would normally use the ordinary `StopFilterFactory` in your index analyzer and then SuggestStopFilter in your query analyzer.

Factory class: `solr.SuggestStopFilterFactory`

Arguments:

`words`: (optional; default: `StopAnalyzer#ENGLISH_STOP_WORDS_SET`) The name of a stopwords file to parse.

`format`: (optional; default: `wordset`) Defines how the words file will be parsed. If `words` is not specified, then `format` must not be specified. The valid values for the format option are:

- `wordset`: This is the default format, which supports one word per line (including any intra-word whitespace) and allows whole line comments begining with the "`#`" character. Blank lines are ignored.
- `snowball`: This format allows for multiple words specified on each line, and trailing comments may be specified using the vertical line ("`|`"). Blank lines are ignored.

`ignoreCase`: (optional; default: `false`) If `true`, matching is case-insensitive.

Example:

```
<analyzer type="query">
  <tokenizer class="solr.WhitespaceTokenizerFactory"/>
  <filter class="solr.LowerCaseFilterFactory"/>
  <filter class="solr.SuggestStopFilterFactory" ignoreCase="true"
          words="stopwords.txt" format="wordset"/>
</analyzer>
```

In: "The The"

Tokenizer to Filter: "the"(1), "the"(2)

Out: "the"(2)

Synonym Filter

This filter does synonym mapping. Each token is looked up in the list of synonyms and if a match is found, then the synonym is emitted in place of the token. The position value of the new tokens are set such they all occur at the same position as the original token.

Factory class: `solr.SynonymFilterFactory`

Arguments:

`synonyms`: (required) The path of a file that contains a list of synonyms, one per line. In the (default) `solr` format - see the `format` argument below for alternatives - blank lines and lines that begin with "`#`" are ignored. This may be an absolute path, or path relative to the Solr config directory. There are two ways to specify synonym mappings:

- A comma-separated list of words. If the token matches any of the words, then all the words in the list are substituted, which will include the original token.
- Two comma-separated lists of words with the symbol "=>" between them. If the token matches any word on the left, then the list on the right is substituted. The original token will not be included unless it is also in the list on the right.

`ignoreCase`: (optional; default: `false`) If `true`, synonyms will be matched case-insensitively.

`expand`: (optional; default: `true`) If `true`, a synonym will be expanded to all equivalent synonyms. If `false`, all equivalent synonyms will be reduced to the first in the list.

`format`: (optional; default: `solr`) Controls how the synonyms will be parsed. The short names `solr` (for `SolrSynonymParser`) and `wordnet` (for `WordnetSynonymParser`) are supported, or you may alternatively supply the name of your own `SynonymMap.Builder` subclass.

`tokenizerFactory`: (optional; default: `WhitespaceTokenizerFactory`) The name of the tokenizer factory to use when parsing the synonyms file. Arguments with the name prefix "`tokenizerFactory.`" will be supplied as init params to the specified tokenizer factory. Any arguments not consumed by the synonym filter factory, including those without the "`tokenizerFactory.`" prefix, will also be supplied as init params to the tokenizer factory. If `tokenizerFactory` is specified, then `analyzer` may not be, and vice versa.

`analyzer`: (optional; default: `WhitespaceTokenizerFactory`) The name of the analyzer class to use when parsing the synonyms file. If `analyzer` is specified, then `tokenizerFactory` may not be, and vice versa.

For the following examples, assume a synonyms file named `mysynonyms.txt`:

```
couch,sofa,divan
teh => the
huge,ginormous,humungous => large
small => tiny,teeny,weeny
```

Example:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.SynonymFilterFactory" synonyms="mysynonyms.txt"/>
</analyzer>
```

In: "teh small couch"

Tokenizer to Filter: "teh"(1), "small"(2), "couch"(3)

Out: "the"(1), "tiny"(2), "teeny"(2), "weeny"(2), "couch"(3), "sofa"(3), "divan"(3)

Example:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory "/>
  <filter class="solr.SynonymFilterFactory" synonyms="mysynonyms.txt"/>
</analyzer>
```

In: "teh ginormous, humungous sofa"

Tokenizer to Filter: "teh"(1), "ginormous"(2), "humungous"(3), "sofa"(4)

Out: "the"(1), "large"(2), "large"(3), "couch"(4), "sofa"(4), "divan"(4)

Token Offset Payload Filter

This filter adds the numeric character offsets of the token as a payload value for that token.

Factory class: `solr.TokenOffsetPayloadTokenFilterFactory`

Arguments: None

Example:

```
<analyzer>
  <tokenizer class="solr.WhitespaceTokenizerFactory"/>
  <filter class="solr.TokenOffsetPayloadTokenFilterFactory"/>
</analyzer>
```

In: "bing bang boom"

Tokenizer to Filter: "bing", "bang", "boom"

Out: "bing"[0,4], "bang"[5,9], "boom"[10,14]

Trim Filter

This filter trims leading and/or trailing whitespace from tokens. Most tokenizers break tokens at whitespace, so this filter is most often used for special situations.

Factory class: `solr.TrimFilterFactory`

Arguments:

`updateOffsets`: if `luceneMatchVersion` is `4.3` or earlier and `updateOffsets="true"`, trimmed tokens' start and end offsets will be updated to those of the first and last characters (plus one) remaining in the token. **This argument is invalid if `luceneMatchVersion` is `5.0` or later.**

Example:

The PatternTokenizerFactory configuration used here splits the input on simple commas, it does not remove whitespace.

```
<analyzer>
  <tokenizer class="solr.PatternTokenizerFactory" pattern=","/>
  <filter class="solr.TrimFilterFactory"/>
</analyzer>
```

In: "one, two , three ,four "

Tokenizer to Filter: "one", " two ", " three ", "four "

Out: "one", "two", "three", "four"

Type As Payload Filter

This filter adds the token's type, as an encoded byte sequence, as its payload.

Factory class: `solr.TypeAsPayloadTokenFilterFactory`

Arguments: None

Example:

```
<analyzer>
  <tokenizer class="solr.WhitespaceTokenizerFactory"/>
  <filter class="solr.TypeAsPayloadTokenFilterFactory"/>
</analyzer>
```

In: "Pay Bob's I.O.U."

Tokenizer to Filter: "Pay", "Bob's", "I.O.U."

Out: "Pay"[<ALPHANUM>], "Bob's"[<APOSTROPHE>], "I.O.U."[<ACRONYM>]

Type Token Filter

This filter blacklists or whitelists a specified list of token types, assuming the tokens have type metadata associated with them. For example, the UAX29 URL Email Tokenizer emits "<URL>" and "<EMAIL>" typed tokens, as well as other types. This filter would allow you to pull out only e-mail addresses from text as tokens, if you wish.

Factory class: `solr.TypeTokenFilterFactory`

Arguments:

`types`: Defines the location of a file of types to filter.

`useWhitelist`: If **true**, the file defined in `types` should be used as include list. If **false**, or undefined, the file defined in `types` is used as a blacklist.

`enablePositionIncrements`: if `luceneMatchVersion` is `4.3` or earlier and `enablePositionIncrements="false"`, no position holes will be left by this filter when it removes tokens. **This argument is invalid if `luceneMatchVersion` is `5.0` or later.**

Example:

```
<analyzer>
  <filter class="solr.TypeTokenFilterFactory" types="stoptypes.txt"
useWhitelist="true"/>
</analyzer>
```

Word Delimiter Filter

This filter splits tokens at word delimiters. The rules for determining delimiters are determined as follows:

- A change in case within a word: "CamelCase" **->** "Camel", "Case". This can be disabled by setting `splitOnCaseChange="0"`.
- A transition from alpha to numeric characters or vice versa: "Gonzo5000" **->** "Gonzo", "5000" "4500XL" **->** "4500", "XL". This can be disabled by setting `splitOnNumerics="0"`.
- Non-alphanumeric characters (discarded): "hot-spot" **->** "hot", "spot"
- A trailing "'s" is removed: "O'Reilly's" **->** "O", "Reilly"
- Any leading or trailing delimiters are discarded: "--hot-spot--" **->** "hot", "spot"

Factory class: `solr.WordDelimiterFilterFactory`

Arguments:

`generateWordParts`: (integer, default 1) If non-zero, splits words at delimiters. For example:"CamelCase", "hot-spot" **->** "Camel", "Case", "hot", "spot"

`generateNumberParts`: (integer, default 1) If non-zero, splits numeric strings at delimiters:"1947-32" **->**"1947", "32"

`splitOnCaseChange`: (integer, default 1) If 0, words are not split on camel-case changes:"BugBlaster-XL" **->** "BugBlaster", "XL". Example 1 below illustrates the default (non-zero) splitting behavior.

`splitOnNumerics`: (integer, default 1) If 0, don't split words on transitions from alpha to numeric:"FemBot3000" **->** "Fem", "Bot3000"

`catenateWords`: (integer, default 0) If non-zero, maximal runs of word parts will be joined: "hot-spot-sensor's" **->** "hotspotsensor"

`catenateNumbers`: (integer, default 0) If non-zero, maximal runs of number parts will be joined: 1947-32" **->** "194732" `catenateAll`: (0/1, default 0) If non-zero, runs of word and number parts will be joined: "Zap-Master-9000" **->** "ZapMaster9000"

`preserveOriginal`: (integer, default 0) If non-zero, the original token is preserved: "Zap-Master-9000" **->** "Zap-Master-9000", "Zap", "Master", "9000"

`protected`: (optional) The pathname of a file that contains a list of protected words that should be passed through without splitting.

`stemEnglishPossessive`: (integer, default 1) If 1, strips the possessive "'s" from each subword.

Example:

Default behavior. The whitespace tokenizer is used here to preserve non-alphanumeric characters.

```
<analyzer>
  <tokenizer class="solr.WhitespaceTokenizerFactory"/>
  <filter class="solr.WordDelimiterFilterFactory"/>
</analyzer>
```

In: "hot-spot RoboBlaster/9000 100XL"

Tokenizer to Filter: "hot-spot", "RoboBlaster/9000", "100XL"

Out: "hot", "spot", "Robo", "Blaster", "9000", "100", "XL"

Example:

Do not split on case changes, and do not generate number parts. Note that by not generating number parts, tokens containing only numeric parts are ultimately discarded.

```
<analyzer>
  <tokenizer class="solr.WhitespaceTokenizerFactory"/>
  <filter class="solr.WordDelimiterFilterFactory" generateNumberParts="0"
splitOnCaseChange="0"/>
</analyzer>
```

In: "hot-spot RoboBlaster/9000 100-42"

Tokenizer to Filter: "hot-spot", "RoboBlaster/9000", "100-42"

Out: "hot", "spot", "RoboBlaster", "9000"

Example:

Concatenate word parts and number parts, but not word and number parts that occur in the same token.

```
<analyzer>
  <tokenizer class="solr.WhitespaceTokenizerFactory"/>
  <filter class="solr.WordDelimiterFilterFactory" catenateWords="1"
catenateNumbers="1"/>
</analyzer>
```

In: "hot-spot 100+42 XL40"

Tokenizer to Filter: "hot-spot"(1), "100+42"(2), "XL40"(3)

Out: "hot"(1), "spot"(2), "hotspot"(2), "100"(3), "42"(4), "10042"(4), "XL"(5), "40"(6)

Example:

Concatenate all. Word and/or number parts are joined together.

```
<analyzer>
  <tokenizer class="solr.WhitespaceTokenizerFactory"/>
  <filter class="solr.WordDelimiterFilterFactory" catenateAll="1"/>
</analyzer>
```

In: "XL-4000/ES"

Tokenizer to Filter: "XL-4000/ES"(1)

Out: "XL"(1), "4000"(2), "ES"(3), "XL4000ES"(3)

Example:

Using a protected words list that contains "AstroBlaster" and "XL-5000" (among others).

```
<analyzer>
  <tokenizer class="solr.WhitespaceTokenizerFactory"/>
  <filter class="solr.WordDelimiterFilterFactory" protected="protwords.txt"/>
</analyzer>
```

In: "FooBar AstroBlaster XL-5000 ==ES-34-"

Tokenizer to Filter: "FooBar", "AstroBlaster", "XL-5000", "==ES-34-"

Out: "FooBar", "FooBar", "AstroBlaster", "XL-5000", "ES", "34"

Related Topics

- TokenFilterFactories

CharFilterFactories

Char Filter is a component that pre-processes input characters. Char Filters can be chained like Token Filters and placed in front of a Tokenizer. Char Filters can add, change, or remove characters while preserving the original character offsets to support features like highlighting.

Topics discussed in this section:

- solr.MappingCharFilterFactory
- solr.HTMLStripCharFilterFactory
- solr.ICUNormalizer2CharFilterFactory
- solr.PatternReplaceCharFilterFactory
- Related Topics

solr.MappingCharFilterFactory

This filter creates `org.apache.lucene.analysis.MappingCharFilter`, which can be used for changing one string to another (for example, for normalizing `é` to `e`.).

This filter requires specifying a `mapping` argument, which is the path and name of a file containing the mappings to perform.

Example:

```
<analyzer>
  <charFilter class="solr.MappingCharFilterFactory"
mapping="mapping-FoldToASCII.txt"/>
  <tokenizer ...>
  [...]
</analyzer>
```

Mapping file syntax:

- Comment lines beginning with a hash mark (#), as well as blank lines, are ignored.
- Each non-comment, non-blank line consists of a mapping of the form: `"source" => "target"`
  - Double-quoted source string, optional whitespace, an arrow (=>), optional whitespace, double-quoted target string.
- Trailing comments on mapping lines are not allowed.
- The source string must contain at least one character, but the target string may be empty.
- The following character escape sequences are recognized within source and target strings:

Escape sequence	Resulting character (ECMA-48 alias)	Unicode character	Example mapping line
`\\`	`\`	U+005C	`"\\" => "/"`
`\"`	`"`	U+0022	`"\"and\"" => "'and'"`
`\b`	backspace (BS)	U+0008	`"\b" => " "`
`\t`	tab (HT)	U+0009	`"\t" => ","`
`\n`	newline (LF)	U+000A	`"\n" => "<br>"`
`\f`	form feed (FF)	U+000C	`"\f" => "\n"`
`\r`	carriage return (CR)	U+000D	`"\r" => "/carriage-return/"`
`\uXXXX`	Unicode char referenced by the 4 hex digits	U+XXXX	`"\uFEFF" => ""`

  - A backslash followed by any other character is interpreted as if the character were present without the backslash.

solr.HTMLStripCharFilterFactory

This filter creates `org.apache.solr.analysis.HTMLStripCharFilter`. This Char Filter strips HTML from the input stream and passes the result to another Char Filter or a Tokenizer.

This filter:

- Removes HTML/XML tags while preserving other content.
- Removes attributes within tags and supports optional attribute quoting.

- Removes XML processing instructions, such as: <?foo bar?>
- Removes XML comments.
- Removes XML elements starting with <!>.
- Removes contents of <script> and <style> elements.
- Handles XML comments inside these elements (normal comment processing will not always work).
- Replaces numeric character entities references like `&#65;` or `&#x7f;` with the corresponding character.
- The terminating ';' is optional if the entity reference at the end of the input; otherwise the terminating ';' is mandatory, to avoid false matches on something like "Alpha&Omega Corp".
- Replaces all named character entity references with the corresponding character.
- `&nbsp;` is replaced with a space instead of the 0xa0 character.
- Newlines are substituted for block-level elements.
- <CDATA> sections are recognized.
- Inline tags, such as <b>, `<i>`, or `<span>` will be removed.
- Uppercase character entities like `quot`, `gt`, `lt` and `amp` are recognized and handled as lowercase.

> The input need not be an HTML document. The filter removes only constructs that look like HTML. If the input doesn't include anything that looks like HTML, the filter won't remove any input.

The table below presents examples of HTML stripping.

Input	Output
`my <a href="www.foo.bar">link</a>`	my link
`<br>hello<!--comment-->`	hello
`hello<script><!-- f('<!--internal--></script>'); --></script>`	hello
`if a<b then print a;`	if a<b then print a;
`hello <td height=22 nowrap align="left">`	hello
`a<b &#65 Alpha&Omega`	a<b A Alpha&Omega

solr.ICUNormalizer2CharFilterFactory

This filter performs pre-tokenization Unicode normalization using ICU4J.

Arguments:

`name`: A Unicode Normalization Form, one of `nfc`, `nfkc`, `nfkc_cf`. Default is `nfkc_cf`.

`mode`: Either `compose` or `decompose`. Default is `compose`. Use `decompose` with `name="nfc"` or `name="nfkc"` to get NFD or NFKD, respectively.

`filter`: A UnicodeSet pattern. Codepoints outside the set are always left unchanged. Default is `[]` (the null set, no filtering - all codepoints are subject to normalization).

Example:

```
<analyzer>
  <charFilter class="solr.ICUNormalizer2CharFilterFactory"/>
  <tokenizer ...>
  [...]
</analyzer>
```

solr.PatternReplaceCharFilterFactory

This filter uses regular expressions to replace or change character patterns.

Arguments:

`pattern`: the regular expression pattern to apply to the incoming text.

`replacement`: the text to use to replace matching patterns.

You can configure this filter in `schema.xml` like this:

```
<analyzer>
  <charFilter class="solr.PatternReplaceCharFilterFactory"
             pattern="([nN][oO]\.)\s*(\d+)" replacement="$1$2"/>
  <tokenizer ...>
  [...]
</analyzer>
```

The table below presents examples of regex-based pattern replacement:

Input	pattern	replacement	Output	Description
see-ing looking	`(\w+)(ing)`	`$1`	see-ing look	Removes "ing" from the end of word.
see-ing looking	`(\w+)ing`	`$1`	see-ing look	Same as above. 2nd parentheses can be omitted.
No.1 NO. no. 543	`[nN][oO]\.\s*(\d+)`	`#$1`	#1 NO. #543	Replace some string literals
abc=1234=5678	`(\w+)=(\d+)=(\d+)`	`$3=$1=$2`	5678=abc=1234	Change the order of the groups.

Related Topics

- CharFilterFactories

Language Analysis

This section contains information about tokenizers and filters related to character set conversion or for use with specific languages. For the European languages, tokenization is fairly straightforward. Tokens are delimited by white space and/or a relatively small set of punctuation characters. In other languages the tokenization rules are often not so simple. Some European languages may require special tokenization rules as well, such as rules for decompounding German words.

For information about language detection at index time, see Detecting Languages During Indexing.

Topics discussed in this section:

- KeywordMarkerFilterFactory
- StemmerOverrideFilterFactory
- Dictionary Compound Word Token Filter
- Unicode Collation
- ASCII Folding Filter
- Language-Specific Factories
- Related Topics

KeywordMarkerFilterFactory

Protects words from being modified by stemmers. A customized protected word list may be specified with the "protected" attribute in the schema. Any words in the protected word list will not be modified by any stemmer in Solr.

A sample Solr `protwords.txt` with comments can be found in the `sample_techproducts_configs` config set directory:

```
<fieldtype name="myfieldtype" class="solr.TextField">
  <analyzer>
    <tokenizer class="solr.WhitespaceTokenizerFactory"/>
    <filter class="solr.KeywordMarkerFilterFactory" protected="protwords.txt" />
    <filter class="solr.PorterStemFilterFactory" />
  </analyzer>
</fieldtype>
```

StemmerOverrideFilterFactory

Overrides stemming algorithms by applying a custom mapping, then protecting these terms from being modified by stemmers.

A customized mapping of words to stems, in a tab-separated file, can be specified to the "dictionary" attribute in the schema. Words in this mapping will be stemmed to the stems from the file, and will not be further changed by any stemmer.

A sample stemdict.txt with comments can be found in the Source Repository.

```
<fieldtype name="myfieldtype" class="solr.TextField">
  <analyzer>
    <tokenizer class="solr.WhitespaceTokenizerFactory"/>
    <filter class="solr.StemmerOverrideFilterFactory" dictionary="stemdict.txt" />
    <filter class="solr.PorterStemFilterFactory" />
  </analyzer>
</fieldtype>
```

Dictionary Compound Word Token Filter

This filter splits, or *decompounds*, compound words into individual words using a dictionary of the component words. Each input token is passed through unchanged. If it can also be decompounded into subwords, each subword is also added to the stream at the same logical position.

Compound words are most commonly found in Germanic languages.

Factory class: `solr.DictionaryCompoundWordTokenFilterFactory`

Arguments:

`dictionary`: (required) The path of a file that contains a list of simple words, one per line. Blank lines and lines that begin with "#" are ignored. This path may be an absolute path, or path relative to the Solr config directory.

`minWordSize`: (integer, default 5) Any token shorter than this is not decompounded.

`minSubwordSize`: (integer, default 2) Subwords shorter than this are not emitted as tokens.

`maxSubwordSize`: (integer, default 15) Subwords longer than this are not emitted as tokens.

`onlyLongestMatch`: (true/false) If true (the default), only the longest matching subwords will generate new tokens.

Example:

Assume that `germanwords.txt` contains at least the following words: `dumm kopf donau dampf schiff`

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.DictionaryCompoundWordTokenFilterFactory"
dictionary="germanwords.txt"/>
</analyzer>
```

In: "Donaudampfschiff dummkopf"

Tokenizer to Filter: "Donaudampfschiff"(1), "dummkopf"(2),

Out: "Donaudampfschiff"(1), "Donau"(1), "dampf"(1), "schiff"(1), "dummkopf"(2), "dumm"(2), "kopf"(2)

Unicode Collation

Unicode Collation is a language-sensitive method of sorting text that can also be used for advanced search purposes.

Unicode Collation in Solr is fast, because all the work is done at index time.

Rather than specifying an analyzer within `<fieldtype ... class="solr.TextField">`, the `solr.CollationField` and `solr.ICUCollationField` field type classes provide this functionality. `solr.ICUCollationField`, which is backed by the ICU4J library, provides more flexible configuration, has more locales, is significantly faster, and requires less memory and less index space, since its keys are smaller than those produced by the JDK implementation that backs `solr.CollationField`.

`solr.ICUCollationField` is included in the Solr `analysis-extras` contrib - see `solr/contrib/analysis-extras/README.txt` for instructions on which jars you need to add to your `SOLR_HOME/lib` in order to use it.

`solr.ICUCollationField` and `solr.CollationField` fields can be created in two ways:

- Based upon a system collator associated with a Locale.
- Based upon a tailored `RuleBasedCollator` ruleset.

Arguments for `solr.ICUCollationField`, specified as attributes within the `<fieldtype>` element:

Using a System collator:

`locale`: (required) RFC 3066 locale ID. See the ICU locale explorer for a list of supported locales.

`strength`: Valid values are `primary`, `secondary`, `tertiary`, `quaternary`, or `identical`. See Comparison Levels in ICU Collation Concepts for more information.

`decomposition`: Valid values are `no` or `canonical`. See Normalization in ICU Collation Concepts for more information.

Using a Tailored ruleset:

`custom`: (required) Path to a UTF-8 text file containing rules supported by the ICU `RuleBasedCollator`

`strength`: Valid values are `primary`, `secondary`, `tertiary`, `quaternary`, or `identical`. See Comparison Levels in ICU Collation Concepts for more information.

`decomposition`: Valid values are `no` or `canonical`. See Normalization in ICU Collation Concepts for more information.

Expert options:

`alternate`: Valid values are `shifted` or `non-ignorable`. Can be used to ignore punctuation/whitespace.

`caseLevel`: (true/false) If true, in combination with `strength="primary"`, accents are ignored but case is taken into account. The default is false. See CaseLevel in ICU Collation Concepts for more information.

`caseFirst`: Valid values are `lower` or `upper`. Useful to control which is sorted first when case is not ignored.

`numeric`: (true/false) If true, digits are sorted according to numeric value, e.g. foobar-9 sorts before foobar-10. The default is false.

`variableTop`: Single character or contraction. Controls what is variable for `alternate`

Sorting Text for a Specific Language

In this example, text is sorted according to the default German rules provided by ICU4J.

Locales are typically defined as a combination of language and country, but you can specify just the language if you want. For example, if you specify "de" as the language, you will get sorting that works well for the German language. If you specify "de" as the language and "CH" as the country, you will get German sorting specifically tailored for Switzerland.

```
<!-- Define a field type for German collation -->
<fieldType name="collatedGERMAN" class="solr.ICUCollationField"
           locale="de"
           strength="primary" />
...
<!-- Define a field to store the German collated manufacturer names. -->
<field name="manuGERMAN" type="collatedGERMAN" indexed="false" stored="false"
docValues="true"/>
...
<!-- Copy the text to this field. We could create French, English, Spanish versions
too,
     and sort differently for different users! -->
<copyField source="manu" dest="manuGERMAN"/>
```

In the example above, we defined the strength as "primary". The strength of the collation determines how strict the sort order will be, but it also depends upon the language. For example, in English, "primary" strength ignores differences in case and accents.

Another example:

```
<fieldType name="polishCaseInsensitive" class="solr.ICUCollationField"
           locale="pl_PL"
           strength="secondary" />
...
<field name="city" type="text_general" indexed="true" stored="true"/>
...
<field name="city_sort" type="polishCaseInsensitive" indexed="true" stored="false"/>
...
<copyField source="city" dest="city_sort"/>
```

The type will be used for the fields where the data contains Polish text. The "secondary" strength will ignore case differences, but, unlike "primary" strength, a letter with diacritic(s) will be sorted differently from the same base letter without diacritics.

An example using the "city_sort" field to sort:

```
q=*:*&fl=city&sort=city_sort+asc
```

Sorting Text for Multiple Languages

There are two approaches to supporting multiple languages: if there is a small list of languages you wish to support, consider defining collated fields for each language and using `copyField`. However, adding a large number of sort fields can increase disk and indexing costs. An alternative approach is to use the Unicode `default` collator.

The Unicode `default` or `ROOT` locale has rules that are designed to work well for most languages. To use the `default` locale, simply define the locale as the empty string. This Unicode default sort is still significantly more advanced than the standard Solr sort.

```
<fieldType name="collatedROOT" class="solr.ICUCollationField"
           locale=""
           strength="primary" />
```

Sorting Text with Custom Rules

You can define your own set of sorting rules. It's easiest to take existing rules that are close to what you want and customize them.

In the example below, we create a custom rule set for German called DIN 5007-2. This rule set treats umlauts in German differently: it treats ö as equivalent to oe, ä as equivalent to ae, and ü as equivalent to ue. For more information, see the ICU RuleBasedCollator javadocs.

This example shows how to create a custom rule set for `solr.ICUCollationField` and dump it to a file:

```
// get the default rules for Germany
// these are called DIN 5007-1 sorting
RuleBasedCollator baseCollator = (RuleBasedCollator) Collator.getInstance(new
ULocale("de", "DE"));

// define some tailorings, to make it DIN 5007-2 sorting.
// For example, this makes ö equivalent to oe
String DIN5007_2_tailorings =
    "& ae , a\u0308 & AE , A\u0308"+
    "& oe , o\u0308 & OE , O\u0308"+
    "& ue , u\u0308 & UE , u\u0308";

// concatenate the default rules to the tailorings, and dump it to a String
RuleBasedCollator tailoredCollator = new RuleBasedCollator(baseCollator.getRules() +
DIN5007_2_tailorings);
String tailoredRules = tailoredCollator.getRules();

// write these to a file, be sure to use UTF-8 encoding!!!
FileOutputStream os = new FileOutputStream(new
File("/solr_home/conf/customRules.dat"));
IOUtils.write(tailoredRules, os, "UTF-8");
```

This rule set can now be used for custom collation in Solr:

```
<fieldType name="collatedCUSTOM" class="solr.ICUCollationField"
           custom="customRules.dat"
           strength="primary" />
```

JDK Collation

As mentioned above, ICU Unicode Collation is better in several ways than JDK Collation, but if you cannot use ICU4J for some reason, you can use `solr.CollationField`.

The principles of JDK Collation are the same as those of ICU Collation; you just specify `language`, `country` and `variant` arguments instead of the combined `locale` argument.

Arguments for `solr.CollationField`, specified as attributes within the `<fieldtype>` element:

Using a System collator (see Oracle's list of locales supported in Java 7):

`language`: (required) ISO-639 language code

`country`: ISO-3166 country code

`variant`: Vendor or browser-specific code

`strength`: Valid values are `primary`, `secondary`, `tertiary` or `identical`. See Oracle Java 7 Collator javadocs for more information.

`decomposition`: Valid values are `no`, `canonical`, or `full`. See Oracle Java 7 Collator javadocs for more information.

Using a Tailored ruleset:

`custom`: (required) Path to a UTF-8 text file containing rules supported by the `JDK RuleBasedCollator`

`strength`: Valid values are `primary`, `secondary`, `tertiary` or `identical`. See Oracle Java 7 Collator javadocs for more information.

`decomposition`: Valid values are `no`, `canonical`, or `full`. See Oracle Java 7 Collator javadocs for more information.

A `solr.CollationField` example:

```
<fieldType name="collatedGERMAN" class="solr.CollationField"
           language="de"
           country="DE"
           strength="primary" /> <!-- ignore Umlauts and letter case when sorting
-->
...
<field name="manuGERMAN" type="collatedGERMAN" indexed="false" stored="false"
docValues="true" />
...
<copyField source="manu" dest="manuGERMAN"/>
```

ASCII Folding Filter

This filter converts alphabetic, numeric, and symbolic Unicode characters which are not in the first 127 ASCII characters (the "Basic Latin" Unicode block) into their ASCII equivalents, if one exists. Only those characters with reasonable ASCII alternatives are converted:

This can increase recall by causing more matches. On the other hand, it can reduce precision because language-specific character differences may be lost.

Factory class: `solr.ASCIIFoldingFilterFactory`

Arguments: None

Example:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.ASCIIFoldingFilterFactory"/>
</analyzer>
```

In: "Björn Ångström"

Tokenizer to Filter: "Björn", "Ångström"

Out: "Bjorn", "Angstrom"

Language-Specific Factories

These factories are each designed to work with specific languages. The languages covered here are:

- Arabic
- Brazilian Portuguese
- Bulgarian
- Catalan
- Chinese
- Simplified Chinese
- CJK
- Czech
- Danish
- Dutch
- Finnish
- French
- Galician
- German
- Greek
- Hebrew, Lao, Myanmar, Khmer
- Hindi
- Indonesian
- Italian
- Irish
- Japanese
- Latvian
- Norwegian
- Persian
- Polish
- Portuguese
- Romanian
- Russian
- Scandinavian
- Serbian
- Spanish
- Swedish
- Thai
- Turkish

Arabic

Solr provides support for the Light-10 (PDF) stemming algorithm, and Lucene includes an example stopword list.

This algorithm defines both character normalization and stemming, so these are split into two filters to provide more flexibility.

Factory classes: `solr.ArabicStemFilterFactory`, `solr.ArabicNormalizationFilterFactory`

Arguments: None

Example:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.ArabicNormalizationFilterFactory"/>
  <filter class="solr.ArabicStemFilterFactory"/>
</analyzer>
```

Brazilian Portuguese

This is a Java filter written specifically for stemming the Brazilian dialect of the Portuguese language. It uses the Lucene class `org.apache.lucene.analysis.br.BrazilianStemmer`. Although that stemmer can be configured to use a list of protected words (which should not be stemmed), this factory does not accept any arguments to specify such a list.

Factory class: `solr.BrazilianStemFilterFactory`

Arguments: None

Example:

```
<analyzer type="index">
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.BrazilianStemFilterFactory"/>
</analyzer>
```

In: "praia praias"

Tokenizer to Filter: "praia", "praias"

Out: "pra", "pra"

Bulgarian

Solr includes a light stemmer for Bulgarian, following this algorithm (PDF), and Lucene includes an example stopword list.

Factory class: `solr.BulgarianStemFilterFactory`

Arguments: None

Example:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.LowerCaseFilterFactory"/>
  <filter class="solr.BulgarianStemFilterFactory"/>
</analyzer>
```

Catalan

Solr can stem Catalan using the Snowball Porter Stemmer with an argument of `language="Catalan"`. Solr includes a set of contractions for Catalan, which can be stripped using `solr.ElisionFilterFactory`.

Factory class: `solr.SnowballPorterFilterFactory`

Arguments:

`language`: (required) stemmer language, "Catalan" in this case

Example:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.LowerCaseFilterFactory"/>
  <filter class="solr.ElisionFilterFactory"
          articles="lang/contractions_ca.txt"/>
  <filter class="solr.SnowballPorterFilterFactory" language="Catalan" />
</analyzer>
```

In: "llengües llengua"

Tokenizer to Filter: "llengües"(1) "llengua"(2),

Out: "llengu"(1), "llengu"(2)

Chinese

Chinese Tokenizer

The Chinese Tokenizer is deprecated as of Solr 3.4. Use the `solr.StandardTokenizerFactory` instead.

Factory class: `solr.ChineseTokenizerFactory`

Arguments: None

Example:

```
<analyzer type="index">
  <tokenizer class="solr.ChineseTokenizerFactory"/>
</analyzer>
```

Chinese Filter Factory

The Chinese Filter Factory is deprecated as of Solr 3.4. Use the `solr.StopFilterFactory` instead.

Factory class: `solr.ChineseFilterFactory`

Arguments: None

Example:

```
<analyzer type="index">
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.ChineseFilterFactory"/>
</analyzer>
```

Simplified Chinese

For Simplified Chinese, Solr provides support for Chinese sentence and word segmentation with the `solr.HMMChineseTokenizerFactory` in the `analysis-extras` contrib module. This component includes a large dictionary and segments Chinese text into words with the Hidden Markov Model. To use this filter, see `solr/contrib/analysis-extras/README.txt` for instructions on which jars you need to add to your `solr_home/lib`.

Factory class: `solr.HMMChineseTokenizerFactory`

Arguments: None

Examples:

To use the default setup with fallback to English Porter stemmer for English words, use:

`<analyzer class="org.apache.lucene.analysis.cn.smart.SmartChineseAnalyzer"/>`

Or to configure your own analysis setup, use the `solr.HMMChineseTokenizerFactory` along with your custom filter setup.

```
<analyzer>
  <tokenizer class="solr.HMMChineseTokenizerFactory"/>
  <filter class="solr.StopFilterFactory
          words="org/apache/lucene/analysis/cn/smart/stopwords.txt"/>
  <filter class="solr.PorterStemFilterFactory"/>
</analyzer>
```

CJK

This tokenizer breaks Chinese, Japanese and Korean language text into tokens. These are not whitespace delimited languages. The tokens generated by this tokenizer are "doubles", overlapping pairs of CJK characters found in the field text.

Factory class: `solr.CJKTokenizerFactory`

Arguments: None

Example:

```
<analyzer type="index">
  <tokenizer class="solr.CJKTokenizerFactory"/>
</analyzer>
```

Czech

Solr includes a light stemmer for Czech, following this algorithm, and Lucene includes an example stopword list.

Factory class: `solr.CzechStemFilterFactory`

Arguments: None

Example:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.LowerCaseFilterFactory"/>
  <filter class="solr.CzechStemFilterFactory"/>
<analyzer>
```

In: "prezidenští, prezidenta, prezidentského"

Tokenizer to Filter: "prezidenští", "prezidenta", "prezidentského"

Out: "preziden", "preziden", "preziden"

Danish

Solr can stem Danish using the Snowball Porter Stemmer with an argument of `language="Danish"`.

Also relevant are the Scandinavian normalization filters.

Factory class: `solr.SnowballPorterFilterFactory`

Arguments:

`language`: (required) stemmer language, "Danish" in this case

Example:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.LowerCaseFilterFactory"/>
  <filter class="solr.SnowballPorterFilterFactory" language="Danish" />
</analyzer>
```

In: "undersøg undersøgelse"

Tokenizer to Filter: "undersøg"(1) "undersøgelse"(2),

Out: "undersøg"(1), "undersøg"(2)

Dutch

Solr can stem Dutch using the Snowball Porter Stemmer with an argument of `language="Dutch"`.

Factory class: `solr.SnowballPorterFilterFactory`

Arguments:

`language`: (required) stemmer language, "Dutch" in this case

Example:

```
<analyzer type="index">
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.LowerCaseFilterFactory"/>
  <filter class="solr.SnowballPorterFilterFactory" language="Dutch"/>
</analyzer>
```

In: "kanaal kanalen"

Tokenizer to Filter: "kanaal", "kanalen"

Out: "kanal", "kanal"

Finnish

Solr includes support for stemming Finnish, and Lucene includes an example stopword list.

Factory class: `solr.FinnishLightStemFilterFactory`

Arguments: None

Example:

```
<analyzer type="index">
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.FinnishLightStemFilterFactory"/>
</analyzer>
```

In: "kala kalat"

Tokenizer to Filter: "kala", "kalat"

Out: "kala", "kala"

French

Elision Filter

Removes article elisions from a token stream. This filter can be useful for languages such as French, Catalan, Italian, and Irish.

Factory class: `solr.ElisionFilterFactory`

Arguments:

`articles`: The pathname of a file that contains a list of articles, one per line, to be stripped. Articles are words such as "le", which are commonly abbreviated, such as in *l'avion* (the plane). This file should include the abbreviated form, which precedes the apostrophe. In this case, simply "*l*". If no `articles` attribute is specified, a default set of French articles is used.

`ignoreCase`: (boolean) If true, the filter ignores the case of words when comparing them to the common word file. Defaults to `false`

Example:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.ElisionFilterFactory"
          ignoreCase="true"
          articles="lang/contractions_fr.txt"/>
</analyzer>
```

In: "L'histoire d'art"

Tokenizer to Filter: "L'histoire", "d'art"

Out: "histoire", "art"

French Light Stem Filter

Solr includes three stemmers for French: one in the `solr.SnowballPorterFilterFactory`, a lighter stemmer called `solr.FrenchLightStemFilterFactory`, and an even less aggressive stemmer called `solr.FrenchMinimalStemFilterFactory`. Lucene includes an example stopword list.

Factory classes: `solr.FrenchLightStemFilterFactory`, `solr.FrenchMinimalStemFilterFactory`

Arguments: None

Examples:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.LowerCaseFilterFactory"/>
  <filter class="solr.ElisionFilterFactory"
          articles="lang/contractions_fr.txt"/>
  <filter class="solr.FrenchLightStemFilterFactory"/>
</analyzer>
```

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.LowerCaseFilterFactory"/>
  <filter class="solr.ElisionFilterFactory"
          articles="lang/contractions_fr.txt"/>
  <filter class="solr.FrenchMinimalStemFilterFactory"/>
</analyzer>
```

In: "le chat, les chats"

Tokenizer to Filter: "le", "chat", "les", "chats"

Out: "le", "chat", "le", "chat"

Galician

Solr includes a stemmer for Galician following this algorithm, and Lucene includes an example stopword list.

Factory class: `solr.GalicianStemFilterFactory`

Arguments: None

Example:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.LowerCaseFilterFactory"/>
  <filter class="solr.GalicianStemFilterFactory"/>
</analyzer>
```

In: "felizmente Luzes"

Tokenizer to Filter: "felizmente", "luzes"

Out: "feliz", "luz"

German

Solr includes four stemmers for German: one in the `solr.SnowballPorterFilterFactory language="German"`, a stemmer called `solr.GermanStemFilterFactory`, a lighter stemmer called `solr.GermanLightStemFilterFactory`, and an even less aggressive stemmer called `solr.GermanMinimalStemFilterFactory`. Lucene includes an example stopword list.

Factory classes: `solr.GermanStemFilterFactory`, `solr.LightGermanStemFilterFactory`, `solr.MinimalGermanStemFilterFactory`

Arguments: None

Examples:

```
<analyzer type="index">
  <tokenizer class="solr.StandardTokenizerFactory "/>
  <filter class="solr.GermanStemFilterFactory"/>
</analyzer>
```

```
<analyzer type="index">
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.GermanLightStemFilterFactory"/>
</analyzer>
```

```
<analyzer type="index">
  <tokenizer class="solr.StandardTokenizerFactory "/>
  <filter class="solr.GermanMinimalStemFilterFactory"/>
</analyzer>
```

In: "haus häuser"

Tokenizer to Filter: "haus", "häuser"

Out: "haus", "haus"

Greek

This filter converts uppercase letters in the Greek character set to the equivalent lowercase character.

Factory class: `solr.GreekLowerCaseFilterFactory`

Arguments: None

> ⚠ Use of custom charsets is not longer supported as of Solr 3.1. If you need to index text in these encodings, please use Java's character set conversion facilities (InputStreamReader, and so on.) during I/O, so that Lucene can analyze this text as Unicode instead.

Example:

```
<analyzer type="index">
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.GreekLowerCaseFilterFactory"/>
</analyzer>
```

Hindi

Solr includes support for stemming Hindi following this algorithm (PDF), support for common spelling differences through the `solr.HindiNormalizationFilterFactory`, support for encoding differences through the `solr.IndicNormalizationFilterFactory` following this algorithm, and Lucene includes an example stopword list.

Factory classes: `solr.IndicNormalizationFilterFactory`, `solr.HindiNormalizationFilterFactory`, `solr.HindiStemFilterFactory`

Arguments: None

Example:

```
<analyzer type="index">
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.IndicNormalizationFilterFactory"/>
  <filter class="solr.HindiNormalizationFilterFactory"/>
  <filter class="solr.HindiStemFilterFactory"/>
</analyzer>
```

Indonesian

Solr includes support for stemming Indonesian (Bahasa Indonesia) following this algorithm (PDF), and Lucene includes an example stopword list.

Factory class: `solr.IndonesianStemFilterFactory`

Arguments: None

Example:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.LowerCaseFilterFactory"/>
  <filter class="solr.IndonesianStemFilterFactory" stemDerivational="true" />
</analyzer>
```

In: "sebagai sebagainya"

Tokenizer to Filter: "sebagai", "sebagainya"

Out: "bagai", "bagai"

Italian

Solr includes two stemmers for Italian: one in the `solr.SnowballPorterFilterFactory language="Italian"`, and a lighter stemmer called `solr.ItalianLightStemFilterFactory`. Lucene includes an example stopword list.

Factory class: `solr.ItalianStemFilterFactory`

Arguments: None

Example:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.LowerCaseFilterFactory"/>
  <filter class="solr.ElisionFilterFactory"
          articles="lang/contractions_it.txt"/>
  <filter class="solr.ItalianLightStemFilterFactory"/>
</analyzer>
```

In: "propaga propagare propagamento"

Tokenizer to Filter: "propaga", "propagare", "propagamento"

Out: "propag", "propag", "propag"

Irish

Solr can stem Irish using the Snowball Porter Stemmer with an argument of `language="Irish"`. Solr includes `solr.IrishLowerCaseFilterFactory`, which can handle Irish-specific constructs. Solr also includes a set of contractions for Irish which can be stripped using `solr.ElisionFilterFactory`.

Factory class: `solr.SnowballPorterFilterFactory`

Arguments:

`language`: (required) stemmer language, "Irish" in this case

Example:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.ElisionFilterFactory"
          articles="lang/contractions_ga.txt"/>
  <filter class="solr.IrishLowerCaseFilterFactory"/>
  <filter class="solr.SnowballPorterFilterFactory" language="Irish" />
</analyzer>
```

In: "siopadóireacht síceapatacha b'fhearr m'athair"

Tokenizer to Filter: "siopadóireacht", "síceapatacha", "b'fhearr", "m'athair"

Out: "siopadóir", "síceapaite", "fearr", "athair"

Japanese

Solr includes support for analyzing Japanese, via the Lucene Kuromoji morphological analyzer, which includes several analysis components - more details on each below:

- `JapaneseIterationMarkCharFilter` normalizes Japanese horizontal iteration marks (odoriji) to their expanded form.

- `JapaneseTokenizer` tokenizes Japanese using morphological analysis, and annotates each term with part-of-speech, base form (a.k.a. lemma), reading and pronunciation.
- `JapaneseBaseFormFilter` replaces original terms with their base forms (a.k.a. lemmas).
- `JapanesePartOfSpeechStopFilter` removes terms that have one of the configured parts-of-speech.
- `JapaneseKatakanaStemFilter` normalizes common katakana spelling variations ending in a long sound character (U+30FC) by removing the long sound character.

Also useful for Japanese analysis, from lucene-analyzers-common:

- `CJKWidthFilter` folds fullwidth ASCII variants into the equivalent Basic Latin forms, and folds halfwidth Katakana variants into their equivalent fullwidth forms.

Japanese Iteration Mark CharFilter

Normalizes horizontal Japanese iteration marks (odoriji) to their expanded form. Vertical iteration marks are not supported.

Factory class: `JapaneseIterationMarkCharFilterFactory`

Arguments:

`normalizeKanji`: set to `false` to not normalize kanji iteration marks (default is `true`)

`normalizeKana`: set to `false` to not normalize kana iteration marks (default is `true`)

Japanese Tokenizer

Tokenizer for Japanese that uses morphological analysis, and annotates each term with part-of-speech, base form (a.k.a. lemma), reading and pronunciation.

`JapaneseTokenizer` has a `search` mode (the default) that does segmentation useful for search: a heuristic is used to segment compound terms into their constituent parts while also keeping the original compound terms as synonyms.

Factory class: `solr.JapaneseTokenizerFactory`

Arguments:

`mode`: Use `search` mode to get a noun-decompounding effect useful for search. `search` mode improves segmentation for search at the expense of part-of-speech accuracy. Valid values for `mode` are:

- `normal`: default segmentation
- `search`: segmentation useful for search (extra compound splitting)
- `extended`: search mode plus unigramming of unknown words (experimental)

For some applications it might be good to use `search` mode for indexing and `normal` mode for queries to increase precision and prevent parts of compounds from being matched and highlighted.

`userDictionary`: filename for a user dictionary, which allows overriding the statistical model with your own entries for segmentation, part-of-speech tags and readings without a need to specify weights. See `lang/userdict_ja.txt` for a sample user dictionary file.

`userDictionaryEncoding`: user dictionary encoding (default is UTF-8) `discardPunctuation`: set to `false` to keep punctuation, `true` to discard (the default)

Japanese Base Form Filter

Replaces original terms' text with the corresponding base form (lemma). (`JapaneseTokenizer` annotates each term with its base form.)

Factory class: `JapaneseBaseFormFilterFactory`

(no arguments)

Japanese Part Of Speech Stop Filter

Removes terms with one of the configured parts-of-speech. `JapaneseTokenizer` annotates terms with parts-of-speech.

Factory class : `JapanesePartOfSpeechStopFilterFactory`

Arguments:

`tags`: filename for a list of parts-of-speech for which to remove terms; see `conf/lang/stoptags_ja.txt` in the `sample_techproducts_config` config set for an example.

`enablePositionIncrements`: if `luceneMatchVersion` is `4.3` or earlier and `enablePositionIncrements="false"`, no position holes will be left by this filter when it removes tokens. **This argument is invalid if `luceneMatchVersion` is `5.0` or later.**

Japanese Katakana Stem Filter

Normalizes common katakana spelling variations ending in a long sound character (U+30FC) by removing the long sound character.

`CJKWidthFilterFactory` should be specified prior to this filter to normalize half-width katakana to full-width.

Factory class: `JapaneseKatakanaStemFilterFactory`

Arguments:

`minimumLength`: terms below this length will not be stemmed. Default is 4, value must be 2 or more.

CJK Width Filter

Folds fullwidth ASCII variants into the equivalent Basic Latin forms, and folds halfwidth Katakana variants into their equivalent fullwidth forms.

Factory class: `CJKWidthFilterFactory`

(no arguments)

Example:

```
<fieldType name="text_ja" positionIncrementGap="100"
autoGeneratePhraseQueries="false">
  <analyzer>
    <!-- Uncomment if you need to handle iteration marks: -->
    <!-- <charFilter class="solr.JapaneseIterationMarkCharFilterFactory" /> -->
    <tokenizer class="solr.JapaneseTokenizerFactory" mode="search"
userDictionary="lang/userdict_ja.txt"/>
    <filter class="solr.JapaneseBaseFormFilterFactory"/>
    <filter class="solr.JapanesePartOfSpeechStopFilterFactory"
tags="lang/stoptags_ja.txt"/>
    <filter class="solr.CJKWidthFilterFactory"/>
    <filter class="solr.StopFilterFactory" ignoreCase="true"
words="lang/stopwords_ja.txt"/>
    <filter class="solr.JapaneseKatakanaStemFilterFactory" minimumLength="4"/>
    <filter class="solr.LowerCaseFilterFactory"/>
  </analyzer>
</fieldType>
```

Hebrew, Lao, Myanmar, Khmer

Lucene provides support, in addition to UAX#29 word break rules, for Hebrew's use of the double and single quote characters, and for segmenting Lao, Myanmar, and Khmer into syllables with the `solr.ICUTokenizerFactory` in the `analysis-extras` contrib module. To use this tokenizer, see `solr/contrib/analysis-extras/README.txt for` instructions on which jars you need to add to your `solr_home/lib`.

See the ICUTokenizer for more information.

Latvian

Solr includes support for stemming Latvian, and Lucene includes an example stopword list.

Factory class: `solr.LatvianStemFilterFactory`

Arguments: None

Example:

```
<fieldType name="text_lvstem" class="solr.TextField" positionIncrementGap="100">
  <analyzer>
    <tokenizer class="solr.StandardTokenizerFactory"/>
    <filter class="solr.LowerCaseFilterFactory"/>
    <filter class="solr.LatvianStemFilterFactory"/>
  </analyzer>
</fieldType>
```

In: "tirgiem tirgus"

Tokenizer to Filter: "tirgiem", "tirgus"

Out: "tirg", "tirg"

Norwegian

Solr includes two classes for stemming Norwegian, `NorwegianLightStemFilterFactory` and `NorwegianMinimalStemFilterFactory`. Lucene includes an example stopword list.

Another option is to use the Snowball Porter Stemmer with an argument of language="Norwegian".

Also relevant are the Scandinavian normalization filters.

Norwegian Light Stemmer

The `NorwegianLightStemFilterFactory` requires a "two-pass" sort for the -dom and -het endings. This means that in the first pass the word "kristendom" is stemmed to "kristen", and then all the general rules apply so it will be further stemmed to "krist". The effect of this is that "kristen," "kristendom," "kristendommen," and "kristendommens" will all be stemmed to "krist."

The second pass is to pick up -dom and -het endings. Consider this example:

One pass		Two passes	
Before	**After**	**Before**	**After**
forlegen	forleg	forlegen	forleg
forlegenhet	forlegen	forlegenhet	forleg
forlegenheten	forlegen	forlegenheten	forleg
forlegenhetens	forlegen	forlegenhetens	forleg
firkantet	firkant	firkantet	firkant
firkantethet	firkantet	firkantethet	firkant
firkantetheten	firkantet	firkantetheten	firkant

Factory class: `solr.NorwegianLightStemFilterFactory`

Arguments: `variant:` Choose the Norwegian language variant to use. Valid values are:

- `nb:` Bokmål (default)
- `nn:` Nynorsk
- `no:` both

Example:

```
<fieldType name="text_no" class="solr.TextField" positionIncrementGap="100">
  <analyzer>
    <tokenizer class="solr.StandardTokenizerFactory"/>
    <filter class="solr.LowerCaseFilterFactory"/>
    <filter class="solr.StopFilterFactory" ignoreCase="true"
words="lang/stopwords_no.txt" format="snowball"/>
    <filter class="solr.NorwegianLightStemFilterFactory"/>
  </analyzer>
</fieldType>
```

In: "Forelskelsen"

Tokenizer to Filter: "forelskelsen"

Out: "forelske"

Norwegian Minimal Stemmer

The `NorwegianMinimalStemFilterFactory` stems plural forms of Norwegian nouns only.

Factory class: `solr.NorwegianMinimalStemFilterFactory`

Arguments: `variant:` Choose the Norwegian language variant to use. Valid values are:

- `nb:` Bokmål (default)
- `nn:` Nynorsk
- `no:` both

Example:

```
<fieldType name="text_no" class="solr.TextField" positionIncrementGap="100">
  <analyzer>
    <tokenizer class="solr.StandardTokenizerFactory"/>
    <filter class="solr.LowerCaseFilterFactory"/>
    <filter class="solr.StopFilterFactory" ignoreCase="true"
words="lang/stopwords_no.txt" format="snowball"/>
    <filter class="solr.NorwegianMinimalStemFilterFactory"/>
  </analyzer>
</fieldType>
```

In: "Bilens"

Tokenizer to Filter: "bilens"

Out: "bil"

Persian

Persian Filter Factories

Solr includes support for normalizing Persian, and Lucene includes an example stopword list.

Factory class: `solr.PersianNormalizationFilterFactory`

Arguments: None

Example:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.ArabicNormalizationFilterFactory"/>
  <filter class="solr.PersianNormalizationFilterFactory">
</analyzer>
```

Polish

Solr provides support for Polish stemming with the `solr.StempelPolishStemFilterFactory`, and `solr.MorphologikFilterFactory` for lemmatization, in the `contrib/analysis-extras` module. The `solr.StempelPolishStemFilterFactory` component includes an algorithmic stemmer with tables for Polish. To use either of these filters, see `solr/contrib/analysis-extras/README.txt` for instructions on which jars you need to add to your `solr_home/lib`.

Factory class: `solr.StempelPolishStemFilterFactory` and `solr.MorfologikFilterFactory`

Arguments: None

Example:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.LowerCaseFilterFactory"/>
  <filter class="solr.StempelPolishStemFilterFactory"/>
</analyzer>
```

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.LowerCaseFilterFactory"/>
  <filter class="solr.MorfologikFilterFactory" dictionary-resource="pl"/>
</analyzer>
```

In: ""studenta studenci"

Tokenizer to Filter: "studenta", "studenci"

Out: "student", "student"

More information about the Stempel stemmer is available in the Lucene javadocs.

The Morfologik `dictionary-resource` param value is a constant specifying which dictionary to choose. The dictionary resource must be named `morfologik/dictionaries/{dictionaryResource}.dict` and have an associated `.info` metadata file. See the Morfologik project for details.

Portuguese

Solr includes four stemmers for Portuguese: one in the `solr.SnowballPorterFilterFactory`, an alternative stemmer called `solr.PortugueseStemFilterFactory`, a lighter stemmer called `solr.PortugueseLightStemFilterFactory`, and an even less aggressive stemmer called `solr.PortugueseMinimalStemFilterFactory`. Lucene includes an example stopword list.

Factory classes: `solr.PortugueseStemFilterFactory`, `solr.PortugueseLightStemFilterFactory`, `solr.PortugueseMinimalStemFilterFactory`

Arguments: None

Example:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.LowerCaseFilterFactory"/>
  <filter class="solr.PortugueseStemFilterFactory"/>
</analyzer>
```

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.LowerCaseFilterFactory"/>
  <filter class="solr.PortugueseLightStemFilterFactory"/>
</analyzer>
```

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.LowerCaseFilterFactory"/>
  <filter class="solr.PortugueseMinimalStemFilterFactory"/>
</analyzer>
```

In: "praia praias"

Tokenizer to Filter: "praia", "praias"

Out: "pra", "pra"

Romanian

Solr can stem Romanian using the Snowball Porter Stemmer with an argument of `language="Romanian"`.

Factory class: `solr.SnowballPorterFilterFactory`

Arguments:

`language`: (required) stemmer language, "Romanian" in this case

Example:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.LowerCaseFilterFactory"/>
  <filter class="solr.SnowballPorterFilterFactory" language="Romanian" />
</analyzer>
```

Russian

Russian Stem Filter

Solr includes two stemmers for Russian: one in the `solr.SnowballPorterFilterFactory language="Russian"`, and a lighter stemmer called `solr.RussianLightStemFilterFactory`. Lucene includes an example stopword list.

Factory class: `solr.RussianLightStemFilterFactory`

Arguments: None

> Use of custom charsets is no longer supported as of Solr 3.4. If you need to index text in these encodings, please use Java's character set conversion facilities (InputStreamReader, and so on.) during I/O, so that Lucene can analyze this text as Unicode instead.

Example:

```
<analyzer type="index">
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.LowerCaseFilterFactory"/>
  <filter class="solr.RussianLightStemFilterFactory"/>
</analyzer>
```

Scandinavian

Scandinavian is a language group spanning three languages Norwegian, Swedish and Danish which are very similar.

Swedish å,ä,ö are in fact the same letters as Norwegian and Danish å,æ,ø and thus interchangeable when used between these languages. They are however folded differently when people type them on a keyboard lacking these characters.

In that situation almost all Swedish people use a, a, o instead of å, ä, ö. Norwegians and Danes on the other hand usually type aa, ae and oe instead of å, æ and ø. Some do however use a, a, o, oo, ao and sometimes permutations of everything above.

There are two filters for helping with normalization between Scandinavian languages: one is `solr.ScandinavianNormalizationFilterFactory` trying to preserve the special characters (æäöå) and another `solr.ScandinavianFoldingFilterFactory` which folds these to the more broad ø/ö->o etc.

See also each language section for other relevant filters.

Scandinavian Normalization Filter

This filter normalize use of the interchangeable Scandinavian characters æÆäÄöÖøØ and folded variants (aa, ao, ae, oe and oo) by transforming them to åÅæÆøØ.

It's a semantically less destructive solution than `ScandinavianFoldingFilter`, most useful when a person with a Norwegian or Danish keyboard queries a Swedish index and vice versa. This filter does **not** perform the common Swedish folds of å and ä to a nor ö to o.

Factory class: `solr.ScandinavianNormalizationFilterFactory`

Arguments: None

Example:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.LowerCaseFilterFactory"/>
  <filter class="solr.ScandinavianNormalizationFilterFactory"/>
</analyzer>
```

In: "blåbærsyltetøj blåbärsyltetöj blaabaarsyltetoej blabarsyltetoj"

Tokenizer to Filter: "blåbærsyltetøj", "blåbärsyltetöj", "blaabaersyltetoej", "blabarsyltetoj"

Out: "blåbærsyltetøj", "blåbærsyltetøj", "blåbærsyltetøj", "blabarsyltetoj"

Scandinavian Folding Filter

This filter folds Scandinavian characters åÅäæÄÆ->a and öÖøØ->o. It also discriminate against use of double vowels aa, ae, ao, oe and oo, leaving just the first one.

It's is a semantically more destructive solution than `ScandinavianNormalizationFilter`, but can in addition help with matching raksmorgas as räksmörgås.

Factory class: `solr.ScandinavianFoldingFilterFactory`

Arguments: None

Example:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.LowerCaseFilterFactory"/>
  <filter class="solr.ScandinavianFoldingFilterFactory"/>
</analyzer>
```

In: "blåbærsyltetøj blåbärsyltetöj blaabaarsyltetoej blabarsyltetoj"

Tokenizer to Filter: "blåbærsyltetøj", "blåbärsyltetöj", "blaabaersyltetoej", "blabarsyltetoj"

Out: "blabarsyltetoj", "blabarsyltetoj", "blabarsyltetoj", "blabarsyltetoj"

Serbian

Serbian Normalization Filter

Solr includes a filter that normalizes Serbian Cyrillic and Latin characters to "bald" Latin. Cyrillic characters are first converted to Latin; then, Latin characters have their diacritics removed, with the exception of "" which is converted to "`dj`". Note that this filter expects lowercased input.

Factory class: `solr.SerbianNormalizationFilterFactory`

Arguments: None

Example:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.LowerCaseFilterFactory"/>
  <filter class="solr.SerbianNormalizationFilterFactory"/>
</analyzer>
```

In: "ura () "

Tokenizer to Filter: "ura" "" ""

Out: "djura", "djura", "srpski"

Spanish

Solr includes two stemmers for Spanish: one in the `solr.SnowballPorterFilterFactory language="Spanish"`, and a lighter stemmer called `solr.SpanishLightStemFilterFactory`. Lucene includes an example stopword list.

Factory class: `solr.SpanishStemFilterFactory`

Arguments: None

Example:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.LowerCaseFilterFactory"/>
  <filter class="solr.SpanishLightStemFilterFactory"/>
</analyzer>
```

In: "torear toreara torearlo"

Tokenizer to Filter: "torear", "toreara", "torearlo"

Out: "tor", "tor", "tor"

Swedish

Swedish Stem Filter

Solr includes two stemmers for Swedish: one in the `solr.SnowballPorterFilterFactory language="Swedish"`, and a lighter stemmer called `solr.SwedishLightStemFilterFactory`. Lucene includes an example stopword list.

Also relevant are the Scandinavian normalization filters.

Factory class: `solr.SwedishStemFilterFactory`

Arguments: None

Example:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.LowerCaseFilterFactory"/>
  <filter class="solr.SwedishLightStemFilterFactory"/>
</analyzer>
```

In: "kloke klokhet klokheten"

Tokenizer to Filter: "kloke", "klokhet", "klokheten"

Out: "klok", "klok", "klok"

Thai

This filter converts sequences of Thai characters into individual Thai words. Unlike European languages, Thai does not use whitespace to delimit words.

Factory class: `solr.ThaiTokenizerFactory`

Arguments: None

Example:

```
<analyzer type="index">
  <tokenizer class="solr.ThaiTokenizerFactory"/>
  <filter class="solr.LowerCaseFilterFactory"/>
</analyzer>
```

Turkish

Solr includes support for stemming Turkish through the `solr.SnowballPorterFilterFactory`; support for case-insensitive search through the `solr.TurkishLowerCaseFilterFactory`; support for stripping apostrophes and following suffixes through `solr.ApostropheFilterFactory` (see Role of Apostrophes in Turkish Information Retrieval); support for a form of stemming that truncating tokens at a configurable maximum length through the solr.TruncateTokenFilterFactory (see Information Retrieval on Turkish Texts); and Lucene includes an example stopword list.

Factory class: `solr.TurkishLowerCaseFilterFactory`

Arguments: None

Example:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.ApostropheFilterFactory"/>
  <filter class="solr.TurkishLowerCaseFilterFactory"/>
  <filter class="solr.SnowballPorterFilterFactory" language="Turkish"/>
</analyzer>
```

Another example, illustrating diacritics-insensitive search:

```
<analyzer>
  <tokenizer class="solr.StandardTokenizerFactory"/>
  <filter class="solr.ApostropheFilterFactory"/>
  <filter class="solr.TurkishLowerCaseFilterFactory"/>
  <filter class="solr.ASCIIFoldingFilterFactory" preserveOriginal="true"/>
  <filter class="solr.KeywordRepeatFilterFactory"/>
  <filter class="solr.TruncateTokenFilterFactory" prefixLength="5"/>
  <filter class="solr.RemoveDuplicatesTokenFilterFactory"/>
</analyzer>
```

Related Topics

- LanguageAnalysis

Phonetic Matching

Phonetic matching algorithms may be used to encode tokens so that two different spellings that are pronounced similarly will match.

For overviews of and comparisons between algorithms, see http://en.wikipedia.org/wiki/Phonetic_algorithm and http://ntz-develop.blogspot.com/2011/03/phonetic-algorithms.html

Algorithms discussed in this section:

- Beider-Morse Phonetic Matching (BMPM)

- Daitch-Mokotoff Soundex
- Double Metaphone
- Metaphone
- Soundex
- Refined Soundex
- Caverphone
- Kölner Phonetik a.k.a. Cologne Phonetic
- NYSIIS

Beider-Morse Phonetic Matching (BMPM)

To use this encoding in your analyzer, see Beider Morse Filter in the Filter Descriptions section.

Beider-Morse Phonetic Matching (BMPM) is a "soundalike" tool that lets you search using a new phonetic matching system. BMPM helps you search for personal names (or just surnames) in a Solr/Lucene index, and is far superior to the existing phonetic codecs, such as regular soundex, metaphone, caverphone, etc.

In general, phonetic matching lets you search a name list for names that are phonetically equivalent to the desired name. BMPM is similar to a soundex search in that an exact spelling is not required. Unlike soundex, it does not generate a large quantity of false hits.

From the spelling of the name, BMPM attempts to determine the language. It then applies phonetic rules for that particular language to transliterate the name into a phonetic alphabet. If it is not possible to determine the language with a fair degree of certainty, it uses generic phonetic instead. Finally, it applies language-independent rules regarding such things as voiced and unvoiced consonants and vowels to further insure the reliability of the matches.

For example, assume that the matches found when searching for Stephen in a database are "Stefan", "Steph", "Stephen", "Steve", "Steven", "Stove", and "Stuffin". "Stefan", "Stephen", and "Steven" are probably relevant, and are names that you want to see. "Stuffin", however, is probably not relevant. Also rejected were "Steph", "Steve", and "Stove". Of those, "Stove" is probably not one that we would have wanted. But "Steph" and "Steve" are possibly ones that you might be interested in.

For Solr, BMPM searching is available for the following languages:

- English
- French
- German
- Greek
- Hebrew written in Hebrew letters
- Hungarian
- Italian
- Polish
- Romanian
- Russian written in Cyrillic letters
- Russian transliterated into English letters
- Spanish
- Turkish

The name matching is also applicable to non-Jewish surnames from the countries in which those languages are spoken.

For more information, see here: http://stevemorse.org/phoneticinfo.htm and http://stevemorse.org/phonetics/bmpm.htm.

Daitch-Mokotoff Soundex

To use this encoding in your analyzer, see Daitch-Mokotoff Soundex Filter in the Filter Descriptions section.

The Daitch-Mokotoff Soundex algorithm is a refinement of the Russel and American Soundex algorithms, yielding greater accuracy in matching especially Slavish and Yiddish surnames with similar pronunciation but differences in spelling.

The main differences compared to the other soundex variants are:

- coded names are 6 digits long
- initial character of the name is coded
- rules to encoded multi-character n-grams
- multiple possible encodings for the same name (branching)

Note: the implementation used by Solr (commons-codec's `DaitchMokotoffSoundex`) has additional branching rules compared to the original description of the algorithm.

For more information, see http://en.wikipedia.org/wiki/Daitch%E2%80%93Mokotoff_Soundex and http://www.avotaynu.com/soundex.htm

Double Metaphone

To use this encoding in your analyzer, see Double Metaphone Filter in the Filter Descriptions section. Alternatively, you may specify `encoding="DoubleMetaphone"` with the Phonetic Filter, but note that the Phonetic Filter version will **not** provide the second ("alternate") encoding that is generated by the Double Metaphone Filter for some tokens.

Encodes tokens using the double metaphone algorithm by Lawrence Philips. See the original article at http://www.drdobbs.com/the-double-metaphone-search-algorithm/184401251?pgno=2

Metaphone

To use this encoding in your analyzer, specify `encoding="Metaphone"` with the Phonetic Filter.

Encodes tokens using the Metaphone algorithm by Lawrence Philips, described in "Hanging on the Metaphone" in Computer Language, Dec. 1990.

See http://en.wikipedia.org/wiki/Metaphone

Soundex

To use this encoding in your analyzer, specify `encoding="Soundex"` with the Phonetic Filter.

Encodes tokens using the Soundex algorithm, which is used to relate similar names, but can also be used as a general purpose scheme to find words with similar phonemes.

See http://en.wikipedia.org/wiki/Soundex

Refined Soundex

To use this encoding in your analyzer, specify `encoding="RefinedSoundex"` with the Phonetic Filter.

Encodes tokens using an improved version of the Soundex algorithm.

See http://en.wikipedia.org/wiki/Soundex

Caverphone

To use this encoding in your analyzer, specify `encoding="Caverphone"` with the Phonetic Filter.

Caverphone is an algorithm created by the Caversham Project at the University of Otago. The algorithm is optimised for accents present in the southern part of the city of Dunedin, New Zealand.

See http://en.wikipedia.org/wiki/Caverphone and the Caverphone 2.0 specification at http://caversham.otago.ac.nz/files/working/ctp150804.pdf

Kölner Phonetik a.k.a. Cologne Phonetic

To use this encoding in your analyzer, specify `encoding="ColognePhonetic"` with the Phonetic Filter.

The Kölner Phonetik, an algorithm published by Hans Joachim Postel in 1969, is optimized for the German language.

See http://de.wikipedia.org/wiki/K%C3%B6lner_Phonetik

NYSIIS

To use this encoding in your analyzer, specify `encoding="Nysiis"` with the Phonetic Filter.

NYSIIS is an encoding used to relate similar names, but can also be used as a general purpose scheme to find words with similar phonemes.

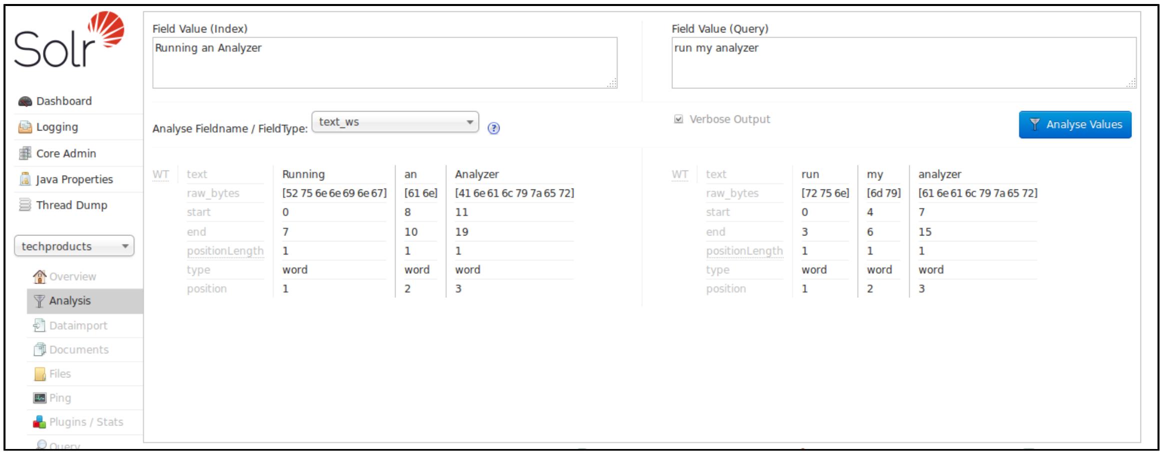
See http://en.wikipedia.org/wiki/NYSIIS and http://www.dropby.com/NYSIIS.html

Running Your Analyzer

Once you've defined a field type in `schema.xml` and specified the analysis steps that you want applied to it, you should test it out to make sure that it behaves the way you expect it to. Luckily, there is a very handy page in the Solr admin interface that lets you do just that. You can invoke the analyzer for any text field, provide sample input, and display the resulting token stream.

For example, let's look at some of the "Text" field types available in the "`bin/solr -e techproducts`" example configuration, and use the Analysis Screen (http://localhost:8983/solr/#/techproducts/analysis) to compare how the tokens produced at index time for the sentence "`Running an Analyzer`" match up with a slightly different query text of "`run my analyzers`"

We can begin with "`text_ws`" - one of the most simplified Text field types available:



Field Value (Index): Running an Analyzer

Field Value (Query): run my analyzer

Analyse Fieldname / FieldType: text_ws

☑ Verbose Output

WT			
text	Running	an	Analyzer
raw_bytes	[52 75 6e 6e 69 6e 67]	[61 6e]	[41 6e 61 6c 79 7a 65 72]
start	0	8	11
end	7	10	19
positionLength	1	1	1
type	word	word	word
position	1	2	3

WT			
text	run	my	analyzer
raw_bytes	[72 75 6e]	[6d 79]	[61 6e 61 6c 79 7a 65 72]
start	0	4	7
end	3	6	15
positionLength	1	1	1
type	word	word	word
position	1	2	3

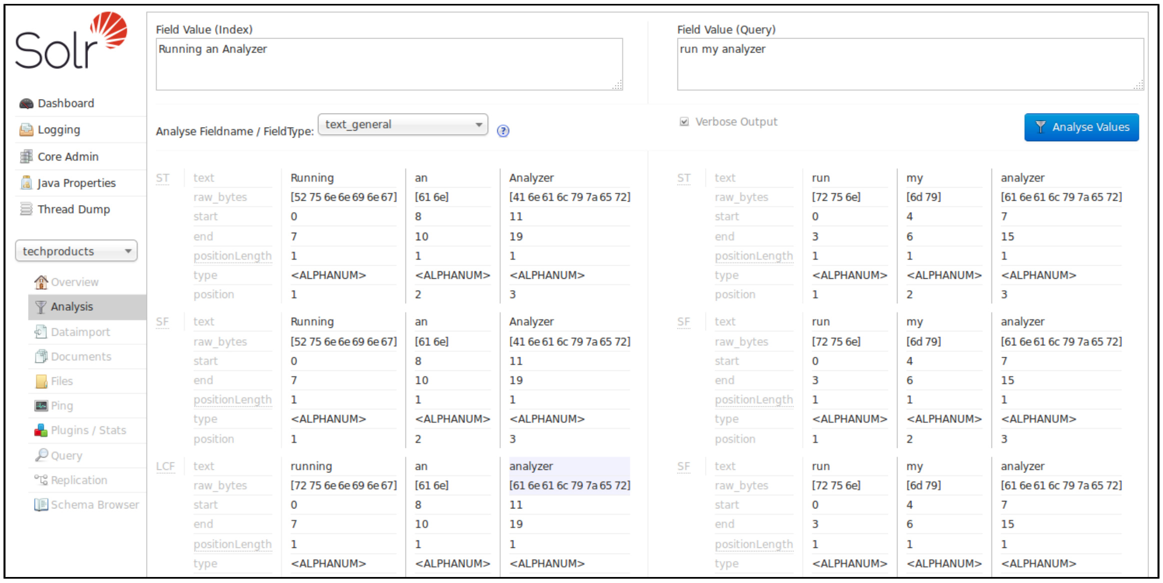
We can see very clearly that the only thing this field type does is tokenize text on whitespace.

If our objective is to allow queries like "`run my analyzer`" to match indexed text like "`Running an Analyzer`" then we will evidently need to pick a different field type with index & query time text analysis that does more processing of the inputs.

In particular we will want:

- Case insensitivity, so "Analyzer" and "analyzer" match.
- Stemming, so words like "Run" and "Running" are considered equivalent terms.
- Stop Word Pruning, so small words like "an" and "my" don't affect the query.

For our next attempt, let's try the "`text_general`" field type:



Field Value (Index): Running an Analyzer

Field Value (Query): run my analyzer

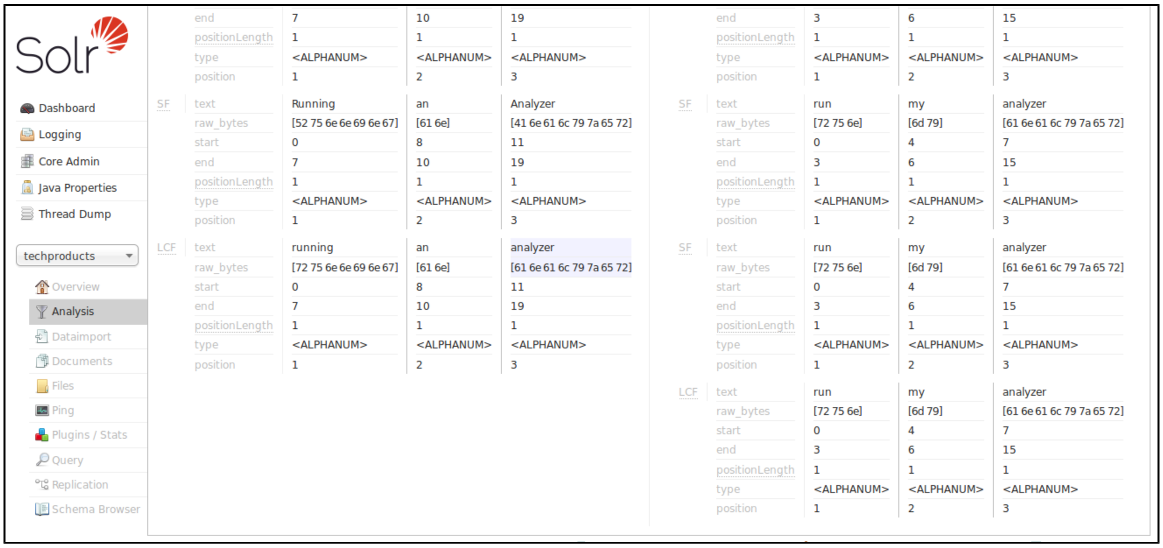
Analyse Fieldname / FieldType: text_general

☑ Verbose Output

ST	text	Running	an	Analyzer
	raw_bytes	[52 75 6e 6e 69 6e 67]	[61 6e]	[41 6e 61 6c 79 7a 65 72]
	start	0	8	11
	end	7	10	19
	positionLength	1	1	1
	type	<ALPHANUM>	<ALPHANUM>	<ALPHANUM>
	position	1	2	3
SF	text	Running	an	Analyzer
	raw_bytes	[52 75 6e 6e 69 6e 67]	[61 6e]	[41 6e 61 6c 79 7a 65 72]
	start	0	8	11
	end	7	10	19
	positionLength	1	1	1
	type	<ALPHANUM>	<ALPHANUM>	<ALPHANUM>
	position	1	2	3
LCF	text	running	an	analyzer
	raw_bytes	[72 75 6e 6e 69 6e 67]	[61 6e]	[61 6e 61 6c 79 7a 65 72]
	start	0	8	11
	end	7	10	19
	positionLength	1	1	1
	type	<ALPHANUM>	<ALPHANUM>	<ALPHANUM>

ST	text	run	my	analyzer
	raw_bytes	[72 75 6e]	[6d 79]	[61 6e 61 6c 79 7a 65 72]
	start	0	4	7
	end	3	6	15
	positionLength	1	1	1
	type	<ALPHANUM>	<ALPHANUM>	<ALPHANUM>
	position	1	2	3
SF	text	run	my	analyzer
	raw_bytes	[72 75 6e]	[6d 79]	[61 6e 61 6c 79 7a 65 72]
	start	0	4	7
	end	3	6	15
	positionLength	1	1	1
	type	<ALPHANUM>	<ALPHANUM>	<ALPHANUM>
	position	1	2	3
SF	text	run	my	analyzer
	raw_bytes	[72 75 6e]	[6d 79]	[61 6e 61 6c 79 7a 65 72]
	start	0	4	7
	end	3	6	15
	positionLength	1	1	1
	type	<ALPHANUM>	<ALPHANUM>	<ALPHANUM>

With the verbose output enabled, we can see how each stage of our new analyzers modify the tokens they receive before passing them on to the next stage. As we scroll down to the final output, we can see that we do start to get a match on "analyzer" from each input string, thanks to the "LCF" stage -- which if you hover over with your mouse, you'll see is the "`LowerCaseFilter`":

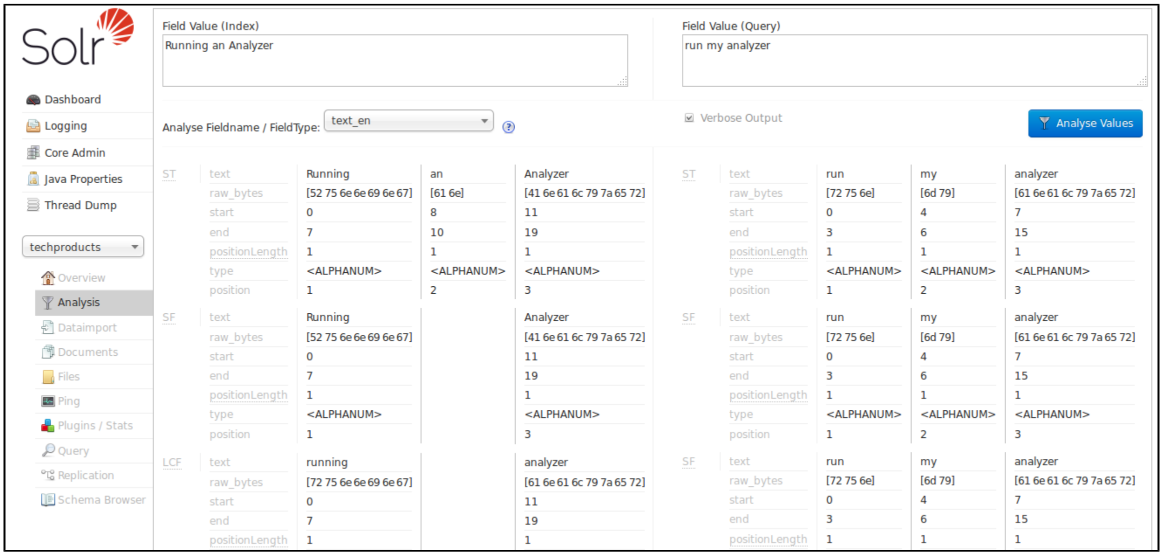


	end	7	10	19
	positionLength	1	1	1
	type	<ALPHANUM>	<ALPHANUM>	<ALPHANUM>
	position	1	2	3
SF	text	Running	an	Analyzer
	raw_bytes	[52 75 6e 6e 69 6e 67]	[61 6e]	[41 6e 61 6c 79 7a 65 72]
	start	0	8	11
	end	7	10	19
	positionLength	1	1	1
	type	<ALPHANUM>	<ALPHANUM>	<ALPHANUM>
	position	1	2	3
LCF	text	running	an	analyzer
	raw_bytes	[72 75 6e 6e 69 6e 67]	[61 6e]	[61 6e 61 6c 79 7a 65 72]
	start	0	8	11
	end	7	10	19
	positionLength	1	1	1
	type	<ALPHANUM>	<ALPHANUM>	<ALPHANUM>
	position	1	2	3

	end	3	6	15
	positionLength	1	1	1
	type	<ALPHANUM>	<ALPHANUM>	<ALPHANUM>
	position	1	2	3
SF	text	run	my	analyzer
	raw_bytes	[72 75 6e]	[6d 79]	[61 6e 61 6c 79 7a 65 72]
	start	0	4	7
	end	3	6	15
	positionLength	1	1	1
	type	<ALPHANUM>	<ALPHANUM>	<ALPHANUM>
	position	1	2	3
SF	text	run	my	analyzer
	raw_bytes	[72 75 6e]	[6d 79]	[61 6e 61 6c 79 7a 65 72]
	start	0	4	7
	end	3	6	15
	positionLength	1	1	1
	type	<ALPHANUM>	<ALPHANUM>	<ALPHANUM>
	position	1	2	3
LCF	text	run	my	analyzer
	raw_bytes	[72 75 6e]	[6d 79]	[61 6e 61 6c 79 7a 65 72]
	start	0	4	7
	end	3	6	15
	positionLength	1	1	1
	type	<ALPHANUM>	<ALPHANUM>	<ALPHANUM>
	position	1	2	3

"`text_general`" is designed to be generally useful for any language, and it has definitely gotten us closer to our objective then "`text_ws`" by solving the problem of case sensitivity, by but it's still not quite what we are looking for.

So now let us try the "`text_en`" field type:



Field Value (Index): Running an Analyzer

Field Value (Query): run my analyzer

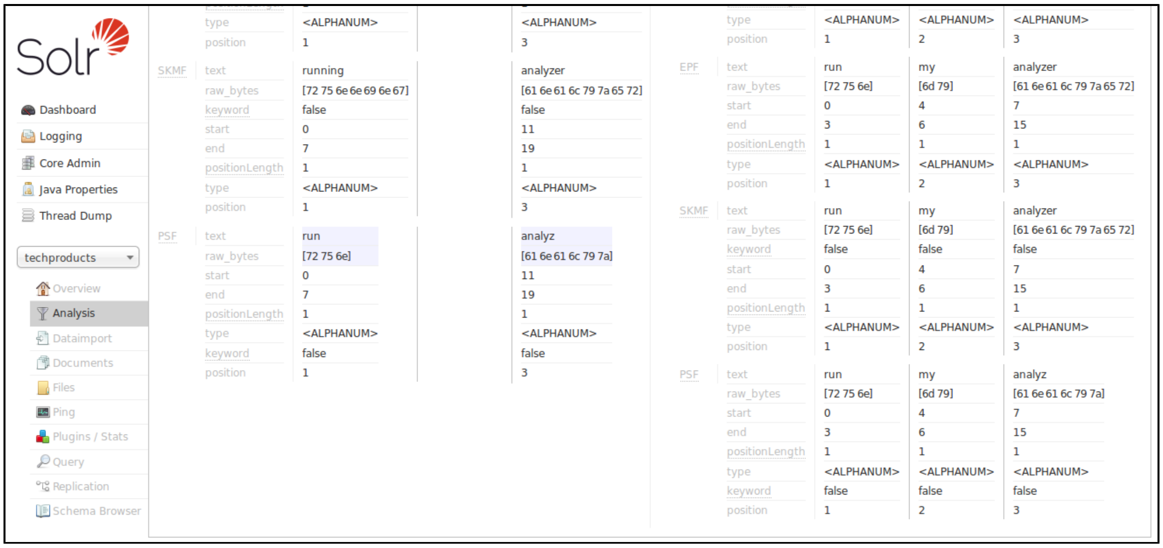
Analyse Fieldname / FieldType: text_en

☑ Verbose Output

ST	text	Running	an	Analyzer
	raw_bytes	[52 75 6e 6e 69 6e 67]	[61 6e]	[41 6e 61 6c 79 7a 65 72]
	start	0	8	11
	end	7	10	19
	positionLength	1	1	1
	type	<ALPHANUM>	<ALPHANUM>	<ALPHANUM>
	position	1	2	3
SF	text	Running		Analyzer
	raw_bytes	[52 75 6e 6e 69 6e 67]		[41 6e 61 6c 79 7a 65 72]
	start	0		11
	end	7		19
	positionLength	1		1
	type	<ALPHANUM>		<ALPHANUM>
	position	1		3
LCF	text	running		analyzer
	raw_bytes	[72 75 6e 6e 69 6e 67]		[61 6e 61 6c 79 7a 65 72]
	start	0		11
	end	7		19
	positionLength	1		1

ST	text	run	my	analyzer
	raw_bytes	[72 75 6e]	[6d 79]	[61 6e 61 6c 79 7a 65 72]
	start	0	4	7
	end	3	6	15
	positionLength	1	1	1
	type	<ALPHANUM>	<ALPHANUM>	<ALPHANUM>
	position	1	2	3
SF	text	run	my	analyzer
	raw_bytes	[72 75 6e]	[6d 79]	[61 6e 61 6c 79 7a 65 72]
	start	0	4	7
	end	3	6	15
	positionLength	1	1	1
	type	<ALPHANUM>	<ALPHANUM>	<ALPHANUM>
	position	1	2	3
SF	text	run	my	analyzer
	raw_bytes	[72 75 6e]	[6d 79]	[61 6e 61 6c 79 7a 65 72]
	start	0	4	7
	end	3	6	15
	positionLength	1	1	1

Now we can see the "SF" (`StopFilter`) stage of the analyzers solving the problem of removing Stop Words, and as we scroll down, we also see the "PSF" (`PorterStemFilter`) stage apply stemming rules suitable for our English language input, such that the terms produced by our "index analyzer" and the terms produced by our "query analyzer" match the way we expect.



	type	<ALPHANUM>		<ALPHANUM>
	position	1		3
SKMF	text	running		analyzer
	raw_bytes	[72 75 6e 6e 69 6e 67]		[61 6e 61 6c 79 7a 65 72]
	keyword	false		false
	start	0		11
	end	7		19
	positionLength	1		1
	type	<ALPHANUM>		<ALPHANUM>
	position	1		3
PSF	text	run		analyz
	raw_bytes	[72 75 6e]		[61 6e 61 6c 79 7a]
	start	0		11
	end	7		19
	positionLength	1		1
	type	<ALPHANUM>		<ALPHANUM>
	keyword	false		false
	position	1		3

	type	<ALPHANUM>	<ALPHANUM>	<ALPHANUM>
	position	1	2	3
EPF	text	run	my	analyzer
	raw_bytes	[72 75 6e]	[6d 79]	[61 6e 61 6c 79 7a 65 72]
	start	0	4	7
	end	3	6	15
	positionLength	1	1	1
	type	<ALPHANUM>	<ALPHANUM>	<ALPHANUM>
	position	1	2	3
SKMF	text	run	my	analyzer
	raw_bytes	[72 75 6e]	[6d 79]	[61 6e 61 6c 79 7a 65 72]
	keyword	false	false	false
	start	0	4	7
	end	3	6	15
	positionLength	1	1	1
	type	<ALPHANUM>	<ALPHANUM>	<ALPHANUM>
	position	1	2	3
PSF	text	run	my	analyz
	raw_bytes	[72 75 6e]	[6d 79]	[61 6e 61 6c 79 7a]
	start	0	4	7
	end	3	6	15
	positionLength	1	1	1
	type	<ALPHANUM>	<ALPHANUM>	<ALPHANUM>
	keyword	false	false	false
	position	1	2	3

At this point, we can continue to experiment with additional inputs, verifying that our analyzers produce matching tokens when we expect them to match, and disparate tokens when we do not expect them to match, as we iterate and tweak our field type configuration.

Indexing and Basic Data Operations

This section describes how Solr adds data to its index. It covers the following topics:

- **Introduction to Solr Indexing**: An overview of Solr's indexing process.
- **Post Tool**: Information about using `post.jar` to quickly upload some content to your system.
- **Uploading Data with Index Handlers**: Information about using Solr's Index Handlers to upload XML/XSLT, JSON and CSV data.
- **Uploading Data with Solr Cell using Apache Tika**: Information about using the Solr Cell framework to upload data for indexing.
- **Uploading Structured Data Store Data with the Data Import Handler**: Information about uploading and indexing data from a structured data store.
- **Updating Parts of Documents**: Information about how to use atomic updates and optimistic concurrency with Solr.
- **Detecting Languages During Indexing**: Information about using language identification during the indexing process.
- **De-Duplication**: Information about configuring Solr to mark duplicate documents as they are indexed.
- **Content Streams**: Information about streaming content to Solr Request Handlers.
- **UIMA Integration**: Information about integrating Solr with Apache's Unstructured Information Management Architecture (UIMA). UIMA lets you define custom pipelines of Analysis Engines that incrementally add metadata to your documents as annotations.

Indexing Using Client APIs

Using client APIs, such as SolrJ, from your applications is an important option for updating Solr indexes. See the Client APIs section for more information.

Introduction to Solr Indexing

This section describes the process of indexing: adding content to a Solr index and, if necessary, modifying that content or deleting it. By adding content to an index, we make it searchable by Solr.

A Solr index can accept data from many different sources, including XML files, comma-separated value (CSV) files, data extracted from tables in a database, and files in common file formats such as Microsoft Word or PDF.

Here are the three most common ways of loading data into a Solr index:

- Using the Solr Cell framework built on Apache Tika for ingesting binary files or structured files such as Office, Word, PDF, and other proprietary formats.
- Uploading XML files by sending HTTP requests to the Solr server from any environment where such requests can be generated.
- Writing a custom Java application to ingest data through Solr's Java Client API (which is described in more detail in Client APIs. Using the Java API may be the best choice if you're working with an application, such as a Content Management System (CMS), that offers a Java API.

Regardless of the method used to ingest data, there is a common basic data structure for data being fed into a Solr index: a *document* containing multiple *fields,* each with a *name* and containing *content,* which may be empty. One of the fields is usually designated as a unique ID field (analogous to a primary key in a database), although the use of a unique ID field is not strictly required by Solr.

If the field name is defined in the `schema.xml` file that is associated with the index, then the analysis steps associated with that field will be applied to its content when the content is tokenized. Fields that are not explicitly defined in the schema will either be ignored or mapped to a dynamic field definition (see Documents, Fields, and Schema Design), if one matching the field name exists.

For more information on indexing in Solr, see the Solr Wiki.

The Solr Example Directory

When starting Solr with the "-e" option, the `example/` directory will be used as base directory for the example Solr instances that are created. This directory also includes an `example/exampledocs/` subdirectory containing sample documents in a variety of formats that you can use to experiment with indexing into the various examples.

The `curl` Utility for Transferring Files

Many of the instructions and examples in this section make use of the `curl` utility for transferring content through a URL. `curl` posts and retrieves data over HTTP, FTP, and many other protocols. Most Linux distributions include a copy of `curl`. You'll find curl downloads for Linux, Windows, and many other operating systems at http://curl.haxx.se/download.html. Documentation for `curl` is available here: http://curl.haxx.se/docs/manpage.html.

> ⚠ Using `curl` or other command line tools for posting data is just fine for examples or tests, but it's not the recommended method for achieving the best performance for updates in production environments. You will achieve better performance with Solr Cell or the other methods described in this section.
>
> Instead of `curl`, you can use utilities such as GNU `wget` (http://www.gnu.org/software/wget/) or manage GETs and POSTS with Perl, although the command line options will differ.

Post Tool

Solr includes a simple command line tool for POSTing various types of content to a Solr server. The tool is `bin/post`. The bin/post tool is a Unix shell script; for Windows (non-Cygwin) usage, see the Windows section below.

To run it, open a window and enter:

```
bin/post -c gettingstarted example/films/films.json
```

This will contact the server at `localhost:8983.` Specifying the `collection/core name` is **mandatory**. The '-help' (or simply '-h') option will output information on its usage (i.e., `bin/post -help)`.

Using the bin/post Tool

Specifying either the `collection/core name` or the full update `url` is **mandatory** when using `bin/post`.

The basic usage of `bin/post` is:

```
$ bin/post -help

Usage: post -c <collection> [OPTIONS] <files|directories|urls|-d ["...",...]>
    or post -help
   collection name defaults to DEFAULT_SOLR_COLLECTION if not specified

OPTIONS
=======
  Solr options:
    -url <base Solr update URL> (overrides collection, host, and port)
    -host <host> (default: localhost)
    -port <port> (default: 8983)
    -commit yes|no (default: yes)
  Web crawl options:
    -recursive <depth> (default: 1)
    -delay <seconds> (default: 10)
  Directory crawl options:
    -delay <seconds> (default: 0)
  stdin/args options:
    -type <content/type> (default: application/xml)
  Other options:
    -filetypes <type>[,<type>,...] (default:
xml,json,csv,pdf,doc,docx,ppt,pptx,xls,xlsx,odt,odp,ods,ott,otp,ots,rtf,htm,html,txt
,log)
    -params "<key>=<value>[&<key>=<value>...]" (values must be URL-encoded; these
pass through to Solr update request)
    -out yes|no (default: no; yes outputs Solr response to console)
...
```

Examples

There are several ways to use `bin/post`. This section presents several examples.

Indexing XML

Add all documents with file extension `.xml` to collection or core named `gettingstarted`.

```
bin/post -c gettingstarted *.xml
```

Add all documents with file extension `.xml` to the `gettingstarted` collection/core on Solr running on port `8984`.

```
bin/post -c gettingstarted -port 8984 *.xml
```

Send XML arguments to delete a document from `gettingstarted`.

```
bin/post -c gettingstarted -d '<delete><id>42</id></delete>'
```

Indexing CSV

Index all CSV files into `gettingstarted`:

```
bin/post -c gettingstarted *.csv
```

Index a tab-separated file into `gettingstarted`:

```
bin/post -c signals -params "separator=%09" -type text/csv data.tsv
```

The content type (`-type`) parameter is required to treat the file as the proper type, otherwise it will be ignored and a WARNING logged as it does not know what type of content a .tsv file is. The CSV handler supports the `separator` parameter, and is passed through using the `-params` setting.

Indexing JSON

Index all JSON files into `gettingstarted`.

```
bin/post -c gettingstarted *.json
```

Indexing rich documents (PDF, Word, HTML, etc)

Index a PDF file into `gettingstarted`.

```
bin/post -c gettingstarted a.pdf
```

Automatically detect content types in a folder, and recursively scan it for documents for indexing into `gettingstarted`.

```
bin/post -c gettingstarted afolder/
```

Automatically detect content types in a folder, but limit it to PPT and HTML files and index into `gettingstarted`.

```
bin/post -c gettingstarted -filetypes ppt,html afolder/
```

Windows support

`bin/post` exists currently only as a Unix shell script, however it delegates its work to a cross-platform capable Java program. The `SimplePostTool` can be run directly in supported environments, including Windows.

SimplePostTool

The `bin/post` script currently delegates to a standalone Java program called `SimplePostTool`. This tool, bundled into a executable JAR, can be run directly using `java -jar example/exampledocs/post.jar`. See the help output and take it from there to post files, recurse a website or file system folder, or send direct commands to a Solr server.

```
$ java -jar example/exampledocs/post.jar -h
SimplePostTool version 5.0.0
Usage: java [SystemProperties] -jar post.jar [-h|-] [<file|folder|url|arg>
[<file|folder|url|arg>...]]
.
.
.
```

Uploading Data with Index Handlers

Index Handlers are Request Handlers designed to add, delete and update documents to the index. In addition to having plugins for importing rich documents using Tika or from structured data sources using the Data Import Handler, Solr natively supports indexing structured documents in XML, CSV and JSON.

The recommended way to configure and use request handlers is with path based names that map to paths in the request url. However, request handlers can also be specified with the `qt` (query type) parameter if the `requestDispatcher` is appropriately configured. It is possible to access the same handler using more than one name, which can be useful if you wish to specify different sets of default options.

A single unified update request handler supports XML, CSV, JSON, and javabin update requests, delegating to the appropriate `ContentStreamLoader` based on the `Content-Type` of the ContentStream.

Topics covered in this section:

UpdateRequestHandler Configuration

The default configuration file has the update request handler configured by default.

```
<requestHandler name="/update" class="solr.UpdateRequestHandler" />
```

XML Formatted Index Updates

Index update commands can be sent as XML message to the update handler using `Content-type: application/xml` or `Content-type: text/xml`.

Adding Documents

The XML schema recognized by the update handler for adding documents is very straightforward:

- The `<add>` element introduces one more documents to be added.
- The `<doc>` element introduces the fields making up a document.
- The `<field>` element presents the content for a specific field.

For example:

```
<add>
  <doc>
   <field name="authors">Patrick Eagar</field>
   <field name="subject">Sports</field>
   <field name="dd">796.35</field>
   <field name="numpages">128</field>
   <field name="desc"></field>
   <field name="price">12.40</field>
   <field name="title" boost="2.0">Summer of the all-rounder: Test and championship
cricket in England 1982</field>
   <field name="isbn">0002166313</field>
   <field name="yearpub">1982</field>
   <field name="publisher">Collins</field>
  </doc>
  <doc boost="2.5">
  ...
  </doc>
</add>
```

Each element has certain optional attributes which may be specified.

Command	Optional Parameter	Parameter Description
<add>	commitWithin=*number*	Add the document within the specified number of milliseconds
<add>	overwrite=*boolean*	Default is true. Indicates if the unique key constraints should be checked to overwrite previous versions of the same document (see below)
<doc>	boost=*float*	Default is 1.0. Sets a boost value for the document.To learn more about boosting, see Searching.
<field>	boost=*float*	Default is 1.0. Sets a boost value for the field.

If the document schema defines a unique key, then by default an `/update` operation to add a document will overwrite (ie: replace) any document in the index with the same unique key. If no unique key has been defined, indexing performance is somewhat faster, as no check has to be made for an existing documents to replace.

If you have a unique key field, but you feel confident that you can safely bypass the uniqueness check (eg: you build your indexes in batch, and your indexing code guarantees it never adds the same document more then once) you can specify the `overwrite="false"` option when adding your documents.

XML Update Commands

Commit and Optimize Operations

The `<commit>` operation writes all documents loaded since the last commit to one or more segment files on the disk. Before a commit has been issued, newly indexed content is not visible to searches. The commit operation opens a new searcher, and triggers any event listeners that have been configured.

Commits may be issued explicitly with a `<commit/>` message, and can also be triggered from `<autocommit>` parameters in `solrconfig.xml`.

The `<optimize>` operation requests Solr to merge internal data structures in order to improve search performance. For a large index, optimization will take some time to complete, but by merging many small segment files into a larger one, search performance will improve. If you are using Solr's replication mechanism to distribute searches across many systems, be aware that after an optimize, a complete index will need to be transferred. In contrast, post-commit transfers are usually much smaller.

The `<commit>` and `<optimize>` elements accept these optional attributes:

Optional Attribute	Description
waitSearcher	Default is true. Blocks until a new searcher is opened and registered as the main query searcher, making the changes visible.
expungeDeletes	(commit only) Default is false. Merges segments that have more than 10% deleted docs, expunging them in the process.
maxSegments	(optimize only) Default is 1. Merges the segments down to no more than this number of segments.

Here are examples of <commit> and <optimize> using optional attributes:

```
<commit waitSearcher="false"/>
<commit waitSearcher="false" expungeDeletes="true"/>
<optimize waitSearcher="false"/>
```

Delete Operations

Documents can be deleted from the index in two ways. "Delete by ID" deletes the document with the specified ID, and can be used only if a UniqueID field has been defined in the schema. "Delete by Query" deletes all documents matching a specified query, although `commitWithin` is ignored for a Delete by Query. A single delete message can contain multiple delete operations.

```
<delete>
  <id>0002166313</id>
  <id>0031745983</id>
  <query>subject:sport</query>
  <query>publisher:penguin</query>
</delete>
```

Rollback Operations

The rollback command rolls back all add and deletes made to the index since the last commit. It neither calls any event listeners nor creates a new searcher. Its syntax is simple: `<rollback/>`.

Using `curl` to Perform Updates

You can use the `curl` utility to perform any of the above commands, using its `--data-binary` option to append the XML message to the `curl` command, and generating a HTTP POST request. For example:

```
curl http://localhost:8983/solr/my_collection/update -H "Content-Type: text/xml"
--data-binary '
<add>
 <doc>
  <field name="authors">Patrick Eagar</field>
  <field name="subject">Sports</field>
  <field name="dd">796.35</field>
  <field name="isbn">0002166313</field>
  <field name="yearpub">1982</field>
  <field name="publisher">Collins</field>
 </doc>
</add>'
```

For posting XML messages contained in a file, you can use the alternative form:

```
curl http://localhost:8983/solr/my_collection/update -H "Content-Type: text/xml"
--data-binary @myfile.xml
```

Short requests can also be sent using a HTTP GET command, URL-encoding the request, as in the following. Note the escaping of "<" and ">":

```
curl http://localhost:8983/solr/my_collection/update?stream.body=%3Ccommit/%3E
```

Responses from Solr take the form shown here:

```
<response>
 <lst name="responseHeader">
  <int name="status">0</int>
  <int name="QTime">127</int>
 </lst>
</response>
```

The status field will be non-zero in case of failure.

Using XSLT to Transform XML Index Updates

The UpdateRequestHandler allows you to index any arbitrary XML using the `<tr>` parameter to apply an XSL transformation. You must have an XSLT stylesheet in the `conf/xslt` directory of your config set that can transform the incoming data to the expected `<add><doc/></add>` format, and use the `tr` parameter to specify the name of that stylesheet.

Here is an example XSLT stylesheet:

```
<xsl:stylesheet version='1.0' xmlns:xsl='http://www.w3.org/1999/XSL/Transform'>
  <xsl:output media-type="text/xml" method="xml" indent="yes"/>
  <xsl:template match='/'>
    <add>
        <xsl:apply-templates select="response/result/doc"/>
    </add>
  </xsl:template>
  <!-- Ignore score (makes no sense to index) -->
  <xsl:template match="doc/*[@name='score']" priority="100">
  </xsl:template>
  <xsl:template match="doc">
    <xsl:variable name="pos" select="position()"/>
    <doc>
        <xsl:apply-templates>
          <xsl:with-param name="pos"><xsl:value-of select="$pos"/></xsl:with-param>
        </xsl:apply-templates>
    </doc>
  </xsl:template>
  <!-- Flatten arrays to duplicate field lines -->
  <xsl:template match="doc/arr" priority="100">
      <xsl:variable name="fn" select="@name"/>
      <xsl:for-each select="*">
                <xsl:element name="field">
                    <xsl:attribute name="name"><xsl:value-of
select="$fn"/></xsl:attribute>
                <xsl:value-of select="."/>
                </xsl:element>
      </xsl:for-each>
  </xsl:template>
  <xsl:template match="doc/*">
      <xsl:variable name="fn" select="@name"/>

        <xsl:element name="field">
            <xsl:attribute name="name"><xsl:value-of select="$fn"/></xsl:attribute>
        <xsl:value-of select="."/>
        </xsl:element>
  </xsl:template>
  <xsl:template match="*"/>
</xsl:stylesheet>
```

This stylesheet transforms Solr's XML search result format into Solr's Update XML syntax. One example usage would be to copy a Solr 1.3 index (which does not have CSV response writer) into a format which can be indexed into another Solr file (provided that all fields are stored):

```
http://localhost:8983/solr/my_collection/select?q=*:*&wt=xslt&tr=updateXml.xsl&rows=
1000
```

You can also use the stylesheet in `XsltUpdateRequestHandler` to transform an index when updating:

```
curl "http://localhost:8983/solr/my_collection/update?commit=true&tr=updateXml.xsl"
-H "Content-Type: text/xml" --data-binary @myexporteddata.xml
```

For more information about the XML Update Request Handler, see https://wiki.apache.org/solr/UpdateXmlMessages.

JSON Formatted Index Updates

Solr can accept JSON that conforms to a defined structure, or can accept arbitrary JSON-formatted documents. If sending arbitrarily formatted JSON, there are some additional parameters that need to be sent with the update request, described below in the section Transforming and Indexing Custom JSON.

Solr-Style JSON

JSON formatted update requests may be sent to Solr's `/update` handler using `Content-Type: application/json` or `Content-Type: text/json`.

JSON formatted updates can take 3 basic forms, described in depth below:

- A single document to add, expressed as a top level JSON Object. To differentiate this from a set of commands, the `json.command=false` request parameter is required.
- A list of documents to add, expressed as a top level JSON Array containing a JSON Object per document.
- A sequence of update commands, expressed as a top level JSON Object (aka: Map).

Adding a Single JSON Document

The simplest way to add Documents via JSON is to send each document individually as a JSON Object, using the `/update/json/docs` path:

```
curl -X POST -H 'Content-Type: application/json'
'http://localhost:8983/solr/my_collection/update/json/docs' --data-binary '
{
  "id": "1",
  "title": "Doc 1"
}'
```

Adding Multiple JSON Documents

Adding multiple documents at one time via JSON can be done via a JSON Array of JSON Objects, where each object represents a document:

```
curl -X POST -H 'Content-Type: application/json'
'http://localhost:8983/solr/my_collection/update' --data-binary '
[
  {
    "id": "1",
    "title": "Doc 1"
  },
  {
    "id": "2",
    "title": "Doc 2"
  }
]'
```

A sample JSON file is provided at `example/exampledocs/books.json` and contains an array of objects that you can add to the Solr `techproducts` example:

```
curl 'http://localhost:8983/solr/techproducts/update?commit=true' --data-binary
@example/exampledocs/books.json -H 'Content-type:application/json'
```

Sending JSON Update Commands

In general, the JSON update syntax supports accepts all of the update commands that the XML update handler supports, through a straightforward mapping. Multiple commands, adding and deleting documents, may be contained in one message:

```
curl -X POST -H 'Content-Type: application/json'
'http://localhost:8983/solr/my_collection/update' --data-binary '
{
  "add": {
    "doc": {
      "id": "DOC1",
      "my_boosted_field": {        /* use a map with boost/value for a boosted field
*/
        "boost": 2.3,
        "value": "test"
      },
      "my_multivalued_field": [ "aaa", "bbb" ]   /* Can use an array for a
multi-valued field */
    }
  },
  "add": {
    "commitWithin": 5000,          /* commit this document within 5 seconds */
    "overwrite": false,            /* don't check for existing documents with the
same uniqueKey */
    "boost": 3.45,                 /* a document boost */
    "doc": {
      "f1": "v1",                  /* Can use repeated keys for a multi-valued field
*/
      "f1": "v2"
    }
  },

  "commit": {},
  "optimize": { "waitSearcher":false },

  "delete": { "id":"ID" },         /* delete by ID */
  "delete": { "query":"QUERY" }    /* delete by query */
}'
```

⚠ Comments are not allowed in JSON, but duplicate names are.

The comments in the above example are for illustrative purposes only, and can not be included in actual commands sent to Solr.

As with other update handlers, parameters such as `commit`, `commitWithin`, `optimize`, and `overwrite` may be specified in the URL instead of in the body of the message.

The JSON update format allows for a simple delete-by-id. The value of a `delete` can be an array which contains a list of zero or more specific document id's (not a range) to be deleted. For example, a single document:

```
{ "delete":"myid" }
```

Or a list of document IDs:

```
{ "delete":["id1","id2"] }
```

The value of a "delete" can be an array which contains a list of zero or more id's to be deleted. It is not a range (start and end).

You can also specify `_version_` with each "delete":

```
{
  "delete":"id":50,
  "_version_":12345
}
```

You can specify the version of deletes in the body of the update request as well.

JSON Update Convenience Paths

In addition to the `/update` handler, there are a few additional JSON specific request handler paths available by default in Solr, that implicitly override the behavior of some request parameters:

Path	Default Parameters
`/update/json`	`stream.contentType=application/json`

`/update/json/docs`	`stream.contentType=application/json`
	`json.command=false`

The `/update/json` path may be useful for clients sending in JSON formatted update commands from applications where setting the Content-Type proves difficult, while the `/update/json/docs` path can be particularly convenient for clients that always want to send in documents – either individually or as a list – with out needing to worry about the full JSON command syntax.

Transforming and Indexing Custom JSON

If you have JSON documents that you would like to index without transforming them into Solr's structure, you can add them to Solr by including some parameters with the update request. These parameters provide information on how to split a single JSON file into multiple Solr documents and how to map fields to Solr's schema. One or more valid JSON documents can be sent to the `/update/json/docs` path with the configuration params.

Mapping Parameters

These parameters allow you to define how a JSON file should be read for multiple Solr documents.

- **split**: Defines the path at which to split the input JSON into multiple Solr documents and is required if you have multiple documents in a single JSON file. If the entire JSON makes a single solr document, the path must be “`/`”.
- **f**: This is a multivalued mapping parameter. At least one field mapping must be provided. The format of

the parameter is `target-field-name:json-path`. The `json-path` is required. The `target-field-name` is the Solr document field name, and is optional. If not specified, it is automatically derived from the input JSON. Wildcards can be used here, see the section Wildcards below for more information.

- **mapUniqueKeyOnly** (boolean): This parameter is particularly convenient when the fields in the input JSON are not available in the schema and schemaless mode is not enabled. This will index all the fields into the default search field (using the `df` parameter, below) and only the `uniqueKey` field is mapped to the corresponding field in the schema. If the input JSON does not have a value for the `uniqueKey` field then a UUID is generated for the same.
- **df**: If the `mapUniqueKeyOnly` flag is used, the update handler needs a field where the data should be indexed to. This is the same field that other handlers use as a default search field.
- **srcField**: This is the name of the field to which the JSON source will be stored into. This can only be used if `split=/` (i.e., you want your JSON input file to be indexed as a single Solr document). Note that atomic updates will cause the field to be out-of-sync with the document.
- **echo**: This is for debugging purpose only. Set it to true if you want the docs to be returned as a response. Nothing will be indexed.

For example, if we have a JSON file that includes two documents, we could define an update request like this:

```
curl 'http://localhost:8983/solr/my_collection/update/json/docs'\
'?split=/exams'\
'&f=first:/first'\
'&f=last:/last'\
'&f=grade:/grade'\
'&f=subject:/exams/subject'\
'&f=test:/exams/test'\
'&f=marks:/exams/marks'\
 -H 'Content-type:application/json' -d '
{
  "first": "John",
  "last": "Doe",
  "grade": 8,
  "exams": [
      {
        "subject": "Maths",
        "test"   : "term1",
        "marks"  : 90},
      {
        "subject": "Biology",
        "test"   : "term1",
        "marks"  : 86}
  ]
}'
```

With this request, we have defined that "exams" contains multiple documents. In addition, we have mapped several fields from the input document to Solr fields.

When the update request is complete, the following two documents will be added to the index:

```
{
  "first":"John",
  "last":"Doe",
  "marks":90,
  "test":"term1",
  "subject":"Maths",
  "grade":8
}
{
  "first":"John",
  "last":"Doe",
  "marks":86,
  "test":"term1",
  "subject":"Biology",
  "grade":8
}
```

In the prior example, all of the fields we wanted to use in Solr had the same names as they did in the input JSON. When that is the case, we can simplify the request as follows:

```
curl 'http://localhost:8983/solr/my_collection/update/json/docs'\
'?split=/exams'\
'&f=/first'\
'&f=/last'\
'&f=/grade'\
'&f=/exams/subject'\
'&f=/exams/test'\
'&f=/exams/marks'\
 -H 'Content-type:application/json' -d '
{
  "first": "John",
  "last": "Doe",
  "grade": 8,
  "exams": [
      {
        "subject": "Maths",
        "test"   : "term1",
        "marks"  : 90},
      {
        "subject": "Biology",
        "test"   : "term1",
        "marks"  : 86}
  ]
}'
```

In this example, we simply named the field paths (such as `/exams/test`). Solr will automatically attempt to add the content of the field from the JSON input to the index in a field with the same name.

> Note that if you are not working in Schemaless Mode, where fields that don't exist will be created on the fly with Solr's best guess for the field type, documents may get rejected if the fields do not exist in the schema before indexing.

Wildcards

Instead of specifying all the field names explicitly, it is possible to specify wildcards to map fields automatically. There are two restrictions: wildcards can only be used at the end of the `json-path`, and the split path cannot use wildcards. A single asterisk "*" maps only to direct children, and a double asterisk "**" maps recursively to all descendants. The following are example wildcard path mappings:

- `f=/docs/*`: maps all the fields under docs and in the name as given in json
- `f=/docs/**`: maps all the fields under docs and its children in the name as given in json
- `f=searchField:/docs/*`: maps all fields under /docs to a single field called ‘searchField’
- `f=searchField:/docs/**`: maps all fields under /docs and its children to searchField
- `f=$FQN:/**`: maps all fields to the fully qualified name (`$FQN`) of the JSON field. The fully qualified name is obtained by concatenating all the keys in the hierarchy with a period (`.`) as a delimiter.

(Note: The default value of `f` is '`$FQN:/**'` fom Solr 5.0 . It used to be '`/**'` in 4.10.x releases. This breaks backward compatibility. If you wish to have the old behavior please specify `f=/**` explicitly.)

With wildcards we can further simplify our previous example as follows:

```
curl 'http://localhost:8983/solr/my_collection/update/json/docs'\
'?split=/exams'\
'&f=/**'\
 -H 'Content-type:application/json' -d '
{
  "first": "John",
  "last": "Doe",
  "grade": 8,
  "exams": [
      {
        "subject": "Maths",
        "test"   : "term1",
        "marks"  : 90},
      {
        "subject": "Biology",
        "test"   : "term1",
        "marks"  : 86}
  ]
}'
```

Because we want the fields to be indexed with the field names as they are found in the JSON input, the double wildcard in `f=/**` will map all fields and their descendants to the same fields in Solr.

It is also possible to send all the values to a single field and do a full text search on that. This is a good option to blindly index and query JSON documents without worrying about fields and schema.

```
curl 'http://localhost:8983/solr/my_collection/update/json/docs'\
'?split=/'\
'&f=txt:/**'\
 -H 'Content-type:application/json' -d '
{
  "first": "John",
  "last": "Doe",
  "grade": 8,
  "exams": [
      {
        "subject": "Maths",
        "test"   : "term1",
        "marks"  : 90},
      {
        "subject": "Biology",
        "test"   : "term1",
        "marks"  : 86}
  ]
}'
```

In the above example, we've said all of the fields should be added to a field in Solr named 'txt'. This will add multiple fields to a single field, so whatever field you choose should be multi-valued.

The default behavior is to use the fully qualified name (FQN) of the node. So, if we don't define any field mappings, like this:

```
curl 'http://localhost:8983/solr/my_collection/update/json/docs?split=/exams'\
    -H 'Content-type:application/json' -d '
    {
    "first": "John",
    "last": "Doe",
    "grade": 8,
    "exams": [
    {
    "subject": "Maths",
    "test"   : "term1",
    "marks"  : 90},
    {
    "subject": "Biology",
    "test"   : "term1",
    "marks"  : 86}
    ]
    }'
```

The indexed documents would be added to the index with fields that look like this:

```
{
      "first":"John",
      "last":"Doe",
      "grade":8,
      "exams.subject":"Maths",
      "exams.test":"term1",
      "exams.marks":90},
{
      "first":"John",
      "last":"Doe",
      "grade":8,
      "exams.subject":"Biology",
      "exams.test":"term1",
      "exams.marks":86}
```

Setting JSON Defaults

If It is possible to send any json to the `/update/json/docs` endpoint and the default configuration of the component is as follows:

```
<initParams path="/update/json/docs">
    <lst name="defaults">
      <!-- this ensures that the entire json doc will be stored verbatim into one
field -->
      <str name="srcField">_src_</str>
      <!-- This means a the uniqueKeyField will be extracted from the fields and
       all fields go into the 'df' field. In this config df is already configured to
be 'text'
        -->
      <str name="mapUniqueKeyOnly">true</str>
      <!-- The default search field where all the values are indexed to
      -->
       <str name="df">text</str>
    </lst>

  </initParams>
```

So, if no params are passed, the entire json file would get indexed to the `_src_` field and all the values in the input JSON would go to a field named `text`. If there is a value for the uniqueKey it is stored and if no value could be obtained from the input JSON, a UUID is created and used as the uniqueKey field value.

CSV Formatted Index Updates

CSV formatted update requests may be sent to Solr's `/update` handler using `Content-Type: application/csv` or `Content-Type: text/csv`.

A sample CSV file is provided at `example/exampledocs/books.csv` that you can use to add some documents to the Solr `techproducts` example:

```
curl 'http://localhost:8983/solr/techproducts/update?commit=true' --data-binary
@example/exampledocs/books.csv -H 'Content-type:application/csv'
```

CSV Update Parameters

The CSV handler allows the specification of many parameters in the URL in the form: `f.parameter.optional_fieldname=value`.

The table below describes the parameters for the update handler.

Parameter	Usage	Global (g) or Per Field (f)	Example
separator	Character used as field separator; default is ","	g,(f: see split)	separator=%

trim	If true, remove leading and trailing whitespace from values. Default=false.	g,f	f.isbn.trim=true
			trim=false

header	Set to true if first line of input contains field names. These will be used if the **fieldnames** parameter is absent.	g	
fieldnames	Comma separated list of field names to use when adding documents.	g	fieldnames=isbn,price,title
literal.<field_name>	Comma separated list of field names to use when processing literal values.	g	literal.color=red,blue,black
skip	Comma separated list of field names to skip.	g	skip=uninteresting,shoesize
skipLines	Number of lines to discard in the input stream before the CSV data starts, including the header, if present. Default=0.	g	skipLines=5
encapsulator	The character optionally used to surround values to preserve characters such as the CSV separator or whitespace. This standard CSV format handles the encapsulator itself appearing in an encapsulated value by doubling the encapsulator.	g,(f: see split)	encapsulator="
escape	The character used for escaping CSV separators or other reserved characters. If an escape is specified, the encapsulator is not used unless also explicitly specified since most formats use either encapsulation or escaping, not both	g	escape=\
keepEmpty	Keep and index zero length (empty) fields. Default=false.	g,f	f.price.keepEmpty=true

map	Map one value to another. Format is value:replacement (which can be empty.)	g,f	map=left:right
			f.subject.map=history:bunk

split	If true, split a field into multiple values by a separate parser.	f	
overwrite	If true (the default), check for and overwrite duplicate documents, based on the uniqueKey field declared in the Solr schema. If you know the documents you are indexing do not contain any duplicates then you may see a considerable speed up setting this to false.	g	
commit	Issues a commit after the data has been ingested.	g	
commitWithin	Add the document within the specified number of milliseconds.	g	commitWithin=10000
rowid	Map the rowid (line number) to a field specified by the value of the parameter, for instance if your CSV doesn't have a unique key and you want to use the row id as such.	g	rowid=id
rowidOffset	Add the given offset (as an int) to the rowid before adding it to the document. Default is 0	g	rowidOffset=10

Indexing Tab-Delimited files

The same feature used to index CSV documents can also be easily used to index tab-delimited files (TSV files) and even handle backslash escaping rather than CSV encapsulation.

For example, one can dump a MySQL table to a tab delimited file with:

```
SELECT * INTO OUTFILE '/tmp/result.txt' FROM mytable;
```

This file could then be imported into Solr by setting the `separator` to tab (%09) and the `escape` to backslash (%5c).

```
curl 'http://localhost:8983/solr/update/csv?commit=true&separator=%09&escape=%5c'
--data-binary @/tmp/result.txt
```

CSV Update Convenience Paths

In addition to the `/update` handler, there is an additional CSV specific request handler path available by default in Solr, that implicitly override the behavior of some request parameters:

Path	Default Parameters
`/update/csv`	`stream.contentType=application/csv`

The `/update/csv` path may be useful for clients sending in CSV formatted update commands from applications where setting the Content-Type proves difficult.

For more information on the CSV Update Request Handler, see https://wiki.apache.org/solr/UpdateCSV.

Nested Child Documents

Solr nested documents using a "Block Join" when indexing as a way to model documents containing other documents, such as a blog post parent document and comments as child documents -- or products as parent documents and sizes, colors, or other variations as child documents. At query time, the Block Join Query Parsers can be used search against these relationships. In terms of performance, indexing the relationships between documents may be more efficient than attempting to do joins only at query time, since the relationships are already stored in the index and do not need to be computed.

Nested documents may be indexed via either the XML or JSON data syntax (or using SolrJ) - but regardless of syntax, you must include a field that identifies the parent document as a parent; it can be any field that suits this purpose, and it will be used as input for the block join query parsers.

XML Examples

For example, here are two documents and their child documents:

```
<add>
  <doc>
  <field name="id">1</field>
  <field name="title">Solr adds block join support</field>
  <field name="content_type">parentDocument</field>
    <doc>
     <field name="id">2</field>
     <field name="comments">SolrCloud supports it too!</field>
    </doc>
  </doc>
  <doc>
    <field name="id">3</field>
    <field name="title">New Lucene and Solr release is out</field>
    <field name="content_type">parentDocument</field>
    <doc>
     <field name="id">4</field>
     <field name="comments">Lots of new features</field>
    </doc>
  </doc>
</add>
```

In this example, we have indexed the parent documents with the field `content_type`, which has the value "parentDocument". We could have also used a boolean field, such as `isParent`, with a value of "true", or any other similar approach.

JSON Examples

This example is equivalent to the XML example above, note the special `_childDocuments_` key need to indicate the nested documents in JSON.

```
[
  {
    "id": "1",
    "title": "Solr adds block join support",
    "content_type": "parentDocument",
    "_childDocuments_": [
      {
        "id": "2",
        "comments": "SolrCloud supports it too!"
      }
    ]
  },
  {
    "id": "3",
    "title": "New Lucene and Solr release is out",
    "content_type": "parentDocument",
    "_childDocuments_": [
      {
        "id": "4",
        "comments": "Lots of new features"
      }
    ]
  }
]
```

Note

One limitation of indexing nested documents is that the whole block of parent-children documents must be updated together whenever any changes are required. In other words, even if a single child document or the parent document is changed, the whole block of parent-child documents must be indexed together.

Uploading Data with Solr Cell using Apache Tika

Solr uses code from the Apache Tika project to provide a framework for incorporating many different file-format parsers such as Apache PDFBox and Apache POI into Solr itself. Working with this framework, Solr's `ExtractingRequestHandler` can use Tika to support uploading binary files, including files in popular formats such as Word and PDF, for data extraction and indexing.

When this framework was under development, it was called the Solr Content Extraction Library or CEL; from that abbreviation came this framework's name: Solr Cell.

If you want to supply your own `ContentHandler` for Solr to use, you can extend the `ExtractingRequestHandler` and override the `createFactory()` method. This factory is responsible for constructing the `SolrContentHandler` that interacts with Tika, and allows literals to override Tika-parsed values. Set the parameter `literalsOverride`, which normally defaults to *true, to *false" to append Tika-parsed values to literal values.

For more information on Solr's Extracting Request Handler, see https://wiki.apache.org/solr/ExtractingRequestH andler.

Topics covered in this section:

Key Concepts

When using the Solr Cell framework, it is helpful to keep the following in mind:

- Tika will automatically attempt to determine the input document type (Word, PDF, HTML) and extract the content appropriately. If you like, you can explicitly specify a MIME type for Tika with the `stream.type` parameter.
- Tika works by producing an XHTML stream that it feeds to a SAX ContentHandler. SAX is a common interface implemented for many different XML parsers. For more information, see http://www.saxproject.org/quickstart.html.
- Solr then responds to Tika's SAX events and creates the fields to index.
- Tika produces metadata such as Title, Subject, and Author according to specifications such as the DublinCore. See http://tika.apache.org/1.7/formats.html for the file types supported.
- Tika adds all the extracted text to the `content` field.
- You can map Tika's metadata fields to Solr fields. You can also boost these fields.
- You can pass in literals for field values. Literals will override Tika-parsed values, including fields in the Tika metadata object, the Tika content field, and any "captured content" fields.
- You can apply an XPath expression to the Tika XHTML to restrict the content that is produced.

> ✓ While Apache Tika is quite powerful, it is not perfect and fails on some files. PDF files are particularly problematic, mostly due to the PDF format itself. In case of a failure processing any file, the `ExtractingRequestHandler` does not have a secondary mechanism to try to extract some text from the file; it will throw an exception and fail.

Trying out Tika with the Solr `techproducts` Example

You can try out the Tika framework using the `techproducts` example included in Solr.

Start the example:

```
bin/solr -e techproducts
```

You can now use curl to send a sample PDF file via HTTP POST:

```
curl
'http://localhost:8983/solr/techproducts/update/extract?literal.id=doc1&commit=true'
-F "myfile=@example/exampledocs/solr-word.pdf"
```

The URL above calls the Extracting Request Handler, uploads the file `solr-word.pdf` and assigns it the unique ID `doc1`. Here's a closer look at the components of this command:

- The `literal.id=doc1` parameter provides the necessary unique ID for the document being indexed.
- The `commit=true parameter` causes Solr to perform a commit after indexing the document, making it immediately searchable. For optimum performance when loading many documents, don't call the commit command until you are done.
- The `-F` flag instructs curl to POST data using the Content-Type `multipart/form-data` and supports the uploading of binary files. The @ symbol instructs curl to upload the attached file.
- The argument `myfile=@tutorial.html` needs a valid path, which can be absolute or relative.

You can also use `bin/post` to send a PDF file into Solr (without the params, the literal.id parameter would be set to the absolute path to the file):

```
bin/post -c techproducts example/exampledocs/solr-word.pdf -params "literal.id=a"
```

Now you should be able to execute a query and find that document. You can make a request like `http://localhost:8983/solr/techproducts/select?q=pdf` .

You may notice that although the content of the sample document has been indexed and stored, there are not a lot of metadata fields associated with this document. This is because unknown fields are ignored according to the default parameters configured for the `/update/extract` handler in `solrconfig.xml`, and this behavior can be easily changed or overridden. For example, to store and see all metadata and content, execute the following:

```
bin/post -c techproducts example/exampledocs/solr-word.pdf -params
"literal.id=doc1&uprefix=attr_"
```

In this command, the `uprefix=attr_` parameter causes all generated fields that aren't defined in the schema to be prefixed with `attr_`, which is a dynamic field that is stored and indexed.

This command allows you to query the document using an attribute, as in: `http://localhost:8983/solr/techproducts/select?q=attr_meta:microsoft`.

Input Parameters

The table below describes the parameters accepted by the Extracting Request Handler.

Parameter	Description
boost.<*fieldname*>	Boosts the specified field by the defined float amount. (Boosting a field alters its importance in a query response. To learn about boosting fields, see Searching.)

capture	Captures XHTML elements with the specified name for a supplementary addition to the Solr document. This parameter can be useful for copying chunks of the XHTML into a separate field. For instance, it could be used to grab paragraphs (`<p>`) and index them into a separate field. Note that content is still also captured into the overall "content" field.
captureAttr	Indexes attributes of the Tika XHTML elements into separate fields, named after the element. If set to true, for example, when extracting from HTML, Tika can return the href attributes in <a> tags as fields named "a". See the examples below.
commitWithin	Add the document within the specified number of milliseconds.
date.formats	Defines the date format patterns to identify in the documents.
defaultField	If the uprefix parameter (see below) is not specified and a field cannot be determined, the default field will be used.
extractOnly	Default is false. If true, returns the extracted content from Tika without indexing the document. This literally includes the extracted XHTML as a string in the response. When viewing manually, it may be useful to use a response format other than XML to aid in viewing the embedded XHTML tags.For an example, see http://wiki.apache.org/solr/TikaExtractOnlyExampleOutput.
extractFormat	Default is "xml", but the other option is "text". Controls the serialization format of the extract content. The xml format is actually XHTML, the same format that results from passing the `-x` command to the Tika command line application, while the text format is like that produced by Tika's `-t` command. This parameter is valid only if `extractOnly` is set to true.
fmap.<*source_field*>	Maps (moves) one field name to another. The `source_field` must be a field in incoming documents, and the value is the Solr field to map to. Example: `fmap.content=text` causes the data in the `content` field generated by Tika to be moved to the Solr's `text` field.
literal.<*fieldname*>	Populates a field with the name supplied with the specified value for each document. The data can be multivalued if the field is multivalued.
literalsOverride	If true (the default), literal field values will override other values with the same field name. If false, literal values defined with `literal.<fieldname>` will be appended to data already in the fields extracted from Tika. If setting `literalsOverride` to "false", the field must be multivalued.
lowernames	Values are "true" or "false". If true, all field names will be mapped to lowercase with underscores, if needed. For example, "Content-Type" would be mapped to "content_type."
multipartUploadLimitInKB	Useful if uploading very large documents, this defines the KB size of documents to allow.
passwordsFile	Defines a file path and name for a file of file name to password mappings.

resource.name	Specifies the optional name of the file. Tika can use it as a hint for detecting a file's MIME type.
resource.password	Defines a password to use for a password-protected PDF or OOXML file
tika.config	Defines a file path and name to a customized Tika configuration file. This is only required if you have customized your Tika implementation.
uprefix	Prefixes all fields that are not defined in the schema with the given prefix. This is very useful when combined with dynamic field definitions. Example: `uprefix=ignored_` would effectively ignore all unknown fields generated by Tika given the example schema contains `<dynamicField name="ignored_*" type="ignored"/>`
xpath	When extracting, only return Tika XHTML content that satisfies the given XPath expression. See http://tika.apache.org/1.7/index.html for details on the format of Tika XHTML. See also http://wiki.apache.org/solr/TikaExtractOnlyExampleOutput.

Order of Operations

Here is the order in which the Solr Cell framework, using the Extracting Request Handler and Tika, processes its input.

1. Tika generates fields or passes them in as literals specified by `literal.<fieldname>=<value>`. If `literalsOverride=false`, literals will be appended as multi-value to the Tika-generated field.
2. If `lowernames=true`, Tika maps fields to lowercase.
3. Tika applies the mapping rules specified by `fmap.` *source* = *target* parameters.
4. If `uprefix` is specified, any unknown field names are prefixed with that value, else if `defaultField` is specified, any unknown fields are copied to the default field.

Configuring the Solr `ExtractingRequestHandler`

If you are not working with the supplied `sample_techproducts_configs` or `data_driven_schema_configs` config set, you must configure your own `solrconfig.xml` to know about the Jar's containing the `ExtractingRequestHandler` and it's dependencies:

```
<lib dir="${solr.install.dir:../../..}/contrib/extraction/lib" regex=".*\.jar" />
  <lib dir="${solr.install.dir:../../..}/dist/" regex="solr-cell-\d.*\.jar" />
```

You can then configure the `ExtractingRequestHandler` in `solrconfig.xml`.

```
<requestHandler name="/update/extract"
class="org.apache.solr.handler.extraction.ExtractingRequestHandler">
  <lst name="defaults">
    <str name="fmap.Last-Modified">last_modified</str>
    <str name="uprefix">ignored_</str>
  </lst>
  <!--Optional.  Specify a path to a tika configuration file. See the Tika docs for
details.-->
  <str name="tika.config">/my/path/to/tika.config</str>
  <!-- Optional. Specify one or more date formats to parse. See
DateUtil.DEFAULT_DATE_FORMATS
       for default date formats -->
  <lst name="date.formats">
    <str>yyyy-MM-dd</str>
  </lst>
</requestHandler>
```

In the defaults section, we are mapping Tika's Last-Modified Metadata attribute to a field named `last_modified`. We are also telling it to ignore undeclared fields. These are all overridden parameters.

The `tika.config` entry points to a file containing a Tika configuration. The `date.formats` allows you to specify various `java.text.SimpleDateFormats` date formats for working with transforming extracted input to a Date. Solr comes configured with the following date formats (see the `DateUtil` in Solr):

`yyyy-MM-dd'T'HH:mm:ss'Z'`
`yyyy-MM-dd'T'HH:mm:ss`
`yyyy-MM-dd`
`yyyy-MM-dd hh:mm:ss`
`yyyy-MM-dd HH:mm:ss`
`EEE MMM d hh:mm:ss z yyyy`
`EEE, dd MMM yyyy HH:mm:ss zzz`
`EEEE, dd-MMM-yy HH:mm:ss zzz`
`EEE MMM d HH:mm:ss yyyy`

You may also need to adjust the `multipartUploadLimitInKB` attribute as follows if you are submitting very large documents.

```
<requestDispatcher handleSelect="true" >
  <requestParsers enableRemoteStreaming="false" multipartUploadLimitInKB="20480" />
  ...
```

Multi-Core Configuration

For a multi-core configuration, you can specify `sharedLib='lib'` in the `<solr/>` section of `solr.xml` and place the necessary jar files there.

For more information about Solr cores, see The Well-Configured Solr Instance.

Indexing Encrypted Documents with the ExtractingUpdateRequestHandler

The ExtractingRequestHandler will decrypt encrypted files and index their content if you supply a password in either `resource.password` on the request, or in a `passwordsFile` file.

In the case of `passwordsFile`, the file supplied must be formatted so there is one line per rule. Each rule contains a file name regular expression, followed by "=", then the password in clear-text. Because the passwords are in clear-text, the file should have strict access restrictions.

```
# This is a comment
myFileName = myPassword
.*\.docx$ = myWordPassword
.*\.pdf$ = myPdfPassword
```

Examples

Metadata

As mentioned before, Tika produces metadata about the document. Metadata describes different aspects of a document, such as the author's name, the number of pages, the file size, and so on. The metadata produced depends on the type of document submitted. For instance, PDFs have different metadata than Word documents do.

In addition to Tika's metadata, Solr adds the following metadata (defined in `ExtractingMetadataConstants`) :

Solr Metadata	Description
stream_name	The name of the Content Stream as uploaded to Solr. Depending on how the file is uploaded, this may or may not be set
stream_source_info	Any source info about the stream. (See the section on Content Streams later in this section.)
stream_size	The size of the stream in bytes.
stream_content_type	The content type of the stream, if available.

⚠ We recommend that you try using the `extractOnly` option to discover which values Solr is setting for these metadata elements.

Examples of Uploads Using the Extracting Request Handler

Capture and Mapping

The command below captures `<div>` tags separately, and then maps all the instances of that field to a dynamic field named `foo_t`.

```
bin/post -c techproducts example/exampledocs/sample.html -params
"literal.id=doc2&captureAttr=true&defaultField=_text_&fmap.div=foo_t&capture=div"
```

Capture, Mapping, and Boosting

The command below captures `<div>` tags separately, maps the field to a dynamic field named `foo_t`, then boosts `foo_t` by 3.

```
bin/post -c techproducts example/exampledocs/sample.html -params
"literal.id=doc3&captureAttr=true&defaultField=_text_&capture=div&fmap.div=foo_t&boo
st.foo_t=3"
```

Using Literals to Define Your Own Metadata

To add in your own metadata, pass in the literal parameter along with the file:

```
bin/post -c techproducts -params
"literal.id=doc4&captureAttr=true&defaultField=text&capture=div&fmap.div=foo_t&boost
.foo_t=3&literal.blah_s=Bah" example/exampledocs/sample.html
```

XPath

The example below passes in an XPath expression to restrict the XHTML returned by Tika:

```
bin/post -c techproducts -params
"literal.id=doc5&captureAttr=true&defaultField=text&capture=div&fmap.div=foo_t&boost
.foo_t=3&xpath=/xhtml:html/xhtml:body/xhtml:div//node()"
example/exampledocs/sample.html
```

Extracting Data without Indexing It

Solr allows you to extract data without indexing. You might want to do this if you're using Solr solely as an extraction server or if you're interested in testing Solr extraction.

The example below sets the `extractOnly=true` parameter to extract data without indexing it.

```
curl "http://localhost:8983/solr/techproducts/update/extract?&extractOnly=true"
--data-binary @example/exampledocs/sample.html -H 'Content-type:text/html'
```

The output includes XML generated by Tika (and further escaped by Solr's XML) using a different output format to make it more readable (`-out yes` instructs the tool to echo Solr's output to the console):

```
bin/post -c techproducts -params "extractOnly=true&wt=ruby&indent=true" -out yes
example/exampledocs/sample.html
```

Sending Documents to Solr with a POST

The example below streams the file as the body of the POST, which does not, then, provide information to Solr about the name of the file.

```
curl
"http://localhost:8983/solr/techproducts/update/extract?literal.id=doc6&defaultField
=text&commit=true" --data-binary @example/exampledocs/sample.html -H
'Content-type:text/html'
```

Sending Documents to Solr with Solr Cell and SolrJ

SolrJ is a Java client that you can use to add documents to the index, update the index, or query the index. You'll find more information on SolrJ in Client APIs.

Here's an example of using Solr Cell and SolrJ to add documents to a Solr index.

First, let's use SolrJ to create a new SolrClient, then we'll construct a request containing a ContentStream (essentially a wrapper around a file) and sent it to Solr:

```
public class SolrCellRequestDemo {
  public static void main (String[] args) throws IOException, SolrServerException {
    SolrClient server = new
HttpSolrClient("http://localhost:8983/solr/my_collection");
    ContentStreamUpdateRequest req = new
ContentStreamUpdateRequest("/update/extract");
    req.addFile(new File("my-file.pdf"));
    req.setParam(ExtractingParams.EXTRACT_ONLY, "true");
    NamedList<Object> result = server.request(req);
    System.out.println("Result: " + result);
}
```

This operation streams the file `my-file.pdf` into the Solr index for `my_collection`.

The sample code above calls the extract command, but you can easily substitute other commands that are supported by Solr Cell. The key class to use is the `ContentStreamUpdateRequest`, which makes sure the ContentStreams are set properly. SolrJ takes care of the rest.

Note that the `ContentStreamUpdateRequest` is not just specific to Solr Cell. You can send CSV to the CSV Update handler and to any other Request Handler that works with Content Streams for updates.

Related Topics

- ExtractingRequestHandler

Uploading Structured Data Store Data with the Data Import Handler

Many search applications store the content to be indexed in a structured data store, such as a relational database. The Data Import Handler (DIH) provides a mechanism for importing content from a data store and indexing it. In addition to relational databases, DIH can index content from HTTP based data sources such as RSS and ATOM feeds, e-mail repositories, and structured XML where an XPath processor is used to generate fields.

The `example/example-DIH` directory contains several collections many of the features of the data import handler. To run this "`dih`" example:

```
bin/solr -e dih
```

For more information about the Data Import Handler, see https://wiki.apache.org/solr/DataImportHandler.
Topics covered in this section:

Concepts and Terminology

Descriptions of the Data Import Handler use several familiar terms, such as entity and processor, in specific ways, as explained in the table below.

Term	Definition
Datasource	As its name suggests, a datasource defines the location of the data of interest. For a database, it's a DSN. For an HTTP datasource, it's the base URL.
Entity	Conceptually, an entity is processed to generate a set of documents, containing multiple fields, which (after optionally being transformed in various ways) are sent to Solr for indexing. For a RDBMS data source, an entity is a view or table, which would be processed by one or more SQL statements to generate a set of rows (documents) with one or more columns (fields).
Processor	An entity processor does the work of extracting content from a data source, transforming it, and adding it to the index. Custom entity processors can be written to extend or replace the ones supplied.
Transformer	Each set of fields fetched by the entity may optionally be transformed. This process can modify the fields, create new fields, or generate multiple rows/documents form a single row. There are several built-in transformers in the DIH, which perform functions such as modifying dates and stripping HTML. It is possible to write custom transformers using the publicly available interface.

Configuration

Configuring `solrconfig.xml`

The Data Import Handler has to be registered in `solrconfig.xml`. For example:

```
<requestHandler name="/dataimport"
class="org.apache.solr.handler.dataimport.DataImportHandler">
  <lst name="defaults">
    <str name="config">/path/to/my/DIHconfigfile.xml</str>
  </lst>
</requestHandler>
```

The only required parameter is the `config` parameter, which specifies the location of the DIH configuration file that contains specifications for the data source, how to fetch data, what data to fetch, and how to process it to generate the Solr documents to be posted to the index.

You can have multiple DIH configuration files. Each file would require a separate definition in the `solrconfig.xml` file, specifying a path to the file.

Configuring the DIH Configuration File

An annotated configuration file, based on the "db" collection in the `dih` example server, is shown below (`example/example-DIH/solr/db/conf/db-data-config.xml`). It extracts fields from the four tables defining a simple product database, with this schema. More information about the parameters and options shown here are described in the sections following.

```
<dataConfig>
<!-- The first element is the dataSource, in this case an HSQLDB database.
     The path to the JDBC driver and the JDBC URL and login credentials are all
specified here.
     Other permissible attributes include whether or not to autocommit to Solr,the
batchsize
     used in the JDBC connection, a 'readOnly' flag -->
  <dataSource driver="org.hsqldb.jdbcDriver"
url="jdbc:hsqldb:./example-DIH/hsqldb/ex" user="sa" />

<!-- a 'document' element follows, containing multiple 'entity' elements.
     Note that 'entity' elements can be nested, and this allows the entity
     relationships in the sample database to be mirrored here, so that we can
     generate a denormalized Solr record which may include multiple features
     for one item, for instance -->
  <document>

<!-- The possible attributes for the entity element are described below.
     Entity elements may contain one or more 'field' elements, which map
     the data source field names to Solr fields, and optionally specify
     per-field transformations -->
<!-- this entity is the 'root' entity. -->
    <entity name="item" query="select * from item"
            deltaQuery="select id from item where last_modified >
'${dataimporter.last_index_time}'">
      <field column="NAME" name="name" />

<!-- This entity is nested and reflects the one-to-many relationship between an item
and its multiple features.
     Note the use of variables; ${item.ID} is the value of the column 'ID' for the
current item
     ('item' referring to the entity name)  -->
      <entity name="feature"
              query="select DESCRIPTION from FEATURE where ITEM_ID='${item.ID}'"
              deltaQuery="select ITEM_ID from FEATURE where last_modified >
'${dataimporter.last_index_time}'"
              parentDeltaQuery="select ID from item where ID=${feature.ITEM_ID}">
        <field name="features" column="DESCRIPTION" />
      </entity>
      <entity name="item_category"
              query="select CATEGORY_ID from item_category where
ITEM_ID='${item.ID}'"
              deltaQuery="select ITEM_ID, CATEGORY_ID from item_category where
last_modified > '${dataimporter.last_index_time}'"
              parentDeltaQuery="select ID from item where
ID=${item_category.ITEM_ID}">
        <entity name="category"
                query="select DESCRIPTION from category where ID =
'${item_category.CATEGORY_ID}'"
                deltaQuery="select ID from category where last_modified >
'${dataimporter.last_index_time}'"
                parentDeltaQuery="select ITEM_ID, CATEGORY_ID from item_category
where CATEGORY_ID=${category.ID}">
          <field column="description" name="cat" />
        </entity>
      </entity>
    </entity>
  </document>
</dataConfig>
```

Datasources can still be specified in `solrconfig.xml`. These must be specified in the defaults section of the handler in `solrconfig.xml`. However, these are not parsed until the main configuration is loaded.

The entire configuration itself can be passed as a request parameter using the `dataConfig` parameter rather than using a file. When configuration errors are encountered, the error message is returned in XML format.

A `reload-config` command is also supported, which is useful for validating a new configuration file, or if you want to specify a file, load it, and not have it reloaded again on import. If there is an `xml` mistake in the configuration a user-friendly message is returned in `xml` format. You can then fix the problem and do a `reload-config`.

> ✓ You can also view the DIH configuration in the Solr Admin UI and there is an interface to import content.

Data Import Handler Commands

DIH commands are sent to Solr via an HTTP request. The following operations are supported.

Command	Description
`abort`	Aborts an ongoing operation. The URL is `http://<host>:<port>/ solr/ <collection_name>/ dataimport? command=abort`.
`delta-import`	For incremental imports and change detection. The command is of the form `http://<host>:<port>/ solr/ <collection_name>/ dataimport? command=delta-import`. It supports the same clean, commit, optimize and debug parameters as full-import command.
`full-import`	A Full Import operation can be started with a URL of the form `http://<host>:<port>/ solr/ <collection_name>/ dataimport? command=full-import`. The command returns immediately. The operation will be started in a new thread and the *status* attribute in the response should be shown as *busy*. The operation may take some time depending on the size of dataset. Queries to Solr are not blocked during full-imports. When a full-import command is executed, it stores the start time of the operation in a file located at `conf/dataimport.properties`. This stored timestamp is used when a delta-import operation is executed. For a list of parameters that can be passed to this command, see below.
`reload-config`	If the configuration file has been changed and you wish to reload it without restarting Solr, run the command `http://<host>:<port>/ solr/ <collection_name>/ dataimport? command=reload-config`.
`status`	The URL is `http://<host>:<port>/ solr/ <collection_name>/ dataimport? command=status`. It returns statistics on the number of documents created, deleted, queries run, rows fetched, status, and so on.

Parameters for the `full-import` Command

The `full-import` command accepts the following parameters:

Parameter	Description

clean	Default is true. Tells whether to clean up the index before the indexing is started.
commit	Default is true. Tells whether to commit after the operation.
debug	Default is false Runs the command in debug mode. It is used by the interactive development mode. Note that in debug mode, documents are never committed automatically. If you want to run debug mode and commit the results too, add `commit=true` as a request parameter.
entity	The name of an entity directly under the `<document>` tag in the configuration file. Use this to execute one or more entities selectively. Multiple "entity" parameters can be passed on to run multiple entities at once. If nothing is passed, all entities are executed.
optimize	Default is true. Tells Solr whether to optimize after the operation.

Property Writer

The `propertyWriter` element defines the date format and locale for use with delta queries. It is an optional configuration. Add the element to the DIH configuration file, directly under the `dataConfig` element.

```
<propertyWriter dateFormat="yyyy-MM-dd HH:mm:ss" type="SimplePropertiesWriter"
directory="data" filename="my_dih.properties" locale="en_US" />
```

The parameters available are:

Parameter	Description
dateFormat	A java.text.SimpleDateFormat to use when converting the date to text. The default is "yyyy-MM-dd HH:mm:ss".
type	The implementation class. Use `SimplePropertiesWriter` for non-SolrCloud installations. If using SolrCloud, use `ZKPropertiesWriter`. If this is not specified, it will default to the appropriate class depending on if SolrCloud mode is enabled.
directory	Used with the `SimplePropertiesWriter` only). The directory for the properties file. If not specified, the default is "conf".
filename	Used with the `SimplePropertiesWriter` only). The name of the properties file. If not specified, the default is the requestHandler name (as defined in `solrconfig.xml`, appended by ".properties" (i.e., "dataimport.properties").
locale	The locale. If not defined, the ROOT locale is used. It must be specified as language-country. For example, `en-US`.

Data Sources

A data source specifies the origin of data and its type. Somewhat confusingly, some data sources are configured within the associated entity processor. Data sources can also be specified in `solrconfig.xml`, which is useful when you have multiple environments (for example, development, QA, and production) differing only in their data sources.

You can create a custom data source by writing a class that extends `org.apache.solr.handler.dataimport.DataSource`.

The mandatory attributes for a data source definition are its name and type. The name identifies the data source to an Entity element.

The types of data sources available are described below.

ContentStreamDataSource

This takes the POST data as the data source. This can be used with any EntityProcessor that uses a `DataSource<Reader>`.

FieldReaderDataSource

This can be used where a database field contains XML which you wish to process using the XPathEntityProcessor. You would set up a configuration with both JDBC and FieldReader data sources, and two entities, as follows:

```
<dataSource name="a1" driver="org.hsqldb.jdbcDriver" ...  />
<dataSource name="a2" type=FieldReaderDataSource" />
<document>

  <!-- processor for database -->

  <entity name ="e1" dataSource="a1" processor="SqlEntityProcessor" pk="docid"
          query="select * from t1 ...">

    <!-- nested XpathEntity; the field in the parent which is to be used for
         Xpath is set in the "datafield" attribute in place of the "url" attribute
-->

    <entity name="e2" dataSource="a2" processor="XPathEntityProcessor"
            dataField="e1.fieldToUseForXPath">

      <!-- Xpath configuration follows -->
      ...
    </entity>
  </entity>
```

The FieldReaderDataSource can take an `encoding` parameter, which will default to "UTF-8" if not specified.It must be specified as language-country. For example, `en-US`.

FileDataSource

This can be used like an URLDataSource, but is used to fetch content from files on disk. The only difference from URLDataSource, when accessing disk files, is how a pathname is specified.

This data source accepts these optional attributes.

Optional Attribute	Description
basePath	The base path relative to which the value is evaluated if it is not absolute.
encoding	Defines the character encoding to use. If not defined, UTF-8 is used.

JdbcDataSource

This is the default datasource. It's used with the SqlEntityProcessor. See the example in the FieldReaderDataSource section for details on configuration.

URLDataSource

This data source is often used with XPathEntityProcessor to fetch content from an underlying `file://` or `http://` location. Here's an example:

```
<dataSource name="a"
            type="URLDataSource"
            baseUrl="http://host:port/"
            encoding="UTF-8"
            connectionTimeout="5000"
            readTimeout="10000"/>
```

The URLDataSource type accepts these optional parameters:

Optional Parameter	Description
baseURL	Specifies a new baseURL for pathnames. You can use this to specify host/port changes between Dev/QA/Prod environments. Using this attribute isolates the changes to be made to the `solrconfig.xml`
connectionTimeout	Specifies the length of time in milliseconds after which the connection should time out. The default value is 5000ms.
encoding	By default the encoding in the response header is used. You can use this property to override the default encoding.
readTimeout	Specifies the length of time in milliseconds after which a read operation should time out. The default value is 10000ms.

Entity Processors

Entity processors extract data, transform it, and add it to a Solr index. Examples of entities include views or tables in a data store.

Each processor has its own set of attributes, described in its own section below. In addition, there are non-specific attributes common to all entities which may be specified.

Attribute	Use
dataSource	The name of a data source. If there are multiple data sources defined, use this attribute with the name of the data source for this entity.
name	Required. The unique name used to identify an entity.
pk	The primary key for the entity. It is optional, and required only when using delta-imports. It has no relation to the uniqueKey defined in `schema.xml` but they can both be the same. It is mandatory if you do delta-imports and then refers to the column name in `${dataimporter.delta.<column-name>}` which is used as the primary key.

processor	Default is SqlEntityProcessor. Required only if the datasource is not RDBMS.
onError	Permissible values are (abort|skip|continue) . The default value is 'abort'. 'Skip' skips the current document. 'Continue' ignores the error and processing continues.
preImportDeleteQuery	Before a full-import command, use this query this to cleanup the index instead of using '*:*'. This is honored only on an entity that is an immediate sub-child of `<document>`.
postImportDeleteQuery	Similar to the above, but executed after the import has completed.
rootEntity	By default the entities immediately under the `<document>` are root entities. If this attribute is set to false, the entity directly falling under that entity will be treated as the root entity (and so on). For every row returned by the root entity, a document is created in Solr.
transformer	Optional. One or more transformers to be applied on this entity.
cacheImpl	Optional. A class (which must implement `DIHCache`) to use for caching this entity when doing lookups from an entity which wraps it. Provided implementation is "`SortedMapBackedCache`".
cacheKey	The name of a property of this entity to use as a cache key if `cacheImpl` is specified.
cacheLookup	An entity + property name that will be used to lookup cached instances of this entity if `cacheImpl` is specified.

Caching of entities in DIH is provided to avoid repeated lookups for same entities again and again. The default `SortedMapBackedCache` is a `HashMap` where a key is a field in the row and the value is a bunch of rows for that same key.

In the example below, each `manufacturer` entity is cached using the '`id`' property as a cache key. Cache lookups will be performed for each `product` entity based on the product's "`manu`" property. When the cache has no data for a particular key, the query is run and the cache is populated

```
<entity name="product" query="select description,sku, manu from product" >
  <entity name="manufacturer" query="select id, name from manufacturer"
cacheKey="id" cacheLookup="product.manu" cacheImpl="SortedMapBackedCache"/>
</entity>
```

The SQL Entity Processor

The SqlEntityProcessor is the default processor. The associated data source should be a JDBC URL.

The entity attributes specific to this processor are shown in the table below.

Attribute	Use
query	Required. The SQL query used to select rows.

deltaQuery	SQL query used if the operation is delta-import. This query selects the primary keys of the rows which will be parts of the delta-update. The pks will be available to the deltaImportQuery through the variable `${dataimporter.delta.<column-name>}`.
parentDeltaQuery	SQL query used if the operation is delta-import.
deletedPkQuery	SQL query used if the operation is delta-import.
deltaImportQuery	SQL query used if the operation is delta-import. If this is not present, DIH tries to construct the import query by(after identifying the delta) modifying the 'query' (this is error prone). There is a namespace `${dataimporter.delta.<column-name>}` which can be used in this query. For example, `select * from tbl where id=${dataimporter.delta.id}`.

The XPathEntityProcessor

This processor is used when indexing XML formatted data. The data source is typically URLDataSource or FileDataSource. Xpath can also be used with the FileListEntityProcessor described below, to generate a document from each file.

The entity attributes unique to this processor are shown below.

Attribute	Use
Processor	Required. Must be set to "XpathEntityProcessor".
url	Required. HTTP URL or file location.
stream	Optional: Set to true for a large file or download.
forEach	Required unless you define `useSolrAddSchema`. The Xpath expression which demarcates each record. This will be used to set up the processing loop.
xsl	Optional: Its value (a URL or filesystem path) is the name of a resource used as a preprocessor for applying the XSL transformation.
useSolrAddSchema	Set this to true if the content is in the form of the standard Solr update XML schema.
flatten	Optional: If set true, then text from under all the tags is extracted into one field.

Each field element in the entity can have the following attributes as well as the default ones.

Attribute	Use
xpath	Required. The XPath expression which will extract the content from the record for this field. Only a subset of Xpath syntax is supported.
commonField	Optional. If true, then when this field is encountered in a record it will be copied to future records when creating a Solr document.

Here is an example from the "`rss`" collection in the `dih` example (`example/example-DIH/solr/rss/conf/rss-data-config.xml`):

```
<!-- slashdot RSS Feed --->
<dataConfig>
  <dataSource type="HttpDataSource" />
    <document>
      <entity name="slashdot"
              pk="link"
              url="http://rss.slashdot.org/Slashdot/slashdot"
              processor="XPathEntityProcessor"

              <!-- forEach sets up a processing loop ; here there are two
expressions-->
              forEach="/RDF/channel | /RDF/item"
              transformer="DateFormatTransformer">
      <field column="source" xpath="/RDF/channel/title" commonField="true" />
      <field column="source-link" xpath="/RDF/channel/link" commonField="true"/>
      <field column="subject" xpath="/RDF/channel/subject" commonField="true" />
      <field column="title" xpath="/RDF/item/title" />
      <field column="link" xpath="/RDF/item/link" />
      <field column="description" xpath="/RDF/item/description" />
      <field column="creator" xpath="/RDF/item/creator" />
      <field column="item-subject" xpath="/RDF/item/subject" />
      <field column="date" xpath="/RDF/item/date"
             dateTimeFormat="yyyy-MM-dd'T'hh:mm:ss" />
      <field column="slash-department" xpath="/RDF/item/department" />
      <field column="slash-section" xpath="/RDF/item/section" />
      <field column="slash-comments" xpath="/RDF/item/comments" />
    </entity>
  </document>
</dataConfig>
```

The MailEntityProcessor

The MailEntityProcessor uses the Java Mail API to index email messages using the IMAP protocol. The MailEntityProcessor works by connecting to a specified mailbox using a username and password, fetching the email headers for each message, and then fetching the full email contents to construct a document (one document for each mail message).

Here is an example from the "`mail`" collection of the `dih` example (`example/example-DIH/mail/conf/mail-data-config.xml`):

```
<dataConfig>
  <document>
      <entity processor="MailEntityProcessor"
              user="email@gmail.com"
              password="password"
              host="imap.gmail.com"
              protocol="imaps"
              fetchMailsSince="2009-09-20 00:00:00"
              batchSize="20"
              folders="inbox"
              processAttachement="false"
              name="sample_entity"/>
  </document>
</dataConfig>
```

The entity attributes unique to the MailEntityProcessor are shown below.

Attribute	Use
processor	Required. Must be set to "MailEntityProcessor".
user	Required. Username for authenticating to the IMAP server; this is typically the email address of the mailbox owner
password	Required. Password for authenticating to the IMAP server
host	Required. The IMAP server to connect to
protocol	Required. The IMAP protocol to use, valid values are: imap, imaps, gimap, and gimaps
fetchMailsSince	Optional. Date/time used to set a filter to import messages that occur after the specified date; expected format is: yyyy-MM-dd HH:mm:ss
folders	Required. Comma-delimited list of folder names to pull messages from, such as "inbox"
recurse	Optional (default is true). Flag to indicate if the processor should recurse all child folders when looking for messages to import
include	Optional. Comma-delimited list of folder patterns to include when processing folders (can be a literal value or regular expression)
exclude	Optional. Comma-delimited list of folder patterns to exclude when processing folders (can be a literal value or regular expression); excluded folder patterns take precedent over include folder patterns.
processAttachement or processAttachments	Optional (default is true). Use Tika to process message attachments.
includeContent	Optional (default is true). Include the message body when constructing Solr documents for indexing

Importing New Emails Only

After running a full import, the MailEntityProcessor keeps track of the timestamp of the previous import so that subsequent imports can use the fetchMailsSince filter to only pull new messages from the mail server. This occurs automatically using the Data Import Handler dataimport.properties file (stored in conf). For instance, if you set fetchMailsSince=2014-08-22 00:00:00 in your mail-data-config.xml, then all mail messages that occur after this date will be imported on the first run of the importer. Subsequent imports will use the date of the previous import as the fetchMailsSince filter, so that only new emails since the last import are indexed each time.

GMail Extensions

When connecting to a GMail account, you can improve the efficiency of the MailEntityProcessor by setting the protocol to **gimap** or **gimaps**. This allows the processor to send the fetchMailsSince filter to the GMail server to have the date filter applied on the server, which means the processor only receives new messages from the server. However, GMail only supports date granularity, so the server-side filter may return previously seen messages if run more than once a day.

The TikaEntityProcessor

The TikaEntityProcessor uses Apache Tika to process incoming documents. This is similar to Uploading Data with Solr Cell using Apache Tika, but using the DataImportHandler options instead.

Here is an example from the "`tika`" collection of the `dih` example (`example/example-DIH/tika/conf/tika-data-config.xml`):

```
<dataConfig>
  <dataSource type="BinFileDataSource" />
  <document>
    <entity name="tika-test" processor="TikaEntityProcessor"
            url="../contrib/extraction/src/test-files/extraction/solr-word.pdf"
format="text">
      <field column="Author" name="author" meta="true"/>
      <field column="title" name="title" meta="true"/>
      <field column="text" name="text"/>
    </entity>
  </document>
</dataConfig>
```

The parameters for this processor are described in the table below:

Attribute	Use
dataSource	This parameter defines the data source and an optional name which can be referred to in later parts of the configuration if needed. This is the same dataSource explained in the description of general entity processor attributes above. The available data source types for this processor are: • BinURLDataSource: used for HTTP resources, but can also be used for files. • BinContentStreamDataSource: used for uploading content as a stream. • BinFileDataSource: used for content on the local filesystem.
url	The path to the source file(s), as a file path or a traditional internet URL. This parameter is required.
htmlMapper	Allows control of how Tika parses HTML. The "default" mapper strips much of the HTML from documents while the "identity" mapper passes all HTML as-is with no modifications. If this parameter is defined, it must be either **default** or **identity**; if it is absent, "default" is assumed.
format	The output format. The options are **text**, **xml**, **html** or **none**. The default is "text" if not defined. The format "none" can be used if metadata only should be indexed and not the body of the documents.
parser	The default parser is `org.apache.tika.parser.AutoDetectParser`. If a custom or other parser should be used, it should be entered as a fully-qualified name of the class and path.

fields	The list of fields from the input documents and how they should be mapped to Solr fields. If the attribute `meta` is defined as "true", the field will be obtained from the metadata of the document and not parsed from the body of the main text.
extractEmbedded	Instructs the TikaEntityProcessor to extract embedded documents or attachments when **true**. If false, embedded documents and attachments will be ignored.
onError	By default, the TikaEntityProcessor will stop processing documents if it finds one that generates an error. If you define `onError` to "skip", the TikaEntityProcessor will instead skip documents that fail processing and log a message that the document was skipped.

The FileListEntityProcessor

This processor is basically a wrapper, and is designed to generate a set of files satisfying conditions specified in the attributes which can then be passed to another processor, such as the XPathEntityProcessor. The entity information for this processor would be nested within the FileListEnitity entry. It generates four implicit fields: `fileAbsolutePath`, `fileSize`, `fileLastModified`, `fileName` which can be used in the nested processor. This processor does not use a data source.

The attributes specific to this processor are described in the table below:

Attribute	Use
fileName	Required. A regular expression pattern to identify files to be included.
basedir	Required. The base directory (absolute path).
recursive	Whether to search directories recursively. Default is 'false'.
excludes	A regular expression pattern to identify files which will be excluded.
newerThan	A date in the format `yyyy-MM-ddHH:mm:ss` or a date math expression (`NOW - 2YEARS`).
olderThan	A date, using the same formats as newerThan.
rootEntity	This should be set to false. This ensures that each row (filepath) emitted by this processor is considered to be a document.
dataSource	Must be set to null.

The example below shows the combination of the FileListEntityProcessor with another processor which will generate a set of fields from each file found.

```
<dataConfig>
  <dataSource type="FileDataSource"/>
  <document>
    <!-- this outer processor generates a list of files satisfying the conditions
         specified in the attributes -->
    <entity name="f" processor="FileListEntityProcessor"
            fileName=".*xml"
            newerThan="'NOW-30DAYS'"
            recursive="true"
            rootEntity="false"
            dataSource="null"
            baseDir="/my/document/directory">

      <!-- this processor extracts content using Xpath from each file found -->

      <entity name="nested" processor="XPathEntityProcessor"
              forEach="/rootelement" url="${f.fileAbsolutePath}" >
        <field column="name" xpath="/rootelement/name"/>
        <field column="number" xpath="/rootelement/number"/>
      </entity>
    </entity>
  </document>
</dataConfig>
```

LineEntityProcessor

This EntityProcessor reads all content from the data source on a line by line basis and returns a field called `rawLine` for each line read. The content is not parsed in any way; however, you may add transformers to manipulate the data within the `rawLine` field, or to create other additional fields.

The lines read can be filtered by two regular expressions specified with the `acceptLineRegex` and `omitLineRegex` attributes. The table below describes the LineEntityProcessor's attributes:

Attribute	Description
url	A required attribute that specifies the location of the input file in a way that is compatible with the configured data source. If this value is relative and you are using FileDataSource or URLDataSource, it assumed to be relative to baseLoc.
acceptLineRegex	An optional attribute that if present discards any line which does not match the regExp.
omitLineRegex	An optional attribute that is applied after any acceptLineRegex and that discards any line which matches this regExp.

For example:

```
<entity name="jc"
        processor="LineEntityProcessor"
        acceptLineRegex="^.*\.xml$"
        omitLineRegex="/obsolete"
        url="file:///Volumes/ts/files.lis"
        rootEntity="false"
        dataSource="myURIreader1"
        transformer="RegexTransformer,DateFormatTransformer">
  ...
```

While there are use cases where you might need to create a Solr document for each line read from a file, it is expected that in most cases that the lines read by this processor will consist of a pathname, which in turn will be consumed by another EntityProcessor, such as XPathEntityProcessor.

PlainTextEntityProcessor

This EntityProcessor reads all content from the data source into an single implicit field called `plainText`. The content is not parsed in any way, however you may add transformers to manipulate the data within the `plainText` as needed, or to create other additional fields.

For example:

```
<entity processor="PlainTextEntityProcessor" name="x" url="http://abc.com/a.txt"
dataSource="data-source-name">
  <!-- copies the text to a field called 'text' in Solr-->
  <field column="plainText" name="text"/>
</entity>
```

Ensure that the dataSource is of type `DataSource<Reader>` (`FileDataSource`, `URLDataSource`).

Transformers

Transformers manipulate the fields in a document returned by an entity. A transformer can create new fields or modify existing ones. You must tell the entity which transformers your import operation will be using, by adding an attribute containing a comma separated list to the `<entity>` element.

```
<entity name="abcde" transformer="org.apache.solr....,my.own.transformer,..." />
```

Specific transformation rules are then added to the attributes of a `<field>` element, as shown in the examples below. The transformers are applied in the order in which they are specified in the transformer attribute.

The Data Import Handler contains several built-in transformers. You can also write your own custom transformers, as described in the Solr Wiki (see http://wiki.apache.org/solr/DIHCustomTransformer). The ScriptTransformer (described below) offers an alternative method for writing your own transformers.

Solr includes the following built-in transformers:

Transformer Name	Use
ClobTransformer	Used to create a String out of a Clob type in database.
DateFormatTransformer	Parse date/time instances.

HTMLStripTransformer	Strip HTML from a field.
LogTransformer	Used to log data to log files or a console.
NumberFormatTransformer	Uses the NumberFormat class in java to parse a string into a number.
RegexTransformer	Use regular expressions to manipulate fields.
ScriptTransformer	Write transformers in Javascript or any other scripting language supported by Java.
TemplateTransformer	Transform a field using a template.

These transformers are described below.

ClobTransformer

You can use the ClobTransformer to create a string out of a CLOB in a database. A CLOB is a character large object: a collection of character data typically stored in a separate location that is referenced in the database. See http://en.wikipedia.org/wiki/Character_large_object. Here's an example of invoking the ClobTransformer.

```
<entity name="e" transformer="ClobTransformer" ...>
  <field column="hugeTextField" clob="true" />
  ...
</entity>
```

The ClobTransformer accepts these attributes:

Attribute	Description
clob	Boolean value to signal if ClobTransformer should process this field or not. If this attribute is omitted, then the corresponding field is not transformed.
sourceColName	The source column to be used as input. If this is absent source and target are same

The DateFormatTransformer

This transformer converts dates from one format to another. This would be useful, for example, in a situation where you wanted to convert a field with a fully specified date/time into a less precise date format, for use in faceting.

DateFormatTransformer applies only on the fields with an attribute `dateTimeFormat`. Other fields are not modified.

This transformer recognizes the following attributes:

Attribute	Description
dateTimeFormat	The format used for parsing this field. This must comply with the syntax of the Java SimpleDateFormat class.
sourceColName	The column on which the dateFormat is to be applied. If this is absent source and target are same.

locale	The locale to use for date transformations. If not specified, the ROOT locale will be used. It must be specified as language-country. For example, `en-US`.

Here is example code that returns the date rounded up to the month "2007-JUL":

```
<entity name="en" pk="id" transformer="DateFormatTransformer" ... >
  ...
  <field column="date" sourceColName="fulldate" dateTimeFormat="yyyy-MMM"/>
</entity>
```

The HTMLStripTransformer

You can use this transformer to strip HTML out of a field. For example:

```
<entity name="e" transformer="HTMLStripTransformer" ... >
  <field column="htmlText" stripHTML="true" />
  ...
</entity>
```

There is one attribute for this transformer, `stripHTML`, which is a boolean value (true/false) to signal if the HTMLStripTransformer should process the field or not.

The LogTransformer

You can use this transformer to log data to the console or log files. For example:

```
<entity ...
        transformer="LogTransformer"
        logTemplate="The name is ${e.name}" logLevel="debug">
  ....
</entity>
```

Unlike other transformers, the LogTransformer does not apply to any field, so the attributes are applied on the entity itself.

The NumberFormatTransformer

Use this transformer to parse a number from a string, converting it into the specified format, and optionally using a different locale.

NumberFormatTransformer will be applied only to fields with an attribute `formatStyle`.

This transformer recognizes the following attributes:

Attribute	Description
formatStyle	The format used for parsing this field. The value of the attribute must be one of (`number|percent|integer|currency`). This uses the semantics of the Java NumberFormat class.
sourceColName	The column on which the NumberFormat is to be applied. This is attribute is absent. The source column and the target column are the same.

locale	The locale to be used for parsing the strings. If this is absent, the ROOT locale is used. It must be specified as language-country. For example, `en-US`.

For example:

```
<entity name="en" pk="id" transformer="NumberFormatTransformer" ...>
  ...

  <!-- treat this field as UK pounds -->

  <field name="price_uk" column="price" formatStyle="currency" locale="en-UK"/>
</entity>
```

The RegexTransformer

The regex transformer helps in extracting or manipulating values from fields (from the source) using Regular Expressions. The actual class name is `org.apache.solr.handler.dataimport.RegexTransformer`. But as it belongs to the default package the package-name can be omitted.

The table below describes the attributes recognized by the regex transformer.

Attribute	Description
regex	The regular expression that is used to match against the column or sourceColName's value(s). If replaceWith is absent, each regex *group* is taken as a value and a list of values is returned.
sourceColName	The column on which the regex is to be applied. If not present, then the source and target are identical.
splitBy	Used to split a string. It returns a list of values.
groupNames	A comma separated list of field column names, used where the regex contains groups and each group is to be saved to a different field. If some groups are not to be named leave a space between commas.
replaceWith	Used along with regex . It is equivalent to the method `new String(<sourceColVal>).replaceAll(<regex>, <replaceWith>)`.

Here is an example of configuring the regex transformer:

```
<entity name="foo" transformer="RegexTransformer"
        query="select full_name, emailids from foo">
  <field column="full_name"/>
  <field column="firstName" regex="Mr(\w*)\b.*" sourceColName="full_name"/>
  <field column="lastName" regex="Mr.*?\b(\w*)" sourceColName="full_name"/>

  <!-- another way of doing the same -->

  <field column="fullName" regex="Mr(\w*)\b(.*)" groupNames="firstName,lastName"/>
  <field column="mailId" splitBy="," sourceColName="emailids"/>
</entity>
```

In this example, regex and sourceColName are custom attributes used by the transformer. The transformer reads the field `full_name` from the resultset and transforms it to two new target fields, `firstName` and `lastName`. Even though the query returned only one column, `full_name`, in the result set, the Solr document gets two extra fields `firstName` and `lastName` which are "derived" fields. These new fields are only created if the regexp matches.

The emailids field in the table can be a comma-separated value. It ends up producing one or more email IDs, and we expect the `mailId` to be a multivalued field in Solr.

Note that this transformer can either be used to split a string into tokens based on a splitBy pattern, or to perform a string substitution as per replaceWith, or it can assign groups within a pattern to a list of groupNames. It decides what it is to do based upon the above attributes `splitBy`, `replaceWith` and `groupNames` which are looked for in order. This first one found is acted upon and other unrelated attributes are ignored.

The ScriptTransformer

The script transformer allows arbitrary transformer functions to be written in any scripting language supported by Java, such as Javascript, JRuby, Jython, Groovy, or BeanShell. Javascript is integrated into Java 7; you'll need to integrate other languages yourself.

Each function you write must accept a row variable (which corresponds to a `Java Map<String,Object>`, thus permitting `get,put,remove` operations). Thus you can modify the value of an existing field or add new fields. The return value of the function is the returned object.

The script is inserted into the DIH configuration file at the top level and is called once for each row.

Here is a simple example.

```
<dataconfig>

  <!-- simple script to generate a new row, converting a temperature from Fahrenheit
to Centigrade -->

  <script><![CDATA[
    function f2c(row) {
      var tempf, tempc;
      tempf = row.get('temp_f');
      if (tempf != null) {
        tempc = (tempf - 32.0)*5.0/9.0;
        row.put('temp_c', temp_c);
      }
      return row;
    }
    ]]>
  </script>
  <document>

    <!-- the function is specified as an entity attribute -->

    <entity name="e1" pk="id" transformer="script:f2c" query="select * from X">
      ....
    </entity>
  </document>
</dataConfig>
```

The TemplateTransformer

You can use the template transformer to construct or modify a field value, perhaps using the value of other fields. You can insert extra text into the template.

```
<entity name="en" pk="id" transformer="TemplateTransformer" ...>
  ...
  <!-- generate a full address from fields containing the component parts -->
  <field column="full_address" template="${en.street},${en.city},${en.zip}" />
</entity>
```

Special Commands for the Data Import Handler

You can pass special commands to the DIH by adding any of the variables listed below to any row returned by any component:

Variable	Description
$skipDoc	Skip the current document; that is, do not add it to Solr. The value can be the string `true|false`.
$skipRow	Skip the current row. The document will be added with rows from other entities. The value can be the string `true|false`
$docBoost	Boost the current document. The boost value can be a number or the `toString` conversion of a number.
$deleteDocById	Delete a document from Solr with this ID. The value has to be the `uniqueKey` value of the document.
$deleteDocByQuery	Delete documents from Solr using this query. The value must be a Solr Query.

Updating Parts of Documents

Once you have indexed the content you need in your Solr index, you will want to start thinking about your strategy for dealing with changes to those documents. Solr supports two approaches to updating documents that have only partially changed.

The first is *atomic updates*. This approach allows changing only one or more fields of a document without having to re-index the entire document.

The second approach is known as *optimistic concurrency* or *optimistic locking*. It is a feature of many NoSQL databases, and allows conditional updating a document based on its version. This approach includes semantics and rules for how to deal with version matches or mis-matches.

Atomic Updates and Optimistic Concurrency may be used as independent strategies for managing changes to documents, or they may be combined: you can use optimistic concurrency to conditionally apply an atomic update.

Atomic Updates

Solr supports several modifiers that atomically update values of a document. This allows updating only specific fields, which can help speed indexing processes in an environment where speed of index additions is critical to the application.

To use atomic updates, add a modifier to the field that needs to be updated. The content can be updated, added to, or incrementally increased if a number.

Modifier	Usage
set	Set or replace the field value(s) with the specified value(s), or remove the values if 'null' or empty list is specified as the new value. May be specified as a single value, or as a list for multivalued fields
add	Adds the specified values to a multivalued field. May be specified as a single value, or as a list.
remove	Removes (all occurrences of) the specified values from a multivalued field. May be specified as a single value, or as a list.
removeregex	Removes all occurrences of the specified regex from a multiValued field. May be specified as a single value, or as a list.
inc	Increments a numeric value by a specific amount. Must be specified as a single numeric value.

⚠ All original source fields must be stored for field modifiers to work correctly, which is the Solr default.

For example, if the following document exists in our collection:

```
{"id":"mydoc",
 "price":10,
 "popularity":42,
 "categories":["kids"],
 "promo_ids":["a123x"],
 "tags":["free_to_try","buy_now","clearance","on_sale"]
}
```

And we apply the following update command:

```
{"id":"mydoc",
 "price":{"set":99},
 "popularity":{"inc":20},
 "categories":{"add":["toys","games"]},
 "promo_ids":{"remove":"a123x"},
 "tags":{"remove":["free_to_try","on_sale"]}
}
```

The resulting document in our collection will be:

```
{"id":"mydoc",
 "price":99,
 "popularity":62,
 "categories":["kids","toys","games"],
 "tags":["buy_now","clearance"]
}
```

Optimistic Concurrency

Optimistic Concurrency is a feature of Solr that can be used by client applications which update/replace documents to ensure that the document they are replacing/updating has not been concurrently modified by another client application. This feature works by requiring a `_version_` field on all documents in the index, and comparing that to a `_version_` specified as part of the update command. By default, Solr's `schema.xml` includes a `_version_` field, and this field is automatically added to each new document.

In general, using optimistic concurrency involves the following work flow:

1. A client reads a document. In Solr, one might retrieve the document with the `/get` handler to be sure to have the latest version.
2. A client changes the document locally.
3. The client resubmits the changed document to Solr, for example, perhaps with the `/update` handler.
4. If there is a version conflict (HTTP error code 409), the client starts the process over.

When the client resubmits a changed document to Solr, the `_version_` can be included with the update to invoke optimistic concurrency control. Specific semantics are used to define when the document should be updated or when to report a conflict.

- If the content in the `_version_` field is greater than '1' (i.e., '12345'), then the `_version_` in the document must match the `_version_` in the index.
- If the content in the `_version_` field is equal to '1', then the document must simply exist. In this case, no version matching occurs, but if the document does not exist, the updates will be rejected.
- If the content in the `_version_` field is less than '0' (i.e., '-1'), then the document must **not** exist. In this case, no version matching occurs, but if the document exists, the updates will be rejected.
- If the content in the `_version_` field is equal to '0', then it doesn't matter if the versions match or if the document exists or not. If it exists, it will be overwritten; if it does not exist, it will be added.

If the document being updated does not include the `_version_` field, and atomic updates are not being used, the document will be treated by normal Solr rules, which is usually to discard the previous version.

When using Optimistic Concurrency, clients can include an optional `versions=true` request parameter to indicate that the *new* versions of the documents being added should be included in the response. This allows clients to immediately know what the `_version_` is of every documented added with out needing to make a redundant `/get` request.

For example...

```
$ curl -X POST -H 'Content-Type: application/json'
'http://localhost:8983/solr/techproducts/update?versions=true' --data-binary '
[ { "id" : "aaa" },
  { "id" : "bbb" } ]'
{"responseHeader":{"status":0,"QTime":6},
 "adds":["aaa",1498562471222312960,
         "bbb",1498562471225458688]}
$ curl -X POST -H 'Content-Type: application/json'
'http://localhost:8983/solr/techproducts/update?_version_=999999&versions=true'
--data-binary '
[{ "id" : "aaa",
   "foo_s" : "update attempt with wrong existing version" }]'
{"responseHeader":{"status":409,"QTime":3},
 "error":{"msg":"version conflict for aaa expected=999999
actual=1498562471222312960",
          "code":409}}
$ curl -X POST -H 'Content-Type: application/json'
'http://localhost:8983/solr/techproducts/update?_version_=1498562471222312960&versio
ns=true&commit=true' --data-binary '
[{ "id" : "aaa",
   "foo_s" : "update attempt with correct existing version" }]'
{"responseHeader":{"status":0,"QTime":5},
 "adds":["aaa",1498562624496861184]}
$ curl 'http://localhost:8983/solr/techproducts/query?q=*:*&fl=id,_version_'
{
  "responseHeader":{
    "status":0,
    "QTime":5,
    "params":{
      "fl":"id,_version_",
      "q":"*:*"}},
  "response":{"numFound":2,"start":0,"docs":[
      {
        "id":"bbb",
        "_version_":1498562471225458688},
      {
        "id":"aaa",
        "_version_":1498562624496861184}]
  }}
```

For more information, please also see Yonik Seeley's presentation on NoSQL features in Solr 4 from Apache Lucene EuroCon 2012.

Power Tip

The _version_ field is by default stored in the inverted index (indexed="true"). However, for some systems with a very large number of documents, the increase in FieldCache memory requirements may be too costly. A solution can be to declare the _version_ field as DocValues:

Sample field definition

```
<field name="_version_" type="long" indexed="false" stored="true"
required="true" docValues="true"/>
```

Document Centric Versioning Constraints

Optimistic Concurrency is extremely powerful, and works very efficiently because it uses an internally assigned, globally unique values for the _version_ field. However, In some situations users may want to configure their own document specific version field, where the version values are assigned on a per-document basis by an external system, and have Solr reject updates that attempt to replace a document with an "older" version. In situations like this the DocBasedVersionConstraintsProcessorFactory can be useful.

The basic usage of DocBasedVersionConstraintsProcessorFactory is to configure it in solrconfig.xml as part of the UpdateRequestProcessorChain and specify the name of your custom versionField in your schema that should be checked when validating updates:

```
<processor class="solr.DocBasedVersionConstraintsProcessorFactory">
  <str name="versionField">my_version_l</str>
</processor>
```

Once configured, this update processor will reject (HTTP error code 409) any attempt to update an existing document where the value of the my_version_l field in the "new" document is not greater then the value of that field in the existing document.

versionField vs _version_

The _version_ field used by Solr for its normal optimistic concurrency also has important semantics in how updates are distributed to replicas in SolrCloud, and **MUST** be assigned internally by Solr. Users can not re-purpose that field and specify it as the versionField for use in the DocBasedVersionConstraintsProcessorFactory configuration.

DocBasedVersionConstraintsProcessorFactory supports two additional configuration params which are optional:

- ignoreOldUpdates - A boolean option which defaults to false. If set to true then instead of rejecting updates where the versionField is too low, the update will be silently ignored (and return a status 200 to the client).
- deleteVersionParam - A String parameter that can be specified to indicate that this processor should also inspect Delete By Id commands. The value of this configuration option should be the name of a request parameter that the processor will now consider mandatory for all attempts to Delete By Id, and

must be be used by clients to specify a value for the `versionField` which is greater then the existing value of the document to be deleted. When using this request param, any Delete By Id command with a high enough document version number to succeed will be internally converted into an Add Document command that replaces the existing document with a new one which is empty except for the Unique Key and `versionField` to keeping a record of the deleted version so future Add Document commands will fail if their "new" version is not high enough.

Please consult the processor javadocs and test configs for additional information and example usages.

De-Duplication

Preventing duplicate or near duplicate documents from entering an index or tagging documents with a signature/fingerprint for duplicate field collapsing can be efficiently achieved with a low collision or fuzzy hash algorithm. Solr natively supports de-duplication techniques of this type via the `<Signature>` class and allows for the easy addition of new hash/signature implementations. A Signature can be implemented several ways:

Method	Description
MD5Signature	128 bit hash used for exact duplicate detection.
Lookup3Signature	64 bit hash used for exact duplicate detection, much faster than MD5 and smaller to index
TextProfileSignature	Fuzzy hashing implementation from nutch for near duplicate detection. It's tunable but works best on longer text.

Other, more sophisticated algorithms for fuzzy/near hashing can be added later.

⚠ Adding in the de-duplication process will change the `allowDups` setting so that it applies to an update Term (with `signatureField` in this case) rather than the unique field Term. Of course the `signatureField` could be the unique field, but generally you want the unique field to be unique. When a document is added, a signature will automatically be generated and attached to the document in the specified `signatureField`.

Configuration Options

There are two places in Solr to configure de-duplication: in `solrconfig.xml` and in `schema.xml`.

In `solrconfig.xml`

The `SignatureUpdateProcessorFactory` has to be registered in the solrconfig.xml as part of the UpdateRequestProcessorChain:

```
<updateRequestProcessorChain name="dedupe">
  <processor class="solr.processor.SignatureUpdateProcessorFactory">
    <bool name="enabled">true</bool>
    <str name="signatureField">id</str>
    <bool name="overwriteDupes">false</bool>
    <str name="fields">name,features,cat</str>
    <str name="signatureClass">solr.processor.Lookup3Signature</str>
  </processor>
</updateRequestProcessorChain>
```

Setting	Default	Description
signatureClass	org.apache.solr.update.processor.Lookup3Signature	A Signature implementation for generating a signature hash.
fields	all fields	The fields to use to generate the signature hash in a comma separated list. By default, all fields on the document will be used.
signatureField	signatureField	The name of the field used to hold the fingerprint/signature. Be sure the field is defined in schema.xml.
enabled	true	Enable/disable de-duplication processing.

In `schema.xml`

If you are using a separate field for storing the signature you must have it indexed:

```
<field name="signature" type="string" stored="true" indexed="true"
multiValued="false" />
```

Be sure to change your update handlers to use the defined chain, i.e.

```
<requestHandler name="/update" >
  <lst name="defaults">
    <str name="update.chain">dedupe</str>
  </lst>
</requestHandler>
```

The update processor can also be specified per request with a parameter of `update.chain=dedupe`.

Detecting Languages During Indexing

Solr can identify languages and map text to language-specific fields during indexing using the `langid` UpdateRequestProcessor. Solr supports two implementations of this feature:

- Tika's language detection feature: http://tika.apache.org/0.10/detection.html

- LangDetect language detection: http://code.google.com/p/language-detection/

You can see a comparison between the two implementations here: http://blog.mikemccandless.com/2011/10/accuracy-and-performance-of-googles.html. In general, the LangDetect implementation supports more languages with higher performance.

For specific information on each of these language identification implementations, including a list of supported languages for each, see the relevant project websites. For more information about the `langid` UpdateRequestProcessor, see the Solr wiki: http://wiki.apache.org/solr/LanguageDetection. For more information about language analysis in Solr, see Language Analysis.

Configuring Language Detection

You can configure the `langid` UpdateRequestProcessor in `solrconfig.xml`. Both implementations take the same parameters, which are described in the following section. At a minimum, you must specify the fields for language identification and a field for the resulting language code.

Configuring Tika Language Detection

Here is an example of a minimal Tika `langid` configuration in `solrconfig.xml`:

```
<processor
class="org.apache.solr.update.processor.TikaLanguageIdentifierUpdateProcessorFactory
">
  <lst name="defaults">
    <str name="langid.fl">title,subject,text,keywords</str>
    <str name="langid.langField">language_s</str>
  </lst>
</processor>
```

Configuring LangDetect Language Detection

Here is an example of a minimal LangDetect `langid` configuration in `solrconfig.xml`:

```
<processor
class="org.apache.solr.update.processor.LangDetectLanguageIdentifierUpdateProcessorF
actory">
  <lst name="defaults">
    <str name="langid.fl">title,subject,text,keywords</str>
    <str name="langid.langField">language_s</str>
  </lst>
</processor>
```

`langid` Parameters

As previously mentioned, both implementations of the `langid` UpdateRequestProcessor take the same parameters.

Parameter	Type	Default	Required	Description
langid	Boolean	true	no	Enables and disables language detection.

langid.fl	string	none	yes	A comma- or space-delimited list of fields to be processed by `langid`.
langid.langField	string	none	yes	Specifies the field for the returned language code.
langid.langsField	multivalued string	none	no	Specifies the field for a list of returned language codes. If you use `langid.map.individual`, each detected language will be added to this field.
langid.overwrite	Boolean	false	no	Specifies whether the content of the `langField` and `langsField` fields will be overwritten if they already contain values.
langid.lcmap	string	none	false	A space-separated list specifying colon delimited language code mappings to apply to the detected languages. For example, you might use this to map Chinese, Japanese, and Korean to a common `cjk` code, and map both American and British English to a single `en` code by using `langid.lcmap=ja:cjk zh:cjk ko:cjk en_GB:en en_US:en`. This affects both the values put into the `langField` and `langsField` fields, as well as the field suffixes when using `langid.map`, unless overridden by `langid.map.lcmap`
langid.threshold	float	0.5	no	Specifies a threshold value between 0 and 1 that the language identification score must reach before `langid` accepts it. With longer text fields, a high threshold such at 0.8 will give good results. For shorter text fields, you may need to lower the threshold for language identification, though you will be risking somewhat lower quality results. We recommend experimenting with your data to tune your results.
langid.whitelist	string	none	no	Specifies a list of allowed language identification codes. Use this in combination with `langid.map` to ensure that you only index documents into fields that are in your schema.

langid.map	Boolean	false	no	Enables field name mapping. If true, Solr will map field names for all fields listed in `langid.fl`.
langid.map.fl	string	none	no	A comma-separated list of fields for `langid.map` that is different than the fields specified in `langid.fl`.
langid.map.keepOrig	Boolean	false	no	If true, Solr will copy the field during the field name mapping process, leaving the original field in place.
langid.map.individual	Boolean	false	no	If true, Solr will detect and map languages for each field individually.
langid.map.individual.fl	string	none	no	A comma-separated list of fields for use with `langid.map.individual` that is different than the fields specified in `langid.fl`.
langid.fallbackFields	string	none	no	If no language is detected that meets the `langid.threshold` score, or if the detected language is not on the `langid.whitelist`, this field specifies language codes to be used as fallback values. If no appropriate fallback languages are found, Solr will use the language code specified in `langid.fallback`.
langid.fallback	string	none	no	Specifies a language code to use if no language is detected or specified in `langid.fallbackFields`.
langid.map.lcmap	string	determined by `langid.lcmap`	no	A space-separated list specifying colon delimited language code mappings to use when mapping field names. For example, you might use this to make Chinese, Japanese, and Korean language fields use a common `*_cjk` suffix, and map both American and British English fields to a single `*_en` by using `langid.map.lcmap=ja:cjk zh:cjk ko:cjk en_GB:en en_US:en`.
langid.map.pattern	Java regular expression	none	no	By default, fields are mapped as <field>_<language>. To change this pattern, you can specify a Java regular expression in this parameter.

langid.map.replace	Java replace	none	no	By default, fields are mapped as <field>_<language>. To change this pattern, you can specify a Java replace in this parameter.
langid.enforceSchema	Boolean	true	no	If false, the `langid` processor does not validate field names against your schema. This may be useful if you plan to rename or delete fields later in the UpdateChain.

Content Streams

When Solr RequestHandlers are accessed using path based URLs, the `SolrQueryRequest` object containing the parameters of the request may also contain a list of ContentStreams containing bulk data for the request. (The name SolrQueryRequest is a bit misleading: it is involved in all requests, regardless of whether it is a query request or an update request.)

Stream Sources

Currently RequestHandlers can get content streams in a variety of ways:

- For multipart file uploads, each file is passed as a stream.
- For POST requests where the content-type is not `application/x-www-form-urlencoded`, the raw POST body is passed as a stream. The full POST body is parsed as parameters and included in the Solr parameters.
- The contents of parameter `stream.body` is passed as a stream.
- If remote streaming is enabled and URL content is called for during request handling, the contents of each `stream.url` and `stream.file` parameters are fetched and passed as a stream.

By default, curl sends a `contentType="application/x-www-form-urlencoded"` header. If you need to test a SolrContentHeader content stream, you will need to set the content type with the "-H" flag.

RemoteStreaming

Remote streaming lets you send the contents of a URL as a stream to a given SolrRequestHandler. You could use remote streaming to send a remote or local file to an update plugin. For convenience, remote streaming is enabled in most of the example `solrconfig.xml` files included with Solr, however it is not recommended in a production situation with out additional security between you and untrusted remote clients.

```
<!-- *** WARNING ***
         The settings below authorize Solr to fetch remote files, You
         should make sure your system has some authentication before
         using enableRemoteStreaming="true"
      -->
    <requestParsers enableRemoteStreaming="true" />
```

The default behavior, when `enableRemoteStreaming` is not specified in `solrconfig.xml` is to *not* allow remote streaming (i.e., `enableRemoteStreaming="false"`).

⚠ If you `enableRemoteStreaming="true"` is used, be aware that this allows *anyone* to send a request to any URL or local file. If DumpRequestHandler is enabled, it will allow anyone to view any file on your system.

Debugging Requests

The example `solrconfig.xml` files include a "dump" RequestHandler:

```
<requestHandler name="/debug/dump" class="solr.DumpRequestHandler" />
```

This handler simply outputs the contents of the SolrQueryRequest using the specified writer type `wt`. This is a useful tool to help understand what streams are available to the RequestHandlers.

UIMA Integration

You can integrate the Apache Unstructured Information Management Architecture (UIMA) with Solr. UIMA lets you define custom pipelines of Analysis Engines that incrementally add metadata to your documents as annotations.

For more information about Solr UIMA integration, see https://wiki.apache.org/solr/SolrUIMA.

Configuring UIMA

The SolrUIMA UpdateRequestProcessor is a custom update request processor that takes documents being indexed, sends them to a UIMA pipeline, and then returns the documents enriched with the specified metadata. To configure UIMA for Solr, follow these steps:

1. Copy `solr-uima-4.x.y.jar` (under `/solr-4.x.y/dist/`) and its libraries (under `contrib/uima/lib`) to a Solr libraries directory, or set `<lib/>` tags in `solrconfig.xml` appropriately to point to those jar files:

    ```
    <lib dir="../../contrib/uima/lib" />
    <lib dir="../../dist/" regex="solr-uima-\d.*\.jar" />
    ```

2. Modify `schema.xml`, adding your desired metadata fields specifying proper values for type, indexed, stored, and multiValued options. For example:

    ```
    <field name="language" type="string" indexed="true" stored="true"
    required="false"/>
    <field name="concept" type="string" indexed="true" stored="true"
    multiValued="true" required="false"/>
    <field name="sentence" type="text" indexed="true" stored="true"
    multiValued="true" required="false" />
    ```

3. Add the following snippet to `solrconfig.xml`:

    ```
    <updateRequestProcessorChain name="uima">
      <processor
    class="org.apache.solr.uima.processor.UIMAUpdateRequestProcessorFactory">
    ```

```
    <lst name="uimaConfig">
      <lst name="runtimeParameters">
        <str name="keyword_apikey">VALID_ALCHEMYAPI_KEY</str>
        <str name="concept_apikey">VALID_ALCHEMYAPI_KEY</str>
        <str name="lang_apikey">VALID_ALCHEMYAPI_KEY</str>
        <str name="cat_apikey">VALID_ALCHEMYAPI_KEY</str>
        <str name="entities_apikey">VALID_ALCHEMYAPI_KEY</str>
        <str name="oc_licenseID">VALID_OPENCALAIS_KEY</str>
      </lst>
      <str
name="analysisEngine">/org/apache/uima/desc/OverridingParamsExtServicesAE.xml<
/str>
      <!-- Set to true if you want to continue indexing even if text
processing fails.
           Default is false. That is, Solr throws RuntimeException and
           never indexed documents entirely in your session. -->
      <bool name="ignoreErrors">true</bool>
      <!-- This is optional. It is used for logging when text processing
fails.
           If logField is not specified, uniqueKey will be used as logField.
      <str name="logField">id</str>
      -->
      <lst name="analyzeFields">
        <bool name="merge">false</bool>
        <arr name="fields">
          <str>text</str>
        </arr>
      </lst>
      <lst name="fieldMappings">
        <lst name="type">
          <str name="name">org.apache.uima.alchemy.ts.concept.ConceptFS</str>
          <lst name="mapping">
            <str name="feature">text</str>
            <str name="field">concept</str>
          </lst>
        </lst>
        <lst name="type">
          <str
name="name">org.apache.uima.alchemy.ts.language.LanguageFS</str>
          <lst name="mapping">
            <str name="feature">language</str>
            <str name="field">language</str>
          </lst>
        </lst>
        <lst name="type">
          <str name="name">org.apache.uima.SentenceAnnotation</str>
          <lst name="mapping">
            <str name="feature">coveredText</str>
            <str name="field">sentence</str>
          </lst>
        </lst>
      </lst>
    </lst>
  </processor>
  <processor class="solr.LogUpdateProcessorFactory" />
  <processor class="solr.RunUpdateProcessorFactory" />
</updateRequestProcessorChain>
```

⚠ `VALID_ALCHEMYAPI_KEY` is your AlchemyAPI Access Key. You need to register an AlchemyAPI Access key to use AlchemyAPI services: http://www.alchemyapi.com/api/register.html.

`VALID_OPENCALAIS_KEY` is your Calais Service Key. You need to register a Calais Service key to use the Calais services: http://www.opencalais.com/apikey.

`analysisEngine` must contain an AE descriptor inside the specified path in the classpath.

`analyzeFields` must contain the input fields that need to be analyzed by UIMA. If `merge=true` then their content will be merged and analyzed only once.

Field mapping describes which features of which types should go in a field.

4. In your `solrconfig.xml` replace the existing default UpdateRequestHandler or create a new UpdateRequestHandler:

```
<requestHandler name="/update" class="solr.XmlUpdateRequestHandler">
  <lst name="defaults">
    <str name="update.processor">uima</str>
  </lst>
</requestHandler>
```

Once you are done with the configuration your documents will be automatically enriched with the specified fields when you index them.

Searching

This section describes how Solr works with search requests. It covers the following topics:

- Overview of Searching in Solr: An introduction to searching with Solr.

- Velocity Search UI: A simple search UI using the VelocityResponseWriter.

- Relevance: Conceptual information about understanding relevance in search results.

- Query Syntax and Parsing: A brief conceptual overview of query syntax and parsing. It also contains the following sub-sections:
    - Common Query Parameters: No matter the query parser, there are several parameters that are common to all of them.
    - The Standard Query Parser: Detailed information about the standard Lucene query parser.
    - The DisMax Query Parser: Detailed information about Solr's DisMax query parser.
    - The Extended DisMax Query Parser: Detailed information about Solr's Extended DisMax (eDisMax) Query Parser.
    - Function Queries: Detailed information about parameters for generating relevancy scores using values from one or more numeric fields.
    - Local Parameters in Queries: How to add local arguments to queries.
    - Other Parsers: More parsers designed for use in specific situations.

- Faceting: Detailed information about categorizing search results based on indexed terms.

- Highlighting: Detailed information about Solr's highlighting utilities. Sub-sections cover the different types of highlighters:
    - Standard Highlighter: Uses the most sophisticated and fine-grained query representation of the three highlighters.
    - FastVector Highlighter: Optimized for term vector options on fields, and good for large documents and multiple languages.
    - Postings Highlighter: Uses similar options as the FastVector highlighter, but is more compact and efficient.

- Spell Checking: Detailed information about Solr's spelling checker.

- Query Re-Ranking: Detailed information about re-ranking top scoring documents from simple queries using more complex scores.
- Transforming Result Documents: Detailed information about using `DocTransformers` to add computed information to individual documents

- Suggester: Detailed information about Solr's powerful autosuggest component.

- MoreLikeThis: Detailed information about Solr's similar results query component.

- Pagination of Results: Detailed information about fetching paginated results for display in a UI, or for fetching all documents matching a query.

- Result Grouping: Detailed information about grouping results based on common field values.

- Result Clustering: Detailed information about grouping search results based on cluster analysis applied to text fields. A bit like "unsupervised" faceting.
- Spatial Search: How to use Solr's spatial search capabilities.
- The Terms Component: Detailed information about accessing indexed terms and the documents that include them.
- The Term Vector Component: How to get term information about specific documents.
- The Stats Component: How to return information from numeric fields within a document set.
- The Query Elevation Component: How to force documents to the top of the results for certain queries.
- Response Writers: Detailed information about configuring and using Solr's response writers.
- Near Real Time Searching: How to include documents in search results nearly immediately after they are indexed.
- RealTime Get: How to get the latest version of a document without opening a searcher.

Overview of Searching in Solr

Solr offers a rich, flexible set of features for search. To understand the extent of this flexibility, it's helpful to begin with an overview of the steps and components involved in a Solr search.

When a user runs a search in Solr, the search query is processed by a **request handler**. A request handler is a Solr plug-in that defines the logic to be used when Solr processes a request. Solr supports a variety of request handlers. Some are designed for processing search queries, while others manage tasks such as index replication.

Search applications select a particular request handler by default. In addition, applications can be configured to allow users to override the default selection in preference of a different request handler.

To process a search query, a request handler calls a **query parser**, which interprets the terms and parameters of a query. Different query parsers support different syntax. The default query parser is the DisMax query parser. Solr also includes an earlier "standard" (Lucene) query parser, and an Extended DisMax (eDisMax) query parser. The standard query parser's syntax allows for greater precision in searches, but the DisMax query parser is much more tolerant of errors. The DisMax query parser is designed to provide an experience similar to that of popular search engines such as Google, which rarely display syntax errors to users. The Extended DisMax query parser is an improved version of DisMax that handles the full Lucene query syntax while still tolerating syntax errors. It also includes several additional features.

In addition, there are common query parameters that are accepted by all query parsers.

Input to a query parser can include:

- search strings---that is, *terms* to search for in the index
- *parameters for fine-tuning the query* by increasing the importance of particular strings or fields, by applying Boolean logic among the search terms, or by excluding content from the search results

- *parameters for controlling the presentation of the query response*, such as specifying the order in which results are to be presented or limiting the response to particular fields of the search application's schema.

Search parameters may also specify a **query filter**. As part of a search response, a query filter runs a query against the entire index and caches the results. Because Solr allocates a separate cache for filter queries, the strategic use of filter queries can improve search performance. (Despite their similar names, query filters are not related to analysis filters. Query filters perform queries at search time against data already in the index, while analysis filters, such as Tokenizers, parse content for indexing, following specified rules).

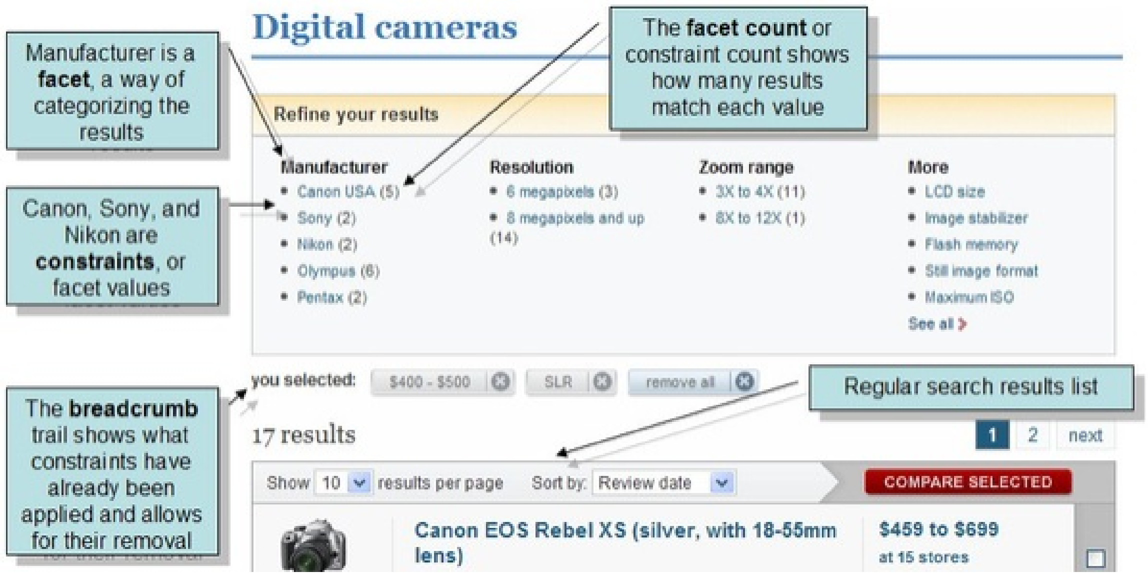
A search query can request that certain terms be highlighted in the search response; that is, the selected terms will be displayed in colored boxes so that they "jump out" on the screen of search results. **Highlighting** can make it easier to find relevant passages in long documents returned in a search. Solr supports multi-term highlighting. Solr includes a rich set of search parameters for controlling how terms are highlighted.

Search responses can also be configured to include **snippets** (document excerpts) featuring highlighted text. Popular search engines such as Google and Yahoo! return snippets in their search results: 3-4 lines of text offering a description of a search result.

To help users zero in on the content they're looking for, Solr supports two special ways of grouping search results to aid further exploration: faceting and clustering.

Faceting is the arrangement of search results into categories (which are based on indexed terms). Within each category, Solr reports on the number of hits for relevant term, which is called a facet constraint. Faceting makes it easy for users to explore search results on sites such as movie sites and product review sites, where there are many categories and many items within a category.

The image below shows an example of faceting from the CNET Web site, which was the first site to use Solr.



Manufacturer is a **facet**, a way of categorizing the results

The **facet count** or constraint count shows how many results match each value

Canon, Sony, and Nikon are **constraints**, or facet values

The **breadcrumb** trail shows what constraints have already been applied and allows for their removal

Regular search results list

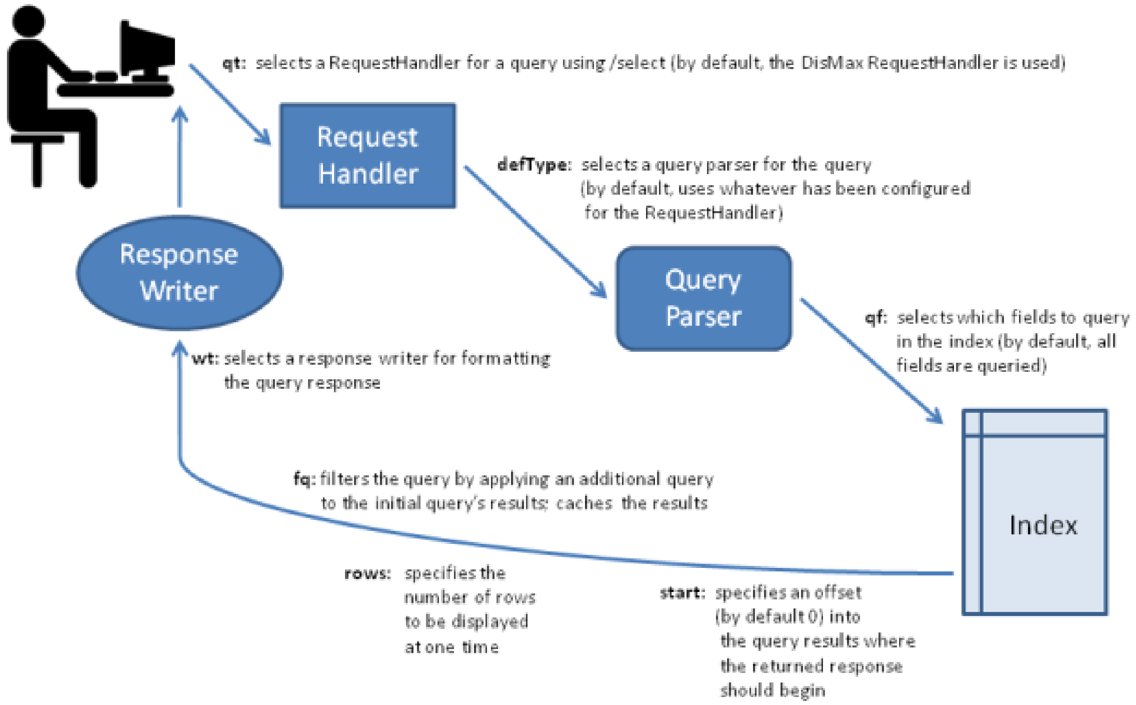
Faceting makes use of fields defined when the search applications were indexed. In the example above, these fields include categories of information that are useful for describing digital cameras: manufacturer, resolution, and zoom range.

Clustering groups search results by similarities discovered when a search is executed, rather than when content is indexed. The results of clustering often lack the neat hierarchical organization found in faceted search results, but clustering can be useful nonetheless. It can reveal unexpected commonalities among search results, and it can help users rule out content that isn't pertinent to what they're really searching for.

Solr also supports a feature called MoreLikeThis, which enables users to submit new queries that focus on particular terms returned in an earlier query. MoreLikeThis queries can make use of faceting or clustering to provide additional aid to users.

A Solr component called a **response writer** manages the final presentation of the query response. Solr includes a variety of response writers, including an XML Response Writer and a JSON Response Writer.

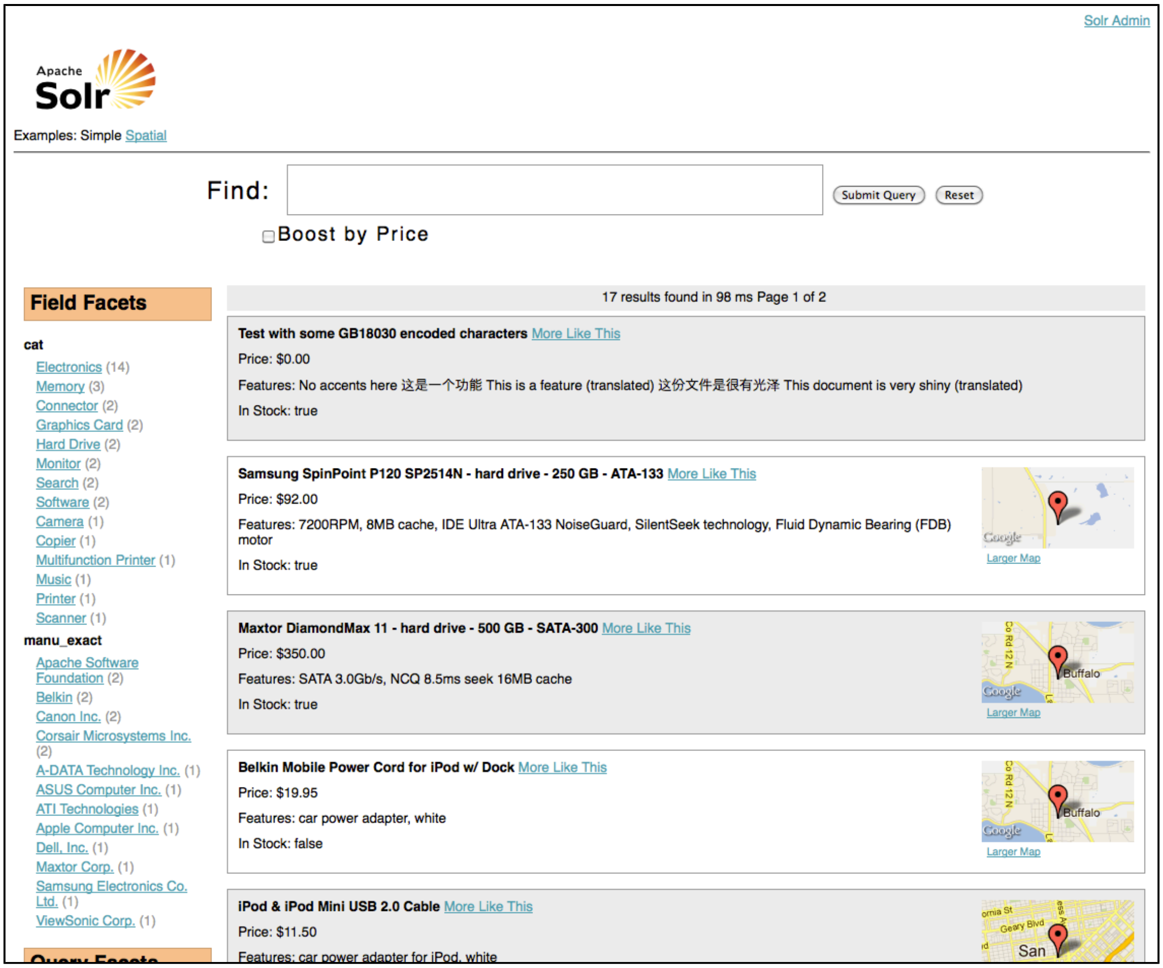
The diagram below summarizes some key elements of the search process.


qt: selects a RequestHandler for a query using /select (by default, the DisMax RequestHandler is used)
Request Handler
defType: selects a query parser for the query (by default, uses whatever has been configured for the RequestHandler)
Query Parser
qf: selects which fields to query in the index (by default, all fields are queried)
Index
Response Writer
wt: selects a response writer for formatting the query response
fq: filters the query by applying an additional query to the initial query's results; caches the results
rows: specifies the number of rows to be displayed at one time
start: specifies an offset (by default 0) into the query results where the returned response should begin

Velocity Search UI

Solr includes a sample search UI based on the VelocityResponseWriter (also known as Solritas) that demonstrates several useful features, such as searching, faceting, highlighting, autocomplete, and geospatial searching.

When using the `sample_techproducts_configs` config set, you can access the Velocity sample Search UI here: `http://localhost:8983/solr/techproducts/browse`



cat

- Electronics (14)
- Memory (3)
- Connector (2)
- Graphics Card (2)
- Hard Drive (2)
- Monitor (2)
- Search (2)
- Software (2)
- Camera (1)
- Copier (1)
- Multifunction Printer (1)
- Music (1)
- Printer (1)
- Scanner (1)

manu_exact

- Apache Software Foundation (2)
- Belkin (2)
- Canon Inc. (2)
- Corsair Microsystems Inc. (2)
- A-DATA Technology Inc. (1)
- ASUS Computer Inc. (1)
- ATI Technologies (1)
- Apple Computer Inc. (1)
- Dell, Inc. (1)
- Maxtor Corp. (1)
- Samsung Electronics Co. Ltd. (1)
- ViewSonic Corp. (1)

Query Facets

17 results found in 98 ms Page 1 of 2

Test with some GB18030 encoded characters More Like This
Price: $0.00
Features: No accents here 这是一个功能 This is a feature (translated) 这份文件是很有光泽 This document is very shiny (translated)
In Stock: true

Samsung SpinPoint P120 SP2514N - hard drive - 250 GB - ATA-133 More Like This
Price: $92.00
Features: 7200RPM, 8MB cache, IDE Ultra ATA-133 NoiseGuard, SilentSeek technology, Fluid Dynamic Bearing (FDB) motor
In Stock: true

Maxtor DiamondMax 11 - hard drive - 500 GB - SATA-300 More Like This
Price: $350.00
Features: SATA 3.0Gb/s, NCQ 8.5ms seek 16MB cache
In Stock: true

Belkin Mobile Power Cord for iPod w/ Dock More Like This
Price: $19.95
Features: car power adapter, white
In Stock: false

iPod & iPod Mini USB 2.0 Cable More Like This
Price: $11.50
Features: car power adapter for iPod, white

The Velocity Search UI

For more information about the Velocity Response Writer, see the Response Writer page.

Relevance

Relevance is the degree to which a query response satisfies a user who is searching for information.

The relevance of a query response depends on the context in which the query was performed. A single search application may be used in different contexts by users with different needs and expectations. For example, a search engine of climate data might be used by a university researcher studying long-term climate trends, a farmer interested in calculating the likely date of the last frost of spring, a civil engineer interested in rainfall patterns and the frequency of floods, and a college student planning a vacation to a region and wondering what to pack. Because the motivations of these users vary, the relevance of any particular response to a query will vary as well.

How comprehensive should query responses be? Like relevance in general, the answer to this question depends on the context of a search. The cost of *not* finding a particular document in response to a query is high in some contexts, such as a legal e-discovery search in response to a subpoena, and quite low in others, such as a search for a cake recipe on a Web site with dozens or hundreds of cake recipes. When configuring Solr, you should weigh comprehensiveness against other factors such as timeliness and ease-of-use.

The e-discovery and recipe examples demonstrate the importance of two concepts related to relevance:

- **Precision** is the percentage of documents in the returned results that are relevant.

- **Recall** is the percentage of relevant results returned out of all relevant results in the system. Obtaining perfect recall is trivial: simply return every document in the collection for every query.

Returning to the examples above, it's important for an e-discovery search application to have 100% recall returning all the documents that are relevant to a subpoena. It's far less important that a recipe application offer this degree of precision, however. In some cases, returning too many results in casual contexts could overwhelm users. In some contexts, returning fewer results that have a higher likelihood of relevance may be the best approach.

Using the concepts of precision and recall, it's possible to quantify relevance across users and queries for a collection of documents. A perfect system would have 100% precision and 100% recall for every user and every query. In other words, it would retrieve all the relevant documents and nothing else. In practical terms, when talking about precision and recall in real systems, it is common to focus on precision and recall at a certain number of results, the most common (and useful) being ten results.

Through faceting, query filters, and other search components, a Solr application can be configured with the flexibility to help users fine-tune their searches in order to return the most relevant results for users. That is, Solr can be configured to balance precision and recall to meet the needs of a particular user community.

The configuration of a Solr application should take into account:

- the needs of the application's various users (which can include ease of use and speed of response, in addition to strictly informational needs)
- the categories that are meaningful to these users in their various contexts (e.g., dates, product categories, or regions)
- any inherent relevance of documents (e.g., it might make sense to ensure that an official product description or FAQ is always returned near the top of the search results)
- whether or not the age of documents matters significantly (in some contexts, the most recent documents might always be the most important)

Keeping all these factors in mind, it's often helpful in the planning stages of a Solr deployment to sketch out the types of responses you think the search application should return for sample queries. Once the application is up and running, you can employ a series of testing methodologies, such as focus groups, in-house testing, TREC te sts and A/B testing to fine tune the configuration of the application to best meet the needs of its users.

For more information about relevance, see Grant Ingersoll's tech article Debugging Search Application Relevance Issues which is available on SearchHub.org.

Query Syntax and Parsing

Solr supports several query parsers, offering search application designers great flexibility in controlling how queries are parsed.

This section explains how to specify the query parser to be used. It also describes the syntax and features supported by the main query parsers included with Solr and describes some other parsers that may be useful for particular situations. There are some query parameters common to all Solr parsers; these are discussed in the section Common Query Parameters.

The parsers discussed in this Guide are:

- The Standard Query Parser
- The DisMax Query Parser
- The Extended DisMax Query Parser

- Other Parsers

The query parser plugins are all subclasses of QParserPlugin. If you have custom parsing needs, you may want to extend that class to create your own query parser.

For more detailed information about the many query parsers available in Solr, see https://wiki.apache.org/solr/SolrQuerySyntax.

Common Query Parameters

The table below summarizes Solr's common query parameters, which are supported by the Standard, DisMax, and eDisMax Request Handlers.

Parameter	Description
defType	Selects the query parser to be used to process the query.
sort	Sorts the response to a query in either ascending or descending order based on the response's score or another specified characteristic.
start	Specifies an offset (by default, 0) into the responses at which Solr should begin displaying content.
rows	Controls how many rows of responses are displayed at a time (default value: 10)
fq	Applies a filter query to the search results.
fl	Limits the information included in a query response to a specified list of fields. The fields need to have been indexed as stored for this parameter to work correctly.
debug	Request additional debugging information in the response. Specifying the `debug=timing` parameter returns just the timing information; specifying the `debug=results` parameter returns "explain" information for each of the documents returned; specifying the `debug=query parameter` returns all of the debug information.
explainOther	Allows clients to specify a Lucene query to identify a set of documents. If non-blank, the explain info of each document which matches this query, relative to the main query (specified by the q parameter) will be returned along with the rest of the debugging information.
timeAllowed	Defines the time allowed for the query to be processed. If the time elapses before the query response is complete, partial information may be returned.
omitHeader	Excludes the header from the returned results, if set to true. The header contains information about the request, such as the time the request took to complete. The default is false.
wt	Specifies the Response Writer to be used to format the query response.
logParamsList	By default, Solr logs all parameters. Set this parameter to restrict which parameters are logged. Valid entries are the parameters to be logged, separated by commas (i.e., `logParamsList=param1,param2`). An empty list will log no parameters, so if logging all parameters is desired, do not define this additional parameter at all.

The following sections describe these parameters in detail.

The `defType` Parameter

The defType parameter selects the query parser that Solr should use to process the main query parameter (`q`) in the request. For example:

`defType=dismax`

If no defType param is specified, then by default, the The Standard Query Parser is used. (eg: `defType=lucene`)

The **`sort`** Parameter

The `sort` parameter arranges search results in either ascending (`asc`) or descending (`desc`) order. The parameter can be used with either numerical or alphabetical content. The directions can be entered in either all lowercase or all uppercase letters (i.e., both `asc` or `ASC`).

Solr can sort query responses according to document scores or the value of any indexed field with a single value (that is, any field whose attributes in `schema.xml` include `multiValued="false"` and `indexed="true"`), provided that:

- the field is non-tokenized (that is, the field has no analyzer and its contents have been parsed into tokens, which would make the sorting inconsistent), or
- the field uses an analyzer (such as the KeywordTokenizer) that produces only a single term.

If you want to be able to sort on a field whose contents you want to tokenize to facilitate searching, use the `<copyField>` directive in the `schema.xml` file to clone the field. Then search on the field and sort on its clone.

The table explains how Solr responds to various settings of the `sort` parameter.

Example	Result
	If the sort parameter is omitted, sorting is performed as though the parameter were set to score `desc`.
score desc	Sorts in descending order from the highest score to the lowest score.
price asc	Sorts in ascending order of the price field
inStock desc, price asc	Sorts by the contents of the `inStock` field in descending order, then within those results sorts in ascending order by the contents of the price field.

Regarding the sort parameter's arguments:

- A sort ordering must include a field name (or `score` as a pseudo field), followed by whitespace (escaped as + or `%20` in URL strings), followed by a sort direction (`asc` or `desc`).
- Multiple sort orderings can be separated by a comma, using this syntax: `sort=<field name>+<direction>,<field name>+<direction>],...`
  - When more than one sort criteria is provided, the second entry will only be used if the first entry results in a tie. If there is a third entry, it will only be used if the first AND second entries are tied. This pattern continues with further entries.

The **`start`** Parameter

When specified, the `start` parameter specifies an offset into a query's result set and instructs Solr to begin displaying results from this offset.

The default value is "0". In other words, by default, Solr returns results without an offset, beginning where the results themselves begin.

Setting the `start` parameter to some other number, such as 3, causes Solr to skip over the preceding records and start at the document identified by the offset.

You can use the `start` parameter this way for paging. For example, if the `rows` parameter is set to 10, you could display three successive pages of results by setting start to 0, then re-issuing the same query and setting start to 10, then issuing the query again and setting start to 20.

The `rows` Parameter

You can use the rows parameter to paginate results from a query. The parameter specifies the maximum number of documents from the complete result set that Solr should return to the client at one time.

The default value is 10. That is, by default, Solr returns 10 documents at a time in response to a query.

The `fq` (Filter Query) Parameter

The `fq` parameter defines a query that can be used to restrict the superset of documents that can be returned, without influencing score. It can be very useful for speeding up complex queries, since the queries specified with `fq` are cached independently of the main query. When a later query uses the same filter, there's a cache hit, and filter results are returned quickly from the cache.

When using the `fq` parameter, keep in mind the following:

- The `fq` parameter can be specified multiple times in a query. Documents will only be included in the result if they are in the intersection of the document sets resulting from each instance of the parameter. In the example below, only documents which have a popularity greater then 10 and have a section of 0 will match.

  ```
  fq=popularity:[10 TO *]&fq=section:0
  ```

- Filter queries can involve complicated Boolean queries. The above example could also be written as a single `fq` with two mandatory clauses like so:

  ```
  fq=+popularity:[10 TO *] +section:0
  ```

- The document sets from each filter query are cached independently. Thus, concerning the previous examples: use a single `fq` containing two mandatory clauses if those clauses appear together often, and use two separate `fq` parameters if they are relatively independent. (To learn about tuning cache sizes and making sure a filter cache actually exists, see The Well-Configured Solr Instance.)
- As with all parameters: special characters in an URL need to be properly escaped and encoded as hex values. Online tools are available to help you with URL-encoding. For example: http://meyerweb.com/eric/tools/dencoder/.

The `fl` (Field List) Parameter

The `fl` parameter limits the information included in a query response to a specified list of fields. The fields need to have been indexed as stored for this parameter to work correctly.

The field list can be specified as a space-separated or comma-separated list of field names. The string "score" can be used to indicate that the score of each document for the particular query should be returned as a field. The wildcard character "*" selects all the stored fields in a document. You can also add psuedo-fields, functions and transformers to the field list request.

This table shows some basic examples of how to use `fl`:

Field List	Result
id name price	Return only the id, name, and price fields.
id,name,price	Return only the id, name, and price fields.
id name, price	Return only the id, name, and price fields.
id score	Return the id field and the score.
*	Return all the fields in each document. This is the default value of the fl parameter.
* score	Return all the fields in each document, along with each field's score.

Function Values

Functions can be computed for each document in the result and returned as a psuedo-field:

```
fl=id,title,product(price,popularity)
```

Document Transformers

Document Transformers can be used to modify the information returned about each documents in the results of a query:

```
fl=id,title,[explain]
```

Field Name Aliases

You can change the key used to in the response for a field, function, or transformer by prefixing it with a `"`*`displayName`*`:`". For example:

```
fl=id,sales_price:price,secret_sauce:prod(price,popularity),why_score:[explain
style=nl]
```

```
"response":{"numFound":2,"start":0,"docs":[
      {
        "id":"6H500F0",
        "secret_sauce":2100.0,
        "sales_price":350.0,
        "why_score":{
          "match":true,
          "value":1.052226,
          "description":"weight(features:cache in 2) [DefaultSimilarity], result
of:",
          "details":[{
...
```

The **debug** Parameter

The `debug` parameter can be specified multiple times and supports the following arguments:

- `debug=query`: return debug information about the query only.
- `debug=timing`: return debug information about how long the query took to process.
- `debug=results`: return debug information about the score results (also known as "explain")
- `debug=all`: return all available debug information about the request request. (alternatively usage: `debug=true`)

For backwards compatibility with older versions of Solr, `debugQuery=true` may instead be specified as an alternative way to indicate `debug=all`

The default behavior is not to include debugging information.

The **explainOther** Parameter

The `explainOther` parameter specifies a Lucene query in order to identify a set of documents. If this parameter is included and is set to a non-blank value, the query will return debugging information, along with the "explain info" of each document that matches the Lucene query, relative to the main query (which is specified by the q parameter). For example:

```
q=supervillians&debugQuery=on&explainOther=id:juggernaut
```

The query above allows you to examine the scoring explain info of the top matching documents, compare it to the explain info for documents matching `id:juggernaut`, and determine why the rankings are not as you expect.

The default value of this parameter is blank, which causes no extra "explain info" to be returned.

The **timeAllowed** Parameter

This parameter specifies the amount of time, in milliseconds, allowed for a search to complete. If this time expires before the search is complete, any partial results will be returned.

The **omitHeader** Parameter

This parameter may be set to either true or false.

If set to true, this parameter excludes the header from the returned results. The header contains information about the request, such as the time it took to complete. The default value for this parameter is false.

The `wt` Parameter

The `wt` parameter selects the Response Writer that Solr should use to format the query's response. For detailed descriptions of Response Writers, see Response Writers.

The cache=false Parameter

Solr caches the results of all queries and filter queries by default. To disable result caching, set the `cache=false` parameter.

You can also use the `cost` option to control the order in which non-cached filter queries are evaluated. This allows you to order less expensive non-cached filters before expensive non-cached filters.

For very high cost filters, if `cache=false` and `cost>=100` and the query implements the `PostFilter` interface, a Collector will be requested from that query and used to filter documents after they have matched the main query and all other filter queries. There can be multiple post filters; they are also ordered by cost.

For example:

```
// normal function range query used as a filter, all matching documents
// generated up front and cached
fq={!frange l=10 u=100}mul(popularity,price)

// function range query run in parallel with the main query like a traditional
// lucene filter
fq={!frange l=10 u=100 cache=false}mul(popularity,price)

// function range query checked after each document that already matches the query
// and all other filters.  Good for really expensive function queries.
fq={!frange l=10 u=100 cache=false cost=100}mul(popularity,price)
```

The `logParamsList` Parameter

By default, Solr logs all parameters of requests. From version 4.7, set this parameter to restrict which parameters of a request are logged. This may help control logging to only those parameters considered important to your organization.

For example, you could define this like:

```
logParamsList=q,fq
```

And only the 'q' and 'fq' parameters will be logged.

If no parameters should be logged, you can send `logParamsList` as empty (i.e., `logParamsList=`).

> This parameter does not only apply to query requests, but to any kind of request to Solr.

The Standard Query Parser

Solr's default Query Parser is also known as the "`lucene`" parser.

The key advantage of the standard query parser is that it supports a robust and fairly intuitive syntax allowing you to create a variety of structured queries. The largest disadvantage is that it's very intolerant of syntax errors, as compared with something like the DisMax query parser which is designed to throw as few errors as possible.

Topics covered in this section:

- Standard Query Parser Parameters
- The Standard Query Parser's Response
- Specifying Terms for the Standard Query Parser
- Specifying Fields in a Query to the Standard Query Parser
- Boolean Operators Supported by the Standard Query Parser
- Grouping Terms to Form Sub-Queries
- Differences between Lucene Query Parser and the Solr Standard Query Parser
- Related Topics

Standard Query Parser Parameters

In addition to the Common Query Parameters, Faceting Parameters, Highlighting Parameters, and MoreLikeThis Parameters, the standard query parser supports the parameters described in the table below.

Parameter	Description
q	Defines a query using standard query syntax. This parameter is mandatory.
q.op	Specifies the default operator for query expressions, overriding the default operator specified in the `schema.xml` file. Possible values are "AND" or "OR".
df	Specifies a default field, overriding the definition of a default field in the `schema.xml` file.

Default parameter values are specified in `solrconfig.xml`, or overridden by query-time values in the request.

The Standard Query Parser's Response

By default, the response from the standard query parser contains one `<result>` block, which is unnamed. If the `debug` parameter is used, then an additional `<lst>` block will be returned, using the name "debug". This will contain useful debugging info, including the original query string, the parsed query string, and explain info for each document in the <result> block. If the `explainOther` parameter is also used, then additional explain info will be provided for all the documents matching that query.

Sample Responses

This section presents examples of responses from the standard query parser.

The URL below submits a simple query and requests the XML Response Writer to use indentation to make the XML response more readable.

```
http://localhost:8983/solr/techproducts/select?q=id:SP2514N
```

Results:

```
<?xml version="1.0" encoding="UTF-8"?>
<response>
<responseHeader><status>0</status><QTime>1</QTime></responseHeader>
<result numFound="1" start="0">
 <doc>
  <arr name="cat"><str>electronics</str><str>hard drive</str></arr>
  <arr name="features"><str>7200RPM, 8MB cache, IDE Ultra ATA-133</str>
    <str>NoiseGuard, SilentSeek technology, Fluid Dynamic Bearing (FDB)
motor</str></arr>
  <str name="id">SP2514N</str>
  <bool name="inStock">true</bool>
  <str name="manu">Samsung Electronics Co. Ltd.</str>
  <str name="name">Samsung SpinPoint P120 SP2514N - hard drive - 250 GB -
ATA-133</str>
  <int name="popularity">6</int>
  <float name="price">92.0</float>
  <str name="sku">SP2514N</str>
 </doc>
</result>
</response>
```

Here's an example of a query with a limited field list.

```
http://localhost:8983/solr/techproducts/select?q=id:SP2514N&fl=id+name
```

Results:

```
<?xml version="1.0" encoding="UTF-8"?>
<response>
<responseHeader><status>0</status><QTime>2</QTime></responseHeader>
<result numFound="1" start="0">
 <doc>
  <str name="id">SP2514N</str>
  <str name="name">Samsung SpinPoint P120 SP2514N - hard drive - 250 GB -
ATA-133</str>
 </doc>
</result>
</response>
```

Specifying Terms for the Standard Query Parser

A query to the standard query parser is broken up into terms and operators. There are two types of terms: single terms and phrases.

- A single term is a single word such as "test" or "hello"
- A phrase is a group of words surrounded by double quotes such as "hello dolly"

Multiple terms can be combined together with Boolean operators to form more complex queries (as described below).

> ⚠ It is important that the analyzer used for queries parses terms and phrases in a way that is consistent with the way the analyzer used for indexing parses terms and phrases; otherwise, searches may produce unexpected results.

Term Modifiers

Solr supports a variety of term modifiers that add flexibility or precision, as needed, to searches. These modifiers include wildcard characters, characters for making a search "fuzzy" or more general, and so on. The sections below describe these modifiers in detail.

Wildcard Searches

Solr's standard query parser supports single and multiple character wildcard searches within single terms. Wildcard characters can be applied to single terms, but not to search phrases.

Wildcard Search Type	Special Character	Example
Single character (matches a single character)	?	The search string `te?t` would match both test and text.

Multiple characters (matches zero or more sequential characters)	*	The wildcard search:
		`tes*`
		would match test, testing, and tester.
		You can also use wildcard characters in the middle of a term. For example:
		`te*t`
		would match test and text.
		`*est`
		would match pest and test.

Fuzzy Searches

Solr's standard query parser supports fuzzy searches based on the Damerau-Levenshtein Distance or Edit Distance algorithm. Fuzzy searches discover terms that are similar to a specified term without necessarily being an exact match. To perform a fuzzy search, use the tilde ~ symbol at the end of a single-word term. For example, to search for a term similar in spelling to "roam," use the fuzzy search:

```
roam~
```

This search will match terms like roams, foam, & foams. It will also match the word "roam" itself.

An optional distance parameter specifies the maximum number of edits allowed, between 0 and 2, defaulting to

2. For example:

```
roam~1
```

This will match terms like roams & foam - but not foams since it has an edit distance of "2".

> ⚠ In many cases, stemming (reducing terms to a common stem) can produce similar effects to fuzzy searches and wildcard searches.

Proximity Searches

A proximity search looks for terms that are within a specific distance from one another.

To perform a proximity search, add the tilde character ~ and a numeric value to the end of a search phrase. For example, to search for a "apache" and "jakarta" within 10 words of each other in a document, use the search:

```
"jakarta apache"~10
```

The distance referred to here is the number of term movements needed to match the specified phrase. In the example above, if "apache" and "jakarta" were 10 spaces apart in a field, but "apache" appeared before "jakarta", more than 10 term movements would be required to move the terms together and position "apache" to the right of "jakarta" with a space in between.

Range Searches

A range search specifies a range of values for a field (a range with an upper bound and a lower bound). The query matches documents whose values for the specified field or fields fall within the range. Range queries can be inclusive or exclusive of the upper and lower bounds. Sorting is done lexicographically, except on numeric fields. For example, the range query below matches all documents whose `mod_date` field has a value between 20020101 and 20030101, inclusive.

```
mod_date:[20020101 TO 20030101]
```

Range queries are not limited to date fields or even numerical fields. You could also use range queries with non-date fields:

```
title:{Aida TO Carmen}
```

This will find all documents whose titles are between Aida and Carmen, but not including Aida and Carmen.

The brackets around a query determine its inclusiveness.

- Square brackets [ ] denote an inclusive range query that matches values including the upper and lower bound.
- Curly brackets { } denote an exclusive range query that matches values between the upper and lower bounds, but excluding the upper and lower bounds themselves.
- You can mix these types so one end of the range is inclusive and the other is exclusive. Here's an example: `count:{1 TO 10]`

Boosting a Term with ^

Lucene/Solr provides the relevance level of matching documents based on the terms found. To boost a term use the caret symbol `^` with a boost factor (a number) at the end of the term you are searching. The higher the boost factor, the more relevant the term will be.

Boosting allows you to control the relevance of a document by boosting its term. For example, if you are searching for

"jakarta apache" and you want the term "jakarta" to be more relevant, you can boost it by adding the ^ symbol along with the boost factor immediately after the term. For example, you could type:

```
jakarta^4 apache
```

This will make documents with the term jakarta appear more relevant. You can also boost Phrase Terms as in the example:

```
"jakarta apache"^4 "Apache Lucene"
```

By default, the boost factor is 1. Although the boost factor must be positive, it can be less than 1 (for example, it could be 0.2).

Constant Score with **^=**

Constant score queries are created with `<query_clause>^=<score>`, which sets the entire clause to the specified score for any documents matching that clause. This is desirable when you only care about matches for a particular clause and don't want other relevancy factors such as term frequency (the number of times the term appears in the field) or inverse document frequency (a measure across the whole index for how rare a term is in a field).

Example:

```
(description:blue OR color:blue)^=1.0 text:shoes
```

Specifying Fields in a Query to the Standard Query Parser

Data indexed in Solr is organized in fields, which are defined in the Solr `schema.xml` file. Searches can take advantage of fields to add precision to queries. For example, you can search for a term only in a specific field, such as a title field.

The `schema.xml` file defines one field as a default field. If you do not specify a field in a query, Solr searches only the default field. Alternatively, you can specify a different field or a combination of fields in a query.

To specify a field, type the field name followed by a colon ":" and then the term you are searching for within the field.

For example, suppose an index contains two fields, title and text,and that text is the default field. If you want to find a document called "The Right Way" which contains the text "don't go this way," you could include either of the following terms in your search query:

```
title:"The Right Way" AND text:go
```

```
title:"Do it right" AND go
```

Since text is the default field, the field indicator is not required; hence the second query above omits it.

The field is only valid for the term that it directly precedes, so the query `title:Do it right` will find only "Do" in the title field. It will find "it" and "right" in the default field (in this case the text field).

Boolean Operators Supported by the Standard Query Parser

Boolean operators allow you to apply Boolean logic to queries, requiring the presence or absence of specific terms or conditions in fields in order to match documents. The table below summarizes the Boolean operators supported by the standard query parser.

Boolean Operator	Alternative Symbol	Description
AND	&&	Requires both terms on either side of the Boolean operator to be present for a match.
NOT	!	Requires that the following term not be present.
OR	||	Requires that either term (or both terms) be present for a match.
	+	Requires that the following term be present.
	-	Prohibits the following term (that is, matches on fields or documents that do not include that term). The `-` operator is functionally similar to the Boolean operator `!`. Because it's used by popular search engines such as Google, it may be more familiar to some user communities.

Boolean operators allow terms to be combined through logic operators. Lucene supports AND, "`+`", OR, NOT and "`-`" as Boolean operators.

⚠ When specifying Boolean operators with keywords such as AND or NOT, the keywords must appear in all uppercase.

ⓘ The standard query parser supports all the Boolean operators listed in the table above. The DisMax query parser supports only `+` and `-`.

The OR operator is the default conjunction operator. This means that if there is no Boolean operator between two terms, the OR operator is used. The OR operator links two terms and finds a matching document if either of the terms exist in a document. This is equivalent to a union using sets. The symbol || can be used in place of the word OR.

In the `schema.xml` file, you can specify which symbols can take the place of Boolean operators such as OR. To search for documents that contain either "jakarta apache" or just "jakarta," use the query:

```
"jakarta apache" jakarta
```

or

```
"jakarta apache" OR jakarta
```

The Boolean Operator +

The `+` symbol (also known as the "required" operator) requires that the term after the `+` symbol exist somewhere in a field in at least one document in order for the query to return a match.

For example, to search for documents that must contain "jakarta" and that may or may not contain "lucene," use the following query:

```
+jakarta lucene
```

This operator is supported by both the standard query parser and the DisMax query parser.

The Boolean Operator AND (`&&`)

The AND operator matches documents where both terms exist anywhere in the text of a single document. This is equivalent to an intersection using sets. The symbol `&&` can be used in place of the word AND.

To search for documents that contain "jakarta apache" and "Apache Lucene," use either of the following queries:

`"jakarta apache" AND "Apache Lucene"`

`"jakarta apache" && "Apache Lucene"`

The Boolean Operator NOT (`!`)

The NOT operator excludes documents that contain the term after NOT. This is equivalent to a difference using sets. The symbol `!` can be used in place of the word NOT.

The following queries search for documents that contain the phrase "jakarta apache" but do not contain the phrase "Apache Lucene":

`"jakarta apache" NOT "Apache Lucene"`

`"jakarta apache" ! "Apache Lucene"`

The Boolean Operator `-`

The `-` symbol or "prohibit" operator excludes documents that contain the term after the `-` symbol.

For example, to search for documents that contain "jakarta apache" but not "Apache Lucene," use the following query:

`"jakarta apache" -"Apache Lucene"`

Escaping Special Characters

Solr gives the following characters special meaning when they appear in a query:

+ - && || ! ( ) { } [ ] ^ " ~ * ? : /

To make Solr interpret any of these characters literally, rather as a special character, precede the character with a backslash character \. For example, to search for (1+1):2 without having Solr interpret the plus sign and parentheses as special characters for formulating a sub-query with two terms, escape the characters by preceding each one with a backslash:

```
\(1\+1\)\:2
```

Grouping Terms to Form Sub-Queries

Lucene/Solr supports using parentheses to group clauses to form sub-queries. This can be very useful if you want to control the Boolean logic for a query.

The query below searches for either "jakarta" or "apache" and "website":

`(jakarta OR apache) AND website`

This adds precision to the query, requiring that the term "website" exist, along with either term "jakarta" and "apache."

Grouping Clauses within a Field

To apply two or more Boolean operators to a single field in a search, group the Boolean clauses within parentheses. For example, the query below searches for a title field that contains both the word "return" and the phrase "pink panther":

`title:(+return +"pink panther")`

Differences between Lucene Query Parser and the Solr Standard Query Parser

Solr's standard query parser differs from the Lucene Query Parser in the following ways:

- A * may be used for either or both endpoints to specify an open-ended range query
    - `field:[* TO 100]` finds all field values less than or equal to 100
    - `field:[100 TO *]` finds all field values greater than or equal to 100
    - `field:[* TO *]` matches all documents with the field
- Pure negative queries (all clauses prohibited) are allowed (only as a top-level clause)
    - `-inStock:false` finds all field values where inStock is not false
    - `-field:[* TO *]` finds all documents without a value for field
- A hook into FunctionQuery syntax. You'll need to use quotes to encapsulate the function if it includes parentheses, as shown in the second example below:
    - `_val_:myfield`
    - `_val_:"recip(rord(myfield),1,2,3)"`
- Support for using any type of query parser as a nested clause.
    - `inStock:true OR {!dismax qf='name manu' v='ipod'}`
- Range queries ("[a TO z]"), prefix queries ("a*"), and wildcard queries ("a*b") are constant-scoring (all matching documents get an equal score). The scoring factors TF, IDF, index boost, and "coord" are not used. There is no limitation on the number of terms that match (as there was in past versions of Lucene).

Specifying Dates and Times

Queries against fields using the `TrieDateField` type (typically range queries) should use the appropriate date syntax:

- `timestamp:[* TO NOW]`
- `createdate:[1976-03-06T23:59:59.999Z TO *]`
- `createdate:[1995-12-31T23:59:59.999Z TO 2007-03-06T00:00:00Z]`
- `pubdate:[NOW-1YEAR/DAY TO NOW/DAY+1DAY]`
- `createdate:[1976-03-06T23:59:59.999Z TO 1976-03-06T23:59:59.999Z+1YEAR]`
- `createdate:[1976-03-06T23:59:59.999Z/YEAR TO 1976-03-06T23:59:59.999Z]`

Related Topics

- Local Parameters in Queries
- Other Parsers

The DisMax Query Parser

The DisMax query parser is designed to process simple phrases (without complex syntax) entered by users and to search for individual terms across several fields using different weighting (boosts) based on the significance of each field. Additional options enable users to influence the score based on rules specific to each use case (independent of user input).

In general, the DisMax query parser's interface is more like that of Google than the interface of the 'standard' Solr request handler. This similarity makes DisMax the appropriate query parser for many consumer applications. It accepts a simple syntax, and it rarely produces error messages.

The DisMax query parser supports an extremely simplified subset of the Lucene QueryParser syntax. As in Lucene, quotes can be used to group phrases, and +/- can be used to denote mandatory and optional clauses. All other Lucene query parser special characters (except AND and OR) are escaped to simplify the user experience. The DisMax query parser takes responsibility for building a good query from the user's input using Boolean clauses containing DisMax queries across fields and boosts specified by the user. It also lets the Solr administrator provide additional boosting queries, boosting functions, and filtering queries to artificially affect the outcome of all searches. These options can all be specified as default parameters for the handler in the `solrconfig.xml` file or overridden in the Solr query URL.

Interested in the technical concept behind the DisMax name? DisMax stands for Maximum Disjunction. Here's a definition of a Maximum Disjunction or "DisMax" query:

> *A query that generates the union of documents produced by its subqueries, and that scores each document with the maximum score for that document as produced by any subquery, plus a tie breaking increment for any additional matching subqueries.*

Whether or not you remember this explanation, do remember that the DisMax request handler was primarily designed to be easy to use and to accept almost any input without returning an error.

DisMax Parameters

In addition to the common request parameter, highlighting parameters, and simple facet parameters, the DisMax query parser supports the parameters described below. Like the standard query parser, the DisMax query parser allows default parameter values to be specified in `solrconfig.xml`, or overridden by query-time values in the request.

Parameter	Description
q	Defines the raw input strings for the query.
q.alt	Calls the standard query parser and defines query input strings, when the q parameter is not used.
qf	Query Fields: specifies the fields in the index on which to perform the query. If absent, defaults to `df`.

mm	Minimum "Should" Match: specifies a minimum number of clauses that must match in a query. If no 'mm' parameter is specified in the query, or as a default in `solrconfig.xml`, the effective value of the `q.op` parameter (either in the query, as a default in `solrconfig.xml`, or from the 'defaultOperator' option in `schema.xml`) is used to influence the behavior. If `q.op` is effectively AND'ed, then mm=100%; if `q.op` is OR'ed, then mm=1. Users who want to force the legacy behavior should set a default value for the 'mm' parameter in their `solrconfig.xml` file. Users should add this as a configured default for their request handlers. This parameter tolerates miscellaneous white spaces in expressions (e.g., `" 3 < -25% 10 < -3\n", " \n-25%\n ", " \n3\n "`).
pf	Phrase Fields: boosts the score of documents in cases where all of the terms in the q parameter appear in close proximity.
ps	Phrase Slop: specifies the number of positions two terms can be apart in order to match the specified phrase.
qs	Query Phrase Slop: specifies the number of positions two terms can be apart in order to match the specified phrase. Used specifically with the `qf` parameter.
tie	Tie Breaker: specifies a float value (which should be something much less than 1) to use as tiebreaker in DisMax queries.
bq	Boost Query: specifies a factor by which a term or phrase should be "boosted" in importance when considering a match.
bf	Boost Functions: specifies functions to be applied to boosts. (See for details about function queries.)

The sections below explain these parameters in detail.

The *q* Parameter

The `q` parameter defines the main "query" constituting the essence of the search. The parameter supports raw input strings provided by users with no special escaping. The + and - characters are treated as "mandatory" and "prohibited" modifiers for terms. Text wrapped in balanced quote characters (for example, "San Jose") is treated as a phrase. Any query containing an odd number of quote characters is evaluated as if there were no quote characters at all.

> The `q` parameter does not support wildcard characters such as *.

The *`q.alt`* Parameter

If specified, the `q.alt` parameter defines a query (which by default will be parsed using standard query parsing syntax) when the main q parameter is not specified or is blank. The `q.alt` parameter comes in handy when you need something like a query to match all documents (don't forget `&rows=0` for that one!) in order to get collection-wise faceting counts.

The *`qf`* (Query Fields) Parameter

The `qf` parameter introduces a list of fields, each of which is assigned a boost factor to increase or decrease that particular field's importance in the query. For example, the query below:

```
qf="fieldOne^2.3 fieldTwo fieldThree^0.4"
```

assigns `fieldOne` a boost of 2.3, leaves `fieldTwo` with the default boost (because no boost factor is specified), and `fieldThree` a boost of 0.4. These boost factors make matches in `fieldOne` much more significant than matches in `fieldTwo`, which in turn are much more significant than matches in `fieldThree`.

The *`mm`* (Minimum Should Match) Parameter

When processing queries, Lucene/Solr recognizes three types of clauses: mandatory, prohibited, and "optional" (also known as "should" clauses). By default, all words or phrases specified in the `q` parameter are treated as "optional" clauses unless they are preceded by a "+" or a "-". When dealing with these "optional" clauses, the `mm` parameter makes it possible to say that a certain minimum number of those clauses must match. The DisMax query parser offers great flexibility in how the minimum number can be specified.

The table below explains the various ways that mm values can be specified.

Syntax	Example	Description
Positive integer	3	Defines the minimum number of clauses that must match, regardless of how many clauses there are in total.
Negative integer	-2	Sets the minimum number of matching clauses to the total number of optional clauses, minus this value.
Percentage	75%	Sets the minimum number of matching clauses to this percentage of the total number of optional clauses. The number computed from the percentage is rounded down and used as the minimum.
Negative percentage	-25%	Indicates that this percent of the total number of optional clauses can be missing. The number computed from the percentage is rounded down, before being subtracted from the total to determine the minimum number.
An expression beginning with a positive integer followed by a > or < sign and another value	3<90%	Defines a conditional expression indicating that if the number of optional clauses is equal to (or less than) the integer, they are all required, but if it's greater than the integer, the specification applies. In this example: if there are 1 to 3 clauses they are all required, but for 4 or more clauses only 90% are required.
Multiple conditional expressions involving > or < signs	2<-25% 9<-3	Defines multiple conditions, each one being valid only for numbers greater than the one before it. In the example at left, if there are 1 or 2 clauses, then both are required. If there are 3-9 clauses all but 25% are required. If there are more then 9 clauses, all but three are required.

When specifying `mm` values, keep in mind the following:

- When dealing with percentages, negative values can be used to get different behavior in edge cases. 75% and -25% mean the same thing when dealing with 4 clauses, but when dealing with 5 clauses 75% means 3 are required, but -25% means 4 are required.
- If the calculations based on the parameter arguments determine that no optional clauses are needed, the usual rules about Boolean queries still apply at search time. (That is, a Boolean query containing no required clauses must still match at least one optional clause).
- No matter what number the calculation arrives at, Solr will never use a value greater than the number of

optional clauses, or a value less than 1. In other words, no matter how low or how high the calculated result, the minimum number of required matches will never be less than 1 or greater than the number of clauses.

- When searching across multiple fields that are configured with different query analyzers, the number of optional clauses may differ between the fields. In such a case, the value specified by mm applies to the maximum number of optional clauses. For example, if a query clause is treated as stopword for one of the fields, the number of optional clauses for that field will be smaller than for the other fields. A query with such a stopword clause would not return a match in that field if mm is set to 100% because the removed clause does not count as matched.

The default value of `mm` is 100% (meaning that all clauses must match).

The *`pf`* (Phrase Fields) Parameter

Once the list of matching documents has been identified using the `fq` and `qf` parameters, the `pf` parameter can be used to "boost" the score of documents in cases where all of the terms in the q parameter appear in close proximity.

The format is the same as that used by the `qf` parameter: a list of fields and "boosts" to associate with each of them when making phrase queries out of the entire q parameter.

The *`ps`* (Phrase Slop) Parameter

The `ps` parameter specifies the amount of "phrase slop" to apply to queries specified with the pf parameter. Phrase slop is the number of positions one token needs to be moved in relation to another token in order to match a phrase specified in a query.

The *`qs`* (Query Phrase Slop) Parameter

The `qs` parameter specifies the amount of slop permitted on phrase queries explicitly included in the user's query string with the `qf` parameter. As explained above, slop refers to the number of positions one token needs to be moved in relation to another token in order to match a phrase specified in a query.

The *`tie`* (Tie Breaker) Parameter

The `tie` parameter specifies a float value (which should be something much less than 1) to use as tiebreaker in DisMax queries.

When a term from the user's input is tested against multiple fields, more than one field may match. If so, each field will generate a different score based on how common that word is in that field (for each document relative to all other documents). The `tie` parameter lets you control how much the final score of the query will be influenced by the scores of the lower scoring fields compared to the highest scoring field.

A value of "0.0" makes the query a pure "disjunction max query": that is, only the maximum scoring subquery contributes to the final score. A value of "1.0" makes the query a pure "disjunction sum query" where it doesn't matter what the maximum scoring sub query is, because the final score will be the sum of the subquery scores. Typically a low value, such as 0.1, is useful.

The *`bq`* (Boost Query) Parameter

The `bq` parameter specifies an additional, optional, query clause that will be added to the user's main query to influence the score. For example, if you wanted to add a relevancy boost for recent documents:

```
q=cheese
bq=date:[NOW/DAY-1YEAR TO NOW/DAY]
```

You can specify multiple `bq` parameters. If you want your query to be parsed as separate clauses with separate boosts, use multiple `bq` parameters.

The `bf` (Boost Functions) Parameter

The `bf` parameter specifies functions (with optional boosts) that will be used to construct FunctionQueries which will be added to the user's main query as optional clauses that will influence the score. Any function supported natively by Solr can be used, along with a boost value. For example:

```
recip(rord(myfield),1,2,3)^1.5
```

Specifying functions with the bf parameter is essentially just shorthand for using the `bq` param combined with the `{!func}` parser.

For example, if you want to show the most recent documents first, you could use either of the following:

```
bf=recip(rord(creationDate),1,1000,1000)
  ...or...
bq={!func}recip(rord(creationDate),1,1000,1000)
```

Examples of Queries Submitted to the DisMax Query Parser

All of the sample URLs in this section assume you are running Solr's "techproducts" example:

```
bin/solr -e techproducts
```

Normal results for the word "video" using the StandardRequestHandler with the default search field:

`http://localhost:8983/solr/techproducts/select?q=video&fl=name+score`

The "dismax" handler is configured to search across the text, features, name, sku, id, manu, and cat fields all with varying boosts designed to ensure that "better" matches appear first, specifically: documents which match on the name and cat fields get higher scores.

`http://localhost:8983/solr/techproducts/select?defType=dismax&q=video`

Note that this instance is also configured with a default field list, which can be overridden in the URL.

`http://localhost:8983/solr/techproducts/select?defType=dismax&q=video&fl=*,score`

You can also override which fields are searched on and how much boost each field gets.

`http://localhost:8983/solr/techproducts/select?defType=dismax&q=video&qf=features^20.0+text^0.3`

You can boost results that have a field that matches a specific value.

`http://localhost:8983/solr/techproducts/select?defType=dismax&q=video&bq=cat:el`

```
ectronics^5.0
```

Another instance of the handler is registered using the `qt` "instock" and has slightly different configuration options, notably: a filter for (you guessed it) `inStock:true`).

```
http://localhost:8983/solr/techproducts/select?defType=dismax&q=video&fl=name,s
core,inStock
```

```
http://localhost:8983/solr/techproducts/select?defType=dismax&q=video&qt=instoc
k&fl=name,score,inStock
```

One of the other really cool features in this handler is robust support for specifying the "BooleanQuery.minimumNumberShouldMatch" you want to be used based on how many terms are in your user's query. These allows flexibility for typos and partial matches. For the dismax handler, one and two word queries require that all of the optional clauses match, but for three to five word queries one missing word is allowed.

```
http://localhost:8983/solr/techproducts/select?defType=dismax&q=belkin+ipod
```

```
http://localhost:8983/solr/techproducts/select?defType=dismax&q=belkin+ipod+gib
berish
```

```
http://localhost:8983/solr/techproducts/select?defType=dismax&q=belkin+ipod+app
le
```

Just like the StandardRequestHandler, it supports the debugQuery option to viewing the parsed query, and the score explanations for each document.

```
http://localhost:8983/solr/techproducts/select?defType=dismax&q=belkin+ipod+gib
berish&debugQuery=true
```

```
http://localhost:8983/solr/techproducts/select?defType=dismax&q=video+card&debu
gQuery=true
```

The Extended DisMax Query Parser

The Extended DisMax (eDisMax) query parser is an improved version of the DisMax query parser. In addition to supporting all the DisMax query parser parameters, Extended Dismax:

- supports the full Lucene query parser syntax.
- supports queries such as AND, OR, NOT, -, and +.
- treats "and" and "or" as "AND" and "OR" in Lucene syntax mode.
- respects the 'magic field' names `_val_` and `_query_`. These are not a real fields in `schema.xml`, but if used it helps do special things (like a function query in the case of `_val_` or a nested query in the case of `_query_`). If `_val_` is used in a term or phrase query, the value is parsed as a function.
- includes improved smart partial escaping in the case of syntax errors; fielded queries, +/-, and phrase queries are still supported in this mode.
- improves proximity boosting by using word shingles; you do not need the query to match all words in the document before proximity boosting is applied.
- includes advanced stopword handling: stopwords are not required in the mandatory part of the query but are still used in the proximity boosting part. If a query consists of all stopwords, such as "to be or not to be", then all words are required.
- includes improved boost function: in Extended DisMax, the `boost` function is a multiplier rather than an addend, improving your boost results; the additive boost functions of DisMax (`bf` and `bq`) are also supported.

- supports pure negative nested queries: queries such as `+foo (-foo)` will match all documents.
- lets you specify which fields the end user is allowed to query, and to disallow direct fielded searches.

Extended DisMax Parameters

In addition to all the DisMax parameters, Extended DisMax includes these query parameters:

The *`boost`* Parameter

A multivalued list of strings parsed as queries with scores multiplied by the score from the main query for all matching documents. This parameter is shorthand for wrapping the query produced by eDisMax using the `BoostQParserPlugin`

The *`lowercaseOperators`* Parameter

A Boolean parameter indicating if lowercase "and" and "or" should be treated the same as operators "AND" and "OR".

The *`ps`* Parameter

Default amount of slop on phrase queries built with `pf`, `pf2` and/or `pf3` fields (affects boosting).

The *`pf2`* Parameter

A multivalued list of fields with optional weights, based on pairs of word shingles.

The *`ps2`* Parameter

This is similar to `ps` but overrides the slop factor used for `pf2`. If not specified, `ps` is used.

The *`pf3`* Parameter

A multivalued list of fields with optional weights, based on triplets of word shingles. Similar to `pf`, except that instead of building a phrase per field out of all the words in the input, it builds a set of phrases for each field out of each triplet of word shingles.

The *`ps3`* Parameter

This is similar to `ps` but overrides the slop factor used for `pf3`. If not specified, `ps` is used.

The *`stopwords`* Parameter

A Boolean parameter indicating if the `StopFilterFactory` configured in the query analyzer should be respected when parsing the query: if it is false, then the `StopFilterFactory` in the query analyzer is ignored.

The *`uf`* Parameter

Specifies which schema fields the end user is allowed to explicitly query. This parameter supports wildcards. The default is to allow all fields, equivalent to `uf=*`. To allow only title field, use `uf=title`. To allow title and all fields ending with _s, use `uf=title,*_s`. To allow all fields except title, use `uf=*-title`. To disallow all fielded searches, use `uf=-*`.

Field aliasing using per-field *`qf`* overrides

Per-field overrides of the `qf` parameter may be specified to provide 1-to-many aliasing from field names specified in the query string, to field names used in the underlying query. By default, no aliasing is used and field names specified in the query string are treated as literal field names in the index.

Examples of Queries Submitted to the Extended DisMax Query Parser

All of the sample URLs in this section assume you are running Solr's "`techproducts`" example:

```
bin/solr -e techproducts
```

Boost the result of the query term "hello" based on the document's popularity:

```
http://localhost:8983/solr/techproducts/select?defType=edismax&q=hello&pf=text&qf=te
xt&boost=popularity
```

Search for iPods OR video:

```
http://localhost:8983/solr/techproducts/select?defType=edismax&q=ipod+OR+video
```

Search across multiple fields, specifying (via boosts) how important each field is relative each other:

```
http://localhost:8983/solr/techproducts/select?q=video&defType=edismax&qf=features^2
0.0+text^0.3
```

You can boost results that have a field that matches a specific value:

```
http://localhost:8983/solr/techproducts/select?q=video&defType=edismax&qf=features^2
0.0+text^0.3&bq=cat:electronics^5.0
```

Using the "mm" param, 1 and 2 word queries require that all of the optional clauses match, but for queries with three or more clauses one missing clause is allowed:

```
http://localhost:8983/solr/techproducts/select?q=belkin+ipod&defType=edismax&mm=2
http://localhost:8983/solr/techproducts/select?q=belkin+ipod+gibberish&defType=edism
ax&mm=2
http://localhost:8983/solr/techproducts/select?q=belkin+ipod+apple&defType=edismax&m
m=2
```

In the example below, we see a per-field override of the `qf` parameter being used to alias "name" in the query string to either the "`last_name`" and "`first_name`" fields:

```
defType=edismax
q=sysadmin name:Mike
qf=title text last_name first_name
f.name.qf=last_name first_name
```

Using negative boost

Negative query boosts have been supported at the "Query" object level for a long time (resulting in negative scores for matching documents). Now the QueryParsers have been updated to handle this too.

Using 'slop'

`Dismax` and `Edismax` can run queries against all query fields, and also run a query in the form of a phrase against the phrase fields. (This will work only for boosting documents, not actually for matching.) However, that phrase query can have a 'slop,' which is the distance between the terms of the query while still considering it a phrase match. For example:

```
q=foo bar
qf=field1^5 field2^10
pf=field1^50 field2^20
defType=dismax
```

With these parameters, the Dismax Query Parser generates a query that looks something like this:

```
(+(field1:foo^5 OR field2:bar^10) AND (field1:bar^5 OR field2:bar^10))
```

But it also generates another query that will only be used for boosting results:

```
field1:"foo bar"^50 OR field2:"foo bar"^20
```

Thus, any document that has the terms "foo" and "bar" will match; however if some of those documents have both of the terms as a phrase, it will score much higher because it's more relevant.

If you add the parameter `ps` (phrase slop), the second query will instead be:

```
ps=10 field1:"foo bar"~10^50 OR field2:"foo bar"~10^20
```

This means that if the terms "foo" and "bar" appear in the document with less than 10 terms between each other, the phrase will match. For example the doc that says:

```
*Foo* term1 term2 term3 *bar*
```

will match the phrase query.

How does one use phrase slop? Usually it is configured in the request handler (in `solrconfig`).

With query slop (`qs`) the concept is similar, but it applies to explicit phrase queries from the user. For example, if you want to search for a name, you could enter:

```
q="Hans Anderson"
```

A document that contains "Hans Anderson" will match, but a document that contains the middle name "Christian" or where the name is written with the last name first ("Anderson, Hans") won't. For those cases one could configure the query field `qs`, so that even if the user searches for an explicit phrase query, a slop is applied.

Finally, `edismax` contains not only a phrase fields (`pf`) parameters, but also phrase and query fields 2 and 3. You can use those fields for setting different fields or boosts. Each of those can use a different phrase slop.

Using the 'magic fields' _val_ and _query_

If the 'magic field' name `_val_` is used in a term or phrase query, the value is parsed as a function.

The Solr Query Parser's use of `_val_` and `_query_` differs from the Lucene Query Parser in the following ways:

- If the magic field name `_val_` is used in a term or phrase query, the value is parsed as a function.
- It provides a hook into `FunctionQuery` syntax. Quotes are necessary to encapsulate the function when it includes parentheses. For example:

  ```
  _val_:myfield
  _val_:"recip(rord(myfield),1,2,3)"
  ```

- The Solr Query Parser offers nested query support for any type of query parser (via QParserPlugin). Quotes are often necessary to encapsulate the nested query if it contains reserved characters. For example:

  ```
  _query_:"{!dismax qf=myfield}how now brown cow"
  ```

Although not technically a syntax difference, note that if you use the Solr `TrieDateField` type (or the deprecated `DateField` type), any queries on those fields (typically range queries) should use either the Complete ISO 8601 Date syntax that field supports, or the DateMath Syntax to get relative dates. For example:

```
timestamp:[* TO NOW]
createdate:[1976-03-06T23:59:59.999Z TO *]
createdate:[1995-12-31T23:59:59.999Z TO 2007-03-06T00:00:00Z]
pubdate:[NOW-1YEAR/DAY TO NOW/DAY+1DAY]
createdate:[1976-03-06T23:59:59.999Z TO 1976-03-06T23:59:59.999Z+1YEAR]
createdate:[1976-03-06T23:59:59.999Z/YEAR TO 1976-03-06T23:59:59.999Z]
```

⚠ TO must be uppercase, or Solr will report a 'Range Group' error.

Function Queries

Function queries enable you to generate a relevancy score using the actual value of one or more numeric fields. Function queries are supported by the DisMax, Extended DisMax, and standard query parsers.

Function queries use *functions*. The functions can be a constant (numeric or string literal), a field, another function or a parameter substitution argument. You can use these functions to modify the ranking of results for users. These could be used to change the ranking of results based on a user's location, or some other calculation.

Function query topics covered in this section:

- Using Function Query
- Available Functions
- Example Function Queries
- Sort By Function

Using Function Query

Functions must be expressed as function calls (for example, `sum(a,b)` instead of simply `a+b`).

There are several ways of using function queries in a Solr query:

- Via an explicit QParser that expects function arguments, such `func` or `frange`. For example:

  ```
  q={!func}div(popularity,price)&fq={!frange l=1000}customer_ratings
  ```

- In a Sort expression. For example:

  ```
  sort=div(popularity,price) desc, score desc
  ```

- Add the results of functions as psuedo-fields to documents in query results. For instance, for:

  ```
  &fl=sum(x, y),id,a,b,c,score
  ```

  the output would be:

  ```
  ...
  <str name="id">foo</str>
  <float name="sum(x,y)">40</float>
  <float name="score">0.343</float>
  ...
  ```

- Use in a parameter that is explicitly for specifying functions, such as the EDisMax query parser's `boost` param, or DisMax query parser's `bf` (boost function) parameter. (Note that the `bf` parameter actually takes a list of function queries separated by white space and each with an optional boost. Make sure you eliminate any internal white space in single function queries when using `bf`). For example:

  ```
  q=dismax&bf="ord(popularity)^0.5 recip(rord(price),1,1000,1000)^0.3"
  ```

- Introduce a function query inline in the lucene QParser with the `_val_` keyword. For example:

  ```
  q=_val_:mynumericfield _val_:"recip(rord(myfield),1,2,3)"
  ```

Only functions with fast random access are recommended.

Available Functions

The table below summarizes the functions available for function queries.

Function	Description	Syntax Examples

abs	Returns the absolute value of the specified value or function.	`abs(x)`
		`abs(-5)`

and	Returns a value of true if and only if all of its operands evaluate to true.	`and(not(exists(popularity)),exists(price)):` returns `true` for any document which has a value in the `price` field, but does not have a value in the `popularity` field
"constant"	Specifies a floating point constant.	`1.5`
def	`def` is short for default. Returns the value of field "field", or if the field does not exist, returns the default value specified. and yields the first value where `exists()==true`.)	`def(rating,5):` This `def()` function returns the rating, or if no rating specified in the doc, returns 5 `def(myfield, 1.0):` equivalent to `if(exists(myfield),myfield,1.0)`

div	Divides one value or function by another. div(x,y) divides x by y.	`div(1,y)`
		`div(sum(x,100),max(y,1))`

dist	Return the distance between two vectors (points) in an n-dimensional space. Takes in the power, plus two or more ValueSource instances and calculates the distances between the two vectors. Each ValueSource must be a number. There must be an even number of ValueSource instances passed in and the method assumes that the first half represent the first vector and the second half represent the second vector.	`dist(2, x, y, 0, 0):` calculates the Euclidean distance between (0,0) and (x,y) for each document `dist(1, x, y, 0, 0)`: calculates the Manhattan (taxicab) distance between (0,0) and (x,y) for each document `dist(2, x,y,z,0,0,0):` Euclidean distance between (0,0,0) and (x,y,z) for each document. `dist(1,x,y,z,e,f,g)`: Euclidean distance between (x,y,z) and (e,f,g) where each letter is a field name

docfreq(field,val)	Returns the number of documents that contain the term in the field. This is a constant (the same value for all documents in the index).
	
	You can quote the term if it's more complex, or do parameter substitution for the term value.
		`docfreq(text,'solr')`
		
		`...&defType=func`
		`&q=docfreq(text,$myterm)`
		`&myterm=solr`

exists	Returns TRUE if any member of the field exists.	`exists(author)` returns TRUE for any document has a value in the "author" field. `exists(query(price:5.00))` returns TRUE if "price" matches "5.00".

field	Returns the numeric field value of an indexed (not multi-valued) field with a maximum of one value per document. The `field()` function can be called using the name of the field as a string, or for most conventional field names simply use the field name by itself.
	0 is returned for documents without a value in the field.
		`myFloatFieldName`
		`field("my complex float fieldName")`

hsin	The Haversine distance calculates the distance between two points on a sphere when traveling along the sphere. The values must be in radians. `hsin` also take a Boolean argument to specify whether the function should convert its output to radians.	`hsin(2, true, x, y, 0, 0)`
idf	Inverse document frequency; a measure of whether the term is common or rare across all documents. Obtained by dividing the total number of documents by the number of documents containing the term, and then taking the logarithm of that quotient. See also `tf`.	`idf(fieldName,'solr')`: measures the inverse of the frequency of the occurrence of the term `'solr'` in `fieldName`.
if	Enables conditional function queries. In `if(test,value1,value2)`: • `test` is or refers to a logical value or expression that returns a logical value (TRUE or FALSE). • `value1` is the value that is returned by the function if `test` yields TRUE. • `value2` is the value that is returned by the function if `test` yields FALSE. An expression can be any function which outputs boolean values, or even functions returning numeric values, in which case value 0 will be interpreted as false, or strings, in which case empty string is interpreted as false.	`if(termfreq(cat,'electronics'),popularity,42)` : This function checks each document for the to see if it contains the term "`electronics`" in the `cat` field. If it does, then the value of the `popularity` field is returned, otherwise the value of `42` is returned.

linear	Implements `m*x+c` where `m` and `c` are constants and `x` is an arbitrary function. This is equivalent to `sum(product(m,x),c)`, but slightly more efficient as it is implemented as a single function.	`linear(x,m,c)`
		`linear(x,2,4)` returns `2*x+4`

log	Returns the log base 10 of the specified function.	`log(x)`
		`log(sum(x,100))`

map	Maps any values of an input function x that fall within min and max inclusive to the specified target. The arguments min and max must be constants. The arguments `target` and `default` can be constants or functions. If the value of x does not fall between min and max, then either the value of x is returned, or a default value is returned if specified as a 5th argument.	`map(x,min,max,target)`
		`map(x,0,0,1)` - changes any values of 0 to 1. This can be useful in handling default 0 values.
		`map(x,min,max,target,default)`
		`map(x,0,100,1,-1)` - changes any values between `0` and `100` to `1`, and all other values to `-1`.
		`map(x,0,100,sum(x,599),docfreq(text,solr))` - changes any values between `0` and `100` to x+599, and all other values to frequency of the term 'solr' in the field text.

max	Returns the max of another function and a constant, which are specified as arguments: `max(x,c)`. The max function is useful for "bottoming out" another function at some constant.	`max(myfield,0)`
maxdoc	Returns the number of documents in the index, including those that are marked as deleted but have not yet been purged. This is a constant (the same value for all documents in the index).	`maxdoc()`

ms	Returns milliseconds of difference between its arguments. Dates are relative to the Unix or POSIX time epoch, midnight, January 1, 1970 UTC. Arguments may be the name of an indexed `TrieDateField`, or date math based on a constant date or `NOW` .
	• `ms()`: Equivalent to `ms(NOW)`, number of milliseconds since the epoch.
	• `ms(a):` Returns the number of milliseconds since the epoch that the argument represents.
	• `ms(a,b)` : Returns the number of milliseconds that b occurs before a (that is, a - b)
		`ms(NOW/DAY)`
		`ms(2000-01-01T00:00:00Z)`
		`ms(mydatefield)`
		`ms(NOW,mydatefield)`
		`ms(mydatefield,2000-01-01T00:00:00Z)`
		`ms(datefield1,datefield2)`

norm(*field*)	Returns the "norm" stored in the index for the specified field. This is the product of the index time boost and the length normalization factor, according to the Similarity for the field.	`norm(fieldName)`
not	The logically negated value of the wrapped function.	`not(exists(author))`: TRUE only when `exists(author)` is false.
numdocs	Returns the number of documents in the index, not including those that are marked as deleted but have not yet been purged. This is a constant (the same value for all documents in the index).	`numdocs()`
or	A logical disjunction.	`or(value1,value2):` TRUE if either `value1` or `value2` is true.
ord	Returns the ordinal of the indexed field value within the indexed list of terms for that field in Lucene index order (lexicographically ordered by unicode value), starting at 1. In other words, for a given field, all values are ordered lexicographically; this function then returns the offset of a particular value in that ordering. The field must have a maximum of one value per document (not multi-valued). 0 is returned for documents without a value in the field. ⚠ `ord()` depends on the position in an index and can change when other documents are inserted or deleted. See also `rord` below.	`ord(myIndexedField)` Example: If there were only three values ("apple","banana","pear") for a particular field X, then: `ord(X)` would be 1 for documents containing "apple", 2 for documnts containing "banana", etc...

pow	Raises the specified base to the specified power. `pow(x,y)` raises x to the power of y.	`pow(x,y)`
		`pow(x,log(y))`
		`pow(x,0.5):` the same as `sqrt`

product	Returns the product of multiple values or functions, which are specified in a comma-separated list. `mul(...)` may also be used as an alias for this function.	`product(x,y,...)`
		`product(x,2)`
		`product(x,y)`
		`mul(x,y)`

query	Returns the score for the given subquery, or the default value for documents not matching the query. Any type of subquery is supported through either parameter de-referencing `$otherparam` or direct specification of the query string in the Local Parameters through the `v` key.	`query(subquery, default)` `q=product(popularity, query({!dismax v='solr rocks'})`: returns the product of the popularity and the score of the DisMax query. `q=product(popularity, query($qq))&qq={!dismax}solr rocks`: equivalent to the previous query, using parameter de-referencing. `q=product(popularity, query($qq,0.1))&qq={!dismax}solr rocks`: specifies a default score of 0.1 for documents that don't match the DisMax query.

recip	Performs a reciprocal function with `recip(x,m,a,b)` implementing `a/(m*x+b)` where `m,a,b` are constants, and `x` is any arbitrarily complex function.
	When a and b are equal, and x>=0, this function has a maximum value of 1 that drops as x increases. Increasing the value of a and b together results in a movement of the entire function to a flatter part of the curve. These properties can make this an ideal function for boosting more recent documents when x is `rord(datefield)`.
		`recip(myfield,m,a,b)`
		`recip(rord(creationDate),1,1000,1000)`

rord	Returns the reverse ordering of that returned by `ord`.	`rord(myDateField)`

scale	Scales values of the function x such that they fall between the specified `minTarget` and `maxTarget` inclusive. The current implementation traverses all of the function values to obtain the min and max, so it can pick the correct scale. The current implementation cannot distinguish when documents have been deleted or documents that have no value. It uses 0.0 values for these cases. This means that if values are normally all greater than 0.0, one can still end up with 0.0 as the min value to map from. In these cases, an appropriate map() function could be used as a workaround to change 0.0 to a value in the real range, as shown here: scale(map(x,0,0,5),1,2)	`scale(x,minTarget,maxTarget)` `scale(x,1,2)`: scales the values of x such that all values will be between 1 and 2 inclusive.
sqedist	The Square Euclidean distance calculates the 2-norm (Euclidean distance) but does not take the square root, thus saving a fairly expensive operation. It is often the case that applications that care about Euclidean distance do not need the actual distance, but instead can use the square of the distance. There must be an even number of ValueSource instances passed in and the method assumes that the first half represent the first vector and the second half represent the second vector.	`sqedist(x_td, y_td, 0, 0)`
sqrt	Returns the square root of the specified value or function.	`sqrt(x)sqrt(100)sqrt(sum(x,100))`

strdist	Calculate the distance between two strings. Uses the Lucene spell checker `StringDistance` interface and supports all of the implementations available in that package, plus allows applications to plug in their own via Solr's resource loading capabilities. `strdist` takes (string1, string2, distance measure). Possible values for distance measure are: jw: Jaro-Winkler edit: Levenstein or Edit distance ngram: The NGramDistance, if specified, can optionally pass in the ngram size too. Default is 2. FQN: Fully Qualified class Name for an implementation of the StringDistance interface. Must have a no-arg constructor.	`strdist("SOLR",id,edit)`

sub	Returns x-y from sub(x,y).	`sub(myfield,myfield2)`
		`sub(100,sqrt(myfield))`

sum	Returns the sum of multiple values or functions, which are specified in a comma-separated list. `add(...)` may be used as an alias for this function	`sum(x,y,...) sum(x,1)`
		`sum(x,y)`
		`sum(sqrt(x),log(y),z,0.5)`
		`add(x,y)`

sumtotaltermfreq	Returns the sum of `totaltermfreq` values for all terms in the field in the entire index (i.e., the number of indexed tokens for that field). (Aliases `sumtotaltermfreq` to `sttf`.)	If doc1:(fieldX:A B C) and doc2:(fieldX:A A A A): `docFreq(fieldX:A)` = 2 (A appears in 2 docs) `freq(doc1, fieldX:A)` = 4 (A appears 4 times in doc 2) `totalTermFreq(fieldX:A)` = 5 (A appears 5 times across all docs) `sumTotalTermFreq(fieldX)` = 7 in `fieldX`, there are 5 As, 1 B, 1 C
termfreq	Returns the number of times the term appears in the field for that document.	`termfreq(text,'memory')`

tf	Term frequency; returns the term frequency factor for the given term, using the Similarity for the field. The `tf-idf` value increases proportionally to the number of times a word appears in the document, but is offset by the frequency of the word in the document, which helps to control for the fact that some words are generally more common than others. See also `idf`.	`tf(text,'solr')`
top	Causes the function query argument to derive its values from the top-level IndexReader containing all parts of an index. For example, the ordinal of a value in a single segment will be different from the ordinal of that same value in the complete index. The `ord()` and `rord()` functions implicitly use `top()`, and hence `ord(foo)` is equivalent to `top(ord(foo))`.	
totaltermfreq	Returns the number of times the term appears in the field in the entire index. (Aliases `totaltermfreq` to `ttf`.)	`ttf(text,'memory')`
xor()	Logical exclusive disjunction, or one or the other but not both.	`xor(field1,field2)` returns TRUE if either `field1` or `field2` is true; FALSE if both are true.

Example Function Queries

To give you a better understanding of how function queries can be used in Solr, suppose an index stores the dimensions in meters x,y,z of some hypothetical boxes with arbitrary names stored in field `boxname`. Suppose we want to search for box matching name `findbox` but ranked according to volumes of boxes. The query parameters would be:

`q=boxname:findbox _val_:"product(x,y,z)"`

This query will rank the results based on volumes. In order to get the computed volume, you will need to request the `score`, which will contain the resultant volume:

`&fl=*, score`

Suppose that you also have a field storing the weight of the box as `weight`. To sort by the density of the box and return the value of the density in score, you would submit the following query:

```
http://localhost:8983/solr/collection_name/select?q=boxname:findbox
_val_:"div(weight,product(x,y,z))"&fl=boxname x y z weight score
```

Sort By Function

You can sort your query results by the output of a function. For example, to sort results by distance, you could enter:

```
http://localhost:8983/solr/collection_name/select?q=*:*&sort=dist(2, point1, point2)
desc
```

Sort by function also supports pseudo-fields: fields can be generated dynamically and return results as though it was normal field in the index. For example,

`&fl=id,sum(x, y),score`

would return:

```
<str name="id">foo</str>
<float name="sum(x,y)">40</float>
<float name="score">0.343</float>
```

Related Topics

- FunctionQuery

Local Parameters in Queries

Local parameters are arguments in a Solr request that are specific to a query parameter. Local parameters provide a way to add meta-data to certain argument types such as query strings. (In Solr documentation, local parameters are sometimes referred to as LocalParams.)

Local parameters are specified as prefixes to arguments. Take the following query argument, for example:

`q=solr rocks`

We can prefix this query string with local parameters to provide more information to the Standard Query Parser. For example, we can change the default operator type to "AND" and the default field to "title":

`q={!q.op=AND df=title}solr rocks`

These local parameters would change the query to require a match on both "solr" and "rocks" while searching the "title" field by default.

Basic Syntax of Local Parameters

To specify a local parameter, insert the following before the argument to be modified:

- Begin with {!
- Insert any number of key=value pairs separated by white space
- End with } and immediately follow with the query argument

You may specify only one local parameters prefix per argument. Values in the key-value pairs may be quoted via single or double quotes, and backslash escaping works within quoted strings.

Query Type Short Form

If a local parameter value appears without a name, it is given the implicit name of "type". This allows short-form representation for the type of query parser to use when parsing a query string. Thus

```
q={!dismax qf=myfield}solr rocks
```

is equivalent to:

```
q={!type=dismax qf=myfield}solr rocks
```

If no "type" is specified (either explicitly or implicitly) then the lucene parser is used by default. Thus

```
fq={!df=summary}solr rocks
```

is equivilent to:

```
fq={!type=lucene df=summary}solr rocks
```

Specifying the Parameter Value with the '**v**' Key

A special key of `v` within local parameters is an alternate way to specify the value of that parameter.

```
q={!dismax qf=myfield}solr rocks
```

is equivalent to

```
q={!type=dismax qf=myfield v='solr rocks'}
```

Parameter Dereferencing

Parameter dereferencing or indirection lets you use the value of another argument rather than specifying it directly. This can be used to simplify queries, decouple user input from query parameters, or decouple front-end GUI parameters from defaults set in `solrconfig.xml`.

```
q={!dismax qf=myfield}solr rocks
```

```
is equivalent to:
```

```
q={!type=dismax qf=myfield v=$qq}&qq=solr rocks
```

Other Parsers

In addition to the main query parsers discussed earlier, there are several other query parsers that can be used instead of or in conjunction with the main parsers for specific purposes. This section details the other parsers, and gives examples for how they might be used.

Many of these parsers are expressed the same way as Local Parameters in Queries.

Query parsers discussed in this section:

- Block Join Query Parsers
- Boost Query Parser
- Collapsing Query Parser
- Complex Phrase Query Parser
- Field Query Parser
- Function Query Parser
- Function Range Query Parser
- Join Query Parser
- Lucene Query Parser
- Max Score Query Parser

- More Like This Query Parser
- Nested Query Parser
- Old Lucene Query Parser
- Prefix Query Parser
- Raw Query Parser
- Re-Ranking Query Parser
- Simple Query Parser
- Spatial Filter Query Parser
- Surround Query Parser
- Switch Query Parser
- Term Query Parser
- Terms Query Parser

Block Join Query Parsers

There are two query parsers that support block joins. These parsers allow indexing and searching for relational content that has been indexed as nested documents.

The example usage of the query parsers below assumes these two documents and each of their child documents have been indexed:

```
<add>
  <doc>
  <field name="id">1</field>
  <field name="title">Solr has block join support</field>
  <field name="content_type">parentDocument</field>
    <doc>
     <field name="id">2</field>
     <field name="comments">SolrCloud supports it too!</field>
    </doc>
  </doc>
  <doc>
    <field name="id">3</field>
    <field name="title">New Lucene and Solr release</field>
    <field name="content_type">parentDocument</field>
    <doc>
     <field name="id">4</field>
     <field name="comments">Lots of new features</field>
    </doc>
  </doc>
</add>
```

Block Join Children Query Parser

This parser takes a query that matches some parent documents and returns their children. The syntax for this parser is: `q={!child of=<allParents>}<someParents>`. The parameter `allParents` is a filter that matches only parent documents; here you would define the field and value that you used to identify a document as a parent. The parameter `someParents` identifies a query that will match some or all of the parent documents. The output is the children.

Using the example documents above, we can construct a query such as `q={!child of="content_type:parentDocument"}title:lucene`. We only get one document in response:

```
<result name="response" numFound="1" start="0">
   <doc>
      <str name="id">4</str>
      <str name="comments">Lots of new features</str>
   </doc>
</result>
```

Block Join Parent Query Parser

This parser takes a query that matches child documents and returns their parents. The syntax for this parser is similar: `q={!parent which=<allParents>}<someChildren>`. Again the parameter The parameter `allParents` is a filter that matches only parent documents; here you would define the field and value that you used to identify a document as a parent. The parameter `someChildren` is a query that matches some or all of the child documents. Note that the query for `someChildren` should match only child documents or you may get an exception.

Again using the example documents above, we can construct a query such as `q={!parent which="content_type:parentDocument"}comments:SolrCloud`. We get this document in response:

```
<result name="response" numFound="1" start="0">
   <doc>
      <str name="id">1</str>
      <arr name="title"><str>Solr has block join support</str></arr>
      <arr name="content_type"><str>parentDocument</str></arr>
   </doc>
</result>
```

Boost Query Parser

`BoostQParser` extends the `QParserPlugin` and creates a boosted query from the input value. The main value is the query to be boosted. Parameter `b` is the function query to use as the boost. The query to be boosted may be of any type.

Examples:

Creates a query "foo" which is boosted (scores are multiplied) by the function query `log(popularity)`:

```
{!boost b=log(popularity)}foo
```

Creates a query "foo" which is boosted by the date boosting function referenced in `ReciprocalFloatFunction`:

```
{!boost b=recip(ms(NOW,mydatefield),3.16e-11,1,1)}foo
```

Collapsing Query Parser

The `CollapsingQParser` is really a *post filter* that provides more performant field collapsing than Solr's standard approach when the number of distinct groups in the result set is high. This parser collapses the result set to a single document per group before it forwards the result set to the rest of the search components. So all downstream components (faceting, highlighting, etc...) will work with the collapsed result set.

Details about using the `CollapsingQParser` can be found in the section Collapse and Expand Results.

Complex Phrase Query Parser

The `ComplexPhraseQParser` provides support for wildcards, ORs, etc., inside phrase queries using Lucene's `ComplexPhraseQueryParser` . Under the covers, this query parser makes use of the Span group of queries, e.g., spanNear, spanOr, etc., and is subject to the same limitations as that family or parsers.

Parameter	Description
`inOrder`	Set to true to force phrase queries to match terms in the order specified. Default: **true**
`df`	The default search field.

Examples:

```
{!complexphrase inOrder=true}name:"Jo* Smith"
```

```
{!complexphrase inOrder=false}name:"(john jon jonathan~) peters*"
```

A mix of ordered and unordered complex phrase queries:

```
+_query_:"{!complexphrase inOrder=true}manu:\"a* c*\"" +_query_:"{!complexphrase
inOrder=false df=name}\"bla* pla*\""
```

Limitations

Performance is sensitive to the number of unique terms that are associated with a pattern. For instance, searching for "a*" will form a large OR clause (technically a SpanOr with many terms) for all of the terms in your index for the indicated field that start with the single letter 'a'. It may be prudent to restrict wildcards to at least two or preferably three letters as a prefix. Allowing very short prefixes may result in to many low-quality documents being returned.

MaxBooleanClauses

You may need to increase MaxBooleanClauses in `solrconfig.xml` as a result of the term expansion above:

```
<maxBooleanClauses>4096</maxBooleanClauses>
```

This property is described in more detail in the section Query Sizing and Warming.

Stopwords

It is recommended not to use stopword elimination with this query parser. Lets say we add **the**, **up**, **to** to `stopwords.txt` for your collection, and index a document containing the text *"Stores up to 15,000 songs, 25,00 photos, or 150 yours of video"* in a field named "features".

While the query below does not use this parser:

```
q=features:"Stores up to 15,000"
```

the document is returned. The next query that *does* use the Complex Phrase Query Parser, as in this query:

```
q=features:"sto* up to 15*"&defType=complexphrase
```

does *not* return that document because SpanNearQuery has no good way to handle stopwords in a way analogous to PhraseQuery. If you must remove stopwords for your use case, use a custom filter factory or perhaps a customized synonyms filter that reduces given stopwords to some impossible token.

Field Query Parser

The `FieldQParser` extends the `QParserPlugin` and creates a field query from the input value, applying text analysis and constructing a phrase query if appropriate. The parameter `f` is the field to be queried.

Example:

```
{!field f=myfield}Foo Bar
```

This example creates a phrase query with "foo" followed by "bar" (assuming the analyzer for `myfield` is a text field with an analyzer that splits on whitespace and lowercase terms). This is generally equivalent to the Lucene query parser expression `myfield:"Foo Bar"`.

Function Query Parser

The `FunctionQParser` extends the `QParserPlugin` and creates a function query from the input value. This is only one way to use function queries in Solr; for another, more integrated, approach, see the section on Function Queries.

Example:

```
{!func}log(foo)
```

Function Range Query Parser

The `FunctionRangeQParser` extends the `QParserPlugin` and creates a range query over a function. This is also referred to as `frange`, as seen in the examples below.

Other parameters:

Parameter	Description
l	The lower bound, optional
u	The upper bound, optional
incl	Include the lower bound: true/false, optional, default=true
incu	Include the upper bound: true/false, optional, default=true

Examples:

```
{!frange l=1000 u=50000}myfield
```

```
fq={!frange l=0 u=2.2} sum(user_ranking,editor_ranking)
```

Both of these examples are restricting the results by a range of values found in a declared field or a function query. In the second example, we're doing a sum calculation, and then defining only values between 0 and 2.2 should be returned to the user.

For more information about range queries over functions, see Yonik Seeley's introductory blog post Ranges over Functions in Solr 1.4, hosted at SearchHub.org.

Join Query Parser

`JoinQParser` extends the `QParserPlugin`. It allows normalizing relationships between documents with a join operation. This is different from the concept of a join in a relational database because no information is being truly joined. An appropriate SQL analogy would be an "inner query".

Examples:

Find all products containing the word "ipod", join them against manufacturer docs and return the list of manufacturers:

```
{!join from=manu_id_s to=id}ipod
```

Find all manufacturer docs named "belkin", join them against product docs, and filter the list to only products with a price less than $12:

```
q  = {!join from=id to=manu_id_s}compName_s:Belkin
fq = price:[* TO 12]
```

Joining Across Collections

You can also specify a `fromIndex` parameter to join with a field from another core or collection. If running in SolrCloud mode, then the collection specified in the `fromIndex` parameter must have a single shard and a replica on all Solr nodes where the collection you're joining to has a replica.

Let's consider an example where you want to use a Solr join query to filter movies by directors that have won an Oscar. Specifically, imagine we have two collections with the following fields:

movies: id, title, director_id, ...

movie_directors: id, name, has_oscar, ...

To filter movies by directors that have won an Oscar using a Solr join on the **movie_directors** collection, you can send the following filter query to the **movies** collection:

```
fq={!join from=id fromIndex=movie_directors to=director_id}has_oscar:true
```

Notice that the query criteria of the filter (`has_oscar:true`) is based on a field in the collection specified using `fromIndex`. Keep in mind that you cannot return fields from the `fromIndex` collection using join queries, you can only use the fields for filtering results in the "to" collection (movies).

Next, let's understand how these collections need to be deployed in your cluster. Imagine the **movies** collection is deployed to a four node SolrCloud cluster and has two shards with a replication factor of two. Specifically, the **movies** collection has replicas on the following four nodes:

node 1: movies_shard1_replica1

node 2: movies_shard1_replica2

node 3: movies_shard2_replica1

node 4: movies_shard2_replica2

To use the **movie_directors** collection in Solr join queries with the **movies** collection, it needs to have a replica on each of the four nodes. In other words, **movie_directors** must have one shard and replication factor of four:

node 1: movie_directors_shard1_replica1

node 2: movie_directors_shard1_replica2

node 3: movie_directors_shard1_replica3

node 4: movie_directors_shard1_replica4

At query time, the `JoinQParser` will access the local replica of the **movie_directors** collection to perform the join. If a local replica is not available or active, then the query will fail. At this point, it should be clear that since you're limited to a single shard and the data must be replicated across all nodes where it is needed, this approach works better with smaller data sets where there is a one-to-many relationship between the from collection and the to collection. Moreover, if you add a replica to the to collection, then you also need to add a replica for the from collection.

For more information about join queries, see the Solr Wiki page on Joins. Erick Erickson has also written a blog post about join performance called Solr and Joins, hosted by SearchHub.org.

Lucene Query Parser

The `LuceneQParser` extends the `QParserPlugin` by parsing Solr's variant on the Lucene QueryParser syntax. This is effectively the same query parser that is used in Lucene. It uses the operators `q.op`, the default operator ("OR" or "AND") and `df`, the default field name.

Example:

```
{!lucene q.op=AND df=text}myfield:foo +bar -baz
```

For more information about the syntax for the Lucene Query Parser, see the Classic QueryParser javadocs.

Max Score Query Parser

The `MaxScoreQParser` extends the `LuceneQParser` but returns the Max score from the clauses. It does this by wrapping all `SHOULD` clauses in a `DisjunctionMaxQuery` with tie=1.0. Any `MUST` or `PROHIBITED` clauses are passed through as-is. Non-boolean queries, e.g. NumericRange falls-through to the `LuceneQParser` parser behavior.

Example:

```
{!maxscore tie=0.01}C OR (D AND E)
```

More Like This Query Parser

`MLTQParser` enables retrieving documents that are similar to a given document. It uses Lucene's existing `More LikeThis` logic and also works in SolrCloud mode. The document identifier used here is the unique id value and not the Lucene internal document id.

This query parser takes the following parameters:

Parameter	Description
qf	Specifies the fields to use for similarity.
mintf	Specifies the Minimum Term Frequency, the frequency below which terms will be ignored in the source document.
mindf	Specifies the Minimum Document Frequency, the frequency at which words will be ignored which do not occur in at least this many documents.
minwl	Sets the minimum word length below which words will be ignored.
maxwl	Sets the maximum word length above which words will be ignored.

Examples:

Find documents like the document with id=1 and using the `name` field for similarity.

```
{!mlt qf=name}1
```

Adding more constraints to what qualifies as similar using mintf and mindf.

```
{!mlt qf=name mintf=2 mindf=3}1
```

Nested Query Parser

The `NestedParser` extends the `QParserPlugin` and creates a nested query, with the ability for that query to redefine its type via local parameters. This is useful in specifying defaults in configuration and letting clients indirectly reference them.

Example:

```
{!query defType=func v=$q1}
```

If the `q1` parameter is price, then the query would be a function query on the price field. If the `q1` parameter is {!lucene}inStock:true}} then a term query is created from the Lucene syntax string that matches documents with `inStock=true`. These parameters would be defined in `solrconfig.xml`, in the `defaults` section:

```
<lst name="defaults"
   <str name="q1">{!lucene}inStock:true</str>
</lst>
```

For more information about the possibilities of nested queries, see Yonik Seeley's blog post Nested Queries in Solr, hosted by SearchHub.org.

Old Lucene Query Parser

`OldLuceneQParser` extends the `QParserPlugin` by parsing Solr's variant of Lucene's QueryParser syntax, including the deprecated sort specification after the query.

Example:

```
{!lucenePlusSort} myfield:foo +bar -baz;price asc
```

Prefix Query Parser

`PrefixQParser` extends the `QParserPlugin` by creating a prefix query from the input value. Currently no analysis or value transformation is done to create this prefix query. The parameter is `f`, the field. The string after the prefix declaration is treated as a wildcard query.

Example:

```
{!prefix f=myfield}foo
```

This would be generally equivalent to the Lucene query parser expression `myfield:foo*`.

Raw Query Parser

`RawQParser` extends the `QParserPlugin` by creating a term query from the input value without any text analysis or transformation. This is useful in debugging, or when raw terms are returned from the terms component (this is not the default). The only parameter is `f`, which defines the field to search.

Example:

```
{!raw f=myfield}Foo Bar
```

This example constructs the query: `TermQuery(Term("myfield","Foo Bar"))`.

For easy filter construction to drill down in faceting, the TermQParserPlugin is recommended. For full analysis on all fields, including text fields, you may want to use the FieldQParserPlugin.

Re-Ranking Query Parser

The `ReRankQParserPlugin` is a special purpose parser for Re-Ranking the top result of a simple query using a more complex ranking query.

Details about using the `ReRankQParserPlugin` can be found in the Other Parsers section.

Simple Query Parser

The Simple query parser in Solr is based on Lucene's SimpleQueryParser. This query parser is designed to allow users to enter queries however they want, and it will do its best to interpret the query and return results.

This parser takes the following parameters:

<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>q.operators</td><td>Enables specific operations for parsing. By default, all operations are enabled, and this can be used to disable specific operations as needed. Passing an empty string with this parameter disables all operations.
<table>
<tr><th>Operator</th><th>Description</th><th>Example</th></tr>
<tr><td>+</td><td>Specifies AND</td><td><code>token1+token2</code></td></tr>
<tr><td>|</td><td>Specifies OR</td><td><code>token1|token2</code></td></tr>
<tr><td>-</td><td>Specifies NOT</td><td><code>-token3</code></td></tr>
<tr><td>"</td><td>Creates a phrase</td><td><code>"term1 term2"</code></td></tr>
<tr><td>*</td><td>Specifies a prefix query</td><td><code>term*</code></td></tr>
<tr><td>~N</td><td>At the end of terms, specifies a fuzzy query</td><td><code>term~1</code></td></tr>
<tr><td>~N</td><td>At the end of phrases, specifies a NEAR query</td><td><code>"term1 term2"~5</code></td></tr>
<tr><td>()</td><td>Specifies precedence; tokens inside the parenthesis will be analyzed first. Otherwise, normal order is left to right.</td><td><code>token1 + (token2 | token3)</code></td></tr>
</table>
If needed, operators can be escaped with the <code>\</code> character.</td></tr>
<tr><td>q.op</td><td>Defines an operator to use by default if none are defined by the user. By default, OR is defined; an alternative option is AND.</td></tr>
<tr><td>qf</td><td>A list of query fields and boosts to use when building the query.</td></tr>
<tr><td>df</td><td>Defines the default field if none is defined in <code>schema.xml</code>, or overrides the default field if it is already defined.</td></tr>
</table>

Any errors in syntax are ignored and the query parser will interpret as best it can. This can mean, however, odd results in some cases.

Spatial Filter Query Parser

`SpatialFilterQParser` extends the `QParserPlugin` by creating a spatial Filter based on the type of spatial point used. The field must implement SpatialQueryable. All units are in Kilometers.

This query parser takes the following parameters:

Parameter	Description
sfield	The field on which to filter. Required.

pt	The point to use as a reference. Must match the dimension of the field. Required.
d	The distance in km. Required.

The distance measure used currently depends on the FieldType. `LatLonType` defaults to using haversine, `PointType` defaults to Euclidean (2-norm).

This example shows the syntax:

```
{!geofilt sfield=<location_field> pt=<lat,lon> d=<distance>}
```

Here are some examples with values configured:

```
fq={!geofilt sfield=store pt=10.312,-20.556 d=3.5}
```

```
fq={!geofilt sfield=store}&pt=10.312,-20&d=3.5
```

```
fq={!geofilt}&sfield=store&pt=10.312,-20&d=3.5
```

If using `geofilt` with `LatLonType`, it is capable of producing scores equal to the computed distance from the point to the field, making it useful as a component of the main query or a boosting query.

There is more information about spatial searches available in the section Spatial Search.

Surround Query Parser

`SurroundQParser` extends the `QParserPlugin`. This provides support for the Surround query syntax, which provides proximity search functionality. There are two operators: `w` creates an ordered span query and `n` creates an unordered one. Both operators take a numeric value to indicate distance between two terms. The default is 1, and the maximum is 99. Note that the query string is not analyzed in any way.

Example:

```
{!surround} 3w(foo, bar)
```

This example would find documents where the terms "foo" and "bar" were no more than 3 terms away from each other (i.e., no more than 2 terms between them).

This query parser will also accept boolean operators (AND, OR, and NOT, in either upper- or lowercase), wildcards, quoting for phrase searches, and boosting. The `w` and `n` operators can also be expressed in upper- or lowercase.

More information about Surround queries can be found at http://wiki.apache.org/solr/SurroundQueryParser.

Switch Query Parser

`SwitchQParser` is a `QParserPlugin` that acts like a "switch" or "case" statement.

The primary input string is trimmed and then prefixed with `case.` for use as a key to lookup a "switch case" in the parser's local params. If a matching local param is found the resulting param value will then be parsed as a subquery, and returned as the parse result.

The `case` local param can be optionally be specified as a switch case to match missing (or blank) input strings. The `default` local param can optionally be specified as a default case to use if the input string does not match any other switch case local params. If default is not specified, then any input which does not match a switch case local param will result in a syntax error.

In the examples below, the result of each query is "XXX":

```
{!switch case.foo=XXX case.bar=zzz case.yak=qqq}foo
```

```
{!switch case.foo=qqq case.bar=XXX case.yak=zzz} bar  // extra whitespace is trimmed
```

```
{!switch case.foo=qqq case.bar=zzz default=XXX}asdf   // fallback to the default
```

```
{!switch case=XXX case.bar=zzz case.yak=qqq}          // blank input uses 'case'
```

A practical usage of this `QParsePlugin`, is in specifying `appends` fq params in the configuration of a SearchHandler, to provide a fixed set of filter options for clients using custom parameter names. Using the example configuration below, clients can optionally specify the custom parameters `in_stock` and `shipping` to override the default filtering behavior, but are limited to the specific set of legal values (shipping=any|free, in_stock=yes|no|all).

```
<requestHandler name="/select" class="solr.SearchHandler">
   <lst name="defaults">
     <str name="in_stock">yes</str>
     <str name="shipping">any</str>
   </lst>
   <lst name="appends">
     <str name="fq">{!switch case.all='*:*'
                             case.yes='inStock:true'
                             case.no='inStock:false'
                             v=$in_stock}</str>
     <str name="fq">{!switch case.any='*:*'
                             case.free='shipping_cost:0.0'
                             v=$shipping}</str>
   </lst>
 </requestHandler>
```

Term Query Parser

`TermQParser` extends the `QParserPlugin` by creating a single term query from the input value equivalent to `readableToIndexed()`. This is useful for generating filter queries from the external human readable terms returned by the faceting or terms components. The only parameter is `f`, for the field.

Example:

```
{!term f=weight}1.5
```

For text fields, no analysis is done since raw terms are already returned from the faceting and terms components. To apply analysis to text fields as well, see the Field Query Parser, above.

If no analysis or transformation is desired for any type of field, see the Raw Query Parser, above.

Terms Query Parser

`TermsQParser` functions similarly to the Term Query Parser but takes in multiple values separated by commas and returns documents matching any of the specified values. This can be useful for generating filter queries from the external human readable terms returned by the faceting or terms components, and may be more efficient in some cases than using the Standard Query Parser to generate an boolean query since the default implementation "`method`" avoids scoring.

This query parser takes the following parameters:

Parameter	Description
f	The field on which to search. Required.
separator	Separator to use when parsing the input. If set to " " (a single blank space), will trim additional white space from the input terms. Defaults to "`,`".
method	The internal implementation to requested for building the query: `termsFilter`, `booleanQuery`, `automaton`, or `docValuesTermsFilter`. Defaults to "`termsFilter`".

Examples:

```
{!terms f=tags}software,apache,solr,lucene
```

```
{!terms f=categoryId method=booleanQuery separator=" "}8  6 7 5309
```

Faceting

As described in the section Overview of Searching in Solr, faceting is the arrangement of search results into categories based on indexed terms. Searchers are presented with the indexed terms, along with numerical counts of how many matching documents were found were each term. Faceting makes it easy for users to explore search results, narrowing in on exactly the results they are looking for.

Topics covered in this section:

- General Parameters
- Field-Value Faceting Parameters
- Range Faceting
- Date Faceting Parameters
- Pivot (Decision Tree) Faceting
- Interval Faceting
- Local Parameters for Faceting
- Related Topics

General Parameters

The table below summarizes the general parameters for controlling faceting.

Parameter	Description

facet	If set to true, enables faceting.
facet.query	Specifies a Lucene query to generate a facet count.

These parameters are described in the sections below.

The `facet` Parameter

If set to "true," this parameter enables facet counts in the query response. If set to "false" to a blank or missing value, this parameter disables faceting. None of the other parameters listed below will have any effect unless this parameter is set to "true." The default value is blank.

The `facet.query` Parameter

This parameter allows you to specify an arbitrary query in the Lucene default syntax to generate a facet count. By default, Solr's faceting feature automatically determines the unique terms for a field and returns a count for each of those terms. Using `facet.query`, you can override this default behavior and select exactly which terms or expressions you would like to see counted. In a typical implementation of faceting, you will specify a number of `facet.query` parameters. This parameter can be particularly useful for numeric-range-based facets or prefix-based facets.

You can set the `facet.query` parameter multiple times to indicate that multiple queries should be used as separate facet constraints.

To use facet queries in a syntax other than the default syntax, prefix the facet query with the name of the query notation. For example, to use the hypothetical `myfunc` query parser, you could set the `facet.query` parameter like so:

```
facet.query={!myfunc}name~fred
```

Field-Value Faceting Parameters

Several parameters can be used to trigger faceting based on the indexed terms in a field.

When using this parameter, it is important to remember that "term" is a very specific concept in Lucene: it relates to the literal field/value pairs that are indexed after any analysis occurs. For text fields that include stemming, lowercasing, or word splitting, the resulting terms may not be what you expect. If you want Solr to perform both analysis (for searching) and faceting on the full literal strings, use the `copyField` directive in the `schema.xml` file to create two versions of the field: one Text and one String. Make sure both are `indexed="true"`. (For more information about the `copyField` directive, see Documents, Fields, and Schema Design.)

The table below summarizes Solr's field value faceting parameters.

Parameter	Description
facet.field	Identifies a field to be treated as a facet.
facet.prefix	Limits the terms used for faceting to those that begin with the specified prefix.
facet.contains	Limits the terms used for faceting to those that contain the specified substring.
facet.contains.ignoreCase	If facet.contains is used, ignore case when searching for the specified substring.

facet.sort	Controls how faceted results are sorted.
facet.limit	Controls how many constraints should be returned for each facet.
facet.offset	Specifies an offset into the facet results at which to begin displaying facets.
facet.mincount	Specifies the minimum counts required for a facet field to be included in the response.
facet.missing	Controls whether Solr should compute a count of all matching results which have no value for the field, in addition to the term-based constraints of a facet field.
facet.method	Selects the algorithm or method Solr should use when faceting a field.
facet.enum.cache.minDF	(Advanced) Specifies the minimum document frequency (the number of documents matching a term) for which the `filterCache` should be used when determining the constraint count for that term.
facet.overrequest.count	(Advanced) A number of documents, beyond the effective `facet.limit` to request from each shard in a distributed search
facet.overrequest.ratio	(Advanced) A multiplier of the effective `facet.limit` to request from each shard in a distributed search
facet.threads	(Advanced) Controls parallel execution of field faceting

These parameters are described in the sections below.

The `facet.field` Parameter

The `facet.field` parameter identifies a field that should be treated as a facet. It iterates over each Term in the field and generate a facet count using that Term as the constraint. This parameter can be specified multiple times in a query to select multiple facet fields.

> ⚠ If you do not set this parameter to at least one field in the schema, none of the other parameters described in this section will have any effect.

The `facet.prefix` Parameter

The `facet.prefix` parameter limits the terms on which to facet to those starting with the given string prefix. This does not limit the query in any way, only the facets that would be returned in response to the query.

This parameter can be specified on a per-field basis with the syntax of `f.<fieldname>.facet.prefix`.

The `facet.contains` Parameter

The `facet.contains` parameter limits the terms on which to facet to those containing the given substring. This does not limit the query in any way, only the facets that would be returned in response to the query.

This parameter can be specified on a per-field basis with the syntax of `f.<fieldname>.facet.contains`.

The `facet.contains.ignoreCase` Parameter

If `facet.contains` is used, the `facet.contains.ignoreCase` parameter causes case to be ignored when matching the given substring against candidate facet terms.

This parameter can be specified on a per-field basis with the syntax of `f.<fieldname>.facet.contains.ignoreCase`.

The `facet.sort` Parameter

This parameter determines the ordering of the facet field constraints.

`facet.sort` Setting	Results
count	Sort the constraints by count (highest count first).
index	Return the constraints sorted in their index order (lexicographic by indexed term). For terms in the ASCII range, this will be alphabetically sorted.

The default is `count` if `facet.limit` is greater than 0, otherwise, the default is `index`.

This parameter can be specified on a per-field basis with the syntax of `f.<fieldname>.facet.sort`.

The `facet.limit` Parameter

This parameter specifies the maximum number of constraint counts (essentially, the number of facets for a field that are returned) that should be returned for the facet fields. A negative value means that Solr will return unlimited number of constraint counts.

The default value is 100.

This parameter can be specified on a per-field basis to apply a distinct limit to each field with the syntax of `f.<fieldname>.facet.limit`.

The `facet.offset` Parameter

The `facet.offset` parameter indicates an offset into the list of constraints to allow paging.

The default value is 0.

This parameter can be specified on a per-field basis with the syntax of `f.<fieldname>.facet.offset`.

The `facet.mincount` Parameter

The `facet.mincount` parameter specifies the minimum counts required for a facet field to be included in the response. If a field's counts are below the minimum, the field's facet is not returned.

The default value is 0.

This parameter can be specified on a per-field basis with the syntax of `f.<fieldname>.facet.mincount`.

The `facet.missing` Parameter

If set to true, this parameter indicates that, in addition to the Term-based constraints of a facet field, a count of all results that match the query but which have no facet value for the field should be computed and returned in the response.

The default value is false.

This parameter can be specified on a per-field basis with the syntax of `f.<fieldname>.facet.missing`.

The `facet.method` Parameter

The facet.method parameter selects the type of algorithm or method Solr should use when faceting a field.

Setting	Results
enum	Enumerates all terms in a field, calculating the set intersection of documents that match the term with documents that match the query. This method is recommended for faceting multi-valued fields that have only a few distinct values. The average number of values per document does not matter. For example, faceting on a field with U.S. States such as `Alabama, Alaska, ... Wyoming` would lead to fifty cached filters which would be used over and over again. The `filterCache` should be large enough to hold all the cached filters.
fc	Calculates facet counts by iterating over documents that match the query and summing the terms that appear in each document. This is currently implemented using an `UnInvertedField` cache if the field either is multi-valued or is tokenized (according to `FieldType.isTokened()`). Each document is looked up in the cache to see what terms/values it contains, and a tally is incremented for each value. This method is excellent for situations where the number of indexed values for the field is high, but the number of values per document is low. For multi-valued fields, a hybrid approach is used that uses term filters from the `filterCache` for terms that match many documents. The letters `fc` stand for field cache.
fcs	Per-segment field faceting for single-valued string fields. Enable with `facet.method=fcs` and control the number of threads used with the `threads` local parameter. This parameter allows faceting to be faster in the presence of rapid index changes.

The default value is `fc` (except for fields using the `BoolField` field type) since it tends to use less memory and is faster when a field has many unique terms in the index.

This parameter can be specified on a per-field basis with the syntax of `f.<fieldname>.facet.method`.

The `facet.enum.cache.minDf` Parameter

This parameter indicates the minimum document frequency (the number of documents matching a term) for which the filterCache should be used when determining the constraint count for that term. This is only used with the `facet.method=enum` method of faceting.

A value greater than zero decreases the filterCache's memory usage, but increases the time required for the query to be processed. If you are faceting on a field with a very large number of terms, and you wish to decrease memory usage, try setting this parameter to a value between 25 and 50, and run a few tests. Then, optimize the parameter setting as necessary.

The default value is 0, causing the filterCache to be used for all terms in the field.

This parameter can be specified on a per-field basis with the syntax of `f.<fieldname>.facet.enum.cache.minDF`.

Over-Request Parameters

In some situations, the accuracy in selecting the "top" constraints returned for a facet in a distributed Solr query can be improved by "Over Requesting" the number of desired constraints (ie: `facet.limit`) from each of the individual Shards. In these situations, each shard is by default asked for the top "`10 + (1.5 * facet.limit)`" constraints.

In some situations, depending on how your docs are partitioned across your shards, and what `facet.limit` value you used, you may find it advantageous to increase or decrease the amount of over-requesting Solr does. This can be achieved by setting the `facet.overrequest.count` (defaults to 10) and `facet.overrequest.ratio` (defaults to 1.5) parameters.

The `facet.threads` Parameter

This param will cause loading the underlying fields used in faceting to be executed in parallel with the number of threads specified. Specify as `facet.threads=N` where `N` is the maximum number of threads used. Omitting this parameter or specifying the thread count as 0 will not spawn any threads, and only the main request thread will be used. Specifying a negative number of threads will create up to Integer.MAX_VALUE threads.

Range Faceting

You can use Range Faceting on any date field or any numeric field that supports range queries. This is particularly useful for stitching together a series of range queries (as facet by query) for things like prices. As of Solr 3.1, Range Faceting is preferred over Date Faceting (described below).

Parameter	Description
facet.range	Specifies the field to facet by range.
facet.range.start	Specifies the start of the facet range.
facet.range.end	Specifies the end of the facet range.
facet.range.gap	Specifies the span of the range as a value to be added to the lower bound.
facet.range.hardend	A boolean parameter that specifies how Solr handles a range gap that cannot be evenly divided between the range start and end values. If true, the last range constraint will have the `facet.range.end` value an upper bound. If false, the last range will have the smallest possible upper bound greater then `facet.range.end` such that the range is the exact width of the specified range gap. The default value for this parameter is false.
facet.range.include	Specifies inclusion and exclusion preferences for the upper and lower bounds of the range. See the `facet.range.include` topic for more detailed information.
facet.range.other	Specifies counts for Solr to compute in addition to the counts for each facet range constraint.

The `facet.range` Parameter

The `facet.range` parameter defines the field for which Solr should create range facets. For example:

```
facet.range=price&facet.range=age
```

The `facet.range.start` Parameter

The `facet.range.start` parameter specifies the lower bound of the ranges. You can specify this parameter on a per field basis with the syntax of `f.<fieldname>.facet.range.start`. For example:

```
f.price.facet.range.start=0.0&f.age.facet.range.start=10
```

The **facet.range.end** Parameter

The facet.range.end specifies the upper bound of the ranges. You can specify this parameter on a per field basis with the syntax of `f.<fieldname>.facet.range.end`. For example:

```
f.price.facet.range.end=1000.0&f.age.facet.range.start=99
```

The **facet.range.gap** Parameter

The span of each range expressed as a value to be added to the lower bound. For date fields, this should be expressed using the `DateMathParser` syntax (such as, `facet.range.gap=%2B1DAY ... '+1DAY'`). You can specify this parameter on a per-field basis with the syntax of `f.<fieldname>.facet.range.gap`. For example:

```
f.price.facet.range.gap=100&f.age.facet.range.gap=10
```

The **facet.range.hardend** Parameter

The `facet.range.hardend` parameter is a Boolean parameter that specifies how Solr should handle cases where the `facet.range.gap` does not divide evenly between `facet.range.start` and `facet.range.end`. If **true**, the last range constraint will have the `facet.range.end` value as an upper bound. If **false**, the last range will have the smallest possible upper bound greater then `facet.range.end` such that the range is the exact width of the specified range gap. The default value for this parameter is false.

This parameter can be specified on a per field basis with the syntax `f.<fieldname>.facet.range.hardend` .

The **facet.range.include** Parameter

By default, the ranges used to compute range faceting between `facet.range.start` and `facet.range.end` are inclusive of their lower bounds and exclusive of the upper bounds. The "before" range defined with the `facet.range.other` parameter is exclusive and the "after" range is inclusive. This default, equivalent to "lower" below, will not result in double counting at the boundaries. You can use the `facet.range.include` parameter to modify this behavior using the following options:

Option	Description
lower	All gap-based ranges include their lower bound.
upper	All gap-based ranges include their upper bound.
edge	The first and last gap ranges include their edge bounds (lower for the first one, upper for the last one) even if the corresponding upper/lower option is not specified.
outer	The "before" and "after" ranges will be inclusive of their bounds, even if the first or last ranges already include those boundaries.
all	Includes all options: lower, upper, edge, outer.

You can specify this parameter on a per field basis with the syntax of `f.<fieldname>.facet.range.include`, and you can specify it multiple times to indicate multiple choices.

ⓘ To ensure you avoid double-counting, do not choose both `lower` and `upper`, do not choose `outer`, and do not choose `all`.

The `facet.range.other` Parameter

The `facet.range.other` parameter specifies that in addition to the counts for each range constraint between `facet.range.start` and `facet.range.end`, counts should also be computed for these options:

Option	Description
before	All records with field values lower then lower bound of the first range.
after	All records with field values greater then the upper bound of the last range.
between	All records with field values between the start and end bounds of all ranges.
none	Do not compute any counts.
all	Compute counts for before, between, and after.

This parameter can be specified on a per field basis with the syntax of `f.<fieldname>.facet.range.other`. In addition to the `all` option, this parameter can be specified multiple times to indicate multiple choices, but `none` will override all other options.

The facet.mincount Parameter in Range Faceting

The `facet.mincount` parameter, the same one as used in field faceting is also applied to range faceting. When used, no ranges with a count below the minimum will be included in the response.

ⓘ **Date Ranges & Time Zones**
Range faceting on date fields is a common situation where the TZ parameter can be useful to ensure that the "facet counts per day" or "facet counts per month" are based on a meaningful definition of when a given day/month "starts" relative to a particular TimeZone.

For more information, see the examples in the Working with Dates section.

Date Faceting Parameters

Date faceting using the type specific `facet.date` parameters has been deprecated since Solr 3.1. Existing users are encouraged to switch to using the more general Range Faceting, which provides the same features for date fields, but can also work with any numeric field.

The response format is slightly different, but the request parameters are virtually identical.

Pivot (Decision Tree) Faceting

Pivoting is a summarization tool that lets you automatically sort, count, total or average data stored in a table. The results are typically displayed in a second table showing the summarized data. Pivot faceting lets you create a summary table of the results from a faceting documents by multiple fields.

Another way to look at it is that the query produces a Decision Tree, in that Solr tells you "for facet A, the constraints/counts are X/N, Y/M, etc. If you were to constrain A by X, then the constraint counts for B would be S/P, T/Q, etc.". In other words, it tells you in advance what the "next" set of facet results would be for a field if you apply a constraint from the current facet results.

facet.pivot

The `facet.pivot` parameter defines the fields to use for the pivot. Multiple `facet.pivot` values will create multiple "facet_pivot" sections in the response. Separate each list of fields with a comma.

facet.pivot.mincount

The `facet.pivot.mincount` parameter defines the minimum number of documents that need to match in order for the facet to be included in results. The default is 1.

Using the "`bin/solr -e techproducts`" example, A query URL like this one will returns the data below, with the pivot faceting results found in the section "facet_pivot":

```
http://localhost:8983/solr/techproducts/select?q=*:*&facet.pivot=cat,popularity,inSt
ock
   &facet.pivot=popularity,cat&facet=true&facet.field=cat&facet.limit=5
   &rows=0&wt=json&indent=true&facet.pivot.mincount=2
```

```
"facet_counts":{
    "facet_queries":{},
    "facet_fields":{
      "cat":[
        "electronics",14,
        "currency",4,
        "memory",3,
        "connector",2,
        "graphics card",2]},
    "facet_dates":{},
    "facet_ranges":{},
    "facet_pivot":{
      "cat,popularity,inStock":[{
          "field":"cat",
          "value":"electronics",
          "count":14,
          "pivot":[{
              "field":"popularity",
              "value":6,
              "count":5,
              "pivot":[{
                  "field":"inStock",
                  "value":true,
                  "count":5}]},
...
```

Combining Stats Component With Pivots

In addition to some of the general local parameters supported by other types of faceting, a `stats` local parameters can be used with `facet.pivot` to refer to `stats.field` instances (by tag) that you would like to have computed for each Pivot Constraint.

In the example below, two different (overlapping) sets of statistics are computed for each of the facet.pivot result hierarchies:

```
stats=true
stats.field={!tag=piv1,piv2 min=true max=true}price
stats.field={!tag=piv2 mean=true}popularity
facet=true
facet.pivot={!stats=piv1}cat,inStock
facet.pivot={!stats=piv2}manu,inStock
```

Results:

```
"facet_pivot":{
  "cat,inStock":[{
      "field":"cat",
      "value":"electronics",
      "count":12,
      "pivot":[{
          "field":"inStock",
          "value":true,
          "count":8,
          "stats":{
            "stats_fields":{
              "price":{
                "min":74.98999786376953,
                "max":399.0}}}},
        {
          "field":"inStock",
          "value":false,
          "count":4,
          "stats":{
            "stats_fields":{
              "price":{
                "min":11.5,
                "max":649.989990234375}}}}],
      "stats":{
        "stats_fields":{
          "price":{
            "min":11.5,
            "max":649.989990234375}}}},
    {
      "field":"cat",
      "value":"currency",
      "count":4,
      "pivot":[{
          "field":"inStock",
          "value":true,
          "count":4,
          "stats":{
            "stats_fields":{
              "price":{
                ...
  "manu,inStock":[{
      "field":"manu",
      "value":"inc",
      "count":8,
      "pivot":[{
          "field":"inStock",
          "value":true,
          "count":7,
          "stats":{
            "stats_fields":{
              "price":{
                "min":74.98999786376953,
                "max":2199.0},
              "popularity":{
                "mean":5.857142857142857}}}},
        {
          "field":"inStock",
          "value":false,
          "count":1,
          "stats":{
            "stats_fields":{
              "price":{
                "min":479.95001220703125,
                "max":479.95001220703125},
              "popularity":{
                "mean":7.0}}}}],
      ...
```

Additional Pivot Parameters

Although `facet.pivot.mincount` deviates in name from the `facet.mincount` parameter used by field faceting, many other Field faceting parameters described above can also be used with pivot faceting:

- `facet.limit`
- `facet.offset`
- `facet.sort`
- `facet.overrequest.count`
- `facet.overrequest.ratio`

Interval Faceting

Another supported form of faceting is interval faceting. This sounds similar to range faceting, but the functionality is really closer to doing facet queries with range queries. Interval faceting allows you to set variable intervals and count the number of documents that have values within those intervals in the specified field.

In order to use interval faceting on a field, it is required that the field has docValues enabled. Even though the same functionality can be achieved by using a facet query with range queries, the implementation of these two methods is very different and will provide different performance depending on the context. If you are concerned about the performance of your searches you should test with both options. Interval faceting tends to be better with multiple intervals for the same fields, while facet query tend to be better in environments where cache is more effective (static indexes for example).

Name	What it does
facet.interval	Specifies the field to facet by interval.
facet.interval.set	Sets the intervals for the field.

The `facet.interval` parameter

This parameter Indicates the field where interval faceting must be applied. It can be used multiple times in the same request to indicate multiple fields. All the interval fields must have docValues="true" in the schema.

`facet.interval=price&facet.interval=size`

The `facet.interval.set` parameter

This parameter is used to set the intervals for the field, it can be specified multiple times to indicate multiple intervals. This parameter is global, which means that it will be used for all fields indicated with `facet.interval` unless there is an override for a specific field. To override this parameter on a specific field you can use: `f.<fieldname>.facet.interval.set`, for example:

`f.price.facet.interval.set=[0,10]&f.price.facet.interval.set=(10,100]`

Interval Syntax

Intervals must begin with either '(' or '[', be followed by the start value, then a comma (','), the end value, and finally a closing ')' or ']'.

For example:

- (1,10) -> will include values greater than 1 and lower than 10
- [1,10) -> will include values greater or equal to 1 and lower than 10
- [1,10] -> will include values greater or equal to 1 and lower or equal to 10

The initial and end values cannot be empty. If the interval needs to be unbounded, the special character '*' can be used for both, start and end limit. When using '*', '(' and '[', and ')' and ']' will be treated equal. [*,*] will include all documents with a value in the field. The interval limits may be strings but there is no need to add quotes. All the text until the comma will be treated as the start limit, and the text after that will be the end limit. For example: [Buenos Aires,New York]. Keep in mind that a string-like comparison will be done to match documents in string intervals (case-sensitive). The comparator can't be changed.

Commas, brackets and square brackets can be escaped by using '\' in front of them. Whitespaces before and after the values will be omitted. The start limit can't be grater than the end limit. Equal limits are allowed, this allows you to indicate the specific values that you want to count, like [A,A], [B,B] and [C,Z].

Interval faceting supports output key replacement described below. Output keys can be replaced in both the `facet.interval parameter` and in the `facet.interval.set parameter`. For example:

```
&facet.interval={!key=popularity}some_field
&facet.interval.set={!key=bad}[0,5]
&facet.interval.set={!key=good}[5,*]
&facet=true
```

Local Parameters for Faceting

The LocalParams syntax allows overriding global settings. It can also provide a method of adding metadata to other parameter values, much like XML attributes.

Tagging and Excluding Filters

You can tag specific filters and exclude those filters when faceting. This is useful when doing multi-select faceting.

Consider the following example query with faceting:

`q=mainquery&fq=status:public&fq=doctype:pdf&facet=true&facet.field=doctype`

Because everything is already constrained by the filter `doctype:pdf`, the `facet.field=doctype` facet command is currently redundant and will return 0 counts for everything except `doctype:pdf`.

To implement a multi-select facet for doctype, a GUI may want to still display the other doctype values and their associated counts, as if the `doctype:pdf` constraint had not yet been applied. For example:

```
=== Document Type ===
  [ ] Word (42)
  [x] PDF  (96)
  [ ] Excel(11)
  [ ] HTML (63)
```

To return counts for doctype values that are currently not selected, tag filters that directly constrain doctype, and exclude those filters when faceting on doctype.

```
q=mainquery&fq=status:public&fq={!tag=dt}doctype:pdf&facet=true&facet.field
={!ex=dt}doctype
```

Filter exclusion is supported for all types of facets. Both the `tag` and `ex` local parameters may specify multiple values by separating them with commas.

Changing the Output Key

To change the output key for a faceting command, specify a new name with the `key` local parameter. For example:

```
facet.field={!ex=dt key=mylabel}doctype
```

The parameter setting above causes the field facet results for the "doctype" field to be returned using the key "mylabel" rather than "doctype" in the response. This can be helpful when faceting on the same field multiple times with different exclusions.

Related Topics

- SimpleFacetParameters from the Solr Wiki.
- Heatmap Faceting (Spatial)

Highlighting

Highlighting in Solr allows fragments of documents that match the user's query to be included with the query response. The fragments are included in a special section of the response (the `highlighting` section), and the client uses the formatting clues also included to determine how to present the snippets to users.

Solr provides a collection of highlighting utilities which allow a great deal of control over the fields fragments are taken from, the size of fragments, and how they are formatted. The highlighting utilities can be called by various Request Handlers and can be used with the DisMax, Extended DisMax, or standard query parsers.

There are three highlighting implementations available:

- **Standard Highlighter**: The Standard Highlighter is the swiss-army knife of the highlighters. It has the most sophisticated and fine-grained query representation of the three highlighters. For example, this highlighter is capable of providing precise matches even for advanced queryparsers such as the `surround` parser. It does not require any special datastructures such as `termVectors`, although it will use them if they are present. If they are not, this highlighter will re-analyze the document on-the-fly to highlight it. This highlighter is a good choice for a wide variety of search use-cases.

- **FastVector Highlighter**: The FastVector Highlighter requires term vector options (`termVectors`, `termPositions`, and `termOffsets`) on the field, and is optimized with that in mind. It tends to work better for more languages than the Standard Highlighter, because it supports Unicode breakiterators. On the other hand, its query-representation is less advanced than the Standard Highlighter: for example it will not work well with the `surround` parser. This highlighter is a good choice for large documents and highlighting text in a variety of languages.

- **Postings Highlighter**: The Postings Highlighter requires `storeOffsetsWithPositions` to be configured on the field. This is a much more compact and efficient structure than term vectors, but is not appropriate for huge numbers of query terms (e.g. wildcard queries). Like the FastVector Highlighter, it supports Unicode algorithms for dividing up the document. On the other hand, it has the most coarse query-representation: it focuses on summary quality and ignores the structure of the query completely, ranking passages based solely on query terms and statistics. This highlighter a good choice for classic full-text keyword search.

Configuring Highlighting

The configuration for highlighting, whichever implementation is chosen, is first to configure a search component and then reference the component in one or more request handlers.

The exact parameters for the search component vary depending on the implementation, but there is a robust example in the `solrconfig.xml` used in the "`techproducts`" example which shows how to configure both the Standard Highlighter and the FastVector Highlighter (see the Postings Highlighter section for details on how to configure that implementation).

Standard Highlighter

The standard highlighter (AKA the default highlighter) doesn't require any special indexing parameters on the fields to highlight. However you can optionally turn on `termVectors`, `termPositions`, and `termOffsets` for any field to be highlighted. This will avoid having to run documents through the analysis chain at query-time and will make highlighting significantly faster and use less memory, particularly for large text fields, and even more so when `hl.usePhraseHighlighter` is enabled.

Standard Highlighting Parameters

The table below describes Solr's parameters for the Standard highlighter. These parameters can be defined in the highlight search component, as defaults for the specific request handler, or passed to the request handler with the query.

Parameter	Default Value	Description
hl	blank (no highlight)	When set to **true**, enables highlighted snippets to be generated in the query response. If set to **false** or to a blank or missing value, disables highlighting.
hl.q	blank	Specifies an overriding query term for highlighting. If `hl.q` is specified, the highlighter will use that term rather than the main query term.
hl.qparser	blank	Specifies a qparser to use for the hl.q query. If blank, will use the defType of the overall query.

hl.fl	blank	Specifies a list of fields to highlight. Accepts a comma- or space-delimited list of fields for which Solr should generate highlighted snippets. If left blank, highlights the defaultSearchField (or the field specified the `df` parameter if used) for the StandardRequestHandler. For the DisMaxRequestHandler, the `qf` fields are used as defaults. A '*' can be used to match field globs, such as 'text_*' or even '*' to highlight on all fields where highlighting is possible. When using '*', consider adding `hl.requireFieldMatch=true`.
hl.snippets	1	Specifies maximum number of highlighted snippets to generate per field. It is possible for any number of snippets from zero to this value to be generated. This parameter accepts per-field overrides.
hl.fragsize	100	Specifies the size, in characters, of fragments to consider for highlighting. **0** indicates that no fragmenting should be considered and the whole field value should be used. This parameter accepts per-field overrides.
hl.mergeContiguous	false	Instructs Solr to collapse contiguous fragments into a single fragment. A value of **true** indicates contiguous fragments will be collapsed into single fragment. This parameter accepts per-field overrides. The default value, **false**, is also the backward-compatible setting.
hl.requireFieldMatch	false	If set to **true**, highlights terms only if they appear in the specified field. If **false**, terms are highlighted in all requested fields regardless of which field matched the query.
hl.maxAnalyzedChars	51200	Specifies the number of characters into a document that Solr should look for suitable snippets.
hl.maxMultiValuedToExamine	`integer.MAX_VALUE`	Specifies the maximum number of entries in a multi-valued field to examine before stopping. This can potentially return zero results if the limit is reached before any matches are found. If used with the `maxMultiValuedToMatch`, whichever limit is reached first will determine when to stop looking.

hl.maxMultiValuedToMatch	`integer.MAX_VALUE`	Specifies the maximum number of matches in a multi-valued field that are found before stopping. If `hl.maxMultiValuedToExamine` is also defined, whichever limit is reached first will determine when to stop looking.
hl.alternateField	blank	Specifies a field to be used as a backup default summary if Solr cannot generate a snippet (i.e., because no terms match). This parameter accepts per-field overrides.
hl.maxAlternateFieldLength	unlimited	Specifies the maximum number of characters of the field to return. Any value less than or equal to 0 means the field's length is unlimited. This parameter is only used in conjunction with the `hl.alternateField` parameter.
hl.formatter	simple	Selects a formatter for the highlighted output. Currently the only legal value is **simple**, which surrounds a highlighted term with a customizable pre- and post-text snippet. This parameter accepts per-field overrides.
hl.simple.pre hl.simple.post	<em> and </em>	Specifies the text that should appear before (`hl.simple.pre`) and after (`hl.simple.post`) a highlighted term, when using the simple formatter. This parameter accepts per-field overrides.
hl.fragmenter	gap	Specifies a text snippet generator for highlighted text. The standard fragmenter is **gap**, which creates fixed-sized fragments with gaps for multi-valued fields. Another option is **regex**, which tries to create fragments that resemble a specified regular expression. This parameter accepts per-field overrides.
hl.usePhraseHighlighter	true	If set to **true**, Solr will use the Lucene SpanScorer class to highlight phrase terms only when they appear within the query phrase in the document.
hl.highlightMultiTerm	true	If set to **true**, Solr will use highlight phrase terms that appear in multi-term queries.

hl.regex.slop	0.6	When using the regex fragmenter (`hl.fragmenter=regex`), this parameter defines the factor by which the fragmenter can stray from the ideal fragment size (given by `hl.fragsize`) to accommodate a regular expression. For instance, a slop of 0.2 with `hl.fragsize=100` should yield fragments between 80 and 120 characters in length. It is usually good to provide a slightly smaller `hl.fragsize` value when using the regex fragmenter.
hl.regex.pattern	blank	Specifies the regular expression for fragmenting. This could be used to extract sentences.
hl.regex.maxAnalyzedChars	10000	Instructs Solr to analyze only this many characters from a field when using the regex fragmenter (after which, the fragmenter produces fixed-sized fragments). Applying a complicated regex to a huge field is computationally expensive.
hl.preserveMulti	false	If **true**, multi-valued fields will return all values in the order they were saved in the index. If **false**, only values that match the highlight request will be returned.
hl.payloads	(automatic)	When hl.usePhraseHighlighter=true and the indexed field has payloads but not term vectors (generally quite rare), the index's payloads will be read into the highlighter's memory index along with the postings. If this may happen and you know you don't need them for highlighting (i.e. your queries don't filter by payload) then you can save a little memory by setting this to false.

Related Content

- HighlightingParameters from the Solr wiki
- Highlighting javadocs

FastVector Highlighter

The FastVectorHighlighter is a TermVector-based highlighter that offers higher performance than the standard highlighter in many cases. To use the FastVectorHighlighter, set the `hl.useFastVectorHighlighter` parameter to `true`.

You must also turn on `termVectors`, `termPositions`, and `termOffsets` for each field that will be highlighted. Lastly, you should use a boundary scanner to prevent the FastVectorHighlighter from truncating your terms. In most cases, using the `breakIterator` boundary scanner will give you excellent results. See the section Using Boundary Scanners with the Fast Vector Highlighter for more details about boundary scanners.

FastVector Highlighter Parameters

The table below describes Solr's parameters for this highlighter, many of which overlap with the standard highlighter. These parameters can be defined in the highlight search component, as defaults for the specific request handler, or passed to the request handler with the query.

Parameter	Default	Description
hl	blank (no highlighting)	When set to **true**, enables highlighted snippets to be generated in the query response. A **false** or blank value disables highlighting.
hl.useFastVectorHighligter	false	When set to **true**, enables the FastVector Highlighter.
hl.q	blank	Specifies an overriding query term for highlighting. If `hl.q` is specified, the highlighter will use that term rather than the main query term.
hl.fl	blank	Specifies a list of fields to highlight. Accepts a comma- or space-delimited list of fields for which Solr should generate highlighted snippets. If left blank, highlights the defaultSearchField (or the field specified the `df` parameter if used) for the StandardRequestHandler. For the DisMaxRequestHandler, the `qf` fields are used as defaults. A '*' can be used to match field globs, such as 'text_*' or even '*' to highlight on all fields where highlighting is possible. When using '*', consider adding `hl.requireFieldMatch=true`.
hl.snippets	1	Specifies maximum number of highlighted snippets to generate per field. It is possible for any number of snippets from zero to this value to be generated. This parameter accepts per-field overrides.
hl.fragsize	100	Specifies the size, in characters, of fragments to consider for highlighting. **0** indicates that no fragmenting should be considered and the whole field value should be used. This parameter accepts per-field overrides.
hl.requireFieldMatch	false	If set to **true**, highlights terms only if they appear in the specified field. If **false**, terms are highlighted in all requested fields regardless of which field matched the query.

hl.maxMultiValuedToExamine	`integer.MAX_VALUE`	Specifies the maximum number of entries in a multi-valued field to examine before stopping. This can potentially return zero results if the limit is reached before any matches are found. If used with the `maxMultiValuedToMatch`, whichever limit is reached first will determine when to stop looking.
hl.maxMultiValuedToMatch	`integer.MAX_VALUE`	Specifies the maximum number of matches in a multi-valued field that are found before stopping. If `hl.maxMultiValuedToExamine` is also defined, whichever limit is reached first will determine when to stop looking.
hl.alternateField	blank	Specifies a field to be used as a backup default summary if Solr cannot generate a snippet (i.e., because no terms match). This parameter accepts per-field overrides.
hl.maxAlternateFieldLength	unlimited	Specifies the maximum number of characters of the field to return. Any value less than or equal to 0 means the field's length is unlimited. This parameter is only used in conjunction with the `hl.alternateField` parameter.
hl.tag.pre hl.tag.post	<em> and </em>	Specifies the text that should appear before (`hl.tag.pre`) and after (`hl.tag.post`) a highlighted term. This parameter accepts per-field overrides.
hl.phraseLimit	`integer.MAX_VALUE`	To improve the performance of the FastVectorHighlighter, you can set a limit on the number (int) of phrases to be analyzed for highlighting.
hl.usePhraseHighlighter	true	If set to **true**, Solr will use the Lucene SpanScorer class to highlight phrase terms only when they appear within the query phrase in the document.
hl.preserveMulti	false	If **true**, multi-valued fields will return all values in the order they were saved in the index. If **false**, the default, only values that match the highlight request will be returned.
hl.fragListBuilder	weighted	The snippet fragmenting algorithm. The **weighted** fragListBuilder uses IDF-weights to order fragments. Other options are **single**, which returns the entire field contents as one snippet, or **simple**. You can select a fragListBuilder with this parameter, or modify an existing implementation in `solrconfig.xml` to be the default by adding "default=true".

hl.fragmentsBuilder	default	The fragments builder is responsible for formatting the fragments, which uses <em> and </em> markup (if `hl.tag.pre` and `hl.tag.post` are not defined). Another pre-configured choice is **colored**, which is an example of how to use the fragments builder to insert HTML into the snippets for colored highlights if you choose. You can also implement your own if you'd like. You can select a fragments builder with this parameter, or modify an existing implementation in `solrconfig.xml` to be the default by adding "default=true".

Using Boundary Scanners with the Fast Vector Highlighter

The Fast Vector Highlighter will occasionally truncate highlighted words. To prevent this, implement a boundary scanner in `solrconfig.xml`, then use the `hl.boundaryScanner` parameter to specify the boundary scanner for highlighting.

Solr supports two boundary scanners: `breakIterator` and `simple`.

The ***`breakIterator`*** Boundary Scanner

The `breakIterator` boundary scanner offers excellent performance right out of the box by taking locale and boundary type into account. In most cases you will want to use the `breakIterator` boundary scanner. To implement the `breakIterator` boundary scanner, add this code to the `highlighting` section of your `solrconfig.xml` file, adjusting the type, language, and country values as appropriate to your application:

```
<boundaryScanner name="breakIterator"
class="solr.highlight.BreakIteratorBoundaryScanner">
  <lst name="defaults">
    <str name="hl.bs.type">WORD</str>
    <str name="hl.bs.language">en</str>
    <str name="hl.bs.country">US</str>
  </lst>
</boundaryScanner>
```

Possible values for the `hl.bs.type` parameter are WORD, LINE, SENTENCE, and CHARACTER.

The ***`simple`*** Boundary Scanner

The `simple` boundary scanner scans term boundaries for a specified maximum character value (`hl.bs.maxScan`) and for common delimiters such as punctuation marks (`hl.bs.chars`). The `simple` boundary scanner may be useful for some custom To implement the `simple` boundary scanner, add this code to the `highlighting` section of your `solrconfig.xml` file, adjusting the values as appropriate to your application:

```
<boundaryScanner name="simple" class="solr.highlight.SimpleBoundaryScanner"
default="true">
  <lst name="defaults">
    <str name="hl.bs.maxScan">10</str>
    <str name="hl.bs.chars">.,!?\t\n</str>
  </lst>
</boundaryScanner>
```

Related Content

- HighlightingParameters from the Solr wiki
- Highlighting javadocs

Postings Highlighter

PostingsHighlighter focuses on good document summarizes and efficiency, but is less flexible than the other highlighters. It uses significantly less disk space, focuses on good document summaries, and provides a performant approach if queries have a low number of terms relative to the number of results per page. However, the drawbacks are that it is not a query matching debugger (it focuses on fast highlighting for full-text search) and it does not allow broken analysis chains.

To use this highlighter, you must turn on `storeOffsetsWithPositions` for the field. There is no need to turn on `termVectors`, `termPositions`, or `termOffsets` in fields since this highlighter does not make use of term vectors.

Configuring Postings Highlighter

The configuration for the Postings Highlighter is done in `solrconfig.xml`.

First, define the search component:

```
<searchComponent class="solr.HighlightComponent" name="highlight">
  <highlighting class="org.apache.solr.highlight.PostingsSolrHighlighter"/>
</searchComponent>
```

Note in this example, we have named the search component "highlight". If you started with a default `solrconfig.xml` file, then you already have a component with that name. You should either replace the default with this example, or rename the search component that is already there so there is no confusion about which search component implementation Solr should use.

Then in the request handler, you can define the defaults, as in this example:

```
<requestHandler name="standard" class="solr.StandardRequestHandler">
  <lst name="defaults">
    <int name="hl.snippets">1</int>
    <str name="hl.tag.pre">&lt;em&gt;</str>
    <str name="hl.tag.post">&lt;/em&gt;</str>
    <str name="hl.tag.ellipsis">... </str>
    <bool name="hl.defaultSummary">true</bool>
    <str name="hl.encoder">simple</str>
    <float name="hl.score.k1">1.2</float>
    <float name="hl.score.b">0.75</float>
    <float name="hl.score.pivot">87</float>
    <str name="hl.bs.language"></str>
    <str name="hl.bs.country"></str>
    <str name="hl.bs.variant"></str>
    <str name="hl.bs.type">SENTENCE</str>
    <int name="hl.maxAnalyzedChars">10000</int>
  </lst>
</requestHandler>
```

This example shows all of the defaults for each parameter. If you intend to keep all of the defaults, you would not need to add anything to the request handler and could override the default values at query time as needed.

Postings Highlighter Parameters

The table below describes Solr's parameters for this highlighter. These parameters can be set as defaults (as in the examples), or the default values can be changed in the request handler or at query time. Most of the parameters can be specified per-field (exceptions noted below).

Parameter	Default	Description
hl	blank (no highlight)	When set to **true**, enables highlighted snippets to be generated in the query response. If set to **false** or to a blank or missing value, disables highlighting.
hl.q	blank	Specifies an overriding query term for highlighting. If `hl.q` is specified, the highlighter will use that term rather than the main query term.
hl.fl	blank	Specifies a list of fields to highlight. Accepts a comma- or space-delimited list of fields for which Solr should generate highlighted snippets. If left blank, highlights the defaultSearchField (or the field specified the `df` parameter if used) for the StandardRequestHandler. For the DisMaxRequestHandler, the `qf` fields are used as defaults. A '*' can be used to match field globs, such as 'text_*' or even '*' to highlight on all fields where highlighting is possible. When using '*', consider adding `hl.requireFieldMatch=true`.

hl.snippets	1	Specifies maximum number of highlighted snippets to generate per field. It is possible for any number of snippets from zero to this value to be generated. This parameter accepts per-field overrides.
hl.tag.pre	<em>	Specifies the text that should appear before a highlighted term.
hl.tag.post	</em>	Specifies the text that should appear after a highlighted term.
hl.tag.ellipsis	"... "	Specifies the text that should join two unconnected passages in the resulting snippet.
hl.maxAnalyzedChars	10000	Specifies the number of characters into a document that Solr should look for suitable snippets. This parameter does not accept per-field overrides.
hl.multiValuedSeparatorChar	" " (space)	Specifies the logical separator between multi-valued fields.
hl.defaultSummary	true	If **true**, a field should have a default summary if highlighting finds no matching passages.
hl.encoder	simple	Defines the encoding for the resulting snippet. The value **simple** applies no escaping, while **html** will escape HTML characters in the text.
hl.score.k1	1.2	Specifies BM25 term frequency normalization parameter 'k1'. For example, it can be set to "0" to rank passages solely based on the number of query terms that match.
hl.score.b	0.75	Specifies BM25 length normalization parameter 'b'. For example, it can be set to "0" to ignore the length of passages entirely when ranking.
hl.score.pivot	87	Specifies BM25 average passage length in characters.
hl.bs.language	blank	Specifies the breakiterator language for dividing the document into passages.
hl.bs.country	blank	Specifies the breakiterator country for dividing the document into passages.
hl.bs.variant	blank	Specifies the breakiterator variant for dividing the document into passages.
hl.bs.type	SENTENCE	Specifies the breakiterator type for dividing the document into passages. Can be **SENTENCE**, **WORD**, **CHARACTER**, **LINE**, or **WHOLE**.

Related Content

- PostingsHighlighter from the Solr wiki
- PostingsSolrHighlighter javadoc

Spell Checking

The SpellCheck component is designed to provide inline query suggestions based on other, similar, terms. The basis for these suggestions can be terms in a field in Solr, externally created text files, or fields in other Lucene indexes.

Topics covered in this section:

- Configuring the SpellCheckComponent
- Spell Check Parameters
- Distributed SpellCheck

Configuring the SpellCheckComponent

Define Spell Check in `solrconfig.xml`

The first step is to specify the source of terms in `solrconfig.xml`. There are three approaches to spell checking in Solr, discussed below.

IndexBasedSpellChecker

The `IndexBasedSpellChecker` uses a Solr index as the basis for a parallel index used for spell checking. It requires defining a field as the basis for the index terms; a common practice is to copy terms from some fields (such as `title`, `body`, etc.) to another field created for spell checking. Here is a simple example of configuring `solrconfig.xml` with the `IndexBasedSpellChecker`:

```
<searchComponent name="spellcheck" class="solr.SpellCheckComponent">
  <lst name="spellchecker">
    <str name="classname">solr.IndexBasedSpellChecker</str>
    <str name="spellcheckIndexDir">./spellchecker</str>
    <str name="field">content</str>
    <str name="buildOnCommit">true</str>
  </lst>
</searchComponent>
```

The first element defines the `searchComponent` to use the `solr.SpellCheckComponent`. The `classname` is the specific implementation of the SpellCheckComponent, in this case `solr.IndexBasedSpellChecker`. Defining the `classname` is optional; if not defined, it will default to `IndexBasedSpellChecker`.

The `spellcheckIndexDir` defines the location of the directory that holds the spellcheck index, while the `field` defines the source field (defined in `schema.xml`) for spell check terms. When choosing a field for the spellcheck index, it's best to avoid a heavily processed field to get more accurate results. If the field has many word variations from processing synonyms and/or stemming, the dictionary will be created with those variations in addition to more valid spelling data.

Finally, *buildOnCommit* defines whether to build the spell check index at every commit (that is, every time new documents are added to the index). It is optional, and can be omitted if you would rather set it to `false`.

DirectSolrSpellChecker

The `DirectSolrSpellChecker` uses terms from the Solr index without building a parallel index like the `IndexBasedSpellChecker`. This spell checker has the benefit of not having to be built regularly, meaning that the terms are always up-to-date with terms in the index. Here is how this might be configured in `solrconfig.xml`

```
<searchComponent name="spellcheck" class="solr.SpellCheckComponent">
  <lst name="spellchecker">
    <str name="name">default</str>
    <str name="field">name</str>
    <str name="classname">solr.DirectSolrSpellChecker</str>
    <str name="distanceMeasure">internal</str>
    <float name="accuracy">0.5</float>
    <int name="maxEdits">2</int>
    <int name="minPrefix">1</int>
    <int name="maxInspections">5</int>
    <int name="minQueryLength">4</int>
    <float name="maxQueryFrequency">0.01</float>
    <float name="thresholdTokenFrequency">.01</float>
  </lst>
</searchComponent>
```

When choosing a `field` to query for this spell checker, you want one which has relatively little analysis performed on it (particularly analysis such as stemming). Note that you need to specify a field to use for the suggestions, so like the `IndexBasedSpellChecker`, you may want to copy data from fields like `title`, `body`, etc., to a field dedicated to providing spelling suggestions.

Many of the parameters relate to how this spell checker should query the index for term suggestions. The `distanceMeasure` defines the metric to use during the spell check query. The value "internal" uses the default Levenshtein metric, which is the same metric used with the other spell checker implementations.

Because this spell checker is querying the main index, you may want to limit how often it queries the index to be sure to avoid any performance conflicts with user queries. The `accuracy` setting defines the threshold for a valid suggestion, while `maxEdits` defines the number of changes to the term to allow. Since most spelling mistakes are only 1 letter off, setting this to 1 will reduce the number of possible suggestions (the default, however, is 2); the value can only be 1 or 2. `minPrefix` defines the minimum number of characters the terms should share. Setting this to 1 means that the spelling suggestions will all start with the same letter, for example.

The `maxInspections` parameter defines the maximum number of possible matches to review before returning results; the default is 5. `minQueryLength` defines how many characters must be in the query before suggestions are provided; the default is 4. `maxQueryFrequency` sets the maximum threshold for the number of documents a term must appear in before being considered as a suggestion. This can be a percentage (such as .01, or 1%) or an absolute value (such as 4). A lower threshold is better for small indexes. Finally, `tresholdTokenFrequency` sets the minimum number of documents a term must appear in, and can also be expressed as a percentage or an absolute value.

FileBasedSpellChecker

The `FileBasedSpellChecker` uses an external file as a spelling dictionary. This can be useful if using Solr as a spelling server, or if spelling suggestions don't need to be based on actual terms in the index. In `solrconfig.xml`, you would define the searchComponent as so:

```
<searchComponent name="spellcheck" class="solr.SpellCheckComponent">
  <lst name="spellchecker">
    <str name="classname">solr.FileBasedSpellChecker</str>
    <str name="name">file</str>
    <str name="sourceLocation">spellings.txt</str>
    <str name="characterEncoding">UTF-8</str>
    <str name="spellcheckIndexDir">./spellcheckerFile</str>
  </lst>
</searchComponent>
```

The differences here are the use of the `sourceLocation` to define the location of the file of terms and the use of `characterEncoding` to define the encoding of the terms file.

> In the previous example, *name* is used to name this specific definition of the spellchecker. Multiple definitions can co-exist in a single `solrconfig.xml`, and the *name* helps to differentiate them when they are defined in the `schema.xml`. If only defining one spellchecker, no name is required.

WordBreakSolrSpellChecker

`WordBreakSolrSpellChecker` offers suggestions by combining adjacent query terms and/or breaking terms into multiple words. It is a `SpellCheckComponent` enhancement, leveraging Lucene's `WordBreakSpellChecker`. It can detect spelling errors resulting from misplaced whitespace without the use of shingle-based dictionaries and provides collation support for word-break errors, including cases where the user has a mix of single-word spelling errors and word-break errors in the same query. It also provides shard support.

Here is how it might be configured in `solrconfig.xml`:

```
<searchComponent name="spellcheck" class="solr.SpellCheckComponent">
  <lst name="spellchecker">
    <str name="name">wordbreak</str>
    <str name="classname">solr.WordBreakSolrSpellChecker</str>
    <str name="field">lowerfilt</str>
    <str name="combineWords">true</str>
    <str name="breakWords">true</str>
    <int name="maxChanges">10</int>
  </lst>
</searchComponent>
```

Some of the parameters will be familiar from the discussion of the other spell checkers, such as `name`, `classname`, and `field`. New for this spell checker is `combineWords`, which defines whether words should be combined in a dictionary search (default is true); `breakWords`, which defines if words should be broken during a dictionary search (default is true); and `maxChanges`, an integer which defines how many times the spell checker should check collation possibilities against the index (default is 10).

The spellchecker can be configured with a traditional checker (ie: `DirectSolrSpellChecker`). The results are combined and collations can contain a mix of corrections from both spellcheckers.

Add It to a Request Handler

Queries will be sent to a RequestHandler. If every request should generate a suggestion, then you would add the following to the `requestHandler` that you are using:

```
<str name="spellcheck">true</str>
```

One of the possible parameters is the `spellcheck.dictionary` to use, and multiples can be defined. With multiple dictionaries, all specified dictionaries are consulted and results are interleaved. Collations are created with combinations from the different spellcheckers, with care taken that multiple overlapping corrections do not occur in the same collation.

Here is an example with multiple dictionaries:

```
<requestHandler name="spellCheckWithWordbreak"
class="org.apache.solr.handler.component.SearchHandler">
  <lst name="defaults">
    <str name="spellcheck.dictionary">default</str>
    <str name="spellcheck.dictionary">wordbreak</str>
    <str name="spellcheck.count">20</str>
  </lst>
  <arr name="last-components">
    <str>spellcheck</str>
  </arr>
</requestHandler>
```

Spell Check Parameters

The SpellCheck component accepts the parameters described in the table below.

Parameter	Description
spellcheck	Turns on or off SpellCheck suggestions for the request. If **true**, then spelling suggestions will be generated.
spellcheck.q or q	Selects the query to be spellchecked.
spellcheck.build	Instructs Solr to build a dictionary for use in spellchecking.
spellcheck.collate	Causes Solr to build a new query based on the best suggestion for each term in the submitted query.
spellcheck.maxCollations	This parameter specifies the maximum number of collations to return.
spellcheck.maxCollationTries	This parameter specifies the number of collation possibilities for Solr to try before giving up.
spellcheck.maxCollationEvaluations	This parameter specifies the maximum number of word correction combinations to rank and evaluate prior to deciding which collation candidates to test against the index.
spellcheck.collateExtendedResult	If true, returns an expanded response detailing the collations found. If `spellcheck.collate` is false, this parameter will be ignored.
spellcheck.collateMaxCollectDocs	The maximum number of documents to collect when testing potential Collations

spellcheck.collateParam.*	Specifies param=value pairs that can be used to override normal query params when validating collations
spellcheck.count	Specifies the maximum number of spelling suggestions to be returned.
spellcheck.dictionary	Specifies the dictionary that should be used for spellchecking.
spellcheck.extendedResults	Causes Solr to return additional information about spellcheck results, such as the frequency of each original term in the index (origFreq) as well as the frequency of each suggestion in the index (frequency). Note that this result format differs from the non-extended one as the returned suggestion for a word is actually an array of lists, where each list holds the suggested term and its frequency.
spellcheck.onlyMorePopular	Limits spellcheck responses to queries that are more popular than the original query.
spellcheck.maxResultsForSuggest	The maximum number of hits the request can return in order to both generate spelling suggestions and set the "correctlySpelled" element to "false".
spellcheck.alternativeTermCount	The count of suggestions to return for each query term existing in the index and/or dictionary.
spellcheck.reload	Reloads the spellchecker.
spellcheck.accuracy	Specifies an accuracy value to help decide whether a result is worthwhile.
spellcheck.<DICT_NAME>.key	Specifies a key/value pair for the implementation handling a given dictionary.

The `spellcheck` Parameter

This parameter turns on SpellCheck suggestions for the request. If **true**, then spelling suggestions will be generated.

The `spellcheck.q` or `q` Parameter

This parameter specifies the query to spellcheck. If `spellcheck.q` is defined, then it is used; otherwise the original input query is used. The `spellcheck.q` parameter is intended to be the original query, minus any extra markup like field names, boosts, and so on. If the `q` parameter is specified, then the `SpellingQueryConverter` class is used to parse it into tokens; otherwise the `WhitespaceTokenizer` is used. The choice of which one to use is up to the application. Essentially, if you have a spelling "ready" version in your application, then it is probably better to use `spellcheck.q`. Otherwise, if you just want Solr to do the job, use the `q` parameter.

> ⚠ The SpellingQueryConverter class does not deal properly with non-ASCII characters. In this case, you have either to use `spellcheck.q`, or implement your own QueryConverter.

The `spellcheck.build` Parameter

If set to **true**, this parameter creates the dictionary that the SolrSpellChecker will use for spell-checking. In a typical search application, you will need to build the dictionary before using the SolrSpellChecker. However, it's not always necessary to build a dictionary first. For example, you can configure the spellchecker to use a dictionary that already exists.

The dictionary will take some time to build, so this parameter should not be sent with every request.

The `spellcheck.reload` Parameter

If set to true, this parameter reloads the spellchecker. The results depend on the implementation of `SolrSpellChecker.reload()`. In a typical implementation, reloading the spellchecker means reloading the dictionary.

The `spellcheck.count` Parameter

This parameter specifies the maximum number of suggestions that the spellchecker should return for a term. If this parameter isn't set, the value defaults to 1. If the parameter is set but not assigned a number, the value defaults to 5. If the parameter is set to a positive integer, that number becomes the maximum number of suggestions returned by the spellchecker.

The `spellcheck.onlyMorePopular` Parameter

If **true**, Solr will to return suggestions that result in more hits for the query than the existing query. Note that this will return more popular suggestions even when the given query term is present in the index and considered "correct".

The `spellcheck.maxResultsForSuggest` Parameter

For example, if this is set to 5 and the user's query returns 5 or fewer results, the spellchecker will report "correctlySpelled=false" and also offer suggestions (and collations if requested). Setting this greater than zero is useful for creating "did-you-mean?" suggestions for queries that return a low number of hits.

The `spellcheck.alternativeTermCount` Parameter

Specify the number of suggestions to return for each query term existing in the index and/or dictionary. Presumably, users will want fewer suggestions for words with docFrequency>0. Also setting this value turns "on" context-sensitive spell suggestions.

The `spellcheck.extendedResults` Parameter

This parameter causes to Solr to include additional information about the suggestion, such as the frequency in the index.

The `spellcheck.collate` Parameter

If **true**, this parameter directs Solr to take the best suggestion for each token (if one exists) and construct a new query from the suggestions. For example, if the input query was "jawa class lording" and the best suggestion for "jawa" was "java" and "lording" was "loading", then the resulting collation would be "java class loading".

The spellcheck.collate parameter only returns collations that are guaranteed to result in hits if re-queried, even when applying original `fq` parameters. This is especially helpful when there is more than one correction per query.

> ⚠ This only returns a query to be used. It does not actually run the suggested query.

The **`spellcheck.maxCollations`** Parameter

The maximum number of collations to return. The default is **1**. This parameter is ignored if `spellcheck.collate` is false.

The **`spellcheck.maxCollationTries`** Parameter

This parameter specifies the number of collation possibilities for Solr to try before giving up. Lower values ensure better performance. Higher values may be necessary to find a collation that can return results. The default value is `0`, which maintains backwards-compatible (Solr 1.4) behavior (do not check collations). This parameter is ignored if `spellcheck.collate` is false.

The **`spellcheck.maxCollationEvaluations`** Parameter

This parameter specifies the maximum number of word correction combinations to rank and evaluate prior to deciding which collation candidates to test against the index. This is a performance safety-net in case a user enters a query with many misspelled words. The default is **10,000** combinations, which should work well in most situations.

The **`spellcheck.collateExtendedResult`** Parameter

If **true**, this parameter returns an expanded response format detailing the collations Solr found. The default value is **false** and this is ignored if `spellcheck.collate` is false.

The **`spellcheck.collateMaxCollectDocs`** Parameter

This parameter specifies the maximum number of documents that should be collect when testing potential collations against the index. A value of **0** indicates that all documents should be collected, resulting in exact hit-counts. Otherwise an estimation is provided as a performance optimization in cases where exact hit-counts are unnecessary – the higher the value specified, the more precise the estimation.

The default value for this parameter is **0**, but when `spellcheck.collateExtendedResults` is **false**, the optimization is always used as if a **1** had been specified.

The **`spellcheck.collateParam.*`** Parameter Prefix

This parameter prefix can be used to specify any additional parameters that you wish to the Spellchecker to use when internally validating collation queries. For example, even if your regular search results allow for loose matching of one or more query terms via parameters like "`q.op=OR&mm=20%`" you can specify override params such as "`spellcheck.collateParam.q.op=AND&spellcheck.collateParam.mm=100%`" to require that only collations consisting of words that are all found in at least one document may be returned.

The **`spellcheck.dictionary`** Parameter

This parameter causes Solr to use the dictionary named in the parameter's argument. The default setting is "default". This parameter can be used to invoke a specific spellchecker on a per request basis.

The **`spellcheck.accuracy`** Parameter

Specifies an accuracy value to be used by the spell checking implementation to decide whether a result is worthwhile or not. The value is a float between 0 and 1. Defaults to `Float.MIN_VALUE`.

The `spellcheck.<DICT_NAME>.key` Parameter

Specifies a key/value pair for the implementation handling a given dictionary. The value that is passed through is just `key=value` (`spellcheck.<DICT_NAME>.` is stripped off.

For example, given a dictionary called `foo`, `spellcheck.foo.myKey=myValue` would result in `myKey=myValue` being passed through to the implementation handling the dictionary `foo`.

Example

Using Solr's "`bin/solr -e techproducts`" example, this query shows the results of a simple request that defines a query using the `spellcheck.q` parameter, and forces the collations to require all input terms must match:

`http://localhost:8983/solr/techproducts/spell?df=text&spellcheck.q=delll+ultra+sharp&spellcheck=true&spellcheck.collateParam.q.op=AND`

Results:

```
<lst name="spellcheck">
  <lst name="suggestions">
    <lst name="delll">
      <int name="numFound">1</int>
      <int name="startOffset">0</int>
      <int name="endOffset">5</int>
      <int name="origFreq">0</int>
      <arr name="suggestion">
        <lst>
          <str name="word">dell</str>
          <int name="freq">1</int>
        </lst>
      </arr>
    </lst>
    <lst name="ultra sharp">
      <int name="numFound">1</int>
      <int name="startOffset">6</int>
      <int name="endOffset">17</int>
      <int name="origFreq">0</int>
      <arr name="suggestion">
        <lst>
          <str name="word">ultrasharp</str>
          <int name="freq">1</int>
        </lst>
      </arr>
    </lst>
  </lst>
  <bool name="correctlySpelled">false</bool>
  <lst name="collations">
    <lst name="collation">
      <str name="collationQuery">dell ultrasharp</str>
      <int name="hits">1</int>
      <lst name="misspellingsAndCorrections">
        <str name="delll">dell</str>
        <str name="ultra sharp">ultrasharp</str>
      </lst>
    </lst>
  </lst>
</lst>
```

Distributed SpellCheck

The `SpellCheckComponent` also supports spellchecking on distributed indexes. If you are using the SpellCheckComponent on a request handler other than "/select", you must provide the following two parameters:

Parameter	Description
shards	Specifies the shards in your distributed indexing configuration. For more information about distributed indexing, see Distributed Search with Index Sharding
shards.qt	Specifies the request handler Solr uses for requests to shards. This parameter is not required for the `/select` request handler.

For example: `http://localhost:8983/solr/techproducts/spell?spellcheck=true&spellcheck.build=true&spellcheck.q=toyata&shards.qt=/spell&shards=solr-shard1:8983/solr/techpr`

`oducts,solr-shard2:8983/solr/techproducts`

In case of a distributed request to the SpellCheckComponent, the shards are requested for at least five suggestions even if the `spellcheck.count` parameter value is less than five. Once the suggestions are collected, they are ranked by the configured distance measure (Levenstein Distance by default) and then by aggregate frequency.

Query Re-Ranking

Query Re-Ranking allows you to run a simple query (A) for matching documents and then re-rank the top N documents using the scores from a more complex query (B). Since the more costly ranking from query B is only applied to the top N documents it will have less impact on performance then just using the complex query B by itself – the trade off is that documents which score very low using the simple query A may not be considered during the re-ranking phase, even if they would score very highly using query B.

Specifying A Ranking Query

A Ranking query can be specified using the "`rq`" request parameter. The "rq" parameter must specify a query string that when parsed, produces a RankQuery. This could also be done with a custom QParserPlugin you have written as a plugin, but most users can just use the "`rerank`" parser provided with Solr.

The "`rerank`" parser wraps a query specified by an local parameter, along with additional parameters indicating how many documents should be re-ranked, and how the final scores should be computed:

Parameter	Default	Description
`reRankQuery`	(Mandatory)	The query string for your complex ranking query - in most cases a variable will be used to refer to another request parameter.
`reRankDocs`	200	The number of top N documents from the original query that should be re-ranked. This number will be treated as a minimum, and may be increased internally automatically in order to rank enough documents to satisfy the query (ie: start+rows)
`reRankWeight`	2.0	A multiplicative factor that will be applied to the score from the reRankQuery for each of the top matching documents, before that score is added to the original score

In the example below, the top 1000 documents matching the query "greetings" will be re-ranked using the query "(hi hello hey hiya)". The resulting scores for each of those 1000 documents will be 3 times their score from the "(hi hello hey hiya)", plus the score from the original "gretings" query:

```
q=greetings&rq={!rerank reRankQuery=$rqq reRankDocs=1000
reRankWeight=3}&rqq=(hi+hello+hey+hiya)
```

If a document matches the original query, but does not match the re-ranking query, the document's original score will remain.

Combining Ranking Queries With Other Solr Features

The "`rq`" parameter and the re-ranking feature in general works well with other Solr features. For example, it can be used in conjunction with the collapse parser to re-rank the group heads after they've been collapsed. It also preserves the order of documents elevated by the elevation component. And it even has it's own custom explain so you can see how the re-ranking scores were derived when looking at debug information.

Transforming Result Documents

Document Transformers can be used to modify the information returned about each documents in the results of a query.

Using Document Transformers

When executing a request, a document transformer can be used by including it in the `fl` parameter using square brackets, for example:

```
fl=id,name,score,[shard]
```

Some transformers allow, or require, local parameters which can be specified as key value pairs inside the brackets:

```
fl=id,name,score,[explain style=nl]
```

As with regular fields, you can change the key used when a Transformer adds a field to a document via a prefix:

```
fl=id,name,score,my_val_a:[value v=42 t=int],my_val_b:[value v=7 t=float]
```

The sections below discuss exactly what these various transformers do.

Available Transformers

`[value]` - ValueAugmenterFactory

Modifies every document to include the exact same value, as if it were a stored field in every document:

```
q=*:*&fl=id,greeting:[value v='hello']
```

The above query would produce results like the following:

```
<result name="response" numFound="32" start="0">
  <doc>
    <str name="id">1</str>
    <str name="greeting">hello</str></doc>
  </doc>
  ...
```

By default, values are returned as a String, but a "`t`" parameter can be specified using a value of int, float, double, or date to force a specific return type:

```
q=*:*&fl=id,my_number:[value v=42 t=int],my_string:[value v=42]
```

In addition to using these request parameters, you can configure additional named instances of

ValueAugmenterFactory, or override the default behavior of the existing `[value]` transformer in your solrconfig.xml file:

```
<transformer name="mytrans2"
class="org.apache.solr.response.transform.ValueAugmenterFactory" >
  <int name="value">5</int>
</transformer>
<transformer name="value"
class="org.apache.solr.response.transform.ValueAugmenterFactory" >
  <double name="defaultValue">5</double>
</transformer>
```

The "`value`" option forces an explicit value to always be used, while the "`defaultValue`" option provides a default that can still be overridden using the "`v`" and "`t`" local parameters.

`[explain]` - ExplainAugmenterFactory

Augments each document with an inline explanation of it's score exactly like the information available about each document in the debug section:

```
q=features:cache&wt=json&fl=id,[explain style=nl]
```

Supported values for "`style`" are "`text`", and "`html`", and "nl" which returns the information as structured data:

```
"response":{"numFound":2,"start":0,"docs":[
      {
        "id":"6H500F0",
        "[explain]":{
          "match":true,
          "value":1.052226,
          "description":"weight(features:cache in 2) [DefaultSimilarity], result
of:",
          "details":[{
...
```

A default style can be configured by specifying an "args" parameter in your configuration:

```
<transformer name="explain"
class="org.apache.solr.response.transform.ExplainAugmenterFactory" >
  <str name="args">nl</str>
</transformer>
```

`[child]` - ChildDocTransformerFactory

This transformer returns all descendant documents of each parent document matching your query in a flat list nested inside the matching parent document. This is useful when you have indexed nested child documents and want to retrieve the child documents for the relevant parent documents for any type of search query.

```
fl=id,[child parentFilter=doc_type:book childFilter=doc_type:chapter limit=100]
```

Note that this transformer can be used even though the query itself is not a Block Join query.

When using this transformer, the `parentFilter` parameter must be specified, and works the same as in all Block Join Queries, additional optional parameters are:

- `childFilter` - query to filter which child documents should be included, this can be particularly useful when you have multiple levels of hierarchical documents (default: all children)
- `limit` - the maximum number of child documents to be returned per parent document (default: 10)

`[shard]` - ShardAugmenterFactory

This transformer adds information about what shard each individual document came from in a distributed request.

ShardAugmenterFactory does not support any request parameters, or configuration options.

`[docid]` - DocIdAugmenterFactory

This transformer adds the internal Lucene document id to each document – this is primarily only useful for debugging purposes.

DocIdAugmenterFactory does not support any request parameters, or configuration options.

`[elevated]` and `[excluded]`

These transformers are available only when using the Query Elevation Component.

- `[elevated]` annotates each document to indicate if it was elevated or not.
- `[excluded]` annotates each document to indicate if it would have been excluded - this is only supported if you also use the `markExcludes` parameter.

```
fl=id,[elevated],[excluded]&excludeIds=GB18030TEST&elevateIds=6H500F0&markExcludes=t
rue
```

```
"response":{"numFound":32,"start":0,"docs":[
      {
        "id":"6H500F0",
        "[elevated]":true,
        "[excluded]":false},
      {
        "id":"GB18030TEST",
        "[elevated]":false,
        "[excluded]":true},
      {
        "id":"SP2514N",
        "[elevated]":false,
        "[excluded]":false},
...
```

Suggester

The SuggestComponent in Solr provides users with automatic suggestions for query terms. You can use this to implement a powerful auto-suggest feature in your search application.

Although it is possible to use the Spell Checking functionality to power autosuggest behavior, Solr has a dedicated SuggestComponent designed for this functionality. This approach utilizes Lucene's Suggester implementation and supports all of the lookup implementations available in Lucene.

The main features of this Suggester are:

- Lookup implementation pluggability
- Term dictionary pluggability, giving you the flexibility to choose the dictionary implementation
- Distributed support

The `solrconfig.xml` found in Solr's "`techproducts`" example has the new Suggester implementation configured already. For more on search components, see the section RequestHandlers and SearchComponents in SolrConfig.

Covered in this section:

Configuring Suggester in solrconfig.xml

The "`techproducts`" example `solrconfig.xml` has a `suggest` search component and a `/suggest` request handler already configured. You can use that as the basis for your configuration, or create it from scratch, as detailed below.

Adding the Suggest Search Component

The first step is to add a search component to `solrconfig.xml` to extend the SpellChecker. Here is some sample code that could be used.

```
<searchComponent name="suggest" class="solr.SuggestComponent">
   <lst name="suggester">
      <str name="name">mySuggester</str>
      <str name="lookupImpl">FuzzyLookupFactory</str>
      <str name="dictionaryImpl">DocumentDictionaryFactory</str>
      <str name="field">cat</str>
      <str name="weightField">price</str>
      <str name="suggestAnalyzerFieldType">string</str>
      <str name="buildOnStartup">false</str>
   </lst>
</searchComponent>
```

Suggester Search Component Parameters

The Suggester search component takes several configuration parameters. The choice of the lookup implementation (`lookupImpl`, how terms are found in the suggestion dictionary) and the dictionary implementation (`dictionaryImpl`, how terms are stored in the suggestion dictionary) will dictate some of the parameters required. Below are the main parameters that can be used no matter what lookup or dictionary implementation is used. In the following sections additional parameters are provided for each implementation.

<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>searchComponent name</td><td>Arbitrary name for the search component.</td></tr>
<tr><td>name</td><td>A symbolic name for this suggester. You can refer to this name in the URL parameters and in the SearchHandler configuration. It is possible to have mutiples of these</td></tr>
<tr><td>lookupImpl</td><td>Lookup implementation. There are several possible implementations, described below in the section Lookup Implementations. If not set, the default lookup is JaspellLookupFactory.</td></tr>
<tr><td>dictionaryImpl</td><td>The dictionary implementation to use. There are several possible implementations, described below in the section Dictionary Implementations . If not set, the default dictionary implementation is HighFrequencyDictionaryFactory unless a <code>sourceLocation</code> is used, in which case, the dictionary implementation will be FileDictionaryFactory</td></tr>
<tr><td>field</td><td>A field from the index to use as the basis of suggestion terms. If <code>sourceLocation</code> is empty (meaning any dictionary implementation other than FileDictionaryFactory) then terms from this field in the index will be used.
To be used as the basis for a suggestion, the field must be stored. You may want to use copyField rules to create a special 'suggest' field comprised of terms from other fields in documents. In any event, you likely want a minimal amount of analysis on the field, so an additional option is to create a field type in your schema that only uses basic tokenizers or filters. One option for such a field type is shown here:
<pre>
<fieldType class="solr.TextField" name="textSuggest"
positionIncrementGap="100">
   <analyzer>
      <tokenizer class="solr.StandardTokenizerFactory"/>
      <filter class="solr.StandardFilterFactory"/>
      <filter class="solr.LowerCaseFilterFactory"/>
   </analyzer>
</fieldType>
</pre>
However, this minimal analysis is not required if you want more analysis to occur on terms. If using the AnalyzingLookupFactory as your lookupImpl, however, you have the option of defining the field type rules to use for index and query time analysis.</td></tr>
<tr><td>sourceLocation</td><td>The path to the dictionary file if using the FileDictionaryFactory. If this value is empty then the main index will be used as a source of terms and weights.</td></tr>
<tr><td>storeDir</td><td>The location to store the dictionary file.</td></tr>
</table>

buildOnCommit or buildOnOptimize	If true then the lookup data structure will be rebuilt after soft-commit. If false, the default, then the lookup data will be built only when requested by URL parameter `suggest.build=true`. Use `buildOnCommit` to rebuild the dictionary with every soft-commit, or `buildOnOptimize` to build the dictionary only when the index is optimized. Some lookup implementations may take a long time to build, specially with large indexes, in such cases, using buildOnCommit or buildOnOptimize, particularly with a high frequency of softCommits is not recommended, and it's recommended instead build the suggester manually issuing requests with `suggest.build=true` at a lower frequency.
buildOnStartup	If true then the lookup data structure will be built when Solr starts or when the core is reloaded. If this parameter is not specified, the suggester will check if the lookup data structure is present on disk and build it if not found. Enabling this to true could lead to the core talking longer to load (or reload) as the suggester data structure needs to be built, which can sometimes take a long time. It's usually preferred to have this setting set to 'false' and build suggesters manually issuing requests with `suggest.build=true`.

Lookup Implementations

The `lookupImpl` parameter defines the algorithms used to look up terms in the suggest index. There are several possible implementations to choose from, and some require additional parameters to be configured.

AnalyzingLookupFactory

A lookup that first analyzes the incoming text and adds the analyzed form to a weighted FST, and then does the same thing at lookup time.

This implementation uses the following additional properties:

- suggestAnalyzerFieldType: The field type to use for the query-time and build-time term suggestion analysis.
- exactMatchFirst: If true, the default, exact suggestions are returned first, even if they are prefixes or other strings in the FST have larger weights.
- preserveSep: If true, the default, then a separator between tokens is preserved. This means that suggestions are sensitive to tokenization (e.g., baseball is different from base ball).
- preservePositionIncrements: If true, the suggester will preserve position increments. This means that token filters which leave gaps (for example, when StopFilter matches a stopword) the position would be respected when building the suggester. The default is false.

FuzzyLookupFactory

This is a suggester which is an extension of the AnalyzingSuggester but is fuzzy in nature. The similarity is measured by the Levenshtein algorithm.

This implementation uses the following additional properties:

- exactMatchFirst: If true, the default, exact suggestions are returned first, even if they are prefixes or other strings in the FST have larger weights.
- preserveSep: If true, the default, then a separator between tokens is preserved. This means that suggestions are sensitive to tokenization (e.g., baseball is different from base ball).
- maxSurfaceFormsPerAnalyzedForm: Maximum number of surface forms to keep for a single analyzed form. When there are too many surface forms we discard the lowest weighted ones.
- maxGraphExpansions: When building the FST ("index-time"), we add each path through the tokenstream

graph as an individual entry. This places an upper-bound on how many expansions will be added for a single suggestion. The default is -1 which means there is no limit.

- preservePositionIncrements: If true, the suggester will preserve position increments. This means that token filters which leave gaps (for example, when StopFilter matches a stopword) the position would be respected when building the suggester. The default is false.
- maxEdits: The maximum number of string edits allowed. The systems hard limit is 2. The default is 1.
- transpositions: If true, the default, transpositions should be treated as a primitive edit operation.
- nonFuzzyPrefix: The length of the common non fuzzy prefix match which must match a suggestion. The default is 1.
- minFuzzyLength: The minimum length of query before which any string edits will be allowed. The default is 3.
- unicodeAware: If true, maxEdits, minFuzzyLength, transpositions and nonFuzzyPrefix parameters will be measured in unicode code points (actual letters) instead of bytes. The default is false.

AnalyzingInfixLookupFactory

Analyzes the input text and then suggests matches based on prefix matches to any tokens in the indexed text. This uses a Lucene index for its dictionary.

This implementation uses the following additional properties.

- indexPath: When using AnalyzingInfixSuggester you can provide your own path where the index will get built. The default is analyzingInfixSuggesterIndexDir and will be created in your collections data directory.
- minPrefixChars: Minimum number of leading characters before PrefixQuery is used (default is 4). Prefixes shorter than this are indexed as character ngrams (increasing index size but making lookups faster).
- allTermsRequired: Boolean option for multiple terms. Default is true - all terms required.
- highlight: Highlight suggest terms. Default is true.

BlendedInfixLookupFactory

An extension of the AnalyzingInfixSuggester which provides additional functionality to weight prefix matches across the matched documents. You can tell it to score higher if a hit is closer to the start of the suggestion or vice versa.

This implementation uses the following additional properties:

- blenderType: used to calculate weight coefficient using the position of the first matching word. Can be one of:
  - linear: weightFieldValue*(1 - 0.10*position): Matches to the start will be given a higher score (Default)
  - reciprocal: weightFieldValue/(1+position): Matches to the end will be given a higher score.
- numFactor: The factor to multiply the number of searched elements from which results will be pruned. Default is 10.
- indexPath: When using BlendedInfixSuggester you can provide your own path where the index will get built. The default directory name is blendedInfixSuggesterIndexDir and will be created in your collections data directory.
- minPrefixChars: Minimum number of leading characters before PrefixQuery is used (default 4). Prefixes shorter than this are indexed as character ngrams (increasing index size but making lookups faster).

FreeTextLookupFactory

It looks at the last tokens plus the prefix of whatever final token the user is typing, if present, to predict the most likely next token. The number of previous tokens that need to be considered can also be specified. This suggester would only be used as a fallback, when the primary suggester fails to find any suggestions.

This implementation uses the following additional properties:

- suggestFreeTextAnalyzerFieldType: The analyzer used at "query-time" and "build-time" to analyze suggestions. This field is required.
- ngrams: The max number of tokens out of which singles will be make the dictionary. The default value is 2. Increasing this would mean you want more than the previous 2 tokens to be taken into consideration when making the suggestions.

FSTLookupFactory

An automaton-based lookup. This implementation is slower to build, but provides the lowest memory cost. We recommend using this implementation unless you need more sophisticated matching results, in which case you should use the Jaspell implementation.

This implementation uses the following additional properties:

- exactMatchFirst: If true, the default, exact suggestions are returned first, even if they are prefixes or other strings in the FST have larger weights.
- weightBuckets: The number of separate buckets for weights which the suggester will use while building its dictionary.

TSTLookupFactory

A simple compact ternary trie based lookup.

WFSTLookupFactory

A weighted automaton representation which is an alternative to FSTLookup for more fine-grained ranking. WFSTLookup does not use buckets, but instead a shortest path algorithm. Note that it expects weights to be whole numbers. If weight is missing it's assumed to be 1.0. Weights affect the sorting of matching suggestions when `spellcheck.onlyMorePopular=true` is selected: weights are treated as "popularity" score, with higher weights preferred over suggestions with lower weights.

JaspellLookupFactory

A more complex lookup based on a ternary trie from the JaSpell project. Use this implementation if you need more sophisticated matching results.

Dictionary Implementations

The dictionary implementations define how terms are stored. There are several options, and multiple dictionaries can be used in a single request if necessary.

DocumentDictionaryFactory

A dictionary with terms, weights, and an optional payload taken from the index.

This dictionary implementation takes the following parameters in addition to parameters described for the Suggester generally and for the lookup implementation:

- weightField: A field that is stored or a numeric DocValue field. This field is optional.
- payloadField: The payloadField should be a field that is stored. This field is optional.

DocumentExpressionDictionaryFactory

This dictionary implementation is the same as the DocumentDictionaryFactory but allows users to specify an arbitrary expression into the 'weightExpression' tag.

This dictionary implementation takes the following parameters in addition to parameters described for the Suggester generally and for the lookup implementation:

- payloadField: The payloadField should be a field that is stored. This field is optional.
- weightExpression: An arbitrary expression used for scoring the suggestions. The fields used must be numeric fields. This field is required.

HighFrequencyDictionaryFactory

This dictionary implementation allows adding a threshold to prune out less frequent terms in cases where very common terms may overwhelm other terms.

This dictionary implementation takes one parameter in addition to parameters described for the Suggester generally and for the lookup implementation:

- threshold: A value between zero and one representing the minimum fraction of the total documents where a term should appear in order to be added to the lookup dictionary.

FileDictionaryFactory

This dictionary implementation allows using an external file that contains suggest entries. Weights and payloads can also be used.

If using a dictionary file, it should be a plain text file in UTF-8 encoding. Blank lines and lines that start with a '#' are ignored. You can use both single terms and phrases in the dictionary file. If adding weights or payloads, those should be separated from terms using the delimiter defined with the `fieldDelimiter` property (the default is '\t', the tab representation).

This dictionary implementation takes one parameter in addition to parameters described for the Suggester generally and for the lookup implementation:

- fieldDelimiter: Specify the delimiter to be used separating the entries, weights and payloads. The default is tab ('\t').

```
# This is a sample dictionary file.

acquire
accidentally\t2.0
accommodate\t3.0
```

Multiple Dictionaries

It is possible to include multiple dictionaryImpl definitions in a single SuggestComponent definition.

To do this, simply define separate suggesters, as in this example:

```
<searchComponent name="suggest" class="solr.SuggestComponent">
   <lst name="suggester">
      <str name="name">mySuggester</str>
      <str name="lookupImpl">FuzzyLookupFactory</str>
      <str name="dictionaryImpl">DocumentDictionaryFactory</str>
      <str name="field">cat</str>
      <str name="weightField">price</str>
      <str name="suggestAnalyzerFieldType">string</str>
   </lst>
   <lst name="suggester">
      <str name="name">altSuggester</str>
      <str name="dictionaryImpl">DocumentExpressionDictionaryFactory</str>
      <str name="lookupImpl">FuzzyLookupFactory</str>
      <str name="field">product_name</str>
      <str name="weightExpression">((price * 2) + ln(popularity))</str>
      <str name="sortField">weight</str>
      <str name="sortField">price</str>
      <str name="storeDir">suggest_fuzzy_doc_expr_dict</str>
      <str name="suggestAnalyzerFieldType">text_en</str>
   </lst>
</searchComponent>
```

When using these Suggesters in a query, you would define multiple 'suggest.dictionary' parameters in the request, referring to the names given for each Suggester in the search component definition. The response will include the terms in sections for each Suggester. See the Examples section below for an example request and response.

Adding the Suggest Request Handler

After adding the search component, a request handler must be added to `solrconfig.xml`. This request handler works the same as any other request handler, and allows you to configure default parameters for serving suggestion requests. The request handler definition must incorporate the "suggest" search component defined previously.

```
<requestHandler name="/suggest" class="solr.SearchHandler" startup="lazy">
    <lst name="defaults">
      <str name="suggest">true</str>
      <str name="suggest.count">10</str>
    </lst>
    <arr name="components">
      <str>suggest</str>
    </arr>
  </requestHandler>
```

Suggest Request Handler Parameters

The following parameters allow you to set defaults for the Suggest request handler:

Parameter	Description
suggest=true	This parameter should always be true, because we always want to run the Suggester for queries submitted to this handler.

suggest.dictionary	The name of the dictionary component configured in the search component. This is a mandatory parameter. It can be set in the request handler, or sent as a parameter at query time.
suggest.q	The query to use for suggestion lookups.
suggest.count	Specifies the number of suggestions for Solr to return.
suggest.build	If true, it will build the suggester index. This is likely useful only for initial requests; you would probably not want to build the dictionary on every request, particularly in a production system. If you would like to keep your dictionary up to date, you should use the `buildOnCommit` or `buildOnOptimize` parameter for the search component.
suggest.reload	If true, it will reload the suggester index.
suggest.buildAll	If true, it will build all suggester indexes.
suggest.reloadAll	If true, it will reload all suggester indexes.

These properties can also be overridden at query time, or not set in the request handler at all and always sent at query time.

Example Usages

Get Suggestions with Weights

This is the basic suggestion using a single dictionary and a single Solr core.

Example query:

```
http://localhost:8983/solr/techproducts/suggest?suggest=true&suggest.build=true&sugg
est.dictionary=mySuggester&wt=json&suggest.q=elec
```

In this example, we've simply requested the string 'elec' with the suggest.q parameter and requested that the suggestion dictionary be built with suggest.build (note, however, that you would likely not want to build the index on every query - instead you should use buildOnCommit or buildOnOptimize if you have regularly changing documents).

Example response:

```
{
    "responseHeader": {
        "status": 0,
        "QTime": 35
    },
    "command": "build",
    "suggest": {
        "mySuggester": {
            "elec": {
                "numFound": 3,
                "suggestions": [
                    {
                        "term": "electronics and computer1",
                        "weight": 2199,
                        "payload": ""
                    },
                    {
                        "term": "electronics",
                        "weight": 649,
                        "payload": ""
                    },
                    {
                        "term": "electronics and stuff2",
                        "weight": 279,
                        "payload": ""
                    }
                ]
            }
        }
    }
}
```

Multiple Dictionaries

If you have defined multiple dictionaries, you can use them in queries.

Example query:

```
http://localhost:8983/solr/techproducts/suggest?suggest=true&suggest.dictionary=mySu
ggester&suggest.dictionary=altSuggester&wt=json&suggest.q=elec
```

In this example we have sent the string 'elec' as the suggest.q parameter and named two suggest.dictionary definitions to be used.

Example response:

```
{
    "responseHeader": {
        "status": 0,
        "QTime": 3
    },
    "suggest": {
        "mySuggester": {
            "elec": {
                "numFound": 1,
                "suggestions": [
                    {
                        "term": "electronics and computer1",
                        "weight": 100,
                        "payload": ""
                    }
                ]
            }
        },
        "altSuggester": {
            "elec": {
                "numFound": 1,
                "suggestions": [
                    {
                        "term": "electronics and computer1",
                        "weight": 10,
                        "payload": ""
                    }
                ]
            }
        }
    }
}
```

MoreLikeThis

The `MoreLikeThis` search component enables users to query for documents similar to a document in their result list. It does this by using terms from the original document to find similar documents in the index.

There are three ways to use MoreLikeThis. The first, and most common, is to use it as a request handler. In this case, you would send text to the MoreLikeThis request handler as needed (as in when a user clicked on a "similar documents" link). The second is to use it as a search component. This is less desirable since it performs the MoreLikeThis analysis on every document returned. This may slow search results. The final approach is to use it as a request handler but with externally supplied text. This case, also referred to as the MoreLikeThisHandler, will supply information about similar documents in the index based on the text of the input document.

Covered in this section:

- How MoreLikeThis Works
- Common Parameters for MoreLikeThis
- Parameters for the MoreLikeThisComponent
- Parameters for the MoreLikeThisHandler

- Related Topics

How MoreLikeThis Works

`MoreLikeThis` constructs a Lucene query based on terms in a document. It does this by pulling terms from the defined list of fields (see the `mlt.fl` parameter, below). For best results, the fields should have stored term vectors in `schema.xml`. For example:

```
<field name="cat" ... termVectors="true" />
```

If term vectors are not stored, `MoreLikeThis` will generate terms from stored fields. A `uniqueKey` must also be stored in order for MoreLikeThis to work properly.

The next phase filters terms from the original document using thresholds defined with the MoreLikeThis parameters. Finally, a query is run with these terms, and any other query parameters that have been defined (see the `mlt.qf` parameter, below) and a new document set is returned.

Common Parameters for MoreLikeThis

The table below summarizes the `MoreLikeThis` parameters supported by Lucene/Solr. These parameters can be used with any of the three possible MoreLikeThis approaches.

Parameter	Description
mlt.fl	Specifies the fields to use for similarity. If possible, these should have stored `termVectors`.
mlt.mintf	Specifies the Minimum Term Frequency, the frequency below which terms will be ignored in the source document.
mlt.mindf	Specifies the Minimum Document Frequency, the frequency at which words will be ignored which do not occur in at least this many documents.
mlt.maxdf	Specifies the Maximum Document Frequency, the frequency at which words will be ignored which occur in more than this many documents.
mlt.minwl	Sets the minimum word length below which words will be ignored.
mlt.maxwl	Sets the maximum word length above which words will be ignored.
mlt.maxqt	Sets the maximum number of query terms that will be included in any generated query.
mlt.maxntp	Sets the maximum number of tokens to parse in each example document field that is not stored with TermVector support.
mlt.boost	Specifies if the query will be boosted by the interesting term relevance. It can be either "true" or "false".
mlt.qf	Query fields and their boosts using the same format as that used by the DisMaxRequestHandler. These fields must also be specified in `mlt.fl`.

Parameters for the MoreLikeThisComponent

Using MoreLikeThis as a search component returns similar documents for each document in the response set. In addition to the common parameters, these additional options are available:

Parameter	Description
mlt	If set to true, activates the `MoreLikeThis` component and enables Solr to return `MoreLikeThis` results.
mlt.count	Specifies the number of similar documents to be returned for each result. The default value is 5.

Parameters for the MoreLikeThisHandler

The table below summarizes parameters accessible through the `MoreLikeThisHandler`. It supports faceting, paging, and filtering using common query parameters, but does not work well with alternate query parsers.

Parameter	Description
mlt.match.include	Specifies whether or not the response should include the matched document. If set to false, the response will look like a normal select response.
mlt.match.offset	Specifies an offset into the main query search results to locate the document on which the `MoreLikeThis` query should operate. By default, the query operates on the first result for the q parameter.
mlt.interestingTerms	Controls how the `MoreLikeThis` component presents the "interesting" terms (the top TF/IDF terms) for the query. Supports three settings. The setting list lists the terms. The setting none lists no terms. The setting details lists the terms along with the boost value used for each term. Unless `mlt.boost=true`, all terms will have `boost=1.0`.

Related Topics

- RequestHandlers and SearchComponents in SolrConfig

Pagination of Results

Basic Pagination

In most search application usage, the "top" matching results (sorted by score, or some other criteria) are then displayed to some human user. In many applications the UI for these sorted results are displayed to the user in "pages" containing a fixed number of matching results, and users don't typically look at results past the first few pages worth of results.

In Solr, this basic paginated searching is supported using the **`start`** and **`rows`** parameters, and performance of this common behaviour can be tuned by utilizing the `queryResultCache` and adjusting the `queryResultWindowSize` configuration options based on your expected page sizes.

Basic Pagination Examples

The easiest way to think about simple pagination, is to simply multiply the page number you want (treating the "first" page number as "0") by the number of rows per page; such as in the following psuedo-code:

```
function fetch_solr_page($page_number, $rows_per_page) {
  $start = $page_number * $rows_per_page
  $params = [ q = $some_query, rows = $rows_per_page, start = $start ]
  return fetch_solr($params)
}
```

How Basic Pagination is Affected by Index Updates

The `start` param specified in a request to Solr indicates an **absolute** "offset" in the complete sorted list of matches that the client wants Solr to use as the beginning of the current "page". If an index modification (such as adding or removing documents) which affects the sequence of ordered documents matching a query occurs in between two requests from a client for subsequent pages of results, then it is possible that these modifications can result in the same document being returned on multiple pages, or documents being "skipped" as the result set shrinks or grows.

For example: consider an index containing 26 documents like so:

id	name
1	A
2	B
...	
26	Z

Followed by the following requests & index modifications interleaved:

- A client requests `q=*:*&rows=5&start=0&sort=name asc`
  - documents with the ids `1-5` will be returned to the client
- Document id 3 is deleted
- The client requests "page #2" using `q=*:*&rows=5&start=5&sort=name asc`
  - Documents `7-11` will be returned
  - Document 6 has been skipped, since it is now the 5th document in the sorted set of all matching results – it would be returned on a new request for "page #1"
- 3 new documents are now added with the ids `90`, `91`, and `92`; All three documents have a name of `A`
- The client requests "page #3" using `q=*:*&rows=5&start=10&sort=name asc`
  - Documents `9-13` will be returned
  - Documents `9`, `10`, and `11` have now been returned on both page #2 and page #3 since they moved farther back in the list of sorted results

In typical situations these impacts from index changes on paginated searching don't significantly affect user experience -- either because they happen extremely infrequently in fairly static collections, or because the users recognize that the collection of data is constantly evolving and expect to see documents shift up and down in the result sets.

Performance Problems with "Deep Paging"

In some situations, the results of a Solr search are not destined for a simple paginated user interface. When you wish to fetch a very large number of sorted results from Solr to feed into an external system, using very large values for the `start` or `rows` parameters can be very inefficient. Pagination using `start` and `rows` not only require Solr to compute (and sort) in memory all of the matching documents that should be fetched for the current page, but also all of the documents that would have appeared on previous pages. So while a request for `start=0&rows=1000000` may be obviously inefficient because it requires Solr to maintain & sort in memory a set of 1 million documents, likewise a request for `start=999000&rows=1000` is equally inefficient for the same reasons. Solr can't compute which matching document is the 999001st result in sorted order, without first determining what the first 999000 matching sorted results are.

Fetching A Large Number of Sorted Results: Cursors

As an alternative to increasing the "start" parameter to request subsequent pages of sorted results, Solr supports using a "Cursor" to scan through results. Cursors in Solr are a logical concept, that doesn't involve caching any state information on the server. Instead the sort values of the last document returned to the client are used to compute a "mark" representing a logical point in the ordered space of sort values. That "mark" can be specified in the parameters of subsequent requests to tell Solr where to continue.

Using Cursors

To use a cursor with Solr, specify a **`cursorMark`** parameter with the value of `"*"`. You can think of this being analogous to `start=0` as a way to tell Solr "start at the beginning of my sorted results" except that it also informs Solr that you want to use a Cursor. So in addition to returning the top N sorted results (where you can control N using the `rows` parameter) the Solr response will also include an encoded String named **`nextCursorMark`**. You then take the `nextCursorMark` String value from the response, and pass it back to Solr as the `cursorMark` parameter for your next request. You can repeat this process until you've fetched as many docs as you want, or until the `nextCursorMark` returned matches the `cursorMark` you've already specified -- indicating that there are no more results.

Constraints when using Cursors

There are a few important constraints to be aware of when using `cursorMark` parameter in a Solr request

1. `cursorMark` and `start` are mutually exclusive parameters
   - Your requests must either not include a `start` parameter, or it must be specified with a value of "`0`".
2. `sort` clauses must include the uniqueKey field (either "`asc`" or "`desc`")
   - If `id` is your uniqueKey field, then sort params like `id asc` and `name asc, id desc` would both work fine, but `name asc` by itself would not

Cursor mark values are computed based on the sort values of each document in the result, which means multiple documents with identical sort values will produce identical Cursor mark values if one of them is the last document on a page of results. In that situation, the subsequent request using that `cursorMark` would not know which of the documents with the identical mark values should be skipped. Requiring that the uniqueKey field be used as a clause in the sort criteria guarantees that a deterministic ordering will be returned, and that every `cursorMark` value will identify a unique point in the sequence of documents.

Cursor Examples

Fetch All Docs

The psuedo-code shown here shows the basic logic involved in fetching all documents matching a query using a cursor:

```
// when fetching all docs, you might as well use a simple id sort
// unless you really need the docs to come back in a specific order
$params = [ q => $some_query, sort => 'id asc', rows => $r, cursorMark => '*' ]
$done = false
while (not $done) {
  $results = fetch_solr($params)
  // do something with $results
  if ($params[cursorMark] == $results[nextCursorMark]) {
    $done = true
  }
  $params[cursorMark] = $results[nextCursorMark]
}
```

Using SolrJ, this psuedo-code would be:

```
SolrQuery q = (new SolrQuery(some_query)).setRows(r).setSort(SortClause.asc("id"));
String cursorMark = CursorMarkParams.CURSOR_MARK_START;
boolean done = false;
while (! done) {
  q.set(CursorMarkParams.CURSOR_MARK_PARAM, cursorMark);
  QueryResponse rsp = solrServer.query(q);
  String nextCursorMark = rsp.getNextCursorMark();
  doCustomProcessingOfResults(rsp);
  if (cursorMark.equals(nextCursorMark)) {
    done = true;
  }
  cursorMark = nextCursorMark;
}
```

If you wanted to do this by hand using curl, the sequence of requests would look something like this:

```
$ curl '...&rows=10&sort=id+asc&cursorMark=*'
{
  "response":{"numFound":32,"start":0,"docs":[
    // ... 10 docs here ...
  ]},
  "nextCursorMark":"AoEjR0JQ"}
$ curl '...&rows=10&sort=id+asc&cursorMark=AoEjR0JQ'
{
  "response":{"numFound":32,"start":0,"docs":[
    // ... 10 more docs here ...
  ]},
  "nextCursorMark":"AoEpVkRCREIxQTE2"}
$ curl '...&rows=10&sort=id+asc&cursorMark=AoEpVkRCREIxQTE2'
{
  "response":{"numFound":32,"start":0,"docs":[
    // ... 10 more docs here ...
  ]},
  "nextCursorMark":"AoEmbWF4dG9y"}
$ curl '...&rows=10&sort=id+asc&cursorMark=AoEmbWF4dG9y'
{
  "response":{"numFound":32,"start":0,"docs":[
    // ... 2 docs here because we've reached the end.
  ]},
  "nextCursorMark":"AoEpdmlld3Nvbmlj"}
$ curl '...&rows=10&sort=id+asc&cursorMark=AoEpdmlld3Nvbmlj'
{
  "response":{"numFound":32,"start":0,"docs":[
    // no more docs here, and note that the nextCursorMark
    // matches the cursorMark param we used
  ]},
  "nextCursorMark":"AoEpdmlld3Nvbmlj"}
```

Fetch first N docs, Based on Post Processing

Since the cursor is stateless from Solr's perspective, your client code can stop fetching additional results as soon as you have decided you have enough information:

```
 while (! done) {
  q.set(CursorMarkParams.CURSOR_MARK_PARAM, cursorMark);
  QueryResponse rsp = solrServer.query(q);
  String nextCursorMark = rsp.getNextCursorMark();
  boolean hadEnough = doCustomProcessingOfResults(rsp);
  if (hadEnough || cursorMark.equals(nextCursorMark)) {
    done = true;
  }
  cursorMark = nextCursorMark;
}
```

How cursors are Affected by Index Updates

Unlike basic pagination, Cursor pagination does not rely on using an absolute "offset" into the completed sorted list of matching documents. Instead, the `cursorMark` specified in a request encapsulates information about the **relative** position of the last document returned, based on the **absolute** sort values of that document. This means that the impact of index modifications is much smaller when using a cursor compared to basic pagination.

Consider the same example index described when discussing basic pagination:

id	name
1	A
2	B
...	
26	Z

- A client requests `q=*:*&rows=5&start=0&sort=name asc, id asc&cursorMark=*`
  - Documents with the ids `1-5` will be returned to the client in order
- Document id `3` is deleted
- The client requests 5 more documents using the `nextCursorMark` from the previous response
  - Documents `6-10` will be returned -- the deletion of a document that's already been returned doesn't affect the relative position of the cursor
- 3 new documents are now added with the ids `90`, `91`, and `92`; All three documents have a name of `A`
- The client requests 5 more documents using the `nextCursorMark` from the previous response
  - Documents `11-15` will be returned -- the addition of new documents with sort values already past does not affect the relative position of the cursor
- Document id `1` is updated to change it's 'name' to `Q`
- Document id 17 is updated to change it's 'name' to `A`
- The client requests 5 more documents using the `nextCursorMark` from the previous response
  - The resulting documents are `16,1,18,19,20` in that order
  - Because the sort value of document `1` changed so that it is *after* the cursor position, the document is returned to the client twice
  - Because the sort value of document `17` changed so that it is *before* the cursor position, the document has been "skipped" and will not be returned to the client as the cursor continues to progress

In a nutshell: When fetching all results matching a query using `cursorMark`, the only way index modifications can result in a document being skipped, or returned twice, is if the sort value of the document changes.

> ✓ One way to ensure that a document will never be returned more then once, is to use the uniqueKey field as the primary (and therefore: only significant) sort criterion.
>
> In this situation, you will be guaranteed that each document is only returned once, no matter how it may be be modified during the use of the cursor.

"Tailing" a Cursor

Because Cursor requests are stateless, and the `cursorMark` values encapsulate the **absolute** sort values of the last document returned from a search, it's possible to "continue" fetching additional results from a cursor that has already reached its end -- if new documents are added (or existing documents are updated) to the end of the results. You can think of this as similar to using something like "`tail -f`" in Unix.

The most common examples of how this can be useful is when you have a "timestamp" field recording when a document has been added/updated in your index. Client applications can continuously poll a cursor using a `sort=timestamp asc, id asc` for documents matching a query, and always be notified when a document is added or updated matching the request criteria. Another common example is when you have uniqueKey values that always increase as new documents are created, and you can continuously poll a cursor using `sort=id asc` to be notified about new documents.

The psuedo-code for tailing a cursor is only a slight modification from our early example for processing all docs matching a query:

```
while (true) {
  $doneForNow = false
  while (not $doneForNow) {
    $results = fetch_solr($params)
    // do something with $results
    if ($params[cursorMark] == $results[nextCursorMark]) {
      $doneForNow = true
    }
    $params[cursorMark] = $results[nextCursorMark]
  }
  sleep($some_configured_delay)
}
```

Result Grouping

Result Grouping groups documents with a common field value into groups and returns the top documents for each group. For example, if you searched for "DVD" on an electronic retailer's e-commerce site, you might be returned three categories such as "TV and Video," "Movies," and "Computers," with three results per category. In this case, the query term "DVD" appeared in all three categories, so Solr groups them together in order to increase relevancy for the user.

Result Grouping is separate from Faceting. Though it is conceptually similar, faceting returns all relevant results and allows the user to refine the results based on the facet category. For example, if you searched for "shoes" on a footwear retailer's e-commerce site, you would be returned all results for that query term, along with selectable facets such as "size," "color," "brand," and so on.

You can however combined grouping with faceting: Grouped faceting supports `facet.field` and `facet.range` but currently doesn't support date and pivot faceting. The facet counts are computed based on the first `group.field` parameter, and other `group.field` parameters are ignored.

Grouped faceting differs from non grouped facets (sum of all facets) == (total of products with that property) as shown in the following example:

Object 1

- name: Phaser 4620a
- ppm: 62
- product_range: 6

Object 2

- name: Phaser 4620i
- ppm: 65
- product_range: 6

Object 3

- name: ML6512
- ppm: 62
- product_range: 7

If you ask Solr to group these documents by "product_range", then the total amount of groups is 2, but the facets for ppm are 2 for 62 and 1 for 65.

Request Parameters

Result Grouping takes the following request parameters. Any number of these request parameters can be included in a single request:

Parameter	Type	Description
group	Boolean	If true, query results will be grouped.
group.field	string	The name of the field by which to group results. The field must be single-valued, and either be indexed or a field type that has a value source and works in a function query, such as `ExternalFileField`. It must also be a string-based field, such as `StrField` or `TextField`
group.func	query	Group based on the unique values of a function query. **NOTE:** This option does not work with distributed searches.
group.query	query	Return a single group of documents that match the given query.
rows	integer	The number of groups to return. The default value is 10.
start	integer	Specifies an initial offset for the list of groups.
group.limit	integer	Specifies the number of results to return for each group. The default value is 1.
group.offset	integer	Specifies an initial offset for the document list of each group.
sort	sortspec	Specifies how Solr sorts the groups relative to each other. For example, `sort=popularity desc` will cause the groups to be sorted according to the highest popularity document in each group. The default value is `score desc`.
group.sort	sortspec	Specifies how Solr sorts documents within a single group. The default value is `score desc`.
group.format	grouped/simple	If this parameter is set to `simple`, the grouped documents are presented in a single flat list, and the `start` and `rows` parameters affect the numbers of documents instead of groups.
group.main	Boolean	If true, the result of the first field grouping command is used as the main result list in the response, using `group.format=simple`.

group.ngroups	Boolean	If true, Solr includes the number of groups that have matched the query in the results. The default value is false. See below for Distributed Result Grouping Caveats when using sharded indexes
group.truncate	Boolean	If true, facet counts are based on the most relevant document of each group matching the query. The default value is false.
group.facet	Boolean	Determines whether to compute grouped facets for the field facets specified in facet.field parameters. Grouped facets are computed based on the first specified group. As with normal field faceting, fields shouldn't be tokenized (otherwise counts are computed for each token). Grouped faceting supports single and multivalued fields. Default is false. See below for Distributed Result Grouping Caveats when using sharded indexes
group.cache.percent	integer between 0 and 100	Setting this parameter to a number greater than 0 enables caching for result grouping. Result Grouping executes two searches; this option caches the second search. The default value is 0. Testing has shown that group caching only improves search time with Boolean, wildcard, and fuzzy queries. For simple queries like term or "match all" queries, group caching degrades performance.

Any number of group commands (`group.field`, `group.func`, `group.query`) may be specified in a single request.

Examples

All of the following sample queries work with Solr's "`bin/solr -e techproducts`" example.

Grouping Results by Field

In this example, we will group results based on the `manu_exact` field, which specifies the manufacturer of the items in the sample dataset.

```
http://localhost:8983/solr/techproducts/select?wt=json&indent=true&fl=id,name&q=so
lr+memory&group=true&group.field=manu_exact
```

```
{
...
"grouped":{
  "manu_exact":{
    "matches":6,
    "groups":[{
        "groupValue":"Apache Software Foundation",
        "doclist":{"numFound":1,"start":0,"docs":[
            {
              "id":"SOLR1000",
              "name":"Solr, the Enterprise Search Server"}]
        }},
      {
        "groupValue":"Corsair Microsystems Inc.",
        "doclist":{"numFound":2,"start":0,"docs":[
            {
              "id":"VS1GB400C3",
              "name":"CORSAIR ValueSelect 1GB 184-Pin DDR SDRAM Unbuffered DDR 400
(PC 3200) System Memory - Retail"}]
        }},
      {
        "groupValue":"A-DATA Technology Inc.",
        "doclist":{"numFound":1,"start":0,"docs":[
            {
              "id":"VDBDB1A16",
              "name":"A-DATA V-Series 1GB 184-Pin DDR SDRAM Unbuffered DDR 400 (PC
3200) System Memory - OEM"}]
        }},
      {
        "groupValue":"Canon Inc.",
        "doclist":{"numFound":1,"start":0,"docs":[
            {
              "id":"0579B002",
              "name":"Canon PIXMA MP500 All-In-One Photo Printer"}]
        }},
      {
        "groupValue":"ASUS Computer Inc.",
        "doclist":{"numFound":1,"start":0,"docs":[
            {
              "id":"EN7800GTX/2DHTV/256M",
              "name":"ASUS Extreme N7800GTX/2DHTV (256 MB)"}]
        }
      }
    ]
  }
}
```

The response indicates that there are six total matches for our query. For each unique value of `group.field`, Solr returns a `docList` with the top scoring document. The `docList` also includes the total number of matches in that group as the `numFound` value. The groups are sorted by the score of the top document within each group.

We can run the same query with the request parameter `group.main=true`. This will format the results as a single flat document list. This flat format does not include as much information as the normal result grouping query results, but it may be easier for existing Solr clients to parse.

`http://localhost:8983/solr/techproducts/select?wt=json&indent=true&fl=id,name,manu`

facturer&q=solr+memory&group=true&group.field=manu_exact&group.main=true

```
{
  "responseHeader":{
    "status":0,
    "QTime":1,
    "params":{
      "fl":"id,name,manufacturer",
      "indent":"true",
      "q":"solr memory",
      "group.field":"manu_exact",
      "group.main":"true",
      "group":"true",
      "wt":"json"}},
  "grouped":{},
  "response":{"numFound":6,"start":0,"docs":[
      {
        "id":"SOLR1000",
        "name":"Solr, the Enterprise Search Server"},
      {
        "id":"VS1GB400C3",
        "name":"CORSAIR ValueSelect 1GB 184-Pin DDR SDRAM Unbuffered DDR 400 (PC
3200) System Memory - Retail"},
      {
        "id":"VDBDB1A16",
        "name":"A-DATA V-Series 1GB 184-Pin DDR SDRAM Unbuffered DDR 400 (PC 3200)
System Memory - OEM"},
      {
        "id":"0579B002",
        "name":"Canon PIXMA MP500 All-In-One Photo Printer"},
      {
        "id":"EN7800GTX/2DHTV/256M",
        "name":"ASUS Extreme N7800GTX/2DHTV (256 MB)"}]
  }
}
```

Grouping by Query

In this example, we will use the `group.query` parameter to find the top three results for "memory" in two different price ranges: 0.00 to 99.99, and over 100.

`http://localhost:8983/solr/techproducts/select?wt=json&indent=true&fl=name,price&q=memory&group=true&group.query=price:[0+TO+99.99]&group.query=price:[100+TO+*]&group.limit=3`

```
{
  "responseHeader":{
    "status":0,
    "QTime":42,
    "params":{
      "fl":"name,price",
      "indent":"true",
      "q":"memory",
      "group.limit":"3",
      "group.query":["price:[0 TO 99.99]",
        "price:[100 TO *]"],
      "group":"true",
      "wt":"json"}},
  "grouped":{
    "price:[0 TO 99.99]":{
      "matches":5,
      "doclist":{"numFound":1,"start":0,"docs":[
          {
            "name":"CORSAIR ValueSelect 1GB 184-Pin DDR SDRAM Unbuffered DDR 400 (PC
3200) System Memory - Retail",
            "price":74.99}]
      }},
    "price:[100 TO *]":{
      "matches":5,
      "doclist":{"numFound":3,"start":0,"docs":[
          {
            "name":"CORSAIR  XMS 2GB (2 x 1GB) 184-Pin DDR SDRAM Unbuffered DDR 400
(PC 3200) Dual Channel
               Kit System Memory - Retail",
            "price":185.0},
          {
            "name":"Canon PIXMA MP500 All-In-One Photo Printer",
            "price":179.99},
          {
            "name":"ASUS Extreme N7800GTX/2DHTV (256 MB)",
            "price":479.95}]
      }
     }
   }
 }
```

In this case, Solr found five matches for "memory," but only returns four results grouped by price. This is because one result for "memory" did not have a price assigned to it.

Distributed Result Grouping Caveats

Grouping is supported for distributed searches, with some caveats:

- Currently `group.func` is is not supported in any distributed searches
- `group.ngroups` and `group.facet` require that all documents in each group must be co-located on the same shard in order for accurate counts to be returned. Document routing via composite keys can be a useful solution in many situations.

Collapse and Expand Results

The collapsing query parser and the expand component combine to form an approach to grouping documents for field collapsing in search results.

Collapsing Query Parser

The `CollapsingQParser` is really a *post filter* that provides more performant field collapsing than Solr's standard approach when the number of distinct groups in the result set is high. This parser collapses the result set to a single document per group before it forwards the result set to the rest of the search components. So all downstream components (faceting, highlighting, etc...) will work with the collapsed result set.

The CollapsingQParser accepts the following local parameters:

Parameter	Description	Default
field	The field that is being collapsed on. The field must be a single valued String, Int or Float	none
min | max	Selects the group heads by the min or max value of a numeric field or function query. If not specified group heads will be selected based on the highest scoring documents in the result set.	none
nullPolicy	There are three null policies: • **ignore**: removes documents with a null value in the collapse field. This is the default. • **expand**: treats each document with a null value in the collapse field as a separate group. • **collapse**: collapses all documents with a null value into a single group using either highest score, or minimum/maximum.	ignore
hint	Currently there is only one hint available "top_fc", which stands for top level FieldCache. The top_fc hint is only available when collapsing on String fields. top_fc provides the best query time speed but takes the longest to warm on startup or following a commit. top_fc also will result in having the collapsed field cached in memory twice if the it's used for faceting or sorting.	none
size	Sets the initial size of the collapse data structures when collapsing on a **numeric field only**. The data structures used for collapsing grow dynamically when collapsing on numeric fields. Setting the size above the number of results expected in the result set will eliminate the resizing cost.	100,000

Sample Syntax:

Collapse based on the highest scoring document:

```
fq={!collapse field=field_name}
```

Collapse based on the minimum value of a numeric field:

```
fq={!collapse field=field_name min=field_name}
```

Collapse based on the maximum value of a numeric field:

```
fq={!collapse field=field_name max=field_name}
```

Collapse based on the min/max value of a function. The **cscore()** function can be used with the CollapsingQParserPlugin to return the score of the current document being collapsed.

```
fq={!collapse field=field_name max=sum(cscore(),field(A))}
```

Collapse with a null policy:

```
fq={!collapse field=field_name nullPolicy=nullPolicy}
```

Collapse with a hint:

```
fq={!collapse field=field_name hint=top_fc}
```

The CollapsingQParserPlugin fully supports the QueryElevationComponent.

Expand Component

The ExpandComponent can be used to expand the groups that were collapsed by the CollapsingQParserPlugin.

Example usage with the CollapsingQParserPlugin:

```
q=foo&fq={!collapse field=ISBN}
```

In the query above, the CollapsingQParserPlugin will collapse the search results on the *ISBN* field. The main search results will contain the highest ranking document from each book.

The ExpandComponent can now be used to expand the results so you can see the documents grouped by ISBN. For example:

```
q=foo&fq={!collapse field=ISBN}&expand=true
```

The “expand=true” parameter turns on the ExpandComponent. The ExpandComponent adds a new section to the search output labeled “expanded”.

Inside the expanded section there is a *map* with each group head pointing to the expanded documents that are within the group. As applications iterate the main collapsed result set, they can access the *expanded* map to retrieve the expanded groups.

The ExpandComponent has the following parameters:

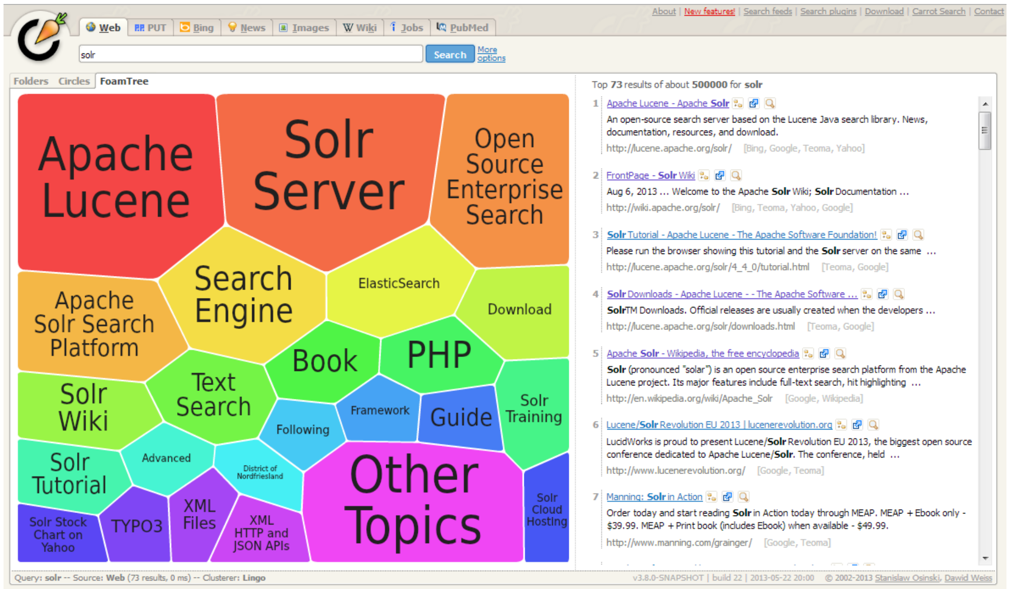
Parameter	Description	Default

expand.sort	Orders the documents within the expanded groups	score desc
expand.rows	The number of rows to display in each group	5
expand.q	Overrides the main q parameter, determines which documents to include in the main group.	main q
expand.fq	Overrides main fq's, determines which documents to include in the main group.	main fq's

Result Clustering

The **clustering** (or **cluster analysis**) plugin attempts to automatically discover groups of related search hits (documents) and assign human-readable labels to these groups. By default in Solr, the clustering algorithm is applied to the search result of each single query—this is called an *on-line* clustering. While Solr contains an extension for for full-index clustering (*off-line* clustering) this section will focus on discussing on-line clustering only.

Clusters discovered for a given query can be perceived as *dynamic facets*. This is beneficial when regular faceting is difficult (field values are not known in advance) or when the queries are exploratory in nature. Take a look at the Carrot2 project's demo page to see an example of search results clustering in action (the groups in the visualization have been discovered automatically in search results to the right, there is no external information involved).



Top **73** results of about **500000** for **solr**

1 Apache Lucene - Apache **Solr**
An open-source search server based on the Lucene Java search library. News, documentation, resources, and download.
http://lucene.apache.org/solr/ [Bing, Google, Teoma, Yahoo]

2 FrontPage - **Solr** Wiki
Aug 6, 2013 ... Welcome to the Apache **Solr** Wiki; **Solr** Documentation ...
http://wiki.apache.org/solr/ [Bing, Teoma, Yahoo, Google]

3 **Solr** Tutorial - Apache Lucene - The Apache Software Foundation!
Please run the browser showing this tutorial and the **Solr** server on the same ...
http://lucene.apache.org/solr/4_4_0/tutorial.html [Teoma, Google]

4 **Solr** Downloads - Apache Lucene - - The Apache Software ...
SolrTM Downloads. Official releases are usually created when the developers ...
http://lucene.apache.org/solr/downloads.html [Teoma, Google]

5 Apache **Solr** - Wikipedia, the free encyclopedia
Solr (pronounced "solar") is an open source enterprise search platform from the Apache Lucene project. Its major features include full-text search, hit highlighting ...
http://en.wikipedia.org/wiki/Apache_Solr [Google, Wikipedia]

6 Lucene/**Solr** Revolution EU 2013 | lucenerevolution.org
LucidWorks is proud to present Lucene/**Solr** Revolution EU 2013, the biggest open source conference dedicated to Apache Lucene/**Solr**. The conference, held ...
http://www.lucenerevolution.org/ [Google, Teoma]

7 Manning: **Solr** in Action
Order today and start reading **Solr** in Action today through MEAP. MEAP + Ebook only - $39.99. MEAP + Print book (includes Ebook) when available - $49.99.
http://www.manning.com/grainger/ [Google, Teoma]

Query: solr -- Source: Web (73 results, 0 ms) -- Clusterer: Lingo

v3.8.0-SNAPSHOT | build 22 | 2013-05-22 20:00 © 2002-2013 Stanislaw Osinski, Dawid Weiss

The query issued to the system was *Solr*. It seems clear that faceting could not yield a similar set of groups, although the goals of both techniques are similar—to let the user explore the set of search results and either rephrase the query or narrow the focus to a subset of current documents. Clustering is also similar to Result Grouping in that it can help to look deeper into search results, beyond the top few hits.

Topics covered in this section:

- Preliminary Concepts
- Quick Start Example
- Installation
- Configuration
- Tweaking Algorithm Settings

Preliminary Concepts

Each **document** passed to the clustering component is composed of several logical parts:

- a unique identifier,
- origin URL,
- the title,
- the main content,
- a language code of the title and content.

The identifier part is mandatory, everything else is optional but at least one of the text fields (title or content) will be required to make the clustering process reasonable. It is important to remember that logical document parts must be mapped to a particular schema and its fields. The content (text) for clustering can be sourced from either a stored text field or context-filtered using a highlighter, all these options are explained below in the configuration section.

A **clustering algorithm** is the actual logic (implementation) that discovers relationships among the documents in the search result and forms human-readable cluster labels. Depending on the choice of the algorithm the clusters may (and probably will) vary. Solr comes with several algorithms implemented in the open source Carrot2 project , commercial alternatives also exist.

Quick Start Example

The "`techproducts`" example included with Solr is pre-configured with all the necessary components for result clustering - but they are disabled by default.

To enable the clustering component contrib and a dedicated search handler configured to use it, specify the "`-a`" option to set a JVM System Property when running the example:

```
bin/solr start -e techproducts -a '-Dsolr.clustering.enabled=true'
```

You can now try out the clustering handler by opening the following URL in a browser: `http://localhost:8983/solr/techproducts/clustering?q=*:*&rows=100`

The output XML should include search hits and an array of automatically discovered clusters at the end, resembling the output shown here:

```
<response>
  <lst name="responseHeader">
    <int name="status">0</int>
    <int name="QTime">299</int>
  </lst>
  <result name="response" numFound="32" start="0" maxScore="1.0">
    <doc>
      <str name="id">GB18030TEST</str>
      <str name="name">Test with some GB18030 encoded characters</str>
      <arr name="features">
        <str>No accents here</str>
        <str></str>
        <str>This is a feature (translated)</str>
        <str></str>
        <str>This document is very shiny (translated)</str>
      </arr>
      <float name="price">0.0</float>
      <str name="price_c">0,USD</str>
      <bool name="inStock">true</bool>
      <long name="_version_">1448955395025403904</long>
      <float name="score">1.0</float>
    </doc>

    <!-- more search hits, omitted -->
  </result>

  <arr name="clusters">
    <lst>
      <arr name="labels">
        <str>DDR</str>
      </arr>
      <double name="score">3.9599865057283354</double>
      <arr name="docs">
        <str>TWINX2048-3200PRO</str>
        <str>VS1GB400C3</str>
        <str>VDBDB1A16</str>
      </arr>
    </lst>
    <lst>
      <arr name="labels">
        <str>iPod</str>
      </arr>
      <double name="score">11.959228467119022</double>
      <arr name="docs">
        <str>F8V7067-APL-KIT</str>
        <str>IW-02</str>
        <str>MA147LL/A</str>
      </arr>
    </lst>

    <!-- More clusters here, omitted. -->

    <lst>
      <arr name="labels">
        <str>Other Topics</str>
      </arr>
      <double name="score">0.0</double>
      <bool name="other-topics">true</bool>
      <arr name="docs">
        <str>adata</str>
        <str>apple</str>
        <str>asus</str>
        <str>ati</str>
        <!-- other unassigned document IDs here -->
      </arr>
    </lst>
  </arr>
</response>
```

There were a few clusters discovered for this query (`*:*`), separating search hits into various categories: DDR, iPod, Hard Drive, etc. Each cluster has a label and score that indicates the "goodness" of the cluster. The score is algorithm-specific and is meaningful only in relation to the scores of other clusters in the same set. In other words, if cluster *A* has a higher score than cluster *B*, cluster *A* should be of better quality (have a better label and/or more coherent document set). Each cluster has an array of identifiers of documents belonging to it. These identifiers correspond to the `uniqueKey` field declared in the schema.

Depending on the quality of input documents, some clusters may not make much sense. Some documents may be left out and not be clustered at all; these will be assigned to the synthetic *Other Topics* group, marked with the `other-topics` property set to `true` (see the XML dump above for an example). The score of the other topics group is zero.

Installation

The clustering contrib extension requires `dist/solr-clustering-*.jar` and all JARs under `contrib/clustering/lib`.

Configuration

Declaration of the Search Component and Request Handler

Clustering extension is a search component and must be declared in `solrconfig.xml`. Such a component can be then appended to a request handler as the last component in the chain (because it requires search results which must be previously fetched by the search component).

An example configuration could look as shown below.

1. Include the required contrib JARs. Note that by default paths are relative to the Solr core so they may need adjustments to your configuration, or an explicit specification of the `$solr.install.dir`.

   ```
   <lib dir="${solr.install.dir:../../..}/contrib/clustering/lib/"
   regex=".*\.jar" />
   <lib dir="${solr.install.dir:../../..}/dist/"
   regex="solr-clustering-\d.*\.jar" />
   ```

2. Declaration of the search component. Each component can also declare multiple clustering pipelines ("engines"), which can be selected at runtime.

```
<searchComponent name="clustering"
class="solr.clustering.ClusteringComponent">
  <!-- Lingo clustering algorithm -->
  <lst name="engine">
    <str name="name">lingo</str>
    <str
name="carrot.algorithm">org.carrot2.clustering.lingo.LingoClusteringAlgorithm<
/str>
  </lst>

  <!-- An example definition for the STC clustering algorithm. -->
  <lst name="engine">
    <str name="name">stc</str>
    <str
name="carrot.algorithm">org.carrot2.clustering.stc.STCClusteringAlgorithm</str
>
  </lst>
</searchComponent>
```

3. A request handler to which we append the clustering component declared above.

```
<requestHandler name="/clustering"
                class="solr.SearchHandler">
  <lst name="defaults">
    <bool name="clustering">true</bool>
    <bool name="clustering.results">true</bool>

    <!-- Logical field to physical field mapping. -->
    <str name="carrot.url">id</str>
    <str name="carrot.title">doctitle</str>
    <str name="carrot.snippet">content</str>

    <!-- Configure any other request handler parameters. We will cluster the
         top 100 search results so bump up the 'rows' parameter. -->
    <str name="rows">100</str>
    <str name="fl">*,score</str>
  </lst>

  <!-- Append clustering at the end of the list of search components. -->
  <arr name="last-components">
    <str>clustering</str>
  </arr>
</requestHandler>
```

Configuration Parameters of the Clustering Component

The table below summarizes parameters of each clustering engine or the entire clustering component (depending where they are declared).

Parameter	Description
`clustering`	When `true`, clustering component is enabled.

`clustering.engine`	Declares which clustering engine to use. If not present, the first declared engine will become the default one.
`clustering.results`	When `true`, the component will perform clustering of search results (this should be enabled).
`clustering.collection`	When `true`, the component will perform clustering of the whole document index (this section does not cover full-index clustering).

At the engine declaration level, the following parameters are supported.

Parameter	Description
`carrot.algorithm`	The algorithm class.
`carrot.resourcesDir`	Algorithm-specific resources and configuration files (stop words, other lexical resources, default settings). By default points to `conf/clustering/carrot2/`
`carrot.outputSubClusters`	If `true` and the algorithm supports hierarchical clustering, sub-clusters will also be emitted.
`carrot.numDescriptions`	Maximum number of per-cluster labels to return (if the algorithm assigns more than one label to a cluster).

The `carrot.algorithm` parameter should contain a fully qualified class name of an algorithm supported by the Carrot2 framework. Currently, the following algorithms are available:

- `org.carrot2.clustering.lingo.LingoClusteringAlgorithm` (open source)
- `org.carrot2.clustering.stc.STCClusteringAlgorithm` (open source)
- `org.carrot2.clustering.kmeans.BisectingKMeansClusteringAlgorithm` (open source)
- `com.carrotsearch.lingo3g.Lingo3GClusteringAlgorithm` (commercial)

For a comparison of characteristics of these algorithms see the following links:

- http://doc.carrot2.org/#section.advanced-topics.fine-tuning.choosing-algorithm
- http://project.carrot2.org/algorithms.html
- http://carrotsearch.com/lingo3g-comparison.html

The question of which algorithm to choose depends on the amount of traffic (STC is faster than Lingo, but arguably produces less intuitive clusters, Lingo3G is the fastest algorithm but is not free or open source), expected result (Lingo3G provides hierarchical clusters, Lingo and STC provide flat clusters), and the input data (each algorithm will cluster the input slightly differently). There is no one answer which algorithm is "the best".

Contextual and Full Field Clustering

The clustering engine can apply clustering to the full content of (stored) fields or it can run an internal highlighter pass to extract context-snippets before clustering. Highlighting is recommended when the logical snippet field contains a lot of content (this would affect clustering performance). Highlighting can also increase the quality of clustering because the content passed to the algorithm will be more focused around the query (it will be query-specific context). The following parameters control the internal highlighter.

Parameter	Description

`carrot.produceSummary`	When `true` the clustering component will run a highlighter pass on the content of logical fields pointed to by `carrot.title` and `carrot.snippet`. Otherwise full content of those fields will be clustered.
`carrot.fragSize`	The size, in characters, of the snippets (aka fragments) created by the highlighter. If not specified, the default highlighting fragsize (`hl.fragsize`) will be used.
`carrot.summarySnippets`	The number of summary snippets to generate for clustering. If not specified, the default highlighting snippet count (`hl.snippets`) will be used.

Logical to Document Field Mapping

As already mentioned in Preliminary Concepts, the clustering component clusters "documents" consisting of logical parts that need to be mapped onto physical schema of data stored in Solr. The field mapping attributes provide a connection between fields and logical document parts. Note that the content of title and snippet fields must be **stored** so that it can be retrieved at search time.

Parameter	Description
`carrot.title`	The field (alternatively comma- or space-separated list of fields) that should be mapped to the logical document's title. The clustering algorithms typically give more weight to the content of the title field compared to the content (snippet). For best results, the field should contain concise, noise-free content. If there is no clear title in your data, you can leave this parameter blank.
`carrot.snippet`	The field (alternatively comma- or space-separated list of fields) that should be mapped to the logical document's main content. If this mapping points to very large content fields the performance of clustering may drop significantly. An alternative then is to use query-context snippets for clustering instead of full field content. See the description of the `carrot.produceSummary` parameter for details.
`carrot.url`	The field that should be mapped to the logical document's content URL. Leave blank if not required.

Clustering Multilingual Content

The field mapping specification can include a `carrot.lang` parameter, which defines the field that stores ISO 639-1 code of the language in which the title and content of the document are written. This information can be stored in the index based on apriori knowledge of the documents' source or a language detection filter applied at indexing time. All algorithms inside the Carrot2 framework will accept ISO codes of languages defined in LanguageCode enum.

The language hint makes it easier for clustering algorithms to separate documents from different languages on input and to pick the right language resources for clustering. If you do have multi-lingual query results (or query results in a language different than English), it is strongly advised to map the language field appropriately.

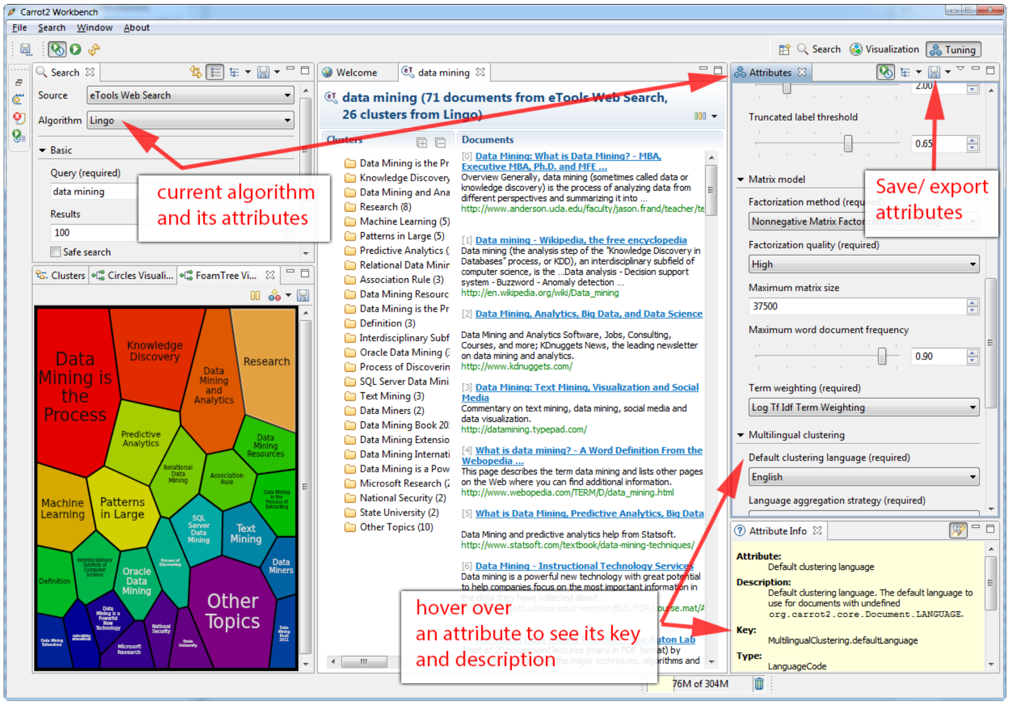
Parameter	Description
`carrot.lang`	The field that stores ISO 639-1 code of the language of the document's text fields.

`carrot.lcmap`	A mapping of arbitrary strings into ISO 639 two-letter codes used by `carrot.lang`. The syntax of this parameter is the same as `langid.map.lcmap`, for example: `langid.map.lcmap=japanese:ja polish:pl english:en`

The default language can also be set using Carrot2-specific algorithm attributes (in this case the MultilingualClustering.defaultLanguage attribute).

Tweaking Algorithm Settings

The algorithms that come with Solr are using their default settings which may be inadequate for all data sets. All algorithms have lexical resources and resources (stop words, stemmers, parameters) that may require tweaking to get better clusters (and cluster labels). For Carrot2-based algorithms it is probably best to refer to a dedicated tuning application called Carrot2 Workbench (screenshot below). From this application one can export a set of algorithm attributes as an XML file, which can be then placed under the location pointed to by `carrot.resourcesDir`.



Source: eTools Web Search
Algorithm: Lingo
Basic
Query (required): data mining
Results: 100
Safe search

data mining (71 documents from eTools Web Search, 26 clusters from Lingo)

Truncated label threshold: 0.65
Matrix model
Factorization method (required): Nonnegative Matrix Factorization
Factorization quality (required): High
Maximum matrix size: 37500
Maximum word document frequency: 0.90
Term weighting (required): Log Tf Idf Term Weighting
Multilingual clustering
Default clustering language (required): English
Language aggregation strategy (required)

Attribute: Default clustering language
Description: Default clustering language. The default language to use for documents with undefined org.carrot2.core.Document.LANGUAGE.
Key: MultilingualClustering.defaultLanguage
Type: LanguageCode

current algorithm and its attributes

Save/ export attributes

hover over an attribute to see its key and description

Providing Defaults

The default attributes for all engines (algorithms) declared in the clustering component are placed under `carrot.resourcesDir` and with an expected file name of `engineName-attributes.xml`. So for an engine named `lingo` and the default value of `carrot.resourcesDir`, the attributes would be read from a file in `conf/clustering/carrot2/lingo-attributes.xml`.

An example XML file changing the default language of documents to Polish is shown below.

```
<attribute-sets default="attributes">
    <attribute-set id="attributes">
      <value-set>
        <label>attributes</label>
          <attribute key="MultilingualClustering.defaultLanguage">
            <value type="org.carrot2.core.LanguageCode" value="POLISH"/>
          </attribute>
      </value-set>
  </attribute-set>
</attribute-sets>
```

Tweaking at Query-Time

The clustering component and Carrot2 clustering algorithms can accept query-time attribute overrides. Note that certain things (for example lexical resources) can only be initialized once (at startup, via the XML configuration files).

An example query that changes the `LingoClusteringAlgorithm.desiredClusterCountBase` parameter for the Lingo algorithm: `http://localhost:8983/solr/techproducts/clustering?q=*:*&rows=100&LingoClusteringAlgorithm.desiredClusterCountBase=20`

Performance Considerations

Dynamic clustering of search results comes with two major performance penalties:

- Increased cost of fetching a larger-than-usual number of search results (50, 100 or more documents),
- Additional computational cost of the clustering itself.

For simple queries, the clustering time will usually dominate the fetch time. If the document content is very long the retrieval of stored content can become a bottleneck. The performance impact of clustering can be lowered in several ways:

- feed less content to the clustering algorithm by enabling `carrot.produceSummary` attribute,
- perform clustering on selected fields (titles only) to make the input smaller,
- use a faster algorithm (STC instead of Lingo, Lingo3G instead of STC),
- tune the performance attributes related directly to a specific algorithm.

Some of these techniques are described in *Apache SOLR and Carrot2 integration strategies* document, available at http://carrot2.github.io/solr-integration-strategies. The topic of improving performance is also included in the Carrot2 manual at http://doc.carrot2.org/#section.advanced-topics.fine-tuning.performance.

Additional Resources

The following resources provide additional information about the clustering component in Solr and its potential applications.

- Apache Solr and Carrot2 integration strategies: http://carrot2.github.io/solr-integration-strategies
- Apache Solr Wiki (covers previous Solr versions, may be inaccurate): http://carrot2.github.io/solr-integration-strategies
- Clustering and Visualization of Solr search results (video from Berlin BuzzWords conference, 2011): http://vimeo.com/26616444

Spatial Search

Solr supports location data for use in spatial/geospatial searches. Using spatial search, you can:

- Index points or other shapes
- Filter search results by a bounding box or circle or by other shapes
- Sort or boost scoring by distance between points, or relative area between rectangles
- Generate a 2D grid of facet count numbers for heatmap generation or point-plotting.

There are three main field types available for spatial search:

- LatLonType (and its non-geodetic twin PointType)
- SpatialRecursivePrefixTreeFieldType (RPT for short)
- BBoxField

RPT offers more features than LatLonType and fast filter performance, although LatLonType is more appropriate when efficient distance sorting/boosting is desired. They can both be used simultaneously for what each does best – LatLonType for sorting/boosting, RPT for filtering.

BBoxField is for indexing bounding boxes, querying by a box, specifying a search predicate (Intersects,Within,Contains,Disjoint,Equals), and a relevancy sort/boost like overlapRatio or simply the area.

For more information on Solr spatial search, see http://wiki.apache.org/solr/SpatialSearch.

Indexing and Configuration

For indexing geodetic points (latitude and longitude), supply the pair of numbers as a string with a comma separating them in latitude then longitude order. For non-geodetic points, the order is x,y for PointType, and for RPT you must use a space instead of a comma, or use WKT.

See the section SpatialRecursivePrefixTreeFieldType below for RPT configuration specifics.

Spatial Filters

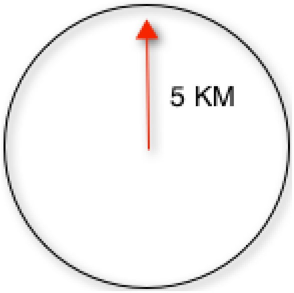
There are 2 types of Spatial filters, which both support the following parameters:

Parameter	Description
d	the radial distance, usually in kilometers. (RPT & BBoxField can set other units via the setting `distanceUnits`)
pt	the center point using the format "lat,lon" if latitude & longitude. Otherwise, "x,y" for PointType or "x y" for RPT field types.
sfield	a spatial indexed field

score	(Advanced option; RPT and BBoxField field types only) If the query is used in a scoring context (e.g. as the main query in `q`), this *local-param* determines what scores will be produced. Valid values are: - `none` - A fixed score of 1.0. (the default) - `kilometers` - distance in kilometers between the field value and the specified center point - `miles` - distance in miles between the field value and the specified center point - `degrees` - distance in degrees between the field value and the specified center point - `distance` - distance between the field value and the specified center point in the `distanceUnits` configured for this field - `recipDistance` - 1 / the distance When used with `BBoxField`,additional options are supported: - `overlapRatio` - The relative overlap between the indexed shape & query shape. - `area` - haversine based area of the overlapping shapes expressed in terms of the `distanceUnits` configured for this field - `area2D` - cartesian coordinates based area of the overlapping shapes expressed in terms of the `distanceUnits` configured for this field
filter	(Advanced option; RPT and BBoxField field types only) If you only want the query to score (with the above `score` local-param), not filter, then set this *local-param* to false.

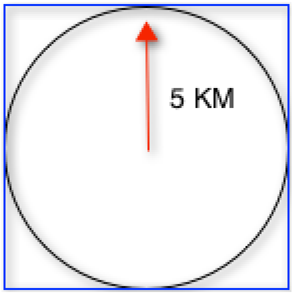
`geofilt`

The `geofilt` filter allows you to retrieve results based on the geospatial distance (AKA the "great circle distance") from a given point. Another way of looking at it is that it creates a circular shape filter. For example, to find all documents within five kilometers of a given lat/lon point, you could enter `&q=*:*&fq={!geofilt sfield=store}&pt=45.15,-93.85&d=5`. This filter returns all results within a circle of the given radius around the initial point:



`bbox`

The `bbox` filter is very similar to `geofilt` except it uses the *bounding box* of the calculated circle. See the blue box in the diagram below. It takes the same parameters as geofilt. Here's a sample query: `&q=*:*&fq={!bbox sfield=store}&pt=45.15,-93.85&d=5`. The rectangular shape is faster to compute and so it's sometimes used as an alternative to geofilt when it's acceptable to return points outside of the radius. However, if the ideal goal is a circle but you want it to run faster, then instead consider using the RPT field and try a large "distErrPct" value like `0.1` (10% radius). This will return results outside the radius but it will do so somewhat uniformly around the shape.



⚠ When a bounding box includes a pole, the bounding box ends up being a "bounding bowl" (a *spherical cap*) that includes all values north of the lowest latitude of the circle if it touches the north pole (or south of the highest latitude if it touches the south pole).

Filtering by an arbitrary rectangle

Sometimes the spatial search requirement calls for finding everything in a rectangular area, such as the area covered by a map the user is looking at. For this case, geofilt and bbox won't cut it. This is somewhat of a trick, but you can use Solr's range query syntax for this by supplying the lower-left corner as the start of the range and the upper-right corner as the end of the range. Here's an example: `&q=*:*&fq=store:[45,-94 TO 46,-93]`. LatLonType does **not** support rectangles that cross the dateline, but RPT does. If you are using RPT with non-geospatial coordinates (`geo="false"`) then you must quote the points due to the space, e.g. `"x y"`.

Optimization: Solr Post Filtering

Most likely, the fastest spatial filters will be to simply use the RPT field type. However, sometimes it may be faster to use LatLonType with *Solr post filtering* in circumstances when both the spatial query isn't worth caching and there aren't many matching documents that match the non-spatial filters (e.g. keyword queries and other filters). To use *Solr post filtering* with LatLonType, use the `bbox` or `geofilt` query parsers in a filter query but specify `cache=false` and `cost=100` (or greater) as local-params. Here's a short example:

```
&q=...mykeywords...&fq=...someotherfilters...&fq={!geofilt cache=false
cost=100}&sfield=store&pt=45.15,-93.85&d=5
```

Distance Function Queries

There are four distance function queries: `geodist`, see below, usually the most appropriate; `dist`, to calculate the p-norm distance between multi-dimensional vectors; `hsin`, to calculate the distance between two points on a sphere; and `sqedist`, to calculate the squared Euclidean distance between two points. For more information about these function queries, see the section on Function Queries.

`geodist`

`geodist` is a distance function that takes three optional parameters: `(sfield,latitude,longitude)`. You can use the `geodist` function to sort results by distance or score return results.

For example, to sort your results by ascending distance, enter `...&q=*:*&fq={!geofilt}&sfield=store&pt=45.15,-93.85&d=50&sort=geodist() asc`.

To return the distance as the document score, enter `...&q={!func}geodist()&sfield=store&pt=45.15,-93.85&sort=score+asc`.

More Examples

Here are a few more useful examples of what you can do with spatial search in Solr.

Use as a Sub-Query to Expand Search Results

Here we will query for results in Jacksonville, Florida, or within 50 kilometers of 45.15,-93.85 (near Buffalo, Minnesota):

```
&q=*:*&fq=(state:"FL" AND city:"Jacksonville") OR
{!geofilt}&sfield=store&pt=45.15,-93.85&d=50&sort=geodist()+asc
```

Facet by Distance

To facet by distance, you can use the Frange query parser:

```
&q=*:*&sfield=store&pt=45.15,-93.85&facet.query={!frange l=0
u=5}geodist()&facet.query={!frange l=5.001 u=3000}geodist()
```

There are other ways to do it too, like using a {!geofilt} in each facet.query.

Boost Nearest Results

Using the DisMax or Extended DisMax, you can combine spatial search with the boost function to boost the nearest results:

```
&q.alt=*:*&fq={!geofilt}&sfield=store&pt=45.15,-93.85&d=50&bf=recip(geodist(),2,20
0,20)&sort=score desc
```

SpatialRecursivePrefixTreeFieldType (abbreviated as RPT)

This field type offers several functional improvements over LatLonType:

- Query by polygons and other complex shapes, in addition to circles & rectangles
- Multi-valued indexed fields
- Ability to index non-point shapes (e.g. polygons) as well as point shapes
- Rectangles with user-specified corners that can cross the dateline
- Multi-value distance sort and score boosting *(warning: non-optimized)*
- Well-Known-Text (WKT) shape syntax (required for specifying polygons & other complex shapes)

RPT incorporates the basic features of LatLonType and PointType, such as lat-lon bounding boxes and circles, in addition to supporting geofilt, bbox, geodist, and a range-queries.

Schema configuration

To use RPT, the field type must be registered and configured in `schema.xml`. There are many options for this field type.

Setting	Description
name	The name of the field type.

class	This should be `solr.SpatialRecursivePrefixTreeFieldType`. But be aware that the Lucene spatial module includes some other so-called "spatial strategies" other than RPT, notably TermQueryPT*, BBox, PointVector*, and SerializedDV. Solr requires a field type to parallel these in order to use them. The asterisked ones have them.
spatialContextFactory	If polygons or linestrings are required, then JTS Topology Suite is a needed to implement them. It's a JAR file that you need to put on Solr's classpath (but not via the standard solrconfig.xml mechanisms). If you intend to use those shapes, set this attribute to `com.spatial4j.core.context.jts.JtsSpatialContextFactory`. Furthermore, the context factory has its own options which are directly configurable on the Solr field type here; follow the link to the Javadocs, and remember to look at the superclass's options in SpatialContextFactory as well. One option in particular you should most likely enable is `autoIndex` (i.e. use PreparedGeometry) as it's been shown to be a major performance boost for polygons. Further details about specifying polygons to index or query are at Solr's Wiki linked below.
geo	If **true**, the default, latitude and longitude coordinates will be used and the mathematical model will generally be a sphere. If false, the coordinates will be generic X & Y on a 2D plane using Euclidean/Cartesian geometry.
distanceUnits	This is used to specify the units for distance measurements used throughout the use of this field. This can be `degrees`, `kilometers` or `miles`. It is applied to nearly all distance measurements involving the field: `maxDistErr`, `distErr`, `d`, `geodist` and the `score` when score is `distance`, `area`, or `area2d`. However, it doesn't affect distances embedded in WKT strings, (eg: "`BUFFER(POINT(200 10),0.2))`"), which are still in degrees. `distanceUnits` defaults to either "`kilometers`" if `geo` is "`true`", or "`degress`" if `geo` is "`false`". `distanceUnits` replaces the `units` attribute; which is now deprecated and mutually exclusive with this attribute.
distErrPct	Defines the default precision of non-point shapes (both index & query), as a fraction between 0.0 (fully precise) to 0.5. The closer this number is to zero, the more accurate the shape will be. However, more precise indexed shapes use more disk space and take longer to index. Bigger distErrPct values will make queries faster but less accurate.
maxDistErr	Defines the highest level of detail required for indexed data. If left blank, the default is one meter – just a bit less than 0.000009 degrees. This setting is used internally to compute an appropriate maxLevels (see below).
worldBounds	Defines the valid numerical ranges for x and y, in the format of `ENVELOPE(minX, maxX, maxY, minY)`. If `geo="true"`, the standard lat-lon world boundaries are assumed. If `geo=false`, you should define your boundaries.
distCalculator	Defines the distance calculation algorithm. If `geo=true`, "haversine" is the default. If `geo=false`, "cartesian" will be the default. Other possible values are "lawOfCosines", "vincentySphere" and "cartesian^2".

prefixTree	Defines the spatial grid implementation. Since a PrefixTree (such as RecursivePrefixTree) maps the world as a grid, each grid cell is decomposed to another set of grid cells at the next level. If `geo=true` then the default prefix tree is "geohash", otherwise it's "quad". Geohash has 32 children at each level, quad has 4. Geohash can only be used for `geo=true` as it's strictly geospatial.
maxLevels	Sets the maximum grid depth for indexed data. Instead, it's usually more intuitive to compute an appropriate maxLevels by specifying `maxDistErr` .

```
<fieldType name="location_rpt"   class="solr.SpatialRecursivePrefixTreeFieldType"

spatialContextFactory="com.spatial4j.core.context.jts.JtsSpatialContextFactory"
               autoIndex="true"
               distErrPct="0.025"
               maxDistErr="0.001"
               distanceUnits="kilometers" />
```

Once the field type has been defined, use it to define a field that uses it.

Because RPT has more advanced features, some of which are new and experimental, please review the Solr Wiki at http://wiki.apache.org/solr/SolrAdaptersForLuceneSpatial4 for more information about using this field type.

Heatmap Faceting

The RPT field supports generating a 2D grid of facet counts for documents having spatial data in each grid cell. For high-detail grids, this can be used to plot points, and for lesser detail it can be used for heatmap generation. The grid cells are determined at index-time based on RPT's configuration. At facet counting time, the indexed cells in the region of interest are traversed and a grid of counters corresponding to each cell are incremented. Solr can return the data in a straight-forward 2D array of integers or in a PNG which compresses better for larger data sets but must be decoded.

The heatmap feature is accessed from Solr's faceting feature. As a part of faceting, it supports the `key` local-param as well as excluding tagged filter queries, just like other types of faceting do. This allows multiple heatmaps to be returned on the same field with different filters.

Parameter	Description
facet	Set to `true` to enable faceting
facet.heatmap	The field name of type RPT
facet.heatmap.geom	The region to compute the heatmap on, specified using the rectangle-range syntax or WKT. It defaults to the world. ex: `["-180 -90" TO "180 90"]`
facet.heatmap.gridLevel	A specific grid level, which determines how big each grid cell is. Defaults to being computed via distErrPct (or distErr)
facet.heatmap.distErrPct	A fraction of the size of geom used to compute gridLevel. Defaults to 0.15. It's computed the same as a similarly named parameter for RPT.
facet.heatmap.distErr	A cell error distance used to pick the grid level indirectly. It's computed the same as a similarly named parameter for RPT.

facet.heatmap.format	The format, either `ints2D` (default) or `png`.

Tip
For heatmap purposes, you'll experiment with different distErrPct values (probably 0.10 - 0.20) with various input geometries till the default size is what you're looking for. The specific details of how it's computed isn't important. For high-detail grids used in point-plotting (loosely one cell per pixel), set distErr to be the number of decimal-degrees of several pixels or so of the map being displayed.

Here's some sample output in JSON (with some ..... inserted for brevity):

```
{gridLevel=6,columns=64,rows=64,minX=-180.0,maxX=180.0,minY=-90.0,maxY=90.0,
counts_ints2D=[[0, 0, 2, 1, ....],[1, 1, 3, 2, ...],...]}
```

The output shows the gridLevel which is interesting since it's often computed from other parameters. If an interface being developed allows an explicit resolution increase/decrease feature then subsequent requests can specify the gridLevel explicitly.

The `minX`, `maxX`, `minY`, `maxY` reports the region where the counts are. This is the minimally enclosing bounding rectangle of the input `geom` at the target grid level. This may wrap the dateline. The `columns` and `rows` values are how many columns and rows that the output rectangle is to be divided by evenly. Note: Don't divide an on-screen projected map rectangle evenly to plot these rectangles/points since the cell data is in the coordinate space of decimal degrees if geo=true or whatever units were given if geo=false. This could be arranged to be the same as an on-screen map but won't necessarily be.

The `counts_ints2D` key has a 2D array of integers. The initial outer level is in row order (top-down), then the inner arrays are the columns (left-right). If any array would be all zeros, a null is returned instead for efficiency reasons. The entire value is null if there is no matching spatial data.

If format=png then the output key is counts_png. It's a base-64 encoded string of a 4-byte PNG. The PNG logically holds the same data that the ints2D does. Note that the alpha channel byte is flipped to make it easier to view the PNG for diagnostic purposes, since otherwise counts would have to exceed 2^24 before it becomes non-opague. Thus counts greater than this value will become opaque.

BBoxField

The `BBoxField` field type indexes a single rectangle (bounding box) per document field and supports searching via a bounding box. It supports most spatial search predicates, it has enhanced relevancy modes based on the overlap or area between the search rectangle and the indexed rectangle. It's particularly useful for its relevancy modes. To configure it in the schema, use a configuration like this:

```
<field name="bbox" type="bbox" />
<fieldType name="bbox" class="solr.BBoxField"
        geo="true" units="kilometers" numberType="_bbox_coord"
storeSubFields="false"/>
<fieldType name="_bbox_coord" class="solr.TrieDoubleField" precisionStep="8"
docValues="true" stored="false"/>
```

BBoxField is actually based off of 4 instances of another field type referred to by numberType. It also uses a boolean to flag a dateline cross. Assuming you want to use the relevancy feature, docValues is required. Some of the attributes are in common with the RPT field like geo, units, worldBounds, and spatialContextFactory because they share some of the same spatial infrastructure.

To index a box, add a field value to a bbox field that's a string in the WKT/CQL ENVELOPE syntax. Example: `ENVELOPE(-10, 20, 15, 10)` which is minX, maxX, maxY, minY order. The parameter ordering is unintuitive but that's what the spec calls for.

To search, you can use the `{!bbox}` query parser, or the range syntax e.g. `[10,-10 TO 15,20]`, or the ENVELOPE syntax wrapped in parenthesis with a leading search predicate. The latter is the only way to choose a predicate other than Intersects. For example:

```
&q={!field f=bbox}Contains(ENVELOPE(-10, 20, 15, 10))
```

Now to sort the results by one of the relevancy modes, use it like this:

```
&q={!field f=bbox score=overlapRatio}Intersects(ENVELOPE(-10, 20, 15, 10))
```

The `score` local-param can be one of `overlapRatio`, `area`, and `area2D`. area scores by the document area using surface-of-a-sphere (assuming geo=true) math, area2D uses simple width * height. overlapRatio computes a [0-1] ranged score based on how much overlap exists relative to the document's area and the query area. The javadocs of BBoxOverlapRatioValueSource have more info on the formula, if you're really curious. There is an additional parameter queryTargetProportion that allows you to weight the query side of the formula to the index (target) side of the formula. You can also use `&debug=results` to see useful score computation info.

The Terms Component

The Terms Component provides access to the indexed terms in a field and the number of documents that match each term. This can be useful for building an auto-suggest feature or any other feature that operates at the term level instead of the search or document level. Retrieving terms in index order is very fast since the implementation directly uses Lucene's TermEnum to iterate over the term dictionary.

In a sense, this search component provides fast field-faceting over the whole index, not restricted by the base query or any filters. The document frequencies returned are the number of documents that match the term, including any documents that have been marked for deletion but not yet removed from the index.

Configuring the Terms Component

By default, the Terms Component is already configured in `solrconfig.xml` for each collection.

Defining the Terms Component

Defining the Terms search component is straightforward: simply give it a name and use the class `solr.TermsComponent`.

```
<searchComponent name="terms" class="solr.TermsComponent"/>
```

This makes the component available for use, but by itself will not be useable until included with a request handler.

Using the Terms Component in a Request Handler

The `/terms` request handler is also defined in `solrConfig.xml` by default.

```
<requestHandler name="/terms" class="solr.SearchHandler" startup="lazy">
  <lst name="defaults">
    <bool name="terms">true</bool>
    <bool name="distrib">false</bool>
  </lst>
  <arr name="components">
    <str>terms</str>
  </arr>
</requestHandler>
```

Note that the defaults for the this request handler set the parameter "terms" to true, which allows terms to be returned on request. The parameter "distrib" is set to false, which allows this handler to be used only on a single Solr core. To finish out the configuration, he Terms Component is included as an available component to this request handler.

You could add this component to another handler if you wanted to, and pass "terms=true" in the HTTP request in order to get terms back. If it is only defined in a separate handler, you must use that handler when querying in order to get terms and not regular documents as results.

Terms Component Parameters

The parameters below allow you to control what terms are returned. You can also any of these to the request handler if you'd like to set them permanently. Or, you can add them to the query request. These parameters are:

Parameter	Required	Default	Description
terms	No	false	If set to true, enables the Terms Component. By default, the Terms Component is off. Example: `terms=true`
terms.fl	Yes	null	Specifies the field from which to retrieve terms. Example: `terms.fl=title`
terms.limit	No	10	Specifies the maximum number of terms to return. The default is 10. If the limit is set to a number less than 0, then no maximum limit is enforced. Although this is not required, either this parameter or `terms.upper` must be defined. Example: `terms.limit=20`
terms.lower	No	empty string	Specifies the term at which to start. If not specified, the empty string is used, causing Solr to start at the beginning of the field. Example: `terms.lower=orange`
terms.lower.incl	No	true	If set to true, includes the lower-bound term (specified with `terms.lower` in the result set. Example: `terms.lower.incl=false`

terms.mincount	No	null	Specifies the minimum document frequency to return in order for a term to be included in a query response. Results are inclusive of the mincount (that is, >= mincount). Example: `terms.mincount=5`
terms.maxcount	No	null	Specifies the maximum document frequency a term must have in order to be included in a query response. The default setting is -1, which sets no upper bound. Results are inclusive of the maxcount (that is, <= maxcount). Example: `terms.maxcount=25`
terms.prefix	No	null	Restricts matches to terms that begin with the specified string. Example: `terms.prefix=inter`
terms.raw	No	false	If set to true, returns the raw characters of the indexed term, regardless of whether it is human-readable. For instance, the indexed form of numeric numbers is not human-readable. Example: `terms.raw=true`
terms.regex	No	null	Restricts matches to terms that match the regular expression. Example: `terms.regex=*pedist`
terms.regex.flag	No	null	Defines a Java regex flag to use when evaluating the regular expression defined with `terms.regex`. See http://docs.oracle.com/javase/tutorial/essential/regex/pattern.html for details of each flag. Valid options are: • case_insensitive • comments • multiline • literal • dotall • unicode_case • canon_eq • unix_lines Example: `terms.regex.flag=case_insensitive`
terms.sort	No	count	Defines how to sort the terms returned. Valid options are **count**, which sorts by the term frequency, with the highest term frequency first, or **index**, which sorts in index order. Example: `terms.sort=index`
terms.upper	No	null	Specifies the term to stop at. Although this parameter is not required, either this parameter or `terms.limit` must be defined. Example: `terms.upper=plum`

terms.upper.incl	No	false	If set to true, the upper bound term is included in the result set. The default is false. Example: `terms.upper.incl=true`

The output is a list of the terms and their document frequency values. See below for examples.

Examples

All of the following sample queries work with Solr's "`bin/solr -e techproducts`" example.

Get Top 10 Terms

This query requests the first ten terms in the name field: `http://localhost:8983/solr/techproducts/terms?terms.fl=name`

Results:

```
<response>
  <lst name="responseHeader">
    <int name="status">0</int>
    <int name="QTime">2</int>
  </lst>
  <lst name="terms">
    <lst name="name">
      <int name="one">5</int>
      <int name="184">3</int>
      <int name="1gb">3</int>
      <int name="3200">3</int>
      <int name="400">3</int>
      <int name="ddr">3</int>
      <int name="gb">3</int>
      <int name="ipod">3</int>
      <int name="memory">3</int>
      <int name="pc">3</int>
    </lst>
  </lst>
</response>
```

Get First 10 Terms Starting with Letter 'a'

This query requests the first ten terms in the name field, in index order (instead of the top 10 results by document count): `http://localhost:8983/solr/techproducts/terms?terms.fl=name&terms.lower=a&terms.sort=index`

Results:

```
<response>
  <lst name="responseHeader">
    <int name="status">0</int>
    <int name="QTime">0</int>
  </lst>
  <lst name="terms">
    <lst name="name">
      <int name="a">1</int>
      <int name="all">1</int>
      <int name="apple">1</int>
      <int name="asus">1</int>
      <int name="ata">1</int>
      <int name="ati">1</int>
      <int name="belkin">1</int>
      <int name="black">1</int>
      <int name="british">1</int>
      <int name="cable">1</int>
    </lst>
  </lst>
</response>
```

Using the Terms Component for an Auto-Suggest Feature

If the Suggester doesn't suit your needs, you can use the Terms component in Solr to build a similar feature for your own search application. Simply submit a query specifying whatever characters the user has typed so far as a prefix. For example, if the user has typed "at", the search engine's interface would submit the following query:

`http://localhost:8983/solr/techproducts/terms?terms.fl=name&terms.prefix=at`

Result:

```
<response>
  <lst name="responseHeader">
    <int name="status">0</int>
    <int name="QTime">1</int>
  </lst>
  <lst name="terms">
    <lst name="name">
      <int name="ata">1</int>
      <int name="ati">1</int>
    </lst>
  </lst>
</response>
```

You can use the parameter `omitHeader=true` to omit the response header from the query response, like in this example, which also returns the response in JSON format: `http://localhost:8983/solr/techproducts/terms?terms.fl=name&terms.prefix=at&indent=true&wt=json&omitHeader=true`

Result:

```
{
  "terms": {
    "name": [
      "ata",
      1,
      "ati",
      1
    ]
  }
}
```

Distributed Search Support

The TermsComponent also supports distributed indexes. For the `/terms` request handler, you must provide the following two parameters:

Parameter	Description
shards	Specifies the shards in your distributed indexing configuration. For more information about distributed indexing, see Distributed Search with Index Sharding.
shards.qt	Specifies the request handler Solr uses for requests to shards.

More Resources

- TermsComponent wiki page
- TermsComponent javadoc

The Term Vector Component

The TermVectorComponent is a search component designed to return additional information about documents matching your search.

For each document in the response, the TermVectorCcomponent can return the term vector, the term frequency, inverse document frequency, position, and offset information.

Configuration

The TermVectorComponent is not enabled implicitly in Solr - it must be explicitly configured in your `solrconfig.xml` file. The examples on this page show how it is configured in Solr's "`techproducts`" example:

```
bin/solr -e techproducts
```

To enable the this component, you need to configure it using a `searchComponent` element:

```
<searchComponent name="tvComponent"
class="org.apache.solr.handler.component.TermVectorComponent"/>
```

A request handler must then be configured to use this component name. In this example, the component is associated with a special request handler named `/tvrh`, that enables term vectors by default using the `tv=true` parameter; but you can associate it with any request handler:

```
<requestHandler name="/tvrh"
class="org.apache.solr.handler.component.SearchHandler">
  <lst name="defaults">
    <bool name="tv">true</bool>
  </lst>
  <arr name="last-components">
    <str>tvComponent</str>
  </arr>
</requestHandler>
```

Once your handler is defined, you may use it to fetch term vectors for any fields configured with the `termVector` attribute in your `schema.xml`, for example:

```
<field name="includes"
       type="text"
       indexed="true"
       stored="true"
       multiValued="true"
       termVectors="true"
       termPositions="true"
       termOffsets="true" />
```

Invoking the Term Vector Component

The example below shows an invocation of this component using the above configuration:

`http://localhost:8983/solr/techproducts/tvrh?q=*%3A*&start=0&rows=10&fl=id,includes`

```
...
<lst name="termVectors">
   <lst name="warnings">
     <arr name="noTermVectors">
       <str>id</str>
     </arr>
   </lst>
   <lst name="doc-5">
     <str name="uniqueKey">MA147LL/A</str>
     <lst name="includes">
       <lst name="cabl"/>
       <lst name="earbud"/>
       <lst name="headphon"/>
       <lst name="usb"/>
     </lst>
   </lst>
   <str name="uniqueKeyFieldName">id</str>
   <lst name="doc-9">
     <str name="uniqueKey">3007WFP</str>
     <lst name="includes">
       <lst name="cabl"/>
       <lst name="usb"/>
     </lst>
   </lst>
   <str name="uniqueKeyFieldName">id</str>
   <lst name="doc-12">
     <str name="uniqueKey">9885A004</str>
     <lst name="includes">
       <lst name="32"/>
       <lst name="av"/>
       <lst name="batteri"/>
       <lst name="cabl"/>
       <lst name="card"/>
       <lst name="mb"/>
       <lst name="sd"/>
       <lst name="usb"/>
     </lst>
   </lst>
   <str name="uniqueKeyFieldName">id</str>
 </lst>
```

Request Parameters

The example below shows the available request parameters for this component:

```
http://localhost:8983/solr/techproducts/tvrh?q=includes:[* TO *]&rows=10&indent=true&tv=true&tv.tf=true&tv.df=true&tv.positions=true&tv.offsets=true&tv.payloads=true&tv.fl=includes
```

Boolean Parameters	Description	Type
tv	Should the component run or not	boolean

tv.docIds	Returns term vectors for the specified list of Lucene document IDs (not the Solr Unique Key).	comma seperated integers
tv.fl	Returns term vectors for the specified list of fields. If not specified, the `fl` parameter is used.	comma seperated list of field names
tv.all	A shortcut that invokes all the boolean parameters listed below.	boolean
tv.df	Returns the Document Frequency (DF) of the term in the collection. This can be computationally expensive.	boolean
tv.offsets	Returns offset information for each term in the document.	boolean
tv.positions	Returns position information.	boolean
tv.payloads	Returns payload information.	boolean
tv.tf	Returns document term frequency info per term in the document.	boolean
tv.tf_idf	Calculates TF*IDF for each term. Requires the parameters `tv.tf` and `tv.df` to be "true". This can be computationally expensive. (The results are not shown in example output)	boolean

To learn more about TermVector component output, see the Wiki page: http://wiki.apache.org/solr/TermVectorComponentExampleOptions

For schema requirements, see the Wiki page: http://wiki.apache.org/solr/FieldOptionsByUseCase

SolrJ and the Term Vector Component

Neither the SolrQuery class nor the QueryResponse class offer specific method calls to set Term Vector Component parameters or get the "termVectors" output. However, there is a patch for it: SOLR-949.

The Stats Component

The Stats component returns simple statistics for numeric, string, and date fields within the document set.

The sample queries in this section assume you are running the "`techproducts`" example included with Solr:

```
bin/solr -e techproducts
```

Stats Component Parameters

The Stats Component accepts the following parameters:

Parameter	Description
stats	If **true**, then invokes the Stats component.

stats.field	Specifies a field for which statistics should be generated. This parameter may be invoked multiple times in a query in order to request statistics on multiple fields. Local Parameters may be used to indicate which subset of the supported statistics should be computed, and/or that statistics should be computed over the results of an arbitrary numeric function (or query) instead of a simple field name. See the examples below.
stats.facet	Returns sub-results for values within the specified facet. This legacy parameter is not recommended for new users - instead please consider combining `stats.field` with `facet.pivot`
stats.calcdistinct	If **true**, distinct values will be calculated and returned as "countDistinct" and "distinctValues" in the response. This calculation can be very expensive for fields that do not have a tiny cardinality, so it is **false** by default. This parameter can be specified using per-filed override (ie: `f.<field>.stats.calcdistinct=true`) but users are encouraged to instead specify it as a Local Parameter - As a top level request parameter, this option is deprecated.

Example

The query below demonstrates computing stats against two different fields numeric fields, as well as stats over the results of a a 'termfreq()' function call using the 'text' field:

```
http://localhost:8983/solr/techproducts/select?q=*:*&stats=true&stats.field={!func}termfreq('text','memory')&stats.field=price&stats.field=popularity&rows=0&indent=true
```

```
<lst name="stats">
  <lst name="stats_fields">
    <lst name="termfreq(text,memory)">
      <double name="min">0.0</double>
      <double name="max">3.0</double>
      <long name="count">32</long>
      <long name="missing">0</long>
      <double name="sum">10.0</double>
      <double name="sumOfSquares">22.0</double>
      <double name="mean">0.3125</double>
      <double name="stddev">0.7803018439949604</double>
      <lst name="facets"/>
    </lst>
    <lst name="price">
      <double name="min">0.0</double>
      <double name="max">2199.0</double>
      <long name="count">16</long>
      <long name="missing">16</long>
      <double name="sum">5251.270030975342</double>
      <double name="sumOfSquares">6038619.175900028</double>
      <double name="mean">328.20437693595886</double>
      <double name="stddev">536.3536996709846</double>
      <lst name="facets"/>
    </lst>
    <lst name="popularity">
      <double name="min">0.0</double>
      <double name="max">10.0</double>
      <long name="count">15</long>
      <long name="missing">17</long>
      <double name="sum">85.0</double>
      <double name="sumOfSquares">603.0</double>
      <double name="mean">5.666666666666667</double>
      <double name="stddev">2.943920288775949</double>
      <lst name="facets"/>
    </lst>
  </lst>
</lst>
```

Statistics Supported

The table below explains the statistics supported by the Stats component. Not all statistics are supported for all field types, and not all statistics are computed by default (See Local Parameters below for details)

Local Param	Sample Input	Output Name	Description	Supported Types	Computed by Default
min	true	min	The minimum value of the field/function in all documents in the set.	All	Yes
max	true	max	The maximum value of the field/function in all documents in the set.	All	Yes

sum	true	sum	The sum of all values of the field/function in all documents in the set.	Numeric & Date	Yes
count	true	count	The number of values found in all documents in the set for this field/function.	All	Yes
missing	true	missing	The number of documents in the set which do not have a value for this field/function.	All	Yes
sumOfSquares	true	sumOfSquares	Sum of all values squared (a by product of computing stddev)	Numeric & Date	Yes
mean	true	mean	The average `(v1 + v2 .... + vN)/N`	Numeric & Date	Yes
stddev	true	stddev	Standard deviation, measuring how widely spread the values in the data set are.	Numeric & Date	Yes
percentiles	"1,99,99.9"	percentiles	A list of percentile values based on cut-off points specified by the param value. These values are an approximation, using the t-digest algorithm.	Numeric	No
calcdistinct	true	distinctValues	The set of all distinct values for the field/function in all of the documents in the set. This calculation can be very expensive for fields that do not have a tiny cardinality.	All	No
calcdistinct	true	countDistinct	The number of distinct values in the field/function in all of the documents in the set. This calculation can be very expensive for fields that do not have a tiny cardinality.	All	No

Local Parameters

Similar to the Facet Component, the `stats.field` parameter supports local parameters for:

- Tagging & Excluding Filters: `stats.field={!ex=filterA}price`
- Changing the Output Key: `stats.field={!key=my_price_stats}price`
- Tagging stats for use with `facet.pivot`: `stats.field={!tag=my_pivot_stats}price`

Local parameters can also be used to specify individual statistics by name, overriding the set of statistics computed by default, eg: `stats.field={min=true max=true percentiles='99,99.9,99.99'}price`

⚠ If any supported statistics are specified via local parameters, then the entire set of default statistics is overridden and only the requested statistics are computed.

Additional "Expert" local params are supported in some cases for affecting the behavior of some statistics:

- `tdigestCompression` - a positive numeric value defaulting to `100.0` controlling the compression factor of the T-Digest. Larger values means more accuracy, but also uses more memory.

Examples

Here we compute some statistics for the price field. The min, max, mean, 90th, and 99th percentile price values are computed against all products that are in stock (`q=*:*` and `fq=inStock:true`), and independently all of the default statistics are computed against all products regardless of whether they are in stock or not (by excluding that filter).

`http://localhost:8983/solr/techproducts/select?q=*:*&fq={!tag=stock_check}inStock:true&stats=true&stats.field={!ex=stock_check+key=instock_prices+min=true+max=true+mean=true+percentiles='90,99'}price&stats.field={!key=all_prices}price&rows=0&indent=true`

```
<lst name="stats">
  <lst name="stats_fields">
    <lst name="instock_prices">
      <double name="min">0.0</double>
      <double name="max">2199.0</double>
      <double name="mean">328.20437693595886</double>
      <lst name="percentiles">
        <double name="90.0">564.9700012207031</double>
        <double name="99.0">1966.6484985351556</double>
      </lst>
    </lst>
    <lst name="all_prices">
      <double name="min">0.0</double>
      <double name="max">2199.0</double>
      <long name="count">12</long>
      <long name="missing">5</long>
      <double name="sum">4089.880027770996</double>
      <double name="sumOfSquares">5385249.921747174</double>
      <double name="mean">340.823335647583</double>
      <double name="stddev">602.3683083752779</double>
    </lst>
  </lst>
</lst>
```

The Stats Component and Faceting

Although the `stats.facet` parameter is no longer recommended, sets of `stats.field` parameters can be referenced by '`tag`' when using Pivot Faceting to compute multiple statistics at every level (i.e.: field) in the tree of pivot constraints.

For more information and a detailed example, please see Combining Stats Component With Pivots.

The Query Elevation Component

The Query Elevation Component lets you configure the top results for a given query regardless of the normal Lucene scoring. This is sometimes called "sponsored search," "editorial boosting," or "best bets." This component matches the user query text to a configured map of top results. The text can be any string or non-string IDs, as long as it's indexed. Although this component will work with any QueryParser, it makes the most sense to use with DisMax or eDisMax.

The Query Elevation Component is supported by distributed searching.

All of the sample configuration and queries used in this section assume you are running Solr's "`techproducts`" example:

```
bin/solr -e techproducts
```

Configuring the Query Elevation Component

You can configure the Query Elevation Component in the `solrconfig.xml` file.

```
<searchComponent name="elevator" class="solr.QueryElevationComponent" >
  <!-- pick a fieldType to analyze queries -->
  <str name="queryFieldType">string</str>
  <str name="config-file">elevate.xml</str>
</searchComponent>

<requestHandler name="/elevate" class="solr.SearchHandler" startup="lazy">
  <lst name="defaults">
    <str name="echoParams">explicit</str>
  </lst>
  <arr name="last-components">
    <str>elevator</str>
  </arr>
</requestHandler>
```

Optionally, in the Query Elevation Component configuration you can also specify the following to distinguish editorial results from "normal" results:

```
<str name="editorialMarkerFieldName">foo</str>
```

The Query Elevation Search Component takes the following arguments:

Argument	Description
`queryFieldType`	Specifies which fieldType should be used to analyze the incoming text. For example, it may be appropriate to use a fieldType with a LowerCaseFilter.
`config-file`	Path to the file that defines query elevation. This file must exist in `<instanceDir>/conf/<config-file>` or `<dataDir>/<config-file>`. If the file exists in the /conf/ directory it will be loaded once at startup. If it exists in the data directory, it will be reloaded for each IndexReader.

`forceElevation`	By default, this component respects the requested `sort` parameter: if the request asks to sort by date, it will order the results by date. If `forceElevation=true` (the default), results will first return the boosted docs, then order by date.

`elevate.xml`

Elevated query results are configured in an external XML file specified in the `config-file` argument. An `elevate.xml` file might look like this:

```
<elevate>
 <query text="foo bar">
  <doc id="1" />
  <doc id="2" />
  <doc id="3" />
 </query>

 <query text="ipod">
   <doc id="MA147LL/A" />  <!-- put the actual ipod at the top -->
   <doc id="IW-02" exclude="true" /> <!-- exclude this cable -->
 </query>
</elevate>
```

In this example, the query "foo bar" would first return documents 1, 2 and 3, then whatever normally appears for the same query. For the query "ipod", it would first return "MA147LL/A", and would make sure that "IW-02" is not in the result set.

Using the Query Elevation Component

The `enableElevation` Parameter

For debugging it may be useful to see results with and without the elevated docs. To hide results, use `enableElevation=false`:

`http://localhost:8983/solr/techproducts/elevate?q=ipod&df=text&debugQuery=true&enableElevation=true`

`http://localhost:8983/solr/techproducts/elevate?q=ipod&df=text&debugQuery=true&enableElevation=false`

The `forceElevation` Parameter

You can force elevation during runtime by adding `forceElevation=true` to the query URL:

`http://localhost:8983/solr/techproducts/elevate?q=ipod&df=text&debugQuery=true&enableElevation=true&forceElevation=true`

The `exclusive` Parameter

You can force Solr to return only the results specified in the elevation file by adding `exclusive=true` to the URL:

`http://localhost:8983/solr/techproducts/elevate?q=ipod&df=text&debugQuery=true&exclusive=true`

Document Transformers and the markExcludes Parameter

The [elevated] Document Transformer can be used to annotate each document with information about whether or not it was elevated:

`http://localhost:8983/solr/techproducts/elevate?q=ipod&df=text&fl=id,[elevated]`

Likewise, it can be helpful when troubleshooting to see all matching documents – including documents that the elevation configuration would normally exclude. This is possible by using the `markExcludes=true` parameter, and then using the `[excluded]` transformer:

`http://localhost:8983/solr/techproducts/elevate?q=ipod&df=text&markExcludes=true&fl=id,[elevated],[excluded]`

The elevateIds and excludeIds Parameters

When the elevation component is in use, the pre-configured list of elevations for a query can be overridden at request time to use the unique keys specified in these request parameters.

For example, in the request below documents 3007WFP and 9885A004 will be elevated, and document IW-02 will be excluded -- regardless of what elevations or exclusions are configured for the query "cable" in elevate.xml:

`http://localhost:8983/solr/techproducts/elevate?q=cable&df=text&excludeIds=IW-02&elevateIds=3007WFP,9885A004`

If either one of these parameters is specified at request time, the the entire elevation configuration for the query is ignored.

For example, in the request below documents IW-02 and F8V7067-APL-KIT will be elevated, and no documents will be excluded – regardless of what elevations or exclusions are configured for the query "ipod" in elevate.xml:

`http://localhost:8983/solr/techproducts/elevate?q=ipod&df=text&elevateIds=IW-02,F8V7067-APL-KIT`

The fq Parameter

Query elevation respects the standard filter query (`fq`) parameter. That is, if the query contains the `fq` parameter, all results will be within that filter even if `elevate.xml` adds other documents to the result set.

Response Writers

A Response Writer generates the formatted response of a search. Solr supports a variety of Response Writers to ensure that query responses can be parsed by the appropriate language or application.

The `wt` parameter selects the Response Writer to be used. The table below lists the most common settings for the `wt` parameter.

`wt` Parameter Setting	Response Writer Selected
csv	CSVResponseWriter
json	JSONResponseWriter
php	PHPResponseWriter

phps	PHPSerializedResponseWriter
python	PythonResponseWriter
ruby	RubyResponseWriter
velocity	VelocityResponseWriter
xml	XMLResponseWriter
xslt	XSLTResponseWriter

The Standard XML Response Writer

The XML Response Writer is the most general purpose and reusable Response Writer currently included with Solr. It is the format used in most discussions and documentation about the response of Solr queries.

Note that the XSLT Response Writer can be used to convert the XML produced by this writer to other vocabularies or text-based formats.

The behavior of the XML Response Writer can be driven by the following query parameters.

The `version` Parameter

The `version` parameter determines the XML protocol used in the response. Clients are strongly encouraged to *always* specify the protocol version, so as to ensure that the format of the response they receive does not change unexpectedly if the Solr server is upgraded and a new default format is introduced.

Currently supported version values are:

XML Version	Notes
2.2	The format of the responseHeader changed to use the same `<lst>` structure as the rest of the response.

The default value is the latest supported.

The `stylesheet` Parameter

The `stylesheet` parameter can be used to direct Solr to include a `<?xml-stylesheet type="text/xsl" href="..."?>` declaration in the XML response it returns.

The default behavior is not to return any stylesheet declaration at all.

> ⚠ Use of the `stylesheet` parameter is discouraged, as there is currently no way to specify external stylesheets, and no stylesheets are provided in the Solr distributions. This is a legacy parameter, which may be developed further in a future release.

The `indent` Parameter

If the `indent` parameter is used, and has a non-blank value, then Solr will make some attempts at indenting its XML response to make it more readable by humans.

The default behavior is not to indent.

The XSLT Response Writer

The XSLT Response Writer applies an XML stylesheet to output. It can be used for tasks such as formatting results for an RSS feed.

`tr` Parameter

The XSLT Response Writer accepts one parameter: the `tr` parameter, which identifies the XML transformation to use. The transformation must be found in the Solr `conf/xslt` directory.

The Content-Type of the response is set according to the `<xsl:output>` statement in the XSLT transform, for example: `<xsl:output media-type="text/html"/>`

Configuration

The example below, from the `sample_techproducts_configs` config set in the Solr distribution , shows how the XSLT Response Writer is configured.

```
<!--
  Changes to XSLT transforms are taken into account
  every xsltCacheLifetimeSeconds at most.
-->
<queryResponseWriter name="xslt"
                     class="org.apache.solr.request.XSLTResponseWriter">
  <int name="xsltCacheLifetimeSeconds">5</int>
</queryResponseWriter>
```

A value of 5 for `xsltCacheLifetimeSeconds` is good for development, to see XSLT changes quickly. For production you probably want a much higher value.

JSON Response Writer

A very commonly used Response Writer is the `JsonResponseWriter`, which formats output in JavaScript Object Notation (JSON), a lightweight data interchange format specified in specified in RFC 4627. Setting the `wt` parameter to `json` invokes this Response Writer.

The default mime type for the JSON writer is `application/json`, however this can be overridden in the `solrconfig.xml` - such as in this example from the "`techproducts`" configuration:

```
<queryResponseWriter name="json" class="solr.JSONResponseWriter">
  <!-- For the purposes of the tutorial, JSON response are written as
       plain text so that it's easy to read in *any* browser.
       If you are building applications that consume JSON, just remove
       this override to get the default "application/json" mime type.
    -->
  <str name="content-type">text/plain</str>
</queryResponseWriter>
```

Python Response Writer

Solr has an optional Python response format that extends its JSON output in the following ways to allow the response to be safely evaluated by the python interpreter:

- true and false changed to True and False
- Python unicode strings are used where needed
- ASCII output (with unicode escapes) is used for less error-prone interoperability
- newlines are escaped
- null changed to None

PHP Response Writer and PHP Serialized Response Writer

Solr has a PHP response format that outputs an array (as PHP code) which can be evaluated. Setting the `wt` parameter to `php` invokes the PHP Response Writer.

Example usage:

```
$code =
file_get_contents('http://localhost:8983/solr/techproducts/select?q=iPod&wt=php');
eval("$result = " . $code . ";");
print_r($result);
```

Solr also includes a PHP Serialized Response Writer that formats output in a serialized array. Setting the `wt` parameter to `phps` invokes the PHP Serialized Response Writer.

Example usage:

```
$serializedResult =
file_get_contents('http://localhost:8983/solr/techproducts/select?q=iPod&wt=phps');
$result = unserialize($serializedResult);
print_r($result);
```

Ruby Response Writer

Solr has an optional Ruby response format that extends its JSON output in the following ways to allow the response to be safely evaluated by Ruby's interpreter:

- Ruby's single quoted strings are used to prevent possible string exploits.
- \ and ' are the only two characters escaped.
- Unicode escapes are not used. Data is written as raw UTF-8.
- nil used for null.
- => is used as the key/value separator in maps.

Here is a simple example of how one may query Solr using the Ruby response format:

```
require 'net/http'
h = Net::HTTP.new('localhost', 8983)
hresp, data = h.get('/solr/techproducts/select?q=iPod&wt=ruby', nil)
rsp = eval(data)
puts 'number of matches = ' + rsp['response']['numFound'].to_s
#print out the name field for each returned document
rsp['response']['docs'].each { |doc| puts 'name field = ' + doc['name'\] }
```

CSV Response Writer

The CSV response writer returns a list of documents in comma-separated values (CSV) format. Other information that would normally be included in a response, such as facet information, is excluded.

The CSV response writer supports multi-valued fields, as well as psuedo-fields, and the output of this CSV format is compatible with Solr's CSV update format.

CSV Parameters

These parameters specify the CSV format that will be returned. You can accept the default values or specify your own.

Parameter	Default Value
csv.encapsulator	"
csv.escape	None
csv.separator	,
csv.header	Defaults to true. If false, Solr does not print the column headers
csv.newline	\n
csv.null	Defaults to a zero length string. Use this parameter when a document has no value for a particular field.

Multi-Valued Field CSV Parameters

These parameters specify how multi-valued fields are encoded. Per-field overrides for these values can be done using `f.<fieldname>.csv.separator=|`.

Parameter	Default Value
csv.mv.encapsulator	None
csv.mv.escape	\
csv.mv.separator	Defaults to the `csv.separator` value

Example

`http://localhost:8983/solr/techproducts/select?q=ipod&fl=id,cat,name,popularity,price,score&wt=csv` returns:

```
id,cat,name,popularity,price,score
IW-02,"electronics,connector",iPod & iPod Mini USB 2.0 Cable,1,11.5,0.98867977
F8V7067-APL-KIT,"electronics,connector",Belkin Mobile Power Cord for iPod w/
Dock,1,19.95,0.6523595
MA147LL/A,"electronics,music",Apple 60 GB iPod with Video Playback
Black,10,399.0,0.2446348
```

Velocity Response Writer

The VelocityResponseWriter is an optional plugin available in the `contrib/velocity` directory. It is used to power the Velocity Search UI in the example configuration.

Its JAR and dependencies must be added (via <lib> or solr/home lib inclusion), and must be registered in `solrconfig.xml` like this:

```
<queryResponseWriter name="velocity" class="solr.VelocityResponseWriter">
  <str name="template.base.dir">${velocity.template.base.dir:}</str>

<!--
  <str name="init.properties.file">velocity-init.properties</str>
  <bool name="params.resource.loader.enabled">true</bool>
  <bool name="solr.resource.loader.enabled">false</bool>
-->
</queryResponseWriter>
```

The above example shows the optional initialization parameters used by VelocityResponseWriter and detailed in the following table. These initialization parameters are only specified in the writer registration in solrconfig.xml, not as request-time parameters. See further below for request-time parameters.

VelocityResponseWriter initialization parameters

Parameter	Description	Default value
template.base.dir	If specified and exists as a file system directory, a file resource loader will be added for this directory. Templates in this directory will override "solr" resource loader templates.	
init.properties.file	Specifies a properties file name which must exist in the Solr conf/ directory (**not** under a velocity/ subdirectory) or root of a JAR file in a <lib>.	
params.resource.loader.enabled	The "params" resource loader allows templates to be specified in Solr request parameters. For example: `http://localhost:8983/solr/gettingstarted/select?q=*:*&wt=velocity&v.template=custom&v.template.custom=CUSTOM%3A%20%23core_name` where v.template=custom says to render a template called "custom" and v.template.custom's value is the actual custom template. This is disabled by default; it'd be a niche, unusual use case to need this enabled.	false
solr.resource.loader.enabled	The "solr" resource loader is the only template loader registered by default. Templates are served from resources visible to the SolrResourceLoader under a `velocity/` subdirectory. The VelocityResponseWriter itself has some built-in templates (in its JAR file, under velocity/) that are available automatically through this loader. These built-in templates can be overridden when the same template name is in conf/velocity/ or by using the `template.base.dir` option.	true

VelocityResponseWriter request parameters

Parameter	Description	Default value
v.template	Specifies the name of the template to render.	
v.layout	Specifies a template name to use as the layout around the main, `v.template`, specified template. The main template is rendered into a string value included into the layout rendering as `$content`.	
v.layout.enabled	Determines if the main template should have a layout wrapped around it. True by default, but requires `v.layout` to specified as well.	true
v.contentType	Specifies the content type used in the HTTP response. If not specified, the default will depend on whether `v.json` is specified or not.	without json.wrf: text/html;charset=UTF-8 with json.wrf: application/json;charset=UTF-8
v.json	Specifies a function name to wrap around the response rendered as JSON. If specified, the content type used in the response will be "application/json;charset=UTF-8", unless overridden by `v.contentType`. Output will be in this format (with v.json=wrf): `wrf("result":"<Velocity generated response string, with quotes and backslashes escaped>")`	

v.locale	Locale to use with the `$resource` tool. The default locale is Locale.ROOT. Localized resources are loaded from standard Java resource bundles named `resources[_locale-code].properties`. Resource bundles can be added by providing a JAR file visible by the SolrResourceLoader with resource bundles under a velocity sub-directory. Resource bundles are not loadable under conf/, as only the class loader aspect of SolrResourceLoader can be used here.	
v.template.<template_name>	When the "params" resource loader is enabled, templates can be specified as part of the Solr request.	

VelocityResponseWriter context objects

Context reference	Description
request	SolrQueryRequest javadocs
response	QueryResponse most of the time, but in some cases where QueryResponse doesn't like the request handlers output (AnalysisRequestHandler, for example, causes a ClassCastException parsing "response") the response will be a SolrResponseBase object.
esc	A Velocity EscapeTool instance
date	A Velocity ComparisonDateTool instance
list	A Velocity ListTool instance
math	A Velocity MathTool instance
number	A Velocity NumberTool instance
sort	A Velocity SortTool instance
display	A Velocity DisplayTool instance
resource	A Velocity ResourceTool instance
engine	The current VelocityEngine instance
page	An instance of Solr's PageTool (only included if the response is a QueryResponse where paging makes sense)

debug	A shortcut to the debug part of the response, or null if debug is not on. This is handy for having debug-only sections in a template using `#if($debug)...#end`
content	The rendered output of the main template, when rendering the layout (v.layout.enabled=true and v.layout=<template>).

For more information about the Velocity Response Writer, see https://wiki.apache.org/solr/VelocityResponseWriter.

Binary Response Writer

Solr also includes a Response Writer that outputs binary format for use with a Java client. See Client APIs for more details.

Near Real Time Searching

Near Real Time (NRT) search means that documents are available for search almost immediately after being indexed: additions and updates to documents are seen in 'near' real time. Solr does not block updates while a commit is in progress. Nor does it wait for background merges to complete before opening a new search of indexes and returning.

With NRT, you can modify a `commit` command to be a **soft commit**, which avoids parts of a standard commit that can be costly. You will still want to do standard commits to ensure that documents are in stable storage, but **soft commits** let you see a very near real time view of the index in the meantime. However, pay special attention to cache and autowarm settings as they can have a significant impact on NRT performance.

Commits and Optimizing

A commit operation makes index changes visible to new search requests. A **hard commit** uses the transaction log to get the id of the latest document changes, and also calls `fsync` on the index files to ensure they have been flushed to stable storage and no data loss will result from a power failure.

A **soft commit** is much faster since it only makes index changes visible and does not `fsync` index files or write a new index descriptor. If the JVM crashes or there is a loss of power, changes that occurred after the last **hard commit** will be lost. Search collections that have NRT requirements (that want index changes to be quickly visible to searches) will want to soft commit often but hard commit less frequently. A softCommit may be "less expensive" in terms of time, but not free, since it can slow throughput.

An **optimize** is like a **hard commit** except that it forces all of the index segments to be merged into a single segment first. Depending on the use, this operation should be performed infrequently (e.g., nightly), if at all, since it involves reading and re-writing the entire index. Segments are normally merged over time anyway (as determined by the merge policy), and optimize just forces these merges to occur immediately.

Soft commit takes uses two parameters: `maxDocs` and `maxTime`.

Parameter	Description
`maxDocs`	Integer. Defines the number of documents to queue before pushing them to the index. It works in conjunction with the `update_handler_autosoftcommit_max_time` parameter in that if either limit is reached, the documents will be pushed to the index.

`maxTime`	The number of milliseconds to wait before pushing documents to the index. It works in conjunction with the `update_handler_autosoftcommit_max_docs` parameter in that if either limit is reached, the documents will be pushed to the index.

Use `maxDocs` and `maxTime` judiciously to fine-tune your commit strategies.

AutoCommits

An autocommit also uses the parameters `maxDocs` and `maxTime`. However it's useful in many strategies to use both a hard `autocommit` and `autosoftcommit` to achieve more flexible commits.

A common configuration is to do a hard `autocommit` every 1-10 minutes and a `autosoftcommit` every second. With this configuration, new documents will show up within about a second of being added, and if the power goes out, soft commits are lost unless a hard commit has been done.

For example:

```
<autoSoftCommit>
  <maxTime>1000</maxTime>
</autoSoftCommit>
```

It's better to use `maxTime` rather than `maxDocs` to modify an `autoSoftCommit`, especially when indexing a large number of documents through the commit operation. It's also better to turn off `autoSoftCommit` for bulk indexing.

Optional Attributes for `commit` and `optimize`

Parameter	Valid Attributes	Description
`waitSearcher`	true, false	Block until a new searcher is opened and registered as the main query searcher, making the changes visible. Default is true.
`softCommit`	true, false	Perform a soft commit. This will refresh the view of the index faster, but without guarantees that the document is stably stored. Default is false.
`expungeDeletes`	true, false	Valid for `commit` only. This parameter purges deleted data from segments. The default is false.
`maxSegments`	integer	Valid for `optimize` only. Optimize down to at most this number of segments. The default is 1.

Example of `commit` and `optimize` with optional attributes:

```
<commit waitSearcher="false"/>
<commit waitSearcher="false" expungeDeletes="true"/>
<optimize waitSearcher="false"/>
```

Passing `commit` and `commitWithin` parameters as part of the URL

Update handlers can also get `commit`-related parameters as part of the update URL. This example adds a small test document and causes an explicit commit to happen immediately afterwards:

```
http://localhost:8983/solr/my_collection/update?stream.body=<add><doc>
   <field name="id">testdoc</field></doc></add>&commit=true
```

Alternately, you may want to use this:

```
http://localhost:8983/solr/my_collection/update?stream.body=<optimize/>
```

This example causes the index to be optimized down to at most 10 segments, but won't wait around until it's done (`waitFlush=false`):

```
curl
'http://localhost:8983/solr/my_collection/update?optimize=true&maxSegments=10&waitFl
ush=false'
```

This example adds a small test document with a `commitWithin` instruction that tells Solr to make sure the document is committed no later than 10 seconds later (this method is generally preferred over explicit commits):

```
curl http://localhost:8983/solr/my_collection/update?commitWithin=10000
  -H "Content-Type: text/xml" --data-binary
  '<add><doc><field name="id">testdoc</field></doc></add>'
```

Changing default `commitWithin` Behavior

The `commitWithin` settings allow forcing document commits to happen in a defined time period. This is used most frequently with Near Real Time Searching, and for that reason the default is to perform a soft commit. This does not, however, replicate new documents to slave servers in a master/slave environment. If that's a requirement for your implementation, you can force a hard commit by adding a parameter, as in this example:

```
<commitWithin>
  <softCommit>false</softCommit>
</commitWithin>
```

With this configuration, when you call `commitWithin` as part of your update message, it will automatically perform a hard commit every time.

RealTime Get

For index updates to be visible (searchable), some kind of commit must reopen a searcher to a new point-in-time view of the index. The **realtime get** feature allows retrieval (by `unique-key`) of the latest version of any documents without the associated cost of reopening a searcher. This is primarily useful when using Solr as a NoSQL data store and not just a search index.

Real Time Get relies on the update log feature, which is enabled by default and can be configured in `solrconfig.xml`:

```
<updateLog>
  <str name="dir">${solr.ulog.dir:}</str>
</updateLog>
```

Real Time Get requests can be performed using the `/get` handler which exists implicitly in Solr - it's equivalent to the following configuration:

```
<requestHandler name="/get" class="solr.RealTimeGetHandler">
  <lst name="defaults">
    <str name="omitHeader">true</str>
    <str name="wt">json</str>
    <str name="indent">true</str>
  </lst>
</requestHandler>
```

For example, if you started Solr using the `bin/solr -e techproducts` example command, you could then index a new document (with out committing it) like so:

```
curl 'http://localhost:8983/solr/techproducts/update/json?commitWithin=10000000'
  -H 'Content-type:application/json' -d '[{"id":"mydoc","name":"realtime-get
test!"}]'
```

If you do a normal search, this document should not be found yet:

```
http://localhost:8983/solr/techproducts/select?q=id:mydoc
...
"response":
{"numFound":0,"start":0,"docs":[]}
```

However if you use the Real Time Get handler exposed at `/get`, you can still retrieve that document:

```
http://localhost:8983/solr/techproducts/get?id=mydoc
...
{"doc":{"id":"mydoc","name":"realtime-get test!", "_version_":1487137811571146752}}
```

You can also specify multiple documents at once via the **ids** parameter and a comma separated list of ids, or by using multiple **id** parameters. If you specify multiple ids, or use the **ids** parameter, the response will mimic a normal query response to make it easier for existing clients to parse.

For example:

```
http://localhost:8983/solr/techproducts/get?ids=mydoc,IW-02
http://localhost:8983/solr/techproducts/get?id=mydoc&id=IW-02
...
{"response":
  {"numFound":2,"start":0,"docs":
    [ { "id":"mydoc",
        "name":"realtime-get test!",
        "_version_":1487137811571146752},
      {
        "id":"IW-02",
        "name":"iPod & iPod Mini USB 2.0 Cable",
        ...
    ]
 }
}
```

Do **NOT** disable the realtime get handler at `/get` if you are using SolrCloud otherwise any leader election will cause a full sync in **ALL** replicas for the shard in question. Similarly, a replica recovery will also always fetch the complete index from the leader because a partial sync will not be possible in the absence of this handler.

Exporting Result Sets

It's possible to export fully sorted result sets using a special rank query parser and response writer specifically designed to work together to handle scenarios that involve sorting and exporting millions of records. This uses a stream sorting technique that begins to send records within milliseconds and continues to stream results until the entire result set has been sorted and exported.

The cases where this functionality may be useful include: session analysis, distributed merge joins, time series roll-ups, aggregations on high cardinality fields, fully distributed field collapsing, and sort based stats.

Field Requirements

All the fields being sorted and exported must have docValues set to true. For more information, see the section on DocValues.

Defining the /export Request Handler

To export the full sorted result set you'll want to use a request handler explicitly configured to only run the "query" component, using the the export "rq" and "wt" params.

An "`/export`" request handler with the appropriate configuration is included in the `techproducts` example `solrconfig.xml`. If however, you would like to add it to an existing `solrconfig.xml`, you can add a section like this:

```
<requestHandler name="/export" class="solr.SearchHandler">
    <lst name="invariants">
      <str name="rq">{!xport}</str>
      <str name="wt">xsort</str>
      <str name="distrib">false</str>
    </lst>
    <arr name="components">
      <str>query</str>
    </arr>
  </requestHandler>
```

Note that this request handler's properties are defined as "invariants", which means they cannot be overridden by other properties passed at another time (such as at query time).

Requesting Results Export

Once the `/export` request handler is defined, you can use it to make requests to export the result set of a query.

All queries must include `sort` and `fl` parameters, or the query will return an error. Filter queries are also supported. Results are always returned in JSON format.

Here is an example of what an export request of some indexed log data might look like:

```
http://localhost:8983/solr/core_name/export?q=my-query&sort=severity+desc,timestamp+
desc&fl=severity,timestamp,msg
```

Specifying the Sort Criteria

The `sort` property defines how documents will be sorted in the exported result set. Results can be sorted by any field that has a field type of int,long, float, double, string. The sort fields must be single valued fields.

Up to four sort fields can be specified per request, with the 'asc' or 'desc' properties.

Specifying the Field List

The `fl` property defines the fields that will be exported with the result set. Any of the field types that can be sorted (i.e., int, long, float, double, string) can be used in the field list. The fields can be single or multi-valued. However, returning scores and wildcards are not supported at this time.

Distributed Support

The initial release treats all queries as non-distributed requests. So the client is responsible for making the calls to each Solr instance and merging the results.

Using SolrJ’s CloudSolrClient as a model, developers could build clients that automatically send requests to all the shards in a collection (or multiple collections) and then merge the sorted sets any way they wish.

The Well-Configured Solr Instance

This section tells you how to fine-tune your Solr instance for optimum performance. This section covers the following topics:

Configuring solrconfig.xml: Describes how to work with the main configuration file for Solr, `solrconfig.xml`, covering the major sections of the file.

Solr Cores and solr.xml: Describes how to work with `solr.xml` and `core.properties` to configure your Solr core, or multiple Solr cores within a single instance.

Solr Plugins: Introduces Solr plugins with pointers to more information.

JVM Settings: Gives some guidance on best practices for working with Java Virtual Machines.

⚠ The focus of this section is generally on configuring a single Solr instance, but for those interested in scaling a Solr implementation in a cluster environment, see also the section SolrCloud. There are also options to scale through sharding or replication, described in the section Legacy Scaling and Distribution.

Configuring solrconfig.xml

The `solrconfig.xml` file is the configuration file with the most parameters affecting Solr itself. While configuring Solr, you'll work with `solrconfig.xml` often. The file comprises a series of XML statements that set configuration values for an individual collection.

In `solrconfig.xml`, you configure important features such as:

- request handlers, which process the requests to Solr, such as requests to add documents to the index or requests to return results for a query
- listeners, processes that "listen" for particular query-related events; listeners can be used to trigger the execution of special code, such as invoking some common queries to warm-up caches
- the Request Dispatcher for managing HTTP communications
- the Admin Web interface
- parameters related to replication and duplication (these parameters are covered in detail in Legacy Scaling and Distribution)

The `solrconfig.xml` file is located in the `conf/` directory for each collection. Several well-commented example files can be found in the `server/solr/configsets/` directories demonstrating best practices for many different types of installations.

We've covered the options in the following sections:

- DataDir and DirectoryFactory in SolrConfig
- Lib Directives in SolrConfig
- Managed Schema Definition in SolrConfig
- IndexConfig in SolrConfig
- RequestHandlers and SearchComponents in SolrConfig
- InitParams in SolrConfig
- UpdateHandlers in SolrConfig

- Query Settings in SolrConfig
- RequestDispatcher in SolrConfig

Substituting Properties in Solr Config Files

Solr supports variable substitution of property values in config files, which allows runtime specification of various configuration options in `solrconfig.xml`. The syntax is `${propertyname[:option default value]}`. This allows defining a default that can be overridden when Solr is launched. If a default value is not specified, then the property *must* be specified at runtime or the configuration file will generate an error when parsed.

There are multiple methods for specifying properties that can be used in configuration files.

JVM System Properties

Any JVM System properties, usually specified using the `-D` flag when starting the JVM, can be used as variables in any XML configuration file in Solr.

For example, in the sample `solrconfig.xml` files, you will see this value which defines the locking type to use:

```
<lockType>${solr.lock.type:native}</lockType>
```

Which means the lock type defaults to "native" but when starting Solr, you could override this using a JVM system property by launching the Solr it with:

```
bin/solr start -Dsolr.lock.type=none
```

In general, any Java system property that you want to set can be passed through the `bin/solr` script using the standard `-Dproperty=value` syntax. Alternatively, you can add common system properties to the `SOLR_OPTS` environment variable defined in the Solr include file (`bin/solr.in.sh`). For more information about how the Solr include file works, refer to: Taking Solr to Production.

`solrcore.properties`

If the configuration directory for a Solr core contains a file named `solrcore.properties` that file can contain any arbitrary user defined property names and values using the Java standard properties file format, and those properties can be used as variables in the XML configuration files for that Solr core.

For example, the following `solrcore.properties` file could be created in the `conf/` directory of a collection using one of the example configurations, to override the lockType used.

```
#conf/solrcore.properties
solr.lock.type=none
```

> The path and name of the `solrcore.properties` file can be overridden using the `properties` property in `core.properties`.

User defined properties from `core.properties`

If you are using a `core.properties` file with solr.xml, then any user defined properties in that file may be specified there and those properties will be available for substitution when parsing XML configuration files for that

Solr core.

For example, consider the following `core.properties` file:

```
#core.properties
name=collection2
my.custom.prop=edismax
```

The `my.custom.prop` property can then be used as a variable, such as in `solrconfig.xml`:

```
<requestHandler name="/select">
    <lst name="defaults">
      <str name="defType">${my.custom.prop}</str>
    </lst>
  </requestHandler>
```

Implicit Core Properties

Several attributes of a Solr core are available as "implicit" properties that can be used in variable substitution, independent of where or how they underlying value is initialized. For example: regardless of whether the name for a particular Solr core is explicitly configured in `core.properties` or inferred from the name of the instance directory, the implicit property `solr.core.name` is available for use as a variable in that core's configuration file...

```
<requestHandler name="/select">
    <lst name="defaults">
      <str name="collection_name">${solr.core.name}</str>
    </lst>
  </requestHandler>
```

All implicit properties use the `solr.core.` name prefix, and reflect the runtime value of the equivalent `core.properties` property:

- `solr.core.name`
- `solr.core.config`
- `solr.core.schema`
- `solr.core.dataDir`
- `solr.core.transient`
- `solr.core.loadOnStartup`

DataDir and DirectoryFactory in SolrConfig

Specifying a Location for Index Data with the `dataDir` Parameter

By default, Solr stores its index data in a directory called `/data` under the Solr home. If you would like to specify a different directory for storing index data, use the `<dataDir>` parameter in the `solrconfig.xml` file. You can specify another directory either with a full pathname or a pathname relative to the instance dir of the SolrCore. For example:

```
<dataDir>/var/data/solr/</dataDir>
```

If you are using replication to replicate the Solr index (as described in Legacy Scaling and Distribution), then the `<dataDir>` directory should correspond to the index directory used in the replication configuration.

Specifying the DirectoryFactory For Your Index

The default `solr.StandardDirectoryFactory` is filesystem based, and tries to pick the best implementation for the current JVM and platform. You can force a particular implementation by specifying `solr.MMapDirectoryFactory`, `solr.NIOFSDirectoryFactory`, or `solr.SimpleFSDirectoryFactory`.

```
<directoryFactory name="DirectoryFactory"
                  class="${solr.directoryFactory:solr.StandardDirectoryFactory}"/>
```

The `solr.RAMDirectoryFactory` is memory based, not persistent, and does not work with replication. Use this DirectoryFactory to store your index in RAM.

```
<directoryFactory class="org.apache.solr.core.RAMDirectoryFactory"/>
```

Lib Directives in SolrConfig

Solr allows loading plugins by defining `<lib/>` directives in `solrconfig.xml`.

The plugins are loaded in the order they appear in `solrconfig.xml`. If there are dependencies, list the lowest level dependency jar first.

Regular expressions can be used to provide control loading jars with dependencies on other jars in the same directory. All directories are resolved as relative to the Solr `instanceDir`.

```
<lib dir="../../../contrib/extraction/lib" regex=".*\.jar" />
<lib dir="../../../dist/" regex="solr-cell-\d.*\.jar" />

<lib dir="../../../contrib/clustering/lib/" regex=".*\.jar" />
<lib dir="../../../dist/" regex="solr-clustering-\d.*\.jar" />

<lib dir="../../../contrib/langid/lib/" regex=".*\.jar" />
<lib dir="../../../dist/" regex="solr-langid-\d.*\.jar" />

<lib dir="../../../contrib/velocity/lib" regex=".*\.jar" />
<lib dir="../../../dist/" regex="solr-velocity-\d.*\.jar" />
```

Managed Schema Definition in SolrConfig

The Schema API enables schema modifications through a REST interface. (Read-only access to all schema elements is also supported.)

There are challenges with allowing programmatic access to a configuration file that is also open to manual edits: system-generated and manual edits may overlap and the system-generated edits may remove comments or other customizations that are critical for the organization to understand why fields, field types, etc., are defined the way they are. You may want to version the file with source control, or limit manual edits altogether.

The `schemaFactory` option in `solrconfig.xml` controls whether the Schema should be defined as a "managed index schema": schema modification is only possible through the Schema API.

By default, if no `schemaFactory` is specified, then the default behavior is to use the `"ClassicIndexSchemaFactory"` as in this example from the `sample_techproducts_configs` config set:

```
<schemaFactory class="ClassicIndexSchemaFactory"/>
```

The `ClassicIndexSchemaFactory` requires the use of a `schema.xml` file, which can be edited manually and is only loaded only when the collection is loaded. This setting disallows Schema API methods that modify the schema.

In the `data_driven_schema_configs` config set however, we see a usage of the `ManagedIndexSchemaFactory`:

```
<!-- To disable dynamic schema REST APIs, use the following for <schemaFactory>:

       <schemaFactory class="ClassicIndexSchemaFactory"/>
       When ManagedIndexSchemaFactory is specified instead, Solr will load the
schema from
       he resource named in 'managedSchemaResourceName', rather than from
schema.xml.
       Note that the managed schema resource CANNOT be named schema.xml.  If the
managed
       schema does not exist, Solr will create it after reading schema.xml, then
rename
       'schema.xml' to 'schema.xml.bak'.

       Do NOT hand edit the managed schema - external modifications will be ignored
and
       overwritten as a result of schema modification REST API calls.
       When ManagedIndexSchemaFactory is specified with mutable = true, schema
       modification REST API calls will be allowed; otherwise, error responses will
be
       sent back for these requests.
  -->
  <schemaFactory class="ManagedIndexSchemaFactory">
    <bool name="mutable">true</bool>
    <str name="managedSchemaResourceName">managed-schema</str>
  </schemaFactory>
```

Here you can see configuration for the managed schema. In order for schema modifications to be possible via the Schema API, the `ManagedIndexSchemaFactory` will need to be used. The parameter `mutable` must also be set to **true**. The `managedSchemaResourceName`, which defaults to "managed-schema", may also be defined, and can be anything other than "`schema.xml`".

With the above configuration, you can use the Schema API to modify the schema as much as you want, and then later change the value of `mutable` to **false** if you wish to "lock" the schema in place and prevent future changes.

If you have an existing Solr collection you wish to convert to use a managed schema, you can simplify modify the `solrconfig.xml` to specify the use of the `ManagedIndexSchemaFactory`. Once Solr is restarted and it detects that a `schema.xml` file exists, but the `managedSchemaResourceName` file does not exist, the existing `schema.xml` file will be renamed to `schema.xml.bak` and the contents are written to a file with the name defined as the `managedSchemaResourceName`. If you look at the resulting file, you'll see this at the top of the page:

```
<!-- Solr managed schema - automatically generated - DO NOT EDIT -->
```

You are now free to use the Schema API as much as you want to make changes, and remove the `schema.xml.bak`.

IndexConfig in SolrConfig

The `<indexConfig>` section of `solrconfig.xml` defines low-level behavior of the Lucene index writers. By default, the settings are commented out in the sample `solrconfig.xml` included with Solr, which means the defaults are used. In most cases, the defaults are fine.

```
<indexConfig>
  ...
</indexConfig>
```

Parameters covered in this section:

- Sizing Index Segments
- Merging Index Segments
- Index Locks
- Other Indexing Settings

Sizing Index Segments

ramBufferSizeMB

Once accumulated document updates exceed this much memory space (defined in megabytes), then the pending updates are flushed. This can also create new segments or trigger a merge. Using this setting is generally preferable to `maxBufferedDocs`. If both `maxBufferedDocs` and `ramBufferSizeMB` are set in `solrconfig.xml`, then a flush will occur when either limit is reached. The default is 100Mb.

```
<ramBufferSizeMB>100</ramBufferSizeMB>
```

maxBufferedDocs

Sets the number of document updates to buffer in memory before they are flushed as a new segment. This may also trigger a merge. The default Solr configuration sets to flush by RAM usage (`ramBufferSizeMB`).

```
<maxBufferedDocs>1000</maxBufferedDocs>
```

maxIndexingThreads

The maximum number of simultaneous threads used to index documents. Once this threshold is reached, additional threads will wait for the others to finish. The default is 8.

```
<maxIndexingThreads>8</maxIndexingThreads>
```

`UseCompoundFile`

Setting `<useCompoundFile>` to **true** combines the various files of a segment into a single file, although the default is **false**. On systems where the number of open files allowed per process is limited, setting this to **false** may avoid hitting that limit (the open files limit might also be tunable for your OS with the Linux/Unix `ulimit` command, or something similar for other operating systems). In some cases, other internal factors may set a segment to "compound=false", even if this is setting is explicitly set to true, so the compounding of the files in a segment may not always happen.

Updating a compound index may incur a minor performance hit for various reasons, depending on the runtime environment. For example, filesystem buffers are typically associated with open file descriptors, which may limit the total cache space available to each index.

This setting may also affect how much data needs to be transferred during index replication operations.

The default is **false**.

```
<useCompoundFile>false</useCompoundFile>
```

Merging Index Segments

`mergePolicy`

Defines how merging segments is done. The default in Solr is `TieredMergePolicy`, which merges segments of approximately equal size, subject to an allowed number of segments per tier. Other policies available are the `LogByteSizeMergePolicy` and `LogDocMergePolicy`. For more information on these policies, please see the MergePolicy javadocs.

```
<mergePolicy class="org.apache.lucene.index.TieredMergePolicy">
  <int name="maxMergeAtOnce">10</int>
  <int name="segmentsPerTier">10</int>
</mergePolicy>
```

`mergeFactor`

For the LogByteSizeMergePolicy, or the (default) TieredMergePolicy, the `<mergeFactor>` configuration option can be used as a convenience setting to indicate how many segments a Lucene index is allowed to merge at one time. It is equivalent to setting either `<int name="mergeFactor">` on the LogByteSizeMergePolicy, or setting both `<int name="maxMergeAtOnce">` and `<int name="segmentsPerTier">` (to the same value) on the TieredMergePolicy.

To understand why a mergeFactor is important, consider what happens when an update is made to an index: Documents are always added to the most recently opened segment. When a segment fills up, a new segment is created and subsequent updates are placed there. If creating a new segment would cause the number of lowest-level segments to exceed the `mergeFactor` value, then all those segments are merged together to form a single large segment. Thus, if the merge factor is 10, each merge results in the creation of a single segment that is roughly ten times larger than each of its ten constituents. When there are 10 of these larger segments, then they in turn are merged into an even larger single segment. This process can continue indefinitely.

Choosing the best merge factor is generally a trade-off of indexing speed vs. searching speed. Having fewer segments in the index generally accelerates searches, because there are fewer places to look. It also can also result in fewer physical files on disk. But to keep the number of segments low, merges will occur more often, which can add load to the system and slow down updates to the index.

Conversely, keeping more segments can accelerate indexing, because merges happen less often, making an update is less likely to trigger a merge. But searches become more computationally expensive and will likely be slower, because search terms must be looked up in more index segments. Faster index updates also means shorter commit turnaround times, which means more timely search results.

The default behavior of both LogByteSizeMergePolicy and TieredMergePolicy is an effective `mergeFactor` of 10:

```
<mergeFactor>10</mergeFactor>
```

`mergeScheduler`

The merge scheduler controls how merges are performed. The default `ConcurrentMergeScheduler` performs merges in the background using separate threads. The alternative, `SerialMergeScheduler`, does not perform merges with separate threads.

```
<mergeScheduler class="org.apache.lucene.index.ConcurrentMergeScheduler"/>
```

`mergedSegmentWarmer`

When using Solr in for Near Real Time Searching a merged segment warmer can be configured to warm the reader on the newly merged segment, before the merge commits. This is not required for near real-time search, but will reduce search latency on opening a new near real-time reader after a merge completes.

```
<mergedSegmentWarmer class="org.apache.lucene.index.SimpleMergedSegmentWarmer"/>
```

`checkIntegrityAtMerge`

If set to `true`, any actions that result in merging segments will first trigger an integrity check using checksums stored in the index segments (if available). If the checksums are not correct, the merge will fail and throw an Exception. (defaults to "`false`" for backwards compatibility)

```
<checkIntegrityAtMerge>true</checkIntegrityAtMerge>
```

Index Locks

`lockType`

The LockFactory options specify the locking implementation to use.

The set of valid lock type options depends on the DirectoryFactory you have configured. The values listed below are are supported by `StandardDirectoryFactory` (the default):

- `native` (default) uses NativeFSLockFactory to specify native OS file locking. If a second Solr process attempts to access the directory, it will fail. Do not use when multiple Solr web applications are attempting to share a single index.
- `simple` uses SimpleFSLockFactory to specify a plain file for locking.
- `single` (expert) uses SingleInstanceLockFactory. Use for special situations of a read-only index directory, or when there is no possibility of more than one process trying to modify the index (even sequentially). This type will protect against multiple cores within the*same*JVM attempting to access the same index. WARNING! If multiple Solr instances in different JVMs modify an index, this type will*not*protect against index corruption.

For more information on the nuances of each LockFactory, see http://wiki.apache.org/lucene-java/AvailableLockFactories.

```
<lockType>native</lockType>
```

`unlockOnStartup`

If **true**, any write or commit locks that have been held will be unlocked on system startup. This defeats the locking mechanism that allows multiple processes to safely access a Lucene index. The default is **false**, and changing this should only be done with care. This parameter is not used if the `lockType` is "none" or "single".

```
<unlockOnStartup>false</unlockOnStartup>
```

`writeLockTimeout`

The maximum time to wait for a write lock on an IndexWriter. The default is 1000, expressed in milliseconds.

```
<writeLockTimeout>1000</writeLockTimeout>
```

Other Indexing Settings

There are a few other parameters that may be important to configure for your implementation. These settings affect how or when updates are made to an index.

Setting	Description
reopenReaders	Controls if IndexReaders will be re-opened, instead of closed and then opened, which is often less efficient. The default is true.
deletionPolicy	Controls how commits are retained in case of rollback. The default is `SolrDeletionPolicy`, which has sub-parameters for the maximum number of commits to keep (`maxCommitsToKeep`), the maximum number of optimized commits to keep (`maxOptimizedCommitsToKeep`), and the maximum age of any commit to keep (`maxCommitAge`), which supports `DateMathParser` syntax.
infoStream	The InfoStream setting instructs the underlying Lucene classes to write detailed debug information from the indexing process as Solr log messages.

```
<reopenReaders>true</reopenReaders>
<deletionPolicy class="solr.SolrDeletionPolicy">
  <str name="maxCommitsToKeep">1</str>
  <str name="maxOptimizedCommitsToKeep">0</str>
  <str name="maxCommitAge">1DAY</str>
</deletionPolicy>
<infoStream>false</infoStream>
```

RequestHandlers and SearchComponents in SolrConfig

After the `<query>` section of `solrconfig.xml`, request handlers and search components are configured.

A *request handler* processes requests coming to Solr. These might be query requests or index update requests. You will likely need several of these defined, depending on how you want Solr to handle the various requests you will make.

A *search component* is a feature of search, such as highlighting or faceting. The search component is defined in `solrconfig.xml` separate from the request handlers, and then registered with a request handler as needed.

These are often referred to as "requestHandler" and "searchComponent", which is how they are defined in `solrconfig.xml`.

Topics covered in this section:

- Request Handlers
  - SearchHandlers
  - UpdateRequestHandlers
  - ShardHandlers
  - Other Request Handlers
- Search Components
  - Default Components
  - First-Components and Last-Components
  - Components
  - Other Useful Components

Request Handlers

Every request handler is defined with a name and a class. The name of the request handler is referenced with the request to Solr, typically as a path. For example, if Solr is installed at `http://localhost:8983/solr/` and you have a collection named "`gettingstarted`", you can make a request using URLs like this:

```
http://localhost:8983/solr/gettingstarted/select?q=solr
```

This query will be processed by the request handler with the name "`/select`". We've only used the "q" parameter here, which includes our query term, a simple keyword of "solr". If the request handler has more parameters defined, those will be used with any query we send to this request handler unless they are over-ridden by the client (or user) in the query itself.

If you have another request handler defined, you would send your request with that name. For example, `/update` is a request handler that handles index updates (i.e., sending new documents to the index). By default, `/select` is a request handler that handles query requests.

Request handlers can also process requests for nested paths of their names, for example, a request using `/myhandler/extrapath` may be processed by a request handler registered with the name `/myhandler`. If a request handler is explicitly defined by the name `/myhandler/extrapath`, that would take precedence over the nested path. This assumes you are using the request handler classes included with Solr; if you create your own request handler, you should make sure it includes the ability to handle nested paths if you want to use them with your custom request handler.

It is also possible to configure defaults for request handlers with a section called `initParams`. These defaults can be used when you want to have common properties that will be used by each separate handler. For example, if you intend to create several request handlers that will all request the same list of fields in the response, you can configure an `initParams` section with your list of fields. For more information about `initParams`, see the section InitParams in SolrConfig.

SearchHandlers

The primary request handler defined with Solr by default is the "SearchHandler", which handles search queries. The request handler is defined, and then a list of defaults for the handler are defined with a `defaults` list.

For example, in the default `solrconfig.xml`, the first request handler defined looks like this:

```
<requestHandler name="/select" class="solr.SearchHandler">
  <lst name="defaults">
    <str name="echoParams">explicit</str>
    <int name="rows">10</int>
  </lst>
</requestHandler>
```

This example defines the `rows` parameter, which defines how many search results to return, to "10". The `echoParams` parameter defines that the parameters defined in the query should be returned when debug information is returned. Note also that the way the defaults are defined in the list varies if the parameter is a string, an integer, or another type.

All of the parameters described in the section on searching can be defined as defaults for any of the SearchHandlers.

Besides `defaults`, there are other options for the SearchHandler, which are:

- `appends`: This allows definition of parameters that are added to the user query. These might be filter queries, or other query rules that should be added to each query. There is no mechanism in Solr to allow a client to override these additions, so you should be absolutely sure you always want these parameters applied to queries.

  ```
  <lst name="appends">
    <str name="fq">inStock:true</str>
  </lst>
  ```

  In this example, the filter query "inStock:true" will always be added to every query.
- `invariants`: This allows definition of parameters that cannot be overridden by a client. The values defined in an `invariants` section will always be used regardless of the values specified by the user, by the client, in `defaults` or in `appends`.

```
<lst name="invariants">
  <str name="facet.field">cat</str>
  <str name="facet.field">manu_exact</str>
  <str name="facet.query">price:[* TO 500]</str>
  <str name="facet.query">price:[500 TO *]</str>
</lst>
```

In this example, facet fields have been defined which limits the facets that will be returned by Solr. If the client requests facets, the facets defined with a configuration like this are the only facets they will see.

The final section of a request handler definition is `components`, which defines a list of search components that can be used with a request handler. They are only registered with the request handler. How to define a search component is discussed further on in the section on Search Components. The `components` element can only be used with a request handler that is a SearchHandler.

The `solrconfig.xml` file includes many other examples of SearchHandlers that can be used or modified as needed.

UpdateRequestHandlers

The UpdateRequestHandlers are request handlers which process updates to the index.

In this guide, we've covered these handlers in detail in the section Uploading Data with Index Handlers.

ShardHandlers

It is possible to configure a request handler to search across shards of a cluster, used with distributed search. More information about distributed search and how to configure the shardHandler is in the section Distributed Search with Index Sharding.

Other Request Handlers

There are other request handlers defined in `solrconfig.xml`, covered in other sections of this guide:

- RealTime Get
- Index Replication
- Ping

Search Components

Search components define the logic that is used by the SearchHandler to perform queries for users.

Default Components

There are several default search components that work with all SearchHandlers without any additional configuration. If no components are defined (with the exception of `first-components` and `last-components` - see below), these are executed by default, in the following order:

Component Name	Class Name	More Information
query	solr.QueryComponent	Described in the section Query Syntax and Parsing.

facet	solr.FacetComponent	Described in the section Faceting.
mlt	solr.MoreLikeThisComponent	Described in the section MoreLikeThis.
highlight	solr.HighlightComponent	Described in the section Highlighting.
stats	solr.StatsComponent	Described in the section The Stats Component.
debug	solr.DebugComponent	Described in the section on Common Query Parameters.
expand	solr.ExpandComponent	Described in the section Collapse and Expand Results.

If you register a new search component with one of these default names, the newly defined component will be used instead of the default.

First-Components and Last-Components

It's possible to define some components as being used before (with `first-components`) or after (with `last-components`) the default components listed above.

> ⚠ `first-components` and/or `last-components` may only be used in conjunction with the default components. If you define your own `components`, the default components will not be executed, and `first-components` and `last-components` are disallowed.

```
<arr name="first-components">
  <str>mycomponent</str>
</arr>
<arr name="last-components">
  <str>spellcheck</str>
</arr>
```

Components

If you define `components`, the default components (see above) will not be executed, and `first-components` and `last-components` are disallowed:

```
<arr name="components">
  <str>mycomponent</str>
  <str>query</str>
  <str>debug</str>
</arr>
```

Other Useful Components

Many of the other useful components are described in sections of this Guide for the features they support. These are:

- `SpellCheckComponent`, described in the section Spell Checking.
- `TermVectorComponent`, described in the section The Term Vector Component.
- `QueryElevationComponent`, described in the section The Query Elevation Component.
- `TermsComponent`, described in the section The Terms Component.

InitParams in SolrConfig

An `<initParams>` section of `solrconfig.xml` allows you to define request handler parameters outside of the handler configuration.

The use cases are

- Some handlers are implicitly defined in code and there should be a way to add/append/override some of the implicitly defined properties
- There are a few properties that are used across handlers . This helps you keep only a single definition of those properties and apply them over multiple handlers

For example, if you want several of your search handlers to return the same list of fields, you can create an `<initParams>` section without having to define the same set of parameters in each request handler definition. If you have a single request handler that should return different fields, you can define the overriding parameters in individual `<requestHandler>` sections as usual.

The properties and configuration of an `<initParams>` section mirror the properties and configuration of a request handler. It can include sections for defaults, appends, and invariants, the same as any request handler.

For example, here is one of the `<initParams>` sections defined by default in the `data_driven_config` example:

```
<initParams path="/update/**,/query,/select,/tvrh,/elevate,/spell,/browse">
    <lst name="defaults">
      <str name="df">_text_</str>
    </lst>
  </initParams>
```

This sets the default search field ("df") to be "_text_" for all of the request handlers named in the path section. If we later want to change the `/query` request handler to search a different field by default, we could override the `<initParams>` by defining the parameter in the `<requestHandler>` section for `/query`.

The syntax and semantics are similar to that of a `<requestHandler>` . The following are the attributes

property	Description
path	A comma-separated list of paths which will use the parameters. Wildcards can be used in paths to define nested paths, as described below.

name	The name of this set of parameters. The name can be directly in a requestHandler definition if a path is not explicitly named. If you give your `<initParams>` a name, you can refer to the params in a `<requestHandler>` that is not defined as a path.
	For example, if an `<initParams>` section has the name "myParams", you can call the name when defining your request handler:
	`<requestHandler name="/dump1" class="DumpRequestHandler"`
	`initParams="myParams"/>`

Wildcards

An `<initParams>` section can support wildcards to define nested paths that should use the parameters defined. A single asterisk (*) denotes that a nested path one level deeper should use the parameters. Double asterisks (**) denote all nested paths no matter how deep should use the parameters.

For example, if we have an `<initParams>` that looks like this:

```
<initParams name="myParams" path="/myhandler,/root/*,/root1/**">
    <lst name="defaults">
      <str name="fl">_text_</str>
    </lst>
    <lst name="invariants">
      <str name="rows">10</str>
    </lst>
    <lst name="appends">
      <str name="df">title</str>
    </lst>
  </initParams>
```

We've defined three paths with this section:

- `/myhandler` declared as a direct path.
- `/root/*` with a single asterisk to indicate the parameters should apply to paths that are one level deep.
- `/root1/**` with double asterisks to indicate the parameters should apply to all nested paths, no matter how deep.

When we define the request handlers, the wildcards will work in the following ways:

```
<requestHandler name="/myhandler" class="SearchHandler"/>
```

The `/myhandler` class was named as a path in the `<initParams>` so this will use those parameters.

Next we have a request handler named `/root/search5`:

```
<requestHandler name="/root/search5" class="SearchHandler"/>
```

We defined a wildcard for nested paths that are one level deeper than `/root`, so this request handler will use the parameters. This one, however, will not, because `/root/search5/test` is more than one level deep from `/root`:

```
<requestHandler name="/root/search5/test" class="SearchHandler"/>
```

If we want to define all levels of nested paths, we should use double asterisks, as in the example path `/root1/**`:

```
<requestHandler name="/root1/search/tests" class="SearchHandler"/>
```

Any path under `/root1`, whether explicitly defined in a request handler or not, will use the parameters defined in the matching `initParams` section.

UpdateHandlers in SolrConfig

The settings in this section are configured in the `<updateHandler>` element in `solrconfig.xml` and may affect the performance of index updates. These settings affect how updates are done internally. `<updateHandler>` configurations do not affect the higher level configuration of RequestHandlers that process client update requests.

```
<updateHandler class="solr.DirectUpdateHandler2">
  ...
</updateHandler>
```

Topics covered in this section:

- Commits
  - commit and softCommit
  - autoCommit
  - commitWithin
  - maxPendingDeletes
- Event Listeners
- Transaction Log

Commits

Data sent to Solr is not searchable until it has been *committed* to the index. The reason for this is that in some cases commits can be slow and they should be done in isolation from other possible commit requests to avoid overwriting data. So, it's preferable to provide control over when data is committed. Several options are available to control the timing of commits.

`commit` and `softCommit`

In Solr, a `commit` is an action which asks Solr to "commit" those changes to the Lucne index files. By default commit actions result in a "hard commit" of all the Lucene index files to stable storage (disk). When a client includes a `commit=true` parameter with an update request, this ensures that all index segments affected by the adds & deletes on an update are written to disk as soon as index updates are completed.

If an additional flag `softCommit=true` is specified, then Solr performs a 'soft commit', meaning that Solr will commit your changes to the Lucene data structures quickly but not guarantee that the Lucene index files are written to stable storage. This is an implementation of Near Real Time storage, a feature that boosts document visibility, since you don't have to wait for background merges and storage (to ZooKeeper, if using SolrCloud) to finish before moving on to something else. A full commit means that, if a server crashes, Solr will know exactly where your data was stored; a soft commit means that the data is stored, but the location information isn't yet stored. The tradeoff is that a soft commit gives you faster visibility because it's not waiting for background merges to finish.

For more information about Near Real Time operations, see Near Real Time Searching.

`autoCommit`

These settings control how often pending updates will be automatically pushed to the index. An alternative to `autoCommit` is to use `commitWithin`, which can be defined when making the update request to Solr (i.e., when pushing documents), or in an update RequestHandler.

Setting	Description
maxDocs	The number of updates that have occurred since the last commit.
maxTime	The number of milliseconds since the oldest uncommitted update.
openSearcher	Whether to open a new searcher when performing a commit. If this is **false**, the default, the commit will flush recent index changes to stable storage, but does not cause a new searcher to be opened to make those changes visible

If either of these `maxDocs` or `maxTime` limits are reached, Solr automatically performs a commit operation. If the `autoCommit` tag is missing, then only explicit commits will update the index. The decision whether to use auto-commit or not depends on the needs of your application.

Determining the best auto-commit settings is a tradeoff between performance and accuracy. Settings that cause frequent updates will improve the accuracy of searches because new content will be searchable more quickly, but performance may suffer because of the frequent updates. Less frequent updates may improve performance but it will take longer for updates to show up in queries.

```
<autoCommit>
  <maxDocs>10000</maxDocs>
  <maxTime>1000</maxTime>
  <openSearcher>false</openSearcher>
</autoCommit>
```

You can also specify 'soft' autoCommits in the same way that you can specify 'soft' commits, except that instead of using `autoCommit` you set the `autoSoftCommit` tag.

```
<autoSoftCommit>
  <maxTime>1000</maxTime>
</autoSoftCommit>
```

`commitWithin`

The `commitWithin` settings allow forcing document commits to happen in a defined time period. This is used most frequently with Near Real Time Searching, and for that reason the default is to perform a soft commit. This does not, however, replicate new documents to slave servers in a master/slave environment. If that's a requirement for your implementation, you can force a hard commit by adding a parameter, as in this example:

```
<commitWithin>
  <softCommit>false</softCommit>
</commitWithin>
```

With this configuration, when you call `commitWithin` as part of your update message, it will automatically perform a hard commit every time.

`maxPendingDeletes`

This value sets a limit on the number of deletions that Solr will buffer during document deletion. This can affect how much memory is used during indexing.

```
<maxPendingDeletes>100000</maxPendingDeletes>
```

Event Listeners

The UpdateHandler section is also where update-related event listeners can be configured. These can be triggered to occur after any commit (`event="postCommit"`) or only after optimize commands (`event="postOptimize"`).

Users can write custom update event listener classes, but a common use case is to run external executables via the `RunExecutableListener`:

Setting	Description
exe	The name of the executable to run. It should include the path to the file, relative to Solr home.
dir	The directory to use as the working directory. The default is ".".
wait	Forces the calling thread to wait until the executable returns a response. The default is **true**.
args	Any arguments to pass to the program. The default is none.
env	Any environment variables to set. The default is none.

Transaction Log

As described in the section RealTime Get, a transaction log is required for that feature. It is configured in the `updateHandler` section of `solrconfig.xml`.

Realtime Get currently relies on the update log feature, which is enabled by default. It relies on an update log, which is configured in `solrconfig.xml`, in a section like:

```
<updateLog>
  <str name="dir">${solr.ulog.dir:}</str>
</updateLog>
```

Two additional expert-level configuration settings affect how far a replica can fall behind on updates before it must enter into full recovery - see the section on write side fault tolerance for more information:

Setting Name	Type	Default	Description
numRecordsToKeep	int	100	The number of update records to keep per log
maxNumLogsToKeep	int	10	The maximum number of logs keep

An example, to be included under `<config><updateHandler>` in `solrconfig.xml`, employing both of the above settings:

```
<updateLog>
  <str name="dir">${solr.ulog.dir:}</str>
  <int name="numRecordsToKeep">500</int>
  <int name="maxNumLogsToKeep">20</int>
</updateLog>
```

Query Settings in SolrConfig

The settings in this section affect the way that Solr will process and respond to queries. These settings are all configured in child elements of the `<query>` element in `solrconfig.xml`.

```
<query>
  ...
</query>
```

Topics covered in this section:

- Caches
- Query Sizing and Warming
- Query-Related Listeners

Caches

Solr caches are associated with a specific instance of an Index Searcher, a specific view of an index that doesn't change during the lifetime of that searcher. As long as that Index Searcher is being used, any items in its cache will be valid and available for reuse. Caching in Solr differs from caching in many other applications in that cached Solr objects do not expire after a time interval; instead, they remain valid for the lifetime of the Index Searcher.

When a new searcher is opened, the current searcher continues servicing requests while the new one auto-warms its cache. The new searcher uses the current searcher's cache to pre-populate its own. When the new searcher is ready, it is registered as the current searcher and begins handling all new search requests. The old searcher will be closed once it has finished servicing all its requests.

In Solr, there are three cache implementations: `solr.search.LRUCache`, `solr.search.FastLRUCache,` and `solr.search.LFUCache` .

The acronym LRU stands for Least Recently Used. When an LRU cache fills up, the entry with the oldest last-accessed timestamp is evicted to make room for the new entry. The net effect is that entries that are accessed frequently tend to stay in the cache, while those that are not accessed frequently tend to drop out and will be re-fetched from the index if needed again.

The `FastLRUCache`, which was introduced in Solr 1.4, is designed to be lock-free, so it is well suited for caches which are hit several times in a request.

Both `LRUCache` and `FastLRUCache` use an auto-warm count that supports both integers and percentages which get evaluated relative to the current size of the cache when warming happens.

The `LFUCache` refers to the Least Frequently Used cache. This works in a way similar to the LRU cache, except that when the cache fills up, the entry that has been used the least is evicted.

The Statistics page in the Solr Admin UI will display information about the performance of all the active caches. This information can help you fine-tune the sizes of the various caches appropriately for your particular application. When a Searcher terminates, a summary of its cache usage is also written to the log.

Each cache has settings to define it's initial size (`initialSize`), maximum size (`size`) and number of items to use for during warming (`autowarmCount`). The LRU and FastLRU cache implementations can take a percentage instead of an absolute value for `autowarmCount`.

Details of each cache are described below.

`filterCache`

This cache is used by `SolrIndexSearcher` for filters (DocSets) for unordered sets of all documents that match a query. The numeric attributes control the number of entries in the cache.

Solr uses the `filterCache` to cache results of queries that use the `fq` search parameter. Subsequent queries using the same parameter setting result in cache hits and rapid returns of results. See Searching for a detailed discussion of the `fq` parameter.

Solr also makes this cache for faceting when the configuration parameter `facet.method` is set to `fc`. For a discussion of faceting, see Searching.

```
<filterCache class="solr.LRUCache"
             size="512"
             initialSize="512"
             autowarmCount="128"/>
```

`queryResultCache`

This cache holds the results of previous searches: ordered lists of document IDs (DocList) based on a query, a sort, and the range of documents requested.

```
<queryResultCache class="solr.LRUCache"
                  size="512"
                  initialSize="512"
                  autowarmCount="128"/>
```

`documentCache`

This cache holds Lucene Document objects (the stored fields for each document). Since Lucene internal document IDs are transient, this cache is not auto-warmed. The size for the `documentCache` should always be greater than `max_results` times the `max_concurrent_queries`, to ensure that Solr does not need to refetch a document during a request. The more fields you store in your documents, the higher the memory usage of this cache will be.

```
<documentCache class="solr.LRUCache"
               size="512"
               initialSize="512"
               autowarmCount="0"/>
```

User Defined Caches

You can also define named caches for your own application code to use. You can locate and use your cache object by name by calling the `SolrIndexSearcher` methods `getCache()`, `cacheLookup()` and `cacheInsert()`.

```
<cache name="myUserCache" class="solr.LRUCache"
                          size="4096"
                          initialSize="1024"
                          autowarmCount="1024"
                          regenerator="org.mycompany.mypackage.MyRegenerator" />
```

If you want auto-warming of your cache, include a `regenerator` attribute with the fully qualified name of a class that implements `solr.search.CacheRegenerator`. You can also use the `NoOpRegenerator`, which simply repopulates the cache with old items. Define it with the `regenerator` parameter as`:` `regenerator="solr.NoOpRegenerator"`.

Query Sizing and Warming

`maxBooleanClauses`

This sets the maximum number of clauses allowed in a boolean query. This can affect range or prefix queries that expand to a query with a large number of boolean terms. If this limit is exceeded, an exception is thrown.

```
<maxBooleanClauses>1024</maxBooleanClauses>
```

> This option modifies a global property that effects all Solr cores. If multiple `solrconfig.xml` files disagree on this property, the value at any point in time will be based on the last Solr core that was initialized.

`enableLazyFieldLoading`

If this parameter is set to true, then fields that are not directly requested will be loaded lazily as needed. This can boost performance if the most common queries only need a small subset of fields, especially if infrequently accessed fields are large in size.

```
<enableLazyFieldLoading>true</enableLazyFieldLoading>
```

`useFilterForSortedQuery`

This parameter configures Solr to use a filter to satisfy a search. If the requested sort does not include "score", the `filterCache` will be checked for a filter matching the query. For most situations, this is only useful if the same search is requested often with different sort options and none of them ever use "score".

```
<useFilterForSortedQuery>true</useFilterForSortedQuery>
```

`queryResultWindowSize`

Used with the `queryResultCache`, this will cache a superset of the requested number of document IDs. For example, if the a search in response to a particular query requests documents 10 through 19, and `queryWindowSize` is 50, documents 0 through 49 will be cached.

```
<queryResultWindowSize>20</queryResultWindowSize>
```

queryResultMaxDocsCached

This parameter sets the maximum number of documents to cache for any entry in the `queryResultCache`.

```
<queryResultMaxDocsCached>200</queryResultMaxDocsCached>
```

useColdSearcher

This setting controls whether search requests for which there is not a currently registered searcher should wait for a new searcher to warm up (false) or proceed immediately (true). When set to "false", requests will block until the searcher has warmed its caches.

```
<useColdSearcher>false</useColdSearcher>
```

maxWarmingSearchers

This parameter sets the maximum number of searchers that may be warming up in the background at any given time. Exceeding this limit will raise an error. For read-only slaves, a value of two is reasonable. Masters should probably be set a little higher.

```
<maxWarmingSearchers>2</maxWarmingSearchers>
```

Query-Related Listeners

As described in the section on Caches, new Index Searchers are cached. It's possible to use the triggers for listeners to perform query-related tasks. The most common use of this is to define queries to further "warm" the Index Searchers while they are starting. One benefit of this approach is that field caches are pre-populated for faster sorting.

Good query selection is key with this type of listener. It's best to choose your most common and/or heaviest queries and include not just the keywords used, but any other parameters such as sorting or filtering requests.

There are two types of events that can trigger a listener. A `firstSearcher` event occurs when a new searcher is being prepared but there is no current registered searcher to handle requests or to gain auto-warming data from (i.e., on Solr startup). A `newSearcher` event is fired whenever a new searcher is being prepared and there is a current searcher handling requests.

The (commented out) examples below can be found in the `solrconfig.xml` file of the `sample_techproducts_configs` config set included with Solr, and demonstrate using the `solr.QuerySenderListener` class to warm a set of explicit queries:

```
<listener event="newSearcher" class="solr.QuerySenderListener">
  <arr name="queries">
  <!--
    <lst><str name="q">solr</str><str name="sort">price asc</str></lst>
    <lst><str name="q">rocks</str><str name="sort">weight asc</str></lst>
   -->
  </arr>
</listener>

<listener event="firstSearcher" class="solr.QuerySenderListener">
  <arr name="queries">
    <lst><str name="q">static firstSearcher warming in solrconfig.xml</str></lst>
  </arr>
</listener>
```

> ⚠ The above code comes from a *sample* `solrconfig.xml`. A key best practice is to modify these defaults before taking your application to production, but please note: while the sample queries are commented out in the section for the "newSearcher", the sample quer is not commented out for the "firstSearcher" event. There is no point in auto-warming your Index Searcher with the query string "static firstSearcher warming in solrconfig.xml" if that is not relevant to your search application.

RequestDispatcher in SolrConfig

The `requestDispatcher` element of `solrconfig.xml` controls the way the Solr HTTP `RequestDispatcher` implementation responds to requests. Included are parameters for defining if it should handle `/select` urls (for Solr 1.1 compatibility), if it will support remote streaming, the maximum size of file uploads and how it will respond to HTTP cache headers in requests.

Topics in this section:

- handleSelect Element
- requestParsers Element
- httpCaching Element

`handleSelect` Element

> ⚠ `handleSelect` is for legacy back-compatibility; those new to Solr do not need to change anything about the way this is configured by default.

The first configurable item is the `handleSelect` attribute on the `<requestDispatcher>` element itself. This attribute can be set to one of two values, either "true" or "false". It governs how Solr responds to requests such as `/select?qt=XXX`. The default value "false" will ignore requests to {`/select` if a requestHandler is not explicitly registered with the name `/select`. A value of "true" will route query requests to the parser defined with the `qt` value.

In recent versions of Solr, a `/select` requestHandler is defined by default, so a value of "false" will work fine. See the section RequestHandlers and SearchComponents in SolrConfig for more information.

```
<requestDispatcher handleSelect="true" >
  ...
</requestDispatcher>
```

`requestParsers` Element

The `<requestParsers>` sub-element controls values related to parsing requests. This is an empty XML element that doesn't have any content, only attributes.

The attribute `enableRemoteStreaming` controls whether remote streaming of content is allowed. If set to `false`, streaming will not be allowed. Setting it to `true` (the default) lets you specify the location of content to be streamed using `stream.file` or `stream.url` parameters.

If you enable remote streaming, be sure that you have authentication enabled. Otherwise, someone could potentially gain access to your content by accessing arbitrary URLs. It's also a good idea to place Solr behind a firewall to prevent it being accessed from untrusted clients.

The attribute `multipartUploadLimitInKB` sets an upper limit in kilobytes on the size of a document that may be submitted in a multi-part HTTP POST request. The value specified is multiplied by 1024 to determine the size in bytes.

The attribute `formdataUploadLimitInKB` sets a limit in kilobytes on the size of form data (application/x-www-form-urlencoded) submitted in a HTTP POST request, which can be used to pass request parameters that will not fit in a URL.

The attribute `addHttpRequestToContext` can be used to indicate that the original `HttpServletRequest` object should be included in the context map of the `SolrQueryRequest` using the key `httpRequest`. This `HttpServletRequest` is not used by any Solr component, but may be useful when developing custom plugins.

```
<requestParsers enableRemoteStreaming="true"
                multipartUploadLimitInKB="2048000"
                formdataUploadLimitInKB="2048"
                addHttpRequestToContext="false" />
```

`httpCaching` Element

The `<httpCaching>` element controls HTTP cache control headers. Do not confuse these settings with Solr's internal cache configuration. This element controls caching of HTTP responses as defined by the W3C HTTP specifications.

This element allows for three attributes and one sub-element. The attributes of the `<httpCaching>` element control whether a 304 response to a GET request is allowed, and if so, what sort of response it should be. When an HTTP client application issues a GET, it may optionally specify that a 304 response is acceptable if the resource has not been modified since the last time it was fetched.

Parameter	Description
never304	If present with the value `true`, then a GET request will never respond with a 304 code, even if the requested resource has not been modified. When this attribute is set to true, the next two attributes are ignored. Setting this to true is handy for development, as the 304 response can be confusing when tinkering with Solr responses through a web browser or other client that supports cache headers.

lastModFrom	This attribute may be set to either `openTime` (the default) or `dirLastMod`. The value `openTime` indicates that last modification times, as compared to the If-Modified-Since header sent by the client, should be calculated relative to the time the Searcher started. Use `dirLastMod` if you want times to exactly correspond to when the index was last updated on disk.
etagSeed	This value of this attribute is sent as the value of the `ETag` header. Changing this value can be helpful to force clients to re-fetch content even when the indexes have not changed---for example, when you've made some changes to the configuration.

```
<httpCaching never304="false"
             lastModFrom="openTime"
             etagSeed="Solr">
  <cacheControl>max-age=30, public</cacheControl>
</httpCaching>
```

`cacheControl` Element

In addition to these attributes, `<httpCaching>` accepts one child element: `<cacheControl>`. The content of this element will be sent as the value of the Cache-Control header on HTTP responses. This header is used to modify the default caching behavior of the requesting client. The possible values for the Cache-Control header are defined by the HTTP 1.1 specification in Section 14.9.

Setting the max-age field controls how long a client may re-use a cached response before requesting it again from the server. This time interval should be set according to how often you update your index and whether or not it is acceptable for your application to use content that is somewhat out of date. Setting `must-revalidate` will tell the client to validate with the server that its cached copy is still good before re-using it. This will ensure that the most timely result is used, while avoiding a second fetch of the content if it isn't needed, at the cost of a request to the server to do the check.

Solr Cores and solr.xml

In Solr, the term *core* is used to refer to a single index and associated transaction log and configuration files (including `schema.xml` and `solrconfig.xml`, among others). Your Solr installation can have multiple cores if needed, which allows you to index data with different structures in the same server, and maintain more control over how your data is presented to different audiences.

In older versions of Solr, cores had to be defined in `solr.xml` in order for Solr to know about them. Now, however, Solr supports automatic discovery of cores and they no longer need to be explicitly defined. Instead, core-specific properties (such as the directories to use for the indexes or configuration files, the core name, and other options) are defined in a `core.properties` file. Any `core.properties` file in any directory of your Solr installation (or in a directory under where `solr_home` is defined) will be found by Solr and the defined properties will be used for the core named in the file.

The following sections describe these options in more detail.

- **Format of solr.xml**: Details on how to define `solr.xml`, including the acceptable parameters for the `solr.xml` file
- **Defining core.properties**: Details on placement of `core.properties` and available property options.
- **CoreAdmin API**: Tools and commands for core administration using a REST API.
- **Config Sets**: How to use configsets to avoid duplicating effort when defining a new core.

Format of solr.xml

This section will describe the default `solr.xml` file included with Solr and how to modify it for your needs. For details on how to configure `core.properties`, see the section Defining core.properties.

Defining solr.xml

You can find `solr.xml` in your Solr Home directory. The default `solr.xml` file looks like this:

```
<solr>

  <solrcloud>
    <str name="host">${host:}</str>
    <int name="hostPort">${jetty.port:8983}</int>
    <str name="hostContext">${hostContext:solr}</str>
    <int name="zkClientTimeout">${zkClientTimeout:15000}</int>
    <bool name="genericCoreNodeNames">${genericCoreNodeNames:true}</bool>
  </solrcloud>

  <shardHandlerFactory name="shardHandlerFactory"
    class="HttpShardHandlerFactory">
    <int name="socketTimeout">${socketTimeout:0}</int>
    <int name="connTimeout">${connTimeout:0}</int>
  </shardHandlerFactory>

</solr>
```

As you can see, the discovery Solr configuration is "SolrCloud friendly". However, the presence of the `<solrcloud>` element does *not* mean that the Solr instance is running in SolrCloud mode. Unless the `-DzkHost` or `-DzkRun` are specified at startup time, this section is ignored.

Solr.xml Parameters

The `<solr>` Element

There are no attributes that you can specify in the `<solr>` tag, which is the root element of `solr.xml`. The tables below list the child nodes of each XML element in `solr.xml`.

Node	Description

`adminHandler`	If used, this attribute should be set to the FQN (Fully qualified name) of a class that inherits from CoreAdminHandler. For example, adminHandler="com.myorg.MyAdminHandler" would configure the custom admin handler (MyAdminHandler) to handle admin requests. If this attribute isn't set, Solr uses the default admin handler, org.apache.solr.handler.admin.CoreAdminHandler. For more information on this parameter, see the Solr Wiki at http://wiki.apache.org/solr/CoreAdmin#cores.
`collectionsHandler`	As above, for custom CollectionsHandler implementations.
`infoHandler`	As above, for custom InfoHandler implementations.
`coreLoadThreads`	Specifies the number of threads that will be assigned to load cores in parallel.
`coreRootDirectory`	The root of the core discovery tree, defaults to SOLR_HOME.
`managementPath`	Currently non-operational.
`sharedLib`	Specifies the path to a common library directory that will be shared across all cores. Any JAR files in this directory will be added to the search path for Solr plugins. This path is relative to the top-level container's Solr Home.
`shareSchema`	This attribute, when set to true, ensures that the multiple cores pointing to the same schema.xml will be referring to the same IndexSchema Object. Sharing the IndexSchema Object makes loading the core faster. If you use this feature, make sure that no core-specific property is used in your schema.xml.
`transientCacheSize`	Defines how many cores with transient=true that can be loaded before swapping the least recently used core for a new core.
`configSetBaseDir`	The directory under which configsets for solr cores can be found. Defaults to SOLR_HOME/configsets

The `<solrcloud>` element

This element defines several parameters that relate so SolrCloud. This section is ignored unless the solr instance is started with either `-DzkRun` or `-DzkHost`

Node	Description
`distribUpdateConnTimeout`	Used to set the underlying "connTimeout" for intra-cluster updates.
`distribUpdateSoTimeout`	Used to set the underlying "socketTimeout" for intra-cluster updates.
`host`	The hostname Solr uses to access cores.
`hostContext`	The url context path.
`hostPort`	The port Solr uses to access cores. In the default `solr.xml` file, this is set to `${jetty.port:8983}`, which will use the Solr port defined in Jetty, and otherwise fall back to 8983.

`leaderVoteWait`	When SolrCloud is starting up, how long each Solr node will wait for all known replicas for that shard to be found before assuming that any nodes that haven't reported are down.
`leaderConflictResolveWait`	When trying to elect a leader for a shard, this property sets the maximum time a replica will wait to see conflicting state information to be resolved; temporary conflicts in state information can occur when doing rolling restarts, especially when the node hosting the Overseer is restarted. Typically, the default value of 180000 (ms) is sufficient for conflicts to be resolved; you may need to increase this value if you have hundreds or thousands of small collections in SolrCloud.
`zkClientTimeout`	A timeout for connection to a ZooKeeper server. It is used with SolrCloud.
`zkHost`	In SolrCloud mode, the URL of the ZooKeeper host that Solr should use for cluster state information.
`genericCoreNodeNames`	If `TRUE`, node names are not based on the address of the node, but on a generic name that identifies the core. When a different machine takes over serving that core things will be much easier to understand.

The **`<logging>`** element

Node	Description
`class`	The class to use for logging. The corresponding JAR file must be available to solr, perhaps through a `<lib>` directive in solrconfig.xml.
`enabled`	true/false - whether to enable logging or not.

The ***`<logging><watcher>`*** element

Node	Description
`size`	The number of log events that are buffered.
`threshold`	The logging level above which your particular logging implementation will record. For example when using log4j one might specify DEBUG, WARN, INFO, etc.

The **`<shardHandlerFactory>`** element

Custom shard handlers can be defined in `solr.xml` if you wish to create a custom shard handler.

```
<shardHandlerFactory name="ShardHandlerFactory" class="qualified.class.name">
```

Since this is a custom shard handler, sub-elements are specific to the implementation.

Substituting JVM System Properties in solr.xml

Solr supports variable substitution of JVM system property values in `solr.xml`, which allows runtime specification of various configuration options. The syntax is `${propertyname[:option default value]}`. This allows defining a default that can be overridden when Solr is launched. If a default value is not specified, then the property must be specified at runtime or the solr.xml file will generate an error when parsed.

Any JVM system properties usually specified using the -D flag when starting the JVM, can be used as variables in the solr.xml file.

For example, in the solr.xml file shown below, the socketTimeout and connTimeout values are each set to "0". However, if you start Solr using 'bin/solr -DsocketTimeout=1000', the socketTimeout option of the HttpShardHandlerFactory to be overridden using a value of 1000ms, while the connTimeout option will continue to use the default property value of "0".

```
<solr>
  <shardHandlerFactory name="shardHandlerFactory"
                       class="HttpShardHandlerFactory">
    <int name="socketTimeout">${socketTimeout:0}</int>
    <int name="connTimeout">${connTimeout:0}</int>
  </shardHandlerFactory>
</solr>
```

Defining core.properties

Core discovery means that creating a core is as simple as a core.properties file located on disk. The core.properties file is a simple Java Properties file where each line is just a key=value pair, e.g., name=core1. Notice that no quotes are required.

A minimal core.properties file looks like this (however, it can also be empty, see information on placement of core.properties below):

```
name=my_core_name
```

Placement of core.properties

Solr cores are configured by placing a file named core.properties in a sub-directory under solr.home. There are no a-priori limits to the depth of the tree, nor are there limits to the number of cores that can be defined. Cores may be anywhere in the tree with the exception that cores may *not* be defined under an existing core. That is, the following is not allowed:

```
./cores/core1/core.properties
./cores/core1/coremore/core5/core.properties
```

In this example, the enumeration will stop at "core1".

The following is legal:

```
./cores/somecores/core1/core.properties
./cores/somecores/core2/core.properties
./cores/othercores/core3/core.properties
./cores/extracores/deepertree/core4/core.properties
```

It is possible to segment Solr into multiple cores, each with its own configuration and indices. Cores may be dedicated to a single application or to very different ones, but all are administered through a common administration interface. You can create new Solr cores on the fly, shutdown cores, even replace one running core with another, all without ever stopping or restarting Solr.

Your `core.properties` file can be empty if necessary. Suppose `core.properties` is located in `./cores/core1` (relative to `solr_home`) but is empty. In that case, the core name is assumed to be "core1". The instanceDir will be the folder containing `core.properties` (i.e., `./cores/core1`). The dataDir will be `../cores/core1/data`, etc.

> ⓘ You can run Solr without configuring any cores.

Defining core.properties Files

The minimal `core.properties` file is an empty file, in which case all of the properties are defaulted appropriately.

Java properties files allow the hash ("#") or bang ("!") characters to specify comment-to-end-of-line.

This table defines the recognized properties:

Property	Description
`name`	The name of the SolrCore. You'll use this name to reference the SolrCore when running commands with the CoreAdminHandler.
`config`	The configuration file name for a given core. The default is `solrconfig.xml`.
`schema`	The schema file name for a given core. The default is `schema.xml`
`dataDir`	The core's data directory (where indexes are stored) as a path relative to the core's instanceDir. This is `data` by default.
`configSet`	The name of a defined configset, if desired, to use to configure the core (see the Config Sets for more details).
`properties`	The name of the properties file for this core. The value can be an absolute pathname or a path relative to the value of `instanceDir`.
`transient`	If **true**, the core can be unloaded if Solr reaches the `transientCacheSize`. The default if not specified is **false**. Cores are unloaded in order of least recently used first. *Setting to **true** is not recommended in SolrCloud mode.*
`loadOnStartup`	If **true**, the default if it is not specified, the core will loaded when Solr starts. *Setting to **false** is not recommended in SolrCloud mode.*
`coreNodeName`	Used only in SolrCloud, this is a unique identifier for the node hosting this replica. By default a coreNodeName is generated automatically, but setting this attribute explicitly allows you to manually assign a new core to replace an existing replica. For example: when replacing a machine that has had a hardware failure by restoring from backups on a new machine with a new hostname or port..
`ulogDir`	The absolute or relative directory for the update log for this core (SolrCloud).
`shard`	The shard to assign this core to (SolrCloud).

`collection`	The name of the collection this core is part of (SolrCloud).
`roles`	Future param for SolrCloud or a way for users to mark nodes for their own use.

Additional "user defined" properties may be specified for use as variables. For more information on how to define local properties, see the section Substituting Properties in Solr Config Files.

CoreAdmin API

The CoreAdminHandler is a special SolrRequestHandler that is used to manage Solr cores. Unlike normal SolrRequestHandlers, the CoreAdminHandler is not attached to a single core. Instead, it manages all the cores running in a single Solr instance. Only one CoreAdminHandler exists for each top-level Solr instance.

To use the CoreAdminHandler, make sure that the `adminPath` attribute is defined on the <cores> element; otherwise you will not be able to make HTTP requests to perform Solr core administration.

The action to perform is named by the HTTP request parameter "action", with arguments for a specific action being provided as additional parameters.

All action names are uppercase, and are defined in depth in the sections below.

- STATUS
- CREATE
- RELOAD
- RENAME
- SWAP
- UNLOAD
- MERGEINDEXES
- SPLIT
- REQUESTSTATUS

STATUS

The `STATUS` action returns the status of all running Solr cores, or status for only the named core.

```
http://localhost:8983/solr/admin/cores?action=STATUS&core=core0
```

Input

Query Parameters

Parameter	Type	Required	Default	Description
core	string	No		The name of a core, as listed in the "name" attribute of a `<core>` element in `solr.xml`.
indexInfo	boolean	No	true	If **false**, information about the index will not be returned with a core STATUS request. In Solr implementations with a large number of cores (i.e., more than hundreds), retrieving the index information for each core can take a lot of time and isn't always required.

CREATE

The `CREATE` action creates a new core and registers it.

If a Solr core with the given name already exists, it will continue to handle requests while the new core is initializing. When the new core is ready, it will take new requests and the old core will be unloaded.

```
http://localhost:8983/solr/admin/cores?action=CREATE&name=coreX&instanceDir=pat
h/to/dir&config=config_file_name.xml&schema=schem_file_name.xml&dataDir=data
```

ⓘ **CREATE must be able to find a configuration!**
Your CREATE call must be able to find a configuration, or it will not succeed.

When you are running SolrCloud and create a new core for a collection, the configuration will be inherited from the collection – each collection is linked to a configName, which is stored in the zookeeper database. This satisfies the config requirement.

When you are not running SolrCloud, if you have Config Sets defined, you can use the configSet parameter as documented below. If there are no config sets, then the instanceDir specified in the CREATE call must already exist, and it must contain a conf directory which in turn must contain `solrconfig.xml` and `schema.xml` (or the filenames specified by the config and schema parameters), as well as any files referenced in those configs. One thing you COULD do is use config and schema parameters that point at absolute paths, but this can lead to confusing configurations unless you fully understand what you are doing.

Input

Query Parameters

Parameter	Type	Required	Default	Description
name	string	Yes	N/A	The name of the new core. Same as "name" on the `<core>` element.
instanceDir	string	No	whatever is specified for "name" parameter	The directory where files for this SolrCore should be stored. Same as `instanceDir` on the `<core>` element.
config	string	No		Name of the config file (i.e., `solrconfig.xml`) relative to `instanceDir`.
schema	string	No		Name of the schema file (i.e., `schema.xml`) relative to `instanceDir`.
dataDir	string	No		Name of the data directory relative to `instanceDir`.
configSet	string	No		Name of the configset to use for this core. For more information, see the section Config Sets.

collection	string	No		The name of the collection to which this core belongs. The default is the name of the core. `collection.<param>=<value>` causes a property of `<param>=<value>` to be set if a new collection is being created. Use `collection.configName=<configname>` to point to the configuration for a new collection.
shard	string	No		The shard id this core represents. Normally you want to be auto-assigned a shard id.
property.*name*=*value*	string	No		Sets the core property *name* to *value*. See the section on defining core.properties file contents.
async	string	No		Request ID to track this action which will be processed asynchronously

Use `collection.configName=<configname>` to point to the config for a new collection.

Example

`http://localhost:8983/solr/admin/cores?action=CREATE&name=my_core&collection=my_collection&shard=shard2`

> While it's possible to create a core for a non-existent collection, this approach is not supported and not recommended. Always create a collection using the Collections API before creating a core directly for it.

RELOAD

The `RELOAD` action loads a new core from the configuration of an existing, registered Solr core. While the new core is initializing, the existing one will continue to handle requests. When the new Solr core is ready, it takes over and the old core is unloaded.

```
http://localhost:8983/solr/admin/cores?action=RELOAD&core=core0
```

This is useful when you've made changes to a Solr core's configuration on disk, such as adding new field definitions. Calling the RELOAD action lets you apply the new configuration without having to restart the Web container.

> RELOAD performs "live" reloads of SolrCore, reusing some existing objects. Some configuration options, such as the `dataDir` location and `IndexWriter`-related settings in `solrconfig.xml` can not be changed and made active with a simple RELOAD action.

Input

Query Parameters

Parameter	Type	Required	Default	Description
core	string	Yes	N/A	The name of the core, as listed in the "name" attribute of a `<core>` element in `solr.xml`.

RENAME

The RENAME action changes the name of a Solr core.

```
http://localhost:8983/solr/admin/cores?action=RENAME&core=core0&other=core5
```

Input

Query Parameters

Parameter	Type	Required	Default	Description
core	string	Yes		The name of the Solr core to be renamed.
other	string	Yes		The new name for the Solr core. If the persistent attribute of <solr> is true, the new name will be written to solr.xml as the name attribute of the <core> attribute.
async	string	No		Request ID to track this action which will be processed asynchronously

SWAP

SWAP atomically swaps the names used to access two existing Solr cores. This can be used to swap new content into production. The prior core remains available and can be swapped back, if necessary. Each core will be known by the name of the other, after the swap.

```
http://localhost:8983/solr/admin/cores?action=SWAP&core=core1&other=core0
```

⚠ Do not use SWAP with a SolrCloud node. It is not supported and can result in the core being unusable.

Input

Query Parameters

Parameter	Type	Required	Default	Description
core	string	Yes		The name of one of the cores to be swapped.
other	string	Yes		The name of one of the cores to be swapped.
async	string	No		Request ID to track this action which will be processed asynchronously

UNLOAD

The UNLOAD action removes a core from Solr. Active requests will continue to be processed, but no new requests will be sent to the named core. If a core is registered under more than one name, only the given name is removed.

```
http://localhost:8983/solr/admin/cores?action=UNLOAD&core=core0
```

The UNLOAD action requires a parameter (core) identifying the core to be removed. If the persistent attribute of <solr> is set to true, the <core> element with this name attribute will be removed from solr.xml.

⚠ Unloading all cores in a SolrCloud collection causes the removal of that collection's metadata from ZooKeeper.

Input

Query Parameters

Parameter	Type	Required	Default	Description
core	string	Yes		The name of one of the cores to be removed.
deleteIndex	boolean	No	false	If true, will remove the index when unloading the core.
deleteDataDir	boolean	No	false	If true, removes the `data` directory and all sub-directories.
deleteInstanceDir	boolean	No	false	If true, removes everything related to the core, including the index directory, configuration files and other related files.
async	string	No		Request ID to track this action which will be processed asynchronously

MERGEINDEXES

The `MERGEINDEXES` action merges one or more indexes to another index. The indexes must have completed commits, and should be locked against writes until the merge is complete or the resulting merged index may become corrupted. The target core index must already exist and have a compatible schema with the one or more indexes that will be merged to it. Another commit on the target core should also be performed after the merge is complete.

```
http://localhost:8983/solr/admin/cores?action=MERGEINDEXES&core=new_core_name&i
ndexDir=/solr_home/core1/data/index&indexDir=/solr_home/core2/data/index
```

In this example, we use the `indexDir` parameter to define the index locations of the source cores. The `core` parameter defines the target index. A benefit of this approach is that we can merge any Lucene-based index that may not be associated with a Solr core.

Alternatively, we can instead use a `srcCore` parameter, as in this example:

```
http://localhost:8983/solr/admin/cores?action=mergeindexes&core=new_core_name&s
rcCore=core1&srcCore=core2
```

This approach allows us to define cores that may not have an index path that is on the same physical server as the target core. However, we can only use Solr cores as the source indexes. Another benefit of this approach is that we don't have as high a risk for corruption if writes occur in parallel with the source index.

We can make this call run asynchronously by specifying the `async` parameter and passing a request-id. This id can then be used to check the status of the already submitted task using the REQUESTSTATUS API.

Input

Query Parameters

Parameter	Type	Required	Default	Description
core	string	Yes		The name of the target core/index.
indexDir	string			Multi-valued, directories that would be merged.
srcCore	string			Multi-valued, source cores that would be merged.
async	string			Request ID to track this action which will be processed asynchronously

SPLIT

The `SPLIT` action splits an index into two or more indexes. The index being split can continue to handle requests. The split pieces can be placed into a specified directory on the server's filesystem or it can be merged into running Solr cores.

The `SPLIT` action supports five parameters, which are described in the table below.

Input

Query Parameters

Parameter	Type	Required	Default	Description
core	string	Yes		The name of the core to be split.
path	string			Multi-valued, the directory path in which a piece of the index will be written.
targetCore	string			Multi-valued, the target Solr core to which a piece of the index will be merged
ranges	string	No		A comma-separated list of hash ranges in hexadecimal format
split.key	string	No		The key to be used for splitting the index
async	string	No		Request ID to track this action which will be processed asynchronously

> Either `path` or `targetCore` parameter must be specified but not both. The ranges and split.key parameters are optional and only one of the two should be specified, if at all required.

Examples

The `core` index will be split into as many pieces as the number of `path` or `targetCore` parameters.

Usage with two `targetCore` parameters:

```
http://localhost:8983/solr/admin/cores?action=SPLIT&core=core0&targetCore=core1
&targetCore=core2
```

Here the `core` index will be split into two pieces and merged into the two `targetCore` indexes.

Usage of with two **path** parameters:

```
http://localhost:8983/solr/admin/cores?action=SPLIT&core=core0&path=/path/to/in
dex/1&path=/path/to/index/2
```

The `core` index will be split into two pieces and written into the two directory paths specified.

Usage with the **split.key** parameter:

```
http://localhost:8983/solr/admin/cores?action=SPLIT&core=core0&targetCore=core1
&split.key=A!
```

Here all documents having the same route key as the `split.key` i.e. 'A!' will be split from the `core` index and written to the `targetCore`.

Usage with ranges parameter:

```
http://localhost:8983/solr/admin/cores?action=SPLIT&core=core0&targetCore=core1
&targetCore=core2&targetCore=core3&ranges=0-1f4,1f5-3e8,3e9-5dc
```

This example uses the `ranges` parameter with hash ranges 0-500, 501-1000 and 1001-1500 specified in hexadecimal. Here the index will be split into three pieces with each targetCore receiving documents matching the hash ranges specified i.e. core1 will get documents with hash range 0-500, core2 will receive documents with hash range 501-1000 and finally, core3 will receive documents with hash range 1001-1500. At least one hash range must be specified. Please note that using a single hash range equal to a route key's hash range is NOT equivalent to using the `split.key` parameter because multiple route keys can hash to the same range.

The `targetCore` must already exist and must have a compatible schema with the `core` index. A commit is automatically called on the `core` index before it is split.

This command is used as part of the SPLITSHARD command but it can be used for non-cloud Solr cores as well. When used against a non-cloud core without `split.key` parameter, this action will split the source index and distribute its documents alternately so that each split piece contains an equal number of documents. If the `split.key` parameter is specified then only documents having the same route key will be split from the source index.

REQUESTSTATUS

Request the status of an already submitted asynchronous CoreAdmin API call.

Input

Query Parameters

Parameter	Type	Required	Default	Description
requestid	string	Yes		The user defined request-id for the Asynchronous request.

The call below will return the status of an already submitted Asynchronous CoreAdmin call.

```
http://localhost:8983/solr/admin/cores?action=REQUESTSTATUS&requestid=1
```

Config Sets

On a multicore Solr instance, you may find that you want to share configuration between a number of different cores. You can achieve this using named configsets, which are essentially shared configuration directories stored under a configurable configset base directory.

To create a configset, simply add a new directory under the configset base directory. The configset will be identified by the name of this directory. Then into this copy the config directory you want to share. The structure should look something like this:

```
/<configSetBaseDir>
 /configset1
  /conf
   /schema.xml
   /solrconfig.xml
 /configset2
  /conf
   /schema.xml
   /solrconfig.xml
```

The default base directory is `$SOLR_HOME/configsets`, and it can be configured in `solr.xml`.

To create a new core using a configset, pass `configSet` as one of the core properties. For example, if you do this via the core admin API:

```
http://<solr>/admin/cores?action=CREATE&name=mycore&instanceDir=path/to/instance&configSet=configset2
```

Configuration APIs

Solr includes several APIs that can be used to modify settings in `solrconfig.xml`.

- Blob Store API
- Config API
- Managed Resources
- Request Parameters API

Blob Store API

The Blob Store REST API provides REST methods to store, retrieve or list files in a Lucene index. This can be used to upload a jar file which contains standard solr components such as RequestHandlers, SearchComponents, or other custom code you have written for Solr.

When using the blob store, note that the API does not delete or overwrite a previous object if a new one is uploaded with the same name. It always adds a new version of the blob to the index. Deletes can be performed with standard REST delete commands.

The blob store is only available when running in SolrCloud mode. Solr in standalone mode does not support use of a blob store.

The blob store API is implemented as a requestHandler. A special collection named ".system" must be created as the collection that contains the blob store index.

Create a .system Collection

Before using the blob store, a special collection must be created and it must be named `.system`.

The BlobHandler is automatically registered in the .system collection. The `schema.xml` and other configuration files for the collection are automatically provided by the system and don't need to be defined specifically.

If you do not use the `-shards` or `-replicationFactor` options, then defaults of 1 shard and 1 replica will be used.

You can create the `.system` collection with the Collections API, as in this example:

```
curl
"http://localhost:8983/solr/admin/collections?action=CREATE&name=.system&replication
Factor=2"
```

⚠ Note that the `bin/solr` script cannot be used to create the `.system` collection at this time. Also, please ensure that there is at least one collection created before creating the `.system` collection.

Upload Files to Blob Store

After the `.system` collection has been created, files can be uploaded to the blob store with a request similar to the following:

```
curl -X POST -H 'Content-Type: application/octet-stream' --data-binary @{filename}
http://localhost:8983/solr/.system/blob/{blobname}
```

For example, to upload a file named "test1.jar" as a blob named "test", you would make a POST request like:

```
curl -X POST -H 'Content-Type: application/octet-stream' --data-binary @test1.jar
http://localhost:8983/solr/.system/blob/test
```

A GET request will return the list of blobs and other details:

```
curl http://localhost:8983/solr/.system/blob?omitHeader=true
```

Output:

```
{
  "response":{"numFound":1,"start":0,"docs":[
      {
        "id":"test/1",
        "md5":"20ff915fa3f5a5d66216081ae705c41b",
        "blobName":"test",
        "version":1,
        "timestamp":"2015-02-04T16:45:48.374Z",
        "size":13108}]
  }
}
```

Details on individual blobs can be accessed with a request similar to:

```
curl http://localhost:8983/solr/.system/blob/{blobname}
```

For example, this request will return only the blob named 'test':

```
curl http://localhost:8983/solr/.system/blob/test?omitHeader=true
```

Output:

```
{
  "response":{"numFound":1,"start":0,"docs":[
      {
        "id":"test/1",
        "md5":"20ff915fa3f5a5d66216081ae705c41b",
        "blobName":"test",
        "version":1,
        "timestamp":"2015-02-04T16:45:48.374Z",
        "size":13108}]
  }
}
```

The filestream response writer can return a particular version of a blob for download, as in:

```
curl http://localhost:8983/solr/.system/blob/{blobname}/{version}?wt=filestream >
{outputfilename}
```

For the latest version of a blob, the {version} can be omitted,

```
curl http://localhost:8983/solr/.system/blob/{blobname}?wt=filestream >
{outputfilename}
```

Use a Blob in a Handler or Component

To use the blob as the class for a request handler or search component, you create a request handler in `solrconfig.xml` as usual. You will need to define the following parameters:

- `class`: the fully qualified class name. For example, if you created a new request handler class called CRUDHandler, you would enter `org.apache.solr.core.CRUDHandler`.
- `lib`: the name of the blob given when you uploaded it to the blob store.
- `version`: the blob version to use. As mentioned above, blobs are not overwritten, but saved with a different version.

For example, to use a blob named test, you would configure `solrconfig.xml` like this:

```
<requestHandler name="/myhandler" class="org.apache.solr.core.myHandler" lib="test"
version="1">
</requestHandler>
```

If there are parameters available in the custom handler, you can define them in the same way as any other request handler definition.

Config API

The Config API enables manipulating various aspects of your `solrconfig.xml` using REST-like API calls. This feature is enabled by default and works similarly in both SolrCloud and standalone mode. Many commonly edited properties (such as cache sizes and commit settings) and request handler definitions can be changed with this API.

When using this API, `solrconfig.xml` is is not changed. Instead, all edited configuration is stored in a file called `configoverlay.json`. The values in `configoverlay.json` override the values in `solrconfig.xml`.

API Entry Points

- `/config`: retrieve or modify the config. GET to retrieve and POST for executing commands
- `/config/overlay`: retrieve the details in the `configoverlay.json` alone

Commands

This API uses specific commands to tell Solr what property or type of property to add to `configoverlay.json`. The commands are passed as part of the data sent with the request.

The config commands are categorized into 3 different sections which manipulate various data structures in `solrconfig.xml`. Each of these is described below.

- Common Properties
- Components
- User-defined properties

Commands for Common Properties

The common properties are those that are frequently need to be customized in a Solr instance. They are manipulated with two commands:

- `set-property`: Set a well known property. The names of the properties are predefined and fixed. If the property has already been set, this command will overwrite the previous setting.
- `unset-property`: Remove a property set using the `set-property` command.

The properties that are configured with these commands are predefined and listed below. The names of these properties are derived from their XML paths as found in `solrconfig.xml`.

- `updateHandler.autoCommit.maxDocs`
- `updateHandler.autoCommit.maxTime`
- `updateHandler.autoCommit.openSearcher`
- `updateHandler.autoSoftCommit.maxDocs`
- `updateHandler.autoSoftCommit.maxTime`
- `updateHandler.commitWithin.softCommit`
- `updateHandler.commitIntervalLowerBound`
- `updateHandler.indexWriter.closeWaitsForMerges`
- `query.filterCache.class`
- `query.filterCache.size`
- `query.filterCache.initialSize`
- `query.filterCache.autowarmCount`
- `query.filterCache.regenerator`
- `query.queryResultCache.class`
- `query.queryResultCache.size`
- `query.queryResultCache.initialSize`
- `query.queryResultCache.autowarmCount`
- `query.queryResultCache.regenerator`
- `query.documentCache.class`
- `query.documentCache.size`
- `query.documentCache.initialSize`
- `query.documentCache.autowarmCount`
- `query.documentCache.regenerator`
- `query.fieldValueCache.class`
- `query.fieldValueCache.size`
- `query.fieldValueCache.initialSize`
- `query.fieldValueCache.autowarmCount`
- `query.fieldValueCache.regenerator`
- `query.useFilterForSortedQuery`
- `query.queryResultWindowSize`
- `query.queryResultMaxDocCached`
- `query.enableLazyFieldLoading`
- `query.boolToFilterOptimizer`
- `query.maxBooleanClauses`
- `jmx.agentId`
- `jmx.serviceUrl`
- `jmx.rootName`
- `requestDispatcher.handleSelect`
- `requestDispatcher.requestParsers.multipartUploadLimitInKB`
- `requestDispatcher.requestParsers.formdataUploadLimitInKB`
- `requestDispatcher.requestParsers.enableRemoteStreaming`
- `requestDispatcher.requestParsers.addHttpRequestToContext`

Commands for Custom Handlers and Local Components

Custom request handlers, search components, and other types of localized Solr components (such as custom query parsers, update processors, etc.) can be added, updated and deleted with specific commands for the component being modified.

The syntax is similar in each case: `add-<component-name>`, `update-<component-name>`, and `delete-<component-name>`. Please note that the command name is not case sensitive, so `Add-RequestHandler`, `ADD-REQUESTHANDLER` and `add-requesthandler` are all equivalent. In each case, `add-`commands add the new configuration to `configoverlay.json`, which will override any other settings for the component in `solrconfig.xml`; `update-` commands modify an existing setting in `configoverlay.json`; and `delete-` commands remove the setting from `configoverlay.json`. Settings removed from `configoverlay.json` are not removed from `solrconfig.xml`.

The full list of available commands follows below:

General Purpose Commands

These commands are the most commonly used:

- `add-requesthandler`
- `update-requesthandler`
- `delete-requesthandler`
- `add-searchcomponent`
- `update-searchcomponent`
- `delete-searchcomponent`
- `add-initparams`
- `update-initparams`
- `delete-initparams`
- `add-queryresponsewriter`
- `update-queryresponsewriter`
- `delete-queryresponsewriter`

Advanced Commands

These commands allow registering more advanced customizations to Solr:

- `add-queryparser`
- `update-queryparser`
- `delete-queryparser`
- `add-valuesourceparser`
- `update-valuesourceparser`
- `delete-valuesourceparser`
- `add-transformer`
- `update-transformer`
- `delete-transformer`
- `add-updateprocessor`
- `update-updateprocessor`
- `delete-updateprocessor`
- `add-queryconverter`
- `update-queryconverter`
- `delete-queryconverter`
- `add-listener`
- `update-listener`
- `delete-listener`

- `add-runtimelib`
- `update-runtimelib`
- `delete-runtimelib`

See the section Creating and Updating Request Handlersbelow for examples of using these commands.

What about `<updateRequestProcessorChain>`?

The Config API does not let you create or edit `<updateRequestProcessorChain>` elements. However, it is possible to create `<updateProcessor>` entries and can use them by name to create a chain.

example:

```
curl http://localhost:8983/solr/techproducts/config -H
'Content-type:application/json' -d '{
"add-updateprocessor" : {"name" : "firstFld",
                          "class": "solr.FirstFieldValueUpdateProcessorFactory",
                          "fieldName":"test_s"}}'
```

You can use this directly in your request by adding a parameter in the `<updateRequestProcessorChain>` for the specific update processor called `processor=firstFld`.

Commands for User-Defined Properties

Solr lets users templatize the `solrconfig.xml` using the place holder format `${variable_name:default_val}`. You could set the values using system properties, for example, `-Dvariable_name= my_customvalue`. The same can be achieved during runtime using these commands:

- `set-user-property`: Set a user-defined property. If the property has already been set, this command will overwrite the previous setting.
- `unset-user-property`: Remove a user-defined property.

The structure of the request is similar to the structure of requests using other commands, in the format of `"command":{"variable_name":"property_value"}`. You can add more than one variable at a time if necessary.

For more information about user-defined properties, see the section User defined properties from core.properties . See also the section Creating and Updating User-Defined Properties below for examples of how to use this type of command.

How to Map `solrconfig.xml` Properties to JSON

By using this API, you will be generating JSON representations of properties defined in `solrconfig.xml`. To understand how properties should be represented with the API, let's take a look at a few examples.

Here is what a request handler looks like in `solrconfig.xml`:

```
<requestHandler name="/query" class="solr.SearchHandler">
    <lst name="defaults">
      <str name="echoParams">explicit</str>
      <str name="wt">json</str>
      <str name="indent">true</str>
    </lst>
  </requestHandler>
```

The same request handler defined with the Config API would look like this:

```
{"add-requesthandler":{
   "name":"/query",
   "class":"solr.SearchHandler"
   "defaults":{
      "echoParams":"explicit",
      "wt":"json",
      "indent":true}
}
```

A searchComponent in `solrconfig.xml` looks like this:

```
<searchComponent name="elevator" class="solr.QueryElevationComponent" >
    <str name="queryFieldType">string</str>
    <str name="config-file">elevate.xml</str>
</searchComponent>
```

And the same searchComponent with the Config API:

```
{"add-searchcomponent":
   "name":"elevator",
   "class":"QueryElevationComponent",
   "queryFieldType":"string",
   "config-file":"elevate.xml"
}
```

Set autoCommit properties in `solrconfig.xml`:

```
<autoCommit>
   <maxTime>15000</maxTime>
   <openSearcher>false</openSearcher>
</autoCommit>
```

Define the same properties with the Config API:

```
{"set-property":{
   "updateHandler.autoCommit.maxTime":15000,
   "updateHandler.autoCommit.openSearcher":false
}
```

Name Components for the Config API

The Config API always allows changing the configuration of any component by name. However, some configurations such as `listener` or `initParams` do not require a name in `solrconfig.xml`. In order to be able to `update` and `delete` of the same item in `configoverlay.json`, the name attribute becomes mandatory.

Examples

Creating and Updating Common Properties

This change sets the `query.filterCache.autowarmCount`to 1000 items and unsets the `query.filterCache.size`.

```
curl http://localhost:8983/solr/techproducts/config -H
'Content-type:application/json' -d'{
    "set-property" : {"query.filterCache.autowarmCount":1000},
    "unset-property" :"query.filterCache.size"}'
```

Using the `/config/overlay` endpoint, you can verify the changes with a request like this:

```
curl http://localhost:8983/solr/gettingstarted/config/overlay?omitHeader=true
```

And you should get a response like this:

```
{
  "overlay":{
    "znodeVersion":1,
    "props":{"query":{"filterCache":{
          "autowarmCount":1000,
          "size":25}}}}}
```

Creating and Updating Request Handlers

To create a request handler, we can use the `add-requesthandler` command:

```
curl http://localhost:8983/solr/techproducts/config -H
'Content-type:application/json'  -d '{
"add-requesthandler" : {"name": "/mypath" ,
                           "class":"solr.DumpRequestHandler" ,
                           "defaults":{"x":"y" ,"a":"b", "wt":"json",
"indent":true},
                           "useParams":"x"
                          },
}'
```

Make a call to the new request handler to check if it is registered:

```
curl http://localhost:8983/solr/techproducts/mypath?omitHeader=true
```

And you should see the following as output:

```
{
    "params":{
    "indent":"true",
    "a":"b",
    "x":"y",
    "wt":"json"},
  "context":{
    "webapp":"/solr",
    "path":"/mypath",
    "httpMethod":"GET"}}
```

To update a request handler, you should use the `update-requesthandler` command :

```
curl http://localhost:8983/solr/techproducts/config -H
'Content-type:application/json'  -d '{
"update-requesthandler" : {"name": "/mypath" ,
                           "class":"solr.DumpRequestHandler" ,
                           "defaults":{"x":"new value for X"
,"wt":"json","indent":true},
                           "useParams":"x"
                          }}'
```

As another example, we'll create another request handler, this time adding the 'terms' component as part of the definition:

```
curl http://localhost:8983/solr/techproducts/config -H
'Content-type:application/json'  -d '{
"add-requesthandler" : {"name": "/myterms" ,
                           "class":"solr.Searchhandler" ,
                           "defaults":{"terms":true ,"distrib":false},
                           "components":["terms"]
                          }}'
```

Creating and Updating User-Defined Properties

This command sets a user property.

```
curl http://localhost:8983/solr/techproducts/config
-H'Content-type:application/json' -d '{
    "set-user-property" : {"variable_name":"some_value"}}'
```

Again, we can use the `/config/overlay` endpoint to verify the changes have been made:

```
curl http://localhost:8983/solr/techproducts/config/overlay?omitHeader=true
```

And we would expect to see output like this:

```
{"overlay":{
   "znodeVersion":5,
   "userProps":{
      "variable_name":"some_value"}}
}
```

To unset the variable, issue a command like this:

```
curl http://localhost:8983/solr/techproducts/config
-H'Content-type:application/json' -d '{"unset-user-property" : "variable_name"}'
```

How It Works

Every core watches the ZooKeeper directory for the configset being used with that core. In standalone mode, however, there is no watch (because ZooKeeper is not running). If there are multiple cores in the same node using the same configset, only one ZooKeeper watch is used. For instance, if the configset 'myconf' is used by a core, the node would watch `/configs/myconf`. Every write operation performed through the API would 'touch' the directory (sets an empty byte[] to trigger watches) and all watchers are notified. Every core would check if `schema.xml`, `solrconfig.xml` or `configoverlay.json` is modified by comparing the `znode` versions and if modified, the core is reloaded.

If `params.json` is modified, the params object is just updated without a core reload (see the section Request Parameters API for more information about `params.json`).

Empty Command

If an empty command is sent to the `/config` endpoint, the watch is triggered on all cores using this configset. For example:

```
curl http://localhost:8983/solr/techproducts/config
-H'Content-type:application/json' -d '{}'
```

Directly editing any files without 'touching' the directory **will not** make it visible to all nodes.

It is possible for components to watch for the configset 'touch' events by registering a listener using `SolrCore#registerConfListener()` .

Listening to config Changes

Any component can register a listener using:

`SolrCore#addConfListener(Runnable listener)`

to get notified for config changes. This is not very useful if the files modified result in core reloads (i.e., `configoverlay.xml` or `managedschema.xml`) . Components can use this to reload the files they are interested in.

Managed Resources

Managed resources expose a REST API endpoint for performing Create-Read-Update-Delete (CRUD) operations on a Solr object. Any long-lived Solr object that has configuration settings and/or data is a good candidate to be a managed resource. Managed resources complement other programmatically manageable components in Solr, such as the RESTful schema API to add fields to a managed schema. Consider a Web-based UI that offers Solr-as-a-Service where users need to configure a set of stop words and synonym mappings as part of an initial setup process for their search application. This type of use case can easily be supported using the Managed Stop Filter & Managed Synonym Filter Factories provided by Solr, via the Managed resources REST API. Users can also write their own custom plugins, that leverage the same internal hooks to make additional resources REST managed.

All of the examples in this section assume you are running the "techproducts" Solr example:

```
bin/solr -e techproducts
```

Overview

Let's begin learning about managed resources by looking at a couple of examples provided by Solr for managing stop words and synonyms using a REST API. After reading this section, you'll be ready to dig into the details of how managed resources are implemented in Solr so you can start building your own implementation.

Stop words

To begin, you need to define a field type that uses the ManagedStopFilterFactory, such as:

```
<fieldType name="managed_en" positionIncrementGap="100">
  <analyzer>
    <tokenizer class="solr.StandardTokenizerFactory"/>
    <filter class="solr.ManagedStopFilterFactory"
            managed="english" />
  </analyzer>
</fieldType>
```

There are two important things to notice about this field type definition. First, the filter implementation class is **`solr.ManagedStopFilterFactory`**. This is a special implementation of the StopFilterFactory that uses a set of stop words that are managed from a REST API. Second, the **`managed=”english”`** attribute gives a name to the set of managed stop words, in this case indicating the stop words are for English text.

The REST endpoint for managing the English stop words in the techproducts collection is: `/solr/techproducts/schema/analysis/stopwords/english`.

The example resource path should be mostly self-explanatory. It should be noted that the ManagedStopFilterFactory implementation determines the **/schema/analysis/stopwords** part of the path, which makes sense because this is an analysis component defined by the schema. It follows that a field type that uses the following filter:

```
<filter class="solr.ManagedStopFilterFactory"
        managed="french" />
```

would resolve to path: `/solr/techproducts/schema/analysis/stopwords/french`.

So now let’s see this API in action, starting with a simple GET request:

```
curl "http://localhost:8983/solr/techproducts/schema/analysis/stopwords/english"
```

Assuming you sent this request to Solr, the response body is a JSON document:

```
{
  "responseHeader":{
    "status":0,
    "QTime":1
  },
  "wordSet":{
    "initArgs":{"ignoreCase":true},
    "initializedOn":"2014-03-28T20:53:53.058Z",
    "managedList":[
      "a",
      "an",
      "and",
      "are",
      ... ]
  }
}
```

The `sample_techproducts_configs`config set ships with a pre-built set of managed stop words, however you should only interact with this file using the API and not edit it directly.

One thing that should stand out to you in this response is that it contains a **`managedList`** of words as well as **`initArgs`**. This is an important concept in this framework—managed resources typically have configuration and data. For stop words, the only configuration parameter is a boolean that determines whether to ignore the case of tokens during stop word filtering (ignoreCase=true|false). The data is a list of words, which is represented as a JSON array named **`managedList`** in the response.

Now, let's add a new word to the English stop word list using an HTTP PUT:

```
curl -X PUT -H 'Content-type:application/json' --data-binary '["foo"]'
"http://localhost:8983/solr/techproducts/schema/analysis/stopwords/english"
```

Here we're using cURL to PUT a JSON list containing a single word “foo” to the managed English stop words set. Solr will return 200 if the request was successful. You can also put multiple words in a single PUT request.

You can test to see if a specific word exists by sending a GET request for that word as a child resource of the set, such as:

```
curl "http://localhost:8983/solr/techproducts/schema/analysis/stopwords/english/foo"
```

This request will return a status code of 200 if the child resource (foo) exists or 404 if it does not exist the managed list.

To delete a stop word, you would do:

```
curl -X DELETE
"http://localhost:8983/solr/techproducts/schema/analysis/stopwords/english/foo"
```

Note: PUT/POST is used to add terms to an existing list instead of replacing the list entirely. This is because it is more common to add a term to an existing list than it is to replace a list altogether, so the API favors the more common approach of incrementally adding terms especially since deleting individual terms is also supported.

Synonyms

For the most part, the API for managing synonyms behaves similar to the API for stop words, except instead of working with a list of words, it uses a map, where the value for each entry in the map is a set of synonyms for a term. As with stop words, the `sample_techproducts_configs` config set includes a pre-built set of synonym mappings suitable for the sample data that is activated by the following field type definition in schema.xml:

```
<fieldType name="managed_en" positionIncrementGap="100">
  <analyzer>
    <tokenizer class="solr.StandardTokenizerFactory"/>
    <filter class="solr.ManagedStopFilterFactory"
            managed="english" />

    <filter class="solr.ManagedSynonymFilterFactory"
            managed="english" />

  </analyzer>
</fieldType>
```

To get the map of managed synonyms, send a GET request to:

```
curl "http://localhost:8983/solr/techproducts/schema/analysis/synonyms/english"
```

This request will return a response that looks like:

```
{
  "responseHeader":{
    "status":0,
    "QTime":3},
  "synonymMappings":{
    "initArgs":{
      "ignoreCase":true,
      "format":"solr"},
    "initializedOn":"2014-12-16T22:44:05.33Z",
    "managedMap":{
      "GB":
        ["GiB",
         "Gigabyte"],
      "TV":
        ["Television"],
      "happy":
        ["glad",
         "joyful"]}}}
```

Managed synonyms are returned under the **managedMap** property which contains a JSON Map where the value of each entry is a set of synonyms for a term, such as "happy" has synonyms "glad" and "joyful" in the example above.

To add a new synonym mapping, you can PUT/POST a single mapping such as:

```
curl -X PUT -H 'Content-type:application/json' --data-binary
'{"mad":["angry","upset"]}'
"http://localhost:8983/solr/techproducts/schema/analysis/synonyms/english"
```

The API will return status code 200 if the PUT request was successful. To determine the synonyms for a specific term, you send a GET request for the child resource, such as `/schema/analysis/synonyms/english/mad` would return `["angry","upset"]`. Lastly, you can delete a mapping by sending a DELETE request to the managed endpoint.

Applying Changes

Changes made to managed resources via this REST API are not applied to the active Solr components until the Solr collection (or Solr core in single server mode) is reloaded. For example:, after adding or deleting a stop word, you must reload the core/collection before changes become active.

This approach is required when running in distributed mode so that we are assured changes are applied to all cores in a collection at the same time so that behavior is consistent and predictable. It goes without saying that you don’t want one of your replicas working with a different set of stop words or synonyms than the others.

One subtle outcome of this *apply-changes-at-reload* approach is that the once you make changes with the API, there is no way to read the active data. In other words, the API returns the most up-to-date data from an API perspective, which could be different than what is currently being used by Solr components. However, the intent of this API implementation is that changes will be applied using a reload within a short time frame after making them so the time in which the data returned by the API differs from what is active in the server is intended to be negligible.

> ⚠ Changing things like stop words and synonym mappings typically require re-indexing existing documents if being used by index-time analyzers. The RestManager framework does not guard you from this, it simply makes it possible to programmatically build up a set of stop words, synonyms etc.

RestManager Endpoint

Metadata about registered ManagedResources is available using the **/schema/managed** and **/config/managed** endpoints for each collection. Assuming you have the **managed_en** field type shown above defined in your schema.xml, sending a GET request to the following resource will return metadata about which schema-related resources are being managed by the RestManager:

```
curl "http://localhost:8983/solr/techproducts/schema/managed"
```

The response body is a JSON document containing metadata about managed resources under the /schema root:

```
{
  "responseHeader":{
    "status":0,
    "QTime":3
  },
  "managedResources":[
    {
      "resourceId":"/schema/analysis/stopwords/english",
      "class":"org.apache.solr.rest.schema.analysis.ManagedWordSetResource",
      "numObservers":"1"
    },
    {
      "resourceId":"/schema/analysis/synonyms/english",

"class":"org.apache.solr.rest.schema.analysis.ManagedSynonymFilterFactory$SynonymMan
ager",
      "numObservers":"1"
    }
  ]
}
```

You can also create new managed resource using PUT/POST to the appropriate URL – before ever configuring anything that uses these resources.

For example: imagine we want to build up a set of German stop words. Before we can start adding stop words, we need to create the endpoint:

`/solr/techproducts/schema/analysis/stopwords/german`

To create this endpoint, send the following PUT/POST request to the endpoint we wish to create:

```
curl -X PUT -H 'Content-type:application/json' --data-binary \
'{"class":"org.apache.solr.rest.schema.analysis.ManagedWordSetResource"}' \
"http://localhost:8983/solr/techproducts/schema/analysis/stopwords/german"
```

Solr will respond with status code 200 if the request is successful. Effectively, this action registers a new endpoint for a managed resource in the RestManager. From here you can start adding German stop words as we saw above:

```
curl -X PUT -H 'Content-type:application/json' --data-binary '["die"]' \
"http://localhost:8983/solr/techproducts/schema/analysis/stopwords/german"
```

For most users, creating resources in this way should never be necessary, since managed resources are created automatically when configured.

However: You may want to explicitly delete managed resources if they are no longer being used by a Solr component.

For instance, the managed resource for German that we created above can be deleted because there are no Solr components that are using it, whereas the managed resource for English stop words cannot be deleted because there is a token filter declared in schema.xml that is using it.

```
curl -X DELETE
"http://localhost:8983/solr/techproducts/schema/analysis/stopwords/german"
```

Related Topics

- Using Solr’s REST APIs to manage stop words and synonyms by Tim Potter @ SearchHub.org

Request Parameters API

The Request Parameters API allows creating parameter sets that can override or take the place of parameters defined in `solrconfig.xml`. The parameter sets defined with this API can be used in requests to Solr, or referenced directly in `solrconfig.xml` request handler definitions.

It is really another endpoint of the Config API instead of a separate API, and has distinct commands. It does not replace or modify any sections of `solrconfig.xml`, but instead provides another approach to handling parameters used in requests. It behaves in the same way as the Config API, by storing parameters in another file that will be used at runtime. In this case, the parameters are stored in a file named `params.json`. This file is kept in ZooKeeper or in the `conf` directory of a standalone Solr instance.

The settings stored in `params.json` are used at query time to override settings defined in `solrconfig.xml` in some cases as described below.

When might you want to use this feature?

- To avoid frequently editing your `solrconfig.xml` to update request parameters that change often.
- To reuse parameters across various request handlers.
- To mix and match parameter sets at request time.
- To avoid a reload of your collection for small parameter changes.

The Request Parameters Endpoint

All requests are sent to the `/config/params` endpoint of the Config API.

Setting Request Parameters

The request to set, unset, or update request parameters is sent as a set of Maps with names. These objects can be directly used in a request or a request handler definition.

The available commands are:

- `set`: Create or overwrite a parameter set map.
- `unset`: delete a parameter set map.
- `update`: update a parameter set map. This essentially overwrites the old parameter set, so all parameters must be sent in each update request.

You can mix these commands into a single request if necessary.

Each map must include a name so it can be referenced later, either in a direct request to Solr or in a request handler definition.

In the following example, we are setting 2 sets of parameters named 'myFacets' and 'myQueries'.

```
curl http://localhost:8983/solr/techproducts/config/params -H
'Content-type:application/json'  -d '{
   "set":{
      "myFacets":{
      "facet":"true",
   "facet.limit":5}},
   "set":{
      "myQueries":{
      "defType":"edismax",
   "rows": "5",
   "df":"text_all"}}
}'
```

To see the parameters that have been set, you can use the `/config/params` endpoint to read the contents of `params.json`, or use the name in the request:

```
curl http://localhost:8983/solr/techproducts/config/params

#Or use the params name
curl http://localhost:8983/solr/techproducts/config/params/myQueries
```

The ***`useParams`*** Parameter

When making a request, the `useParams` parameter applies the request parameters set to the request. This is translated at request time to the actual params.

For example (using the names we set up in the earlier example, please replace with your own name):

```
http://localhost/solr/techproducts/select?useParams=myQueries
```

It is possible to pass more than one parameter set in the same request. For example:

```
http://localhost/solr/techproducts/select?useParams=myFacets,myQueries
```

In the above example the param set 'myQueries' is applied on top of 'myFacets'. So, values in 'myQueries' take precedence over values in 'myFacets'. Additionally, any values passed in the request take precedence over 'useParams' params. This acts like the "defaults" specified in the '`<requestHandler>`' definition in `solrconfig.xml`.

The parameter sets can be used directly in a request handler definition as follows. Please note that the 'useParams' specified here is ignored if the request contains `useParams`.

```
<requestHandler name="/terms" class="solr.SearchHandler" useParams="myQueries">
   <lst name="defaults">
      <bool name="terms">true</bool>
      <bool name="distrib">false</bool>
   </lst>
   <arr name="components">
      <str>terms</str>
   </arr>
</requestHandler>
```

To summarize, parameters are applied in this order:

- parameters defined in `<invariants>` in `solrconfig.xml`.
- parameters defined in the request directly.
- parameter sets defined in the request, in the order they have been listed with `useParams`.
- parameter sets defined in `params.json` that have been defined in the request handler.
- parameters defined in `<defaults>` in `solrconfig.xml`.

Public APIs

The RequestParams Object can be accessed using the method `SolrConfig#getRequestParams()`. Each paramset can be accessed by their name using the method `RequestParams#getRequestParams(String name)`.

Solr Plugins

Solr allows you to load custom code to perform a variety of tasks within Solr, from custom Request Handlers to process your searches, to custom Analyzers and Token Filters for your text field. You can even load custom Field Types. These pieces of custom code are called plugins.

Not everyone will need to create plugins for their Solr instances - what's provided is usually enough for most applications. However, if there's something that you need, you may want to review the Solr Wiki documentation on plugins at SolrPlugins.

If you have a plugin you would like to use, and you are running in SolrCloud mode, you can use the Blob Store API and the Config API to load the jars to Solr. The commands to use are described in the section Adding Custom Plugins in SolrCloud Mode.

Adding Custom Plugins in SolrCloud Mode

When running Solr in SolrCloud mode and you want to use custom code (such as custom analyzers, tokenizers, query parsers, and other plugins), it can be difficult to add jars to the classpath on all nodes in your cluster. Using the Blob Store API and special commands with the Config API, you can upload jars to a special system-level collection and dynamically load them at runtime.

This Feature is Disabled By Default
In addition to requiring that Solr by running in SolrCloud mode, this feature is also disabled by default unless all Solr nodes are run with the `-Denable.runtime.lib=true` option on startup.

Before enabling this feature, users should carefully consider the issues discussed in the Securing Runtime Libraries section below.

Uploading Jar Files

The first step is to use the Blob Store API to upload your jar files. This will to put your jars in the `.system` collection and distribute them across your SolrCloud nodes. These jars are added to a separate classloader and only accessible to components that are configured with the property `runtimeLib=true`. These components are loaded lazily because the `.system` collection may not be loaded when a particular core is loaded.

Config API Commands to use Jars as Runtime Libraries

The runtime library feature uses a special set of commands for the Config API to add, update, or remove jar files currently available in the blob store to the list of runtime libraries.

The following commands are used to manage runtime libs:

- `add-runtimelib`
- `update-runtimelib`
- `delete-runtimelib`

```
curl http://localhost:8983/solr/techproducts/config -H
'Content-type:application/json'  -d '{
   "add-runtimelib" : {"name": "jarblobname" , "version":2 },
   "update-runtimelib" :{"name": "jarblobname" ,"version":3},
   "delete-runtimelib" :"jarblobname"
}'
```

The name to use is the name of the blob that you specified when you uploaded your jar to the blob store. You should also include the version of the jar found in the blob store that you want to use. These details are added to `configoverlay.json`.

The default `SolrResourceLoader` does not have visibility to the jars that have been defined as runtime libraries. There is a classloader that can access these jars which is made available only to those components which are specially annotated.

Every pluggable component can have an optional extra attribute called `runtimeLib=true`, which means that the components are not loaded at core load time. Instead, they will be loaded on demand. If all the dependent jars are not available when the component is loaded, an error is thrown.

This example shows creating a ValueSourceParser using a jar that has been loaded to the Blob store.

```
curl http://localhost:8983/solr/techproducts/config -H
'Content-type:application/json'  -d '{
   "create-valuesourceparser" : {
      "name": "nvl" ,
      "runtimeLib": true,
      "class":"solr.org.apache.solr.search.function.NvlValueSourceParser ,
      "nvlFloatValue":0.0 }
}'
```

Securing Runtime Libraries

A drawback of this feature is that it could be used to load malicious executable code into the system. However, it is possible to restrict the system to load only trusted jars using PKI to verify that the executables loaded into the system are trustworthy.

The following steps will allow you enable security for this feature. The instructions assume you have started all your Solr nodes with the `-Denable.runtime.lib=true`.

Step 1: Generate an RSA Private Key

The first step is to generate an RSA private key. The example below uses a 512-bit key, but you should use the strength appropriate to your needs.

```
$ openssl genrsa -out priv_key.pem 512
```

Step 2: Output the Public Key

The public portion of the key should be output in DER format so Java can read it.

```
$ openssl rsa -in priv_key.pem -pubout -outform DER -out pub_key.der
```

Step 3: Load the Key to ZooKeeper

The .der files that are output from Step 2 should then be loaded to ZooKeeper under a node `/keys/exe` so they are available throughout every node. You can load any number of public keys to that node and all are valid. If a key is removed from the directory, the signatures of that key will cease to be valid. So, before removing the a key, make sure to update your runtime library configurations with valid signatures with the `update-runtimelib` command.

At the current time, you can only use the ZooKeeper `zkCli.sh` (or `zkCli.cmd` on Windows) script to issue these commands (the Solr version has the same name, but is not the same). If you are running the embedded ZooKeeper that is included with Solr, you **do not** have this script already; in order to use it, you will need to download a copy of ZooKeeper v3.4.6 from http://zookeeper.apache.org/. Don't worry about configuring the download, you're just trying to get the command line utility script. When you start the script, you will connect to the embedded ZooKeeper. If you have your own ZooKeeper ensemble running already, you can find the script in `$ZK_INSTALL/bin/zkCli.sh` (or `zkCli.cmd` if you are using Windows).

To load the keys, you will need to connect to ZooKeeper with `zkCli.sh`, create the directories, and then create the key file, as in the following example.

```
# Connect to ZooKeeper
# Replace the server location below with the correct ZooKeeper connect string for
your installation.
$ .bin/zkCli.sh -server localhost:9983

# After connection, you will interact with the ZK prompt.
# Create the directories
[zk: localhost:9983(CONNECTED) 5] create /keys
[zk: localhost:9983(CONNECTED) 5] create /keys/exe

# Now create the public key file in ZooKeeper
# The second path is the path to the .der file on your local machine
[zk: localhost:9983(CONNECTED) 5] create /keys/exe/pub_key.der
/myLocal/pathTo/pub_key.der
```

After this, any attempt to load a jar will fail. All your jars must be signed with one of your private keys for Solr to trust it. The process to sign your jars and use the signature is outlined in Steps 4-6.

Step 4: Sign the jar File

Next you need to sign the sha1 digest of your jar file and get the base64 string.

```
$ openssl dgst -sha1 -sign priv_key.pem myjar.jar | openssl enc -base64
```

The output of this step will be a string that you will need to add the jar to your classpath in Step 6 below.

Step 5: Load the jar to the Blob Store

Load your jar to the Blob store, using the Blob Store API. This step does not require a signature; you will need the signature in Step 6 to add it to your classpath.

```
curl -X POST -H 'Content-Type: application/octet-stream' --data-binary @{filename}
http://localhost:8983/solr/.system/blob/{blobname}
```

The blob name that you give the jar file in this step will be used as the name in the next step.

Step 6: Add the jar to the Classpath

Finally, add the jar to the classpath using the Config API as detailed above. In this step, you will need to provide the signature of the jar that you got in Step 4.

```
curl http://localhost:8983/solr/techproducts/config -H
'Content-type:application/json'  -d '{
   "add-runtimelib" : {
      "name":"blobname",
      "version":2,

"sig":"mW1Gwtz2QazjfVdrLFHfbGwcr8xzFYgUOLu68LHqWRDvLG0uLcy1McQ+AzVmeZFBf1yLPDEHBWJb5
KXr8bdbHN/

PYgUB1nsr9pk4EFyD9KfJ8TqeH/ijQ9waa/vjqyiKEI9U550EtSzruLVZ32wJ7smvV0fj2YYhrUaaPzOn9g0
=" }
}'
```

JVM Settings

Configuring your JVM can be a complex topic. A full discussion is beyond the scope of this document. Luckily, most modern JVMs are quite good at making the best use of available resources with default settings. The following sections contain a few tips that may be helpful when the defaults are not optimal for your situation.

For more general information about improving Solr performance, see https://wiki.apache.org/solr/SolrPerformanceFactors.

Choosing Memory Heap Settings

The most important JVM configuration settings are those that determine the amount of memory it is allowed to allocate. There are two primary command-line options that set memory limits for the JVM. These are `-Xms`, which sets the initial size of the JVM's memory heap, and `-Xmx`, which sets the maximum size to which the heap is allowed to grow.

If your Solr application requires more heap space than you specify with the `-Xms` option, the heap will grow automatically. It's quite reasonable to not specify an initial size and let the heap grow as needed. The only downside is a somewhat slower startup time since the application will take longer to initialize. Setting the initial heap size higher than the default may avoid a series of heap expansions, which often results in objects being shuffled around within the heap, as the application spins up.

The maximum heap size, set with `-Xmx`, is more critical. If the memory heap grows to this size, object creation may begin to fail and throw `OutOfMemoryException`. Setting this limit too low can cause spurious errors in your application, but setting it too high can be detrimental as well.

It doesn't always cause an error when the heap reaches the maximum size. Before an error is raised, the JVM will first try to reclaim any available space that already exists in the heap. Only if all garbage collection attempts fail will your application see an exception. As long as the maximum is big enough, your app will run without error, but it may run more slowly if forced garbage collection kicks in frequently.

The larger the heap the longer it takes to do garbage collection. This can mean minor, random pauses or, in extreme cases, "freeze the world" pauses of a minute or more. As a practical matter, this can become a serious problem for heap sizes that exceed about two gigabytes, even if far more physical memory is available. On robust hardware, you may get better results running multiple JVMs, rather than just one with a large memory heap. Some specialized JVM implementations may have customized garbage collection algorithms that do better with large heaps. Also, Java 7 is expected to have a redesigned GC that should handle very large heaps efficiently. Consult your JVM vendor's documentation.

When setting the maximum heap size, be careful not to let the JVM consume all available physical memory. If the JVM process space grows too large, the operating system will start swapping it, which will severely impact performance. In addition, the operating system uses memory space not allocated to processes for file system cache and other purposes. This is especially important for I/O-intensive applications, like Lucene/Solr. The larger your indexes, the more you will benefit from filesystem caching by the OS. It may require some experimentation to determine the optimal tradeoff between heap space for the JVM and memory space for the OS to use.

On systems with many CPUs/cores, it can also be beneficial to tune the layout of the heap and/or the behavior of the garbage collector. Adjusting the relative sizes of the generational pools in the heap can affect how often GC sweeps occur and whether they run concurrently. Configuring the various settings of how the garbage collector should behave can greatly reduce the overall performance impact when it does run. There is a lot of good information on this topic available on Sun's website. A good place to start is here: Oracle's Java HotSpot Garbage Collection.

Use the Server HotSpot VM

If you are using Sun's JVM, add the `-server` command-line option when you start Solr. This tells the JVM that it should optimize for a long running, server process. If the Java runtime on your system is a JRE, rather than a full JDK distribution (including `javac` and other development tools), then it is possible that it may not support the `-server` JVM option. Test this by running `java -help` and look for `-server` as an available option in the displayed usage message.

Checking JVM Settings

A great way to see what JVM settings your server is using, along with other useful information, is to use the admin RequestHandler, `solr/admin/system`. This request handler will display a wealth of server statistics and settings.

You can also use any of the tools that are compatible with the Java Management Extensions (JMX). See the section *Using JMX with Solr* in Managing Solr for more information.

Managing Solr

This section describes how to run Solr and how to look at Solr when it is running. It contains the following sections:

Taking Solr to Production: Describes how to install Solr as a service on Linux for production environments.

Configuring Logging: Describes how to configure logging for Solr.

Enabling SSL: Describes how to configure single-node Solr and SolrCloud to encrypt internal and external communication using SSL.

Backing Up: Describes backup strategies for your Solr indexes.

Using JMX with Solr: Describes how to use Java Management Extensions with Solr.

Managed Resources: Describes the REST APIs for dealing with resources that various Solr plugins may expose.

Running Solr on HDFS: How to use HDFS to store your Solr indexes and transaction logs.

Taking Solr to Production

This section provides guidance on how to setup Solr to run in production on *nix platforms, such as Ubuntu. Specifically, we'll walk through the process of setting up to run a single Solr instance on a Linux host and then provide tips on how to support multiple Solr nodes running on the same host.

Service Installation Script

Solr includes a service installation script (`bin/install_solr_service.sh`) to help you install Solr as a service on Linux. Currently, the script only supports Red Hat, Ubuntu, Debian, and SUSE Linux distributions. Before running the script, you need to determine a few parameters about your setup. Specifically, you need to decide where to install Solr and which system user should be the owner of the Solr files and process.

Planning your directory structure

We recommend separating your live Solr files, such as logs and index files, from the files included in the Solr distribution bundle, as that makes it easier to upgrade Solr and is considered a good practice to follow as a system administrator.

Solr Installation Directory

By default, the service installation script will extract the distribution archive into `/opt`. You can change this location using the `-i` option when running the installation script. The script will also create a symbolic link to the versioned directory of Solr. For instance, if you run the installation script for Solr 5.0.0, then the following directory structure will be used:

```
/opt/solr-5.0.0
/opt/solr -> /opt/solr-5.0.0
```

Using a symbolic link insulates any scripts from being dependent on the specific Solr version. If, down the road, you need to upgrade to a later version of Solr, you can just update the symbolic link to point to the upgraded version of Solr. We'll use `/opt/solr` to refer to the Solr installation directory in the remaining sections of this page.

Separate Directory for Writable Files

You should also separate writable Solr files into a different directory; by default, the installation script uses `/var/solr`, but you can override this location using the `-d` option. With this approach, the files in `/opt/solr` will remain untouched and all files that change while Solr is running will live under `/var/solr`.

Create the Solr user

Running Solr as `root` is not recommended for security reasons. Consequently, you should determine the username of a system user that will own all of the Solr files and the running Solr process. By default, the installation script will create the **solr** user, but you can override this setting using the -u option. If your organization has specific requirements for creating new user accounts, then you should create the user before running the script. The installation script will make the Solr user the owner of the `/opt/solr` and `/var/solr` directories.

You are now ready to run the installation script.

Run the Solr Installation Script

To run the script, you'll need to download the latest Solr 5.x distribution archive and then do the following (NOTE: replace `solr-5.0.0` with the actual version number):

```
$ tar xzf solr-5.0.0.tgz solr-5.0.0/bin/install_solr_service.sh --strip-components=2
```

The previous command extracts the `install_solr_service.sh` script from the archive into the current directory. If installing on Red Hat, please make sure **lsof** is installed before running the Solr installation script (`sudo yum install lsof`). The installation script must be run as root:

```
$ sudo bash ./install_solr_service.sh solr-5.0.0.tgz
```

By default, the script extracts the distribution archive into `/opt`, configures Solr to write files into `/var/solr`, and runs Solr as the `solr` user. Consequently, the following command produces the same result as the previous command:

```
$ sudo bash ./install_solr_service.sh solr-5.0.0.tgz -i /opt -d /var/solr -u solr -s
solr -p 8983
```

You can customize the service name, installation directories, port, and owner using options passed to the installation script. To see available options, simply do:

```
$ sudo bash ./install_solr_service.sh -help
```

Once the script completes, Solr will be installed as a service and running in the background on your server (on port 8983). To verify, you can do:

```
$ sudo service solr status
```

We'll cover some additional configuration settings you can make to fine-tune your Solr setup in a moment. Before moving on, let's take a closer look at the steps performed by the installation script. This gives you a better overview and will help you understand important details about your Solr installation when reading other pages in this guide; such as when a page refers to Solr home, you'll know exactly where that is on your system.

Solr Home Directory

The Solr home directory (not to be confused with the Solr installation directory) is where Solr reads its main configuration file `solr.xml` and manages index files. By default, the installation script uses `/var/solr/data`. Take a moment to inspect the contents of the Solr home directory on your system. At a minimum, the home directory will contain a `solr.xml` file. When Solr starts up, the Solr start script passes the location of the home directory using the `-Dsolr.solr.home` system property.

Environment overrides include file

The service installation script creates an environment specific include file that overrides defaults used by the `bin/solr` script. The main advantage of using an include file is that it provides a single location where all of your environment-specific overrides are defined. Take a moment to inspect the contents of the `/var/solr/solr.in.sh` file, which is the default path setup by the installation script. There are many settings that you can override using this file. However, at a minimum, this script needs to define the `SOLR_PID_DIR` and `SOLR_HOME` variables , such as:

```
SOLR_PID_DIR=/var/solr
SOLR_HOME=/var/solr/data
```

The `SOLR_PID_DIR` variable sets the directory where the start script will write out a file containing the Solr server’s process ID.

Log settings

Solr uses Apache Log4J for logging. The installation script copies `/opt/solr/server/resources/log4j.properties` to `/var/solr/log4j.properties` and customizes it for your environment. Specifically it updates the Log4J settings to create logs in the `/var/solr/logs` directory. Take a moment to verify that the Solr include file is configured to send logs to the correct location by checking the following settings in `/var/solr/solr.in.sh` :

```
LOG4J_PROPS=/var/solr/log4j.properties
SOLR_LOGS_DIR=/var/solr/logs
```

For more information about Log4J configuration, please see: Configuring Logging

init.d script

When running a service like Solr on Linux, it's common to setup an init.d script so that system administrators can control Solr using the service tool, such as: `service solr start`. The installation script creates a very basic init.d script to help you get started. Take a moment to inspect the `/etc/init.d/solr` script and notice that the following variables are setup for your environment based on the parameters passed to the installation script:

```
SOLR_INSTALL_DIR=/opt/solr
SOLR_ENV=/var/solr/solr.in.sh
RUNAS=solr
```

The `SOLR_INSTALL_DIR` and `SOLR_ENV` variables should be self-explanatory. The `RUNAS` variable sets the owner of the Solr process, such as `solr`; if you don't set this value, the script will run Solr as **root**, which is not recommended for production. You can use the `/etc/init.d/solr` script to start Solr by doing the following as root:

```
# service solr start
```

The `/etc/init.d/solr` script also supports the **stop**, **restart**, and **status** commands. Please keep in mind that the init script that ships with Solr is very basic and is intended to show you how to setup Solr as a service. However, it's also common to use more advanced tools like **supervisord** or **upstart** to control Solr as a service on Linux. While showing how to integrate Solr with tools like supervisord is beyond the scope of this guide, the `init.d/solr` script should provide enough guidance to help you get started. Also, the installation script sets the Solr service to start automatically when the host machine initializes.

Progress Check

In the next section, we cover some additional environment settings to help you fine-tune your production setup. However, before we move on, let's review what we've achieved thus far. Specifically, you should be able to control Solr using `/etc/init.d/solr`. Please verify the following commands work with your setup:

```
$ sudo service solr restart
$ sudo service solr status
```

The status command should give some basic information about the running Solr node that looks similar to:

```
Solr process PID running on port 8983
{
  "version":"5.0.0 - ubuntu - 2014-12-17 19:36:58",
  "startTime":"2014-12-19T19:25:46.853Z",
  "uptime":"0 days, 0 hours, 0 minutes, 8 seconds",
  "memory":"85.4 MB (%17.4) of 490.7 MB"}
```

If the `status` command is not successful, look for error messages in `/var/solr/logs/solr.log`.

Fine tune your production setup

Memory and GC Settings

By default, the `bin/solr` script sets the maximum Java heap size to 512M (-Xmx512m), which is fine for getting started with Solr. For production, you'll want to increase the maximum heap size based on the memory requirements of your search application; values between 10 and 20 gigabytes are not uncommon for production servers. When you need to change the memory settings for your Solr server, use the `SOLR_JAVA_MEM` variable in the include file, such as:

```
SOLR_JAVA_MEM="-Xms10g -Xmx10g"
```

Also, the include file comes with a set of pre-configured Java Garbage Collection settings that have shown to work well with Solr for a number of different workloads. However, these settings may not work well for your specific use of Solr. Consequently, you may need to change the GC settings, which should also be done with the `GC_TUNE` variable in the `/var/solr/solr.in.sh` include file. For more information about tuning your memory and garbage collection settings, see: JVM Settings.

Out-of-Memory Shutdown Hook

The `bin/solr` script registers the `bin/oom_solr.sh` script to be called by the JVM if an OutOfMemoryError occurs. The `oom_solr.sh` script will issue a `kill -9` to the Solr process that experiences the `OutOfMemoryError`. This behavior is recommended when running in SolrCloud mode so that ZooKeeper is immediately notified that a node has experienced a non-recoverable error. Take a moment to inspect the contents of the `/opt/solr/bin/oom_solr.sh` script so that you are familiar with the actions the script will perform if it is invoked by the JVM.

SolrCloud

To run Solr in SolrCloud mode, you need to set the `ZK_HOST` variable in the include file to point to your ZooKeeper ensemble and set `SOLR_MODE=solrcloud`. Running the embedded ZooKeeper is not supported in production environments. For instance, if you have a ZooKeeper ensemble hosted on the following three hosts on the default client port 2181 (zk1, zk2, and zk3), then you would set:

```
SOLR_MODE=solrcloud
ZK_HOST=zk1,zk2,zk3
```

This will cause the script to launch Solr in “cloud” mode.

ZooKeeper chroot

If you're using a ZooKeeper instance that is shared by other systems, it's recommended to isolate the SolrCloud znode tree using ZooKeeper's chroot support. For instance, to ensure all znodes created by SolrCloud are stored under `/solr`, you can put `/solr` on the end of your `ZK_HOST` connection string, such as:

```
ZK_HOST=zk1,zk2,zk3/solr
```

If using a chroot for the first time, you need to bootstrap the Solr znode tree in ZooKeeper by using the `zkcli.sh` script, such as:

```
$ server/scripts/cloud-scripts/zkcli.sh -zkhost ZK_HOST -cmd bootstrap -solrhome
/var/solr/data
```

Solr Hostname

Use the `SOLR_HOST` variable in the include file to set the hostname of the Solr server.

```
SOLR_HOST=solr1.example.com
```

Setting the hostname of the Solr server is recommended, especially when running in SolrCloud mode, as this determines the address of the node when it registers with ZooKeeper.

Override settings in solrconfig.xml

Solr allows configuration properties to be overridden using Java system properties passed at startup using the `-Dproperty=value` syntax. For instance, in `solrconfig.xml`, the default auto soft commit settings are set to:

```
<autoSoftCommit>
  <maxTime>${solr.autoSoftCommit.maxTime:-1}</maxTime>
</autoSoftCommit>
```

In general, whenever you see a property in a Solr configuration file that uses the `${solr.PROPERTY:DEFAULT_VALUE}` syntax, then you know it can be overridden using a Java system property. For instance, to set the maxTime for soft-commits to be 10 seconds, then you can start Solr with `-Dsolr.autoSoftCommit.maxTime=10000`, such as:

```
$ bin/solr start -Dsolr.autoSoftCommit.maxTime=10000
```

The `bin/solr` script simply passes options starting with `-D` on to the JVM during startup. For running in production, we recommend setting these properties in the `SOLR_OPTS` variable defined in the include file. Keeping with our soft-commit example, in `/var/solr/solr.in.sh`, you would do:

```
SOLR_OPTS="$SOLR_OPTS -Dsolr.autoSoftCommit.maxTime=10000"
```

Enable Remote JMX Access

If you need to attach a JMX-enabled Java profiling tool, such as JConsole or VisualVM, to a remote Solr server, then you need to enable remote JMX access when starting the Solr server. Simply change the `ENABLE_REMOTE_JMX_OPTS` property in the include file to true. You’ll also need to choose a port for the JMX RMI connector to bind to, such as 18983. For example, if your Solr include script sets:

```
ENABLE_REMOTE_JMX_OPTS=true
RMI_PORT=18983
```

The JMX RMI connector will allow Java profiling tools to attach to port 18983. When enabled, the following properties are passed to the JVM when starting Solr:

```
-Dcom.sun.management.jmxremote \
-Dcom.sun.management.jmxremote.local.only=false \
-Dcom.sun.management.jmxremote.ssl=false \
-Dcom.sun.management.jmxremote.authenticate=false \
-Dcom.sun.management.jmxremote.port=18983 \
-Dcom.sun.management.jmxremote.rmi.port=18983
```

We don’t recommend enabling remote JMX access in production, but it can sometimes be useful when doing performance and user-acceptance testing prior to going into production.

Running multiple Solr nodes per host

The `bin/solr` script was designed to allow you to run multiple Solr nodes on the same host. At a minimum, you will need unique Solr home directories for each node you want to run; ideally, each home should be on a different physical disk so that multiple Solr nodes don’t have to compete with each other when accessing files on disk. Having different Solr home directories implies that you’ll need a different include file for each node. Moreover, if using the `/etc/init.d/solr` script to control Solr as a service, then you’ll need a separate script for each node. The easiest approach is to use the service installation script to add multiple services on the same host, such as:

```
$ sudo bash ./install_solr_service.sh solr-5.0.0.tgz -s solr2 -p 8984
```

The command shown above will add a service named `solr2` running on port 8984 using `/var/solr2` for writable (aka "live") files; the second server will still be owned and run by the `solr` user and will use the Solr distribution files in `/opt`. After installing the solr2 service, verify it works correctly by doing:

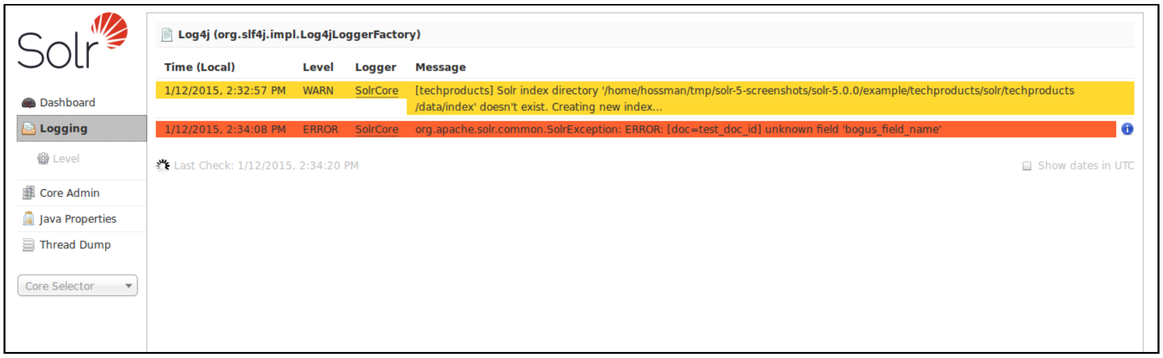
```
$ sudo service solr2 restart
$ sudo service solr2 status
```

Configuring Logging

In addition to the logging options described below, there is a way to configure which request parameters (such as parameters sent as part of queries) are logged with an additional request parameter called `logParamsList`. See the section on Common Query Parameters for more information.

Temporary Logging Settings

You can control the amount of logging output in Solr by using the Admin Web interface. Select the **LOGGING** link. Note that this page only lets you change settings in the running system and is not saved for the next run. (For more information about the Admin Web interface, see Using the Solr Administration User Interface.)



Log4j (org.slf4j.impl.Log4jLoggerFactory)

Time (Local)	Level	Logger	Message
1/12/2015, 2:32:57 PM	WARN	SolrCore	[techproducts] Solr index directory '/home/hossman/tmp/solr-5-screenshots/solr-5.0.0/example/techproducts/solr/techproducts /data/index' doesn't exist. Creating new index...
1/12/2015, 2:34:08 PM	ERROR	SolrCore	org.apache.solr.common.SolrException: ERROR: [doc=test_doc_id] unknown field 'bogus_field_name'

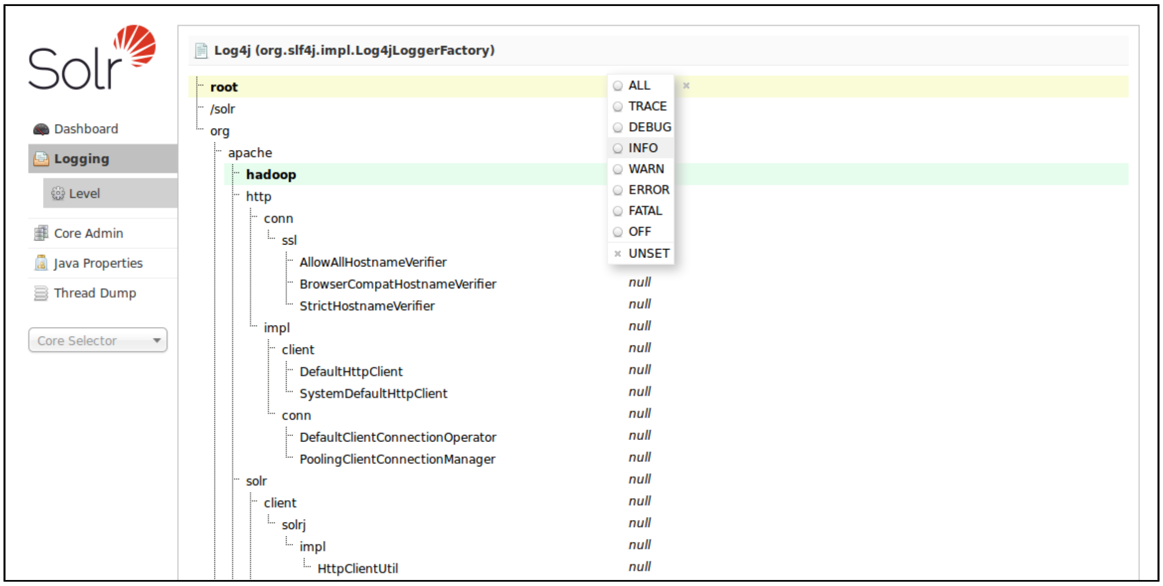
Last Check: 1/12/2015, 2:34:20 PM

□ Show dates in UTC

The Logging screen.

This part of the Admin Web interface allows you to set the logging level for many different log categories. Fortunately, any categories that are **unset** will have the logging level of its parent. This makes it possible to change many categories at once by adjusting the logging level of their parent.

When you select **Level**, you see the following menu:



Log4j (org.slf4j.impl.Log4jLoggerFactory)

```
root
/solr
org
  apache
    hadoop
    http
      conn
        ssl
          AllowAllHostnameVerifier                 null
          BrowserCompatHostnameVerifier            null
          StrictHostnameVerifier                   null
      impl                                         null
        client                                     null
          DefaultHttpClient                        null
          SystemDefaultHttpClient                  null
        conn                                       null
          DefaultClientConnectionOperator          null
          PoolingClientConnectionManager           null
    solr                                           null
      client                                       null
        solrj                                      null
          impl                                     null
            HttpClientUtil                         null
```

The Log Level Menu.

Directories are shown with their current logging levels. The Log Level Menu floats over these. To set a log level for a particular directory, select it and click the appropriate log level button.

Log levels settings are as follows:

Level	Result
FINEST	Reports everything.
FINE	Reports everything but the least important messages.
CONFIG	Reports configuration errors.
INFO	Reports everything but normal status.
WARNING	Reports all warnings.
SEVERE	Reports only the most severe warnings.

OFF	Turns off logging.
UNSET	Removes the previous log setting.

Multiple settings at one time are allowed.

Permanent Logging Settings

Solr uses Log4J version 1.2 for logging and is configured using `server/resources/log4j.properties`. Take a moment to inspect the contents of the `log4j.properties` file so that you are familiar with its structure. By default, Solr log messages will be written to `server/logs/solr.log` and to stdout (console), which is fine when you're just getting started with Solr.

When you're ready to deploy Solr in production, we recommend making a few minor changes to the log settings. Edit `log4j.properties` and set the `solr.log` property to the location where you want Solr to write log files, such as `/var/solr/logs`. Note that if you installed Solr as a service using the instructions provided at Taking Solr to Production, then see `/var/solr/log4j.properties` instead of the default `server/resources` version.

```
solr.log=/var/solr/logs
```

Alternatively, you can use the `solr.solr.home` system property to set the location of the log files, such as:

```
solr.log=${solr.solr.home}/../logs
```

During initialization, Log4J will resolve this to a path based on the `solr.solr.home` system property. While you’re customizing the `log4j.properties` file, we also recommend removing the CONSOLE appender from the rootLogger by changing the `log4j.rootLogger` property to:

```
log4j.rootLogger=INFO, file
```

Also, the default log rotation size threshold of 4MB is too small for production servers and should be increased to a larger value (such as 100MB or more).

```
log4j.appender.file.MaxFileSize=100MB
```

Logging Slow Queries

For high-volume search applications, logging every query can generate a large amount of logs and, depending on the volume, potentially impact performance. If you mine these logs for additional insights into your application, then logging every query request may be useful. On the other hand, if you're only concerned about warnings and error messages related to requests, then you can set the log verbosity to WARN. However, this poses a potential problem in that you won't know if any queries are slow, as slow queries are still logged at the INFO level. Solr provides a way to set your log verbosity threshold to WARN and be able to set a latency threshold above which a request is considered "slow" and log that request at the WARN level to help you identify slow queries in your application. To enable this behavior, configure the `<slowQueryThresholdMillis>` element in the **query** section of solrconfig.xml:

```
<slowQueryThresholdMillis>1000</slowQueryThresholdMillis>
```

Any queries that take longer than the specified threshold will be logged as "slow" queries at the WARN level.

Enabling SSL

Both SolrCloud and single-node Solr can encrypt communications to and from clients, and in SolrCloud between nodes, with SSL. This section describes enabling SSL with the example Jetty server using a self-signed certificate.

For background on SSL certificates and keys, see http://www.tldp.org/HOWTO/SSL-Certificates-HOWTO/.

Basic SSL Setup

Generate a self-signed certificate and a key

To generate a self-signed certificate and a single key that will be used to authenticate both the server and the client, we'll use the JDK `keytool` command and create a separate keystore. This keystore will also be used as a truststore below. It's possible to use the keystore that comes with the JDK for these purposes, and to use a separate truststore, but those options aren't covered here.

Run the commands below in the `server/etc/` directory in the binary Solr distribution. It's assumed that you have the JDK `keytool` utility on your `PATH`, and that `openssl` is also on your `PATH`. See https://www.openssl.org/related/binaries.html for OpenSSL binaries for Windows and Solaris.

The "`-ext SAN=...`" `keytool` option allows you to specify all the DNS names and/or IP addresses that will be allowed during hostname verification (but see below for how to skip hostname verification between Solr nodes so that you don't have to specify all hosts here). In addition to `localhost` and `127.0.0.1`, this example includes a LAN IP address `192.168.1.3` for the machine the Solr nodes will be running on:

```
keytool -genkeypair -alias solr-ssl -keyalg RSA -keysize 2048 -keypass secret
-storepass secret -validity 9999 -keystore solr-ssl.keystore.jks -ext
SAN=DNS:localhost,IP:192.168.1.3,IP:127.0.0.1 -dname "CN=localhost,
OU=Organizational Unit, O=Organization, L=Location, ST=State, C=Country"
```

The above command will create a keystore file named `solr-ssl.keystore.jks` in the current directory.

Convert the certificate and key to PEM format for use with cURL

cURL isn't capable of using JKS formatted keystores, so the JKS keystore needs to be converted to PEM format, which cURL understands.

First convert the JKS keystore into PKCS12 format using `keytool`:

```
keytool -importkeystore -srckeystore solr-ssl.keystore.jks -destkeystore
solr-ssl.keystore.p12 -srcstoretype jks -deststoretype pkcs12
```

The keytool application will prompt you to create a destination keystore password and for the source keystore password, which was set when creating the keystore ("secret" in the example shown above).

Next convert the PKCS12 format keystore, including both the certificate and the key, into PEM format using the `openssl` command:

```
openssl pkcs12 -in solr-ssl.keystore.p12 -out solr-ssl.pem
```

If you want to use cURL on OS X Yosemite (10.10), you'll need to create a certificate-only version of the PEM format, as follows:

```
openssl pkcs12 -nokeys -in solr-ssl.keystore.p12 -out solr-ssl.cacert.pem
```

Set common SSL related system properties

The Solr start script is already setup to pass SSL-related Java system properties to the JVM. To activate the SSL settings, uncomment and update the `SOLR_SSL_OPTS` variable in `bin/solr.in.sh`. (or `bin\solr.in.cmd` on Windows). Note, if you setup Solr as a service on Linux using the steps outlined in Taking Solr to Production, then make these changes in `/var/solr/solr.in.sh` instead.

bin/solr.in.sh example SOLR_SSL_OPTS configuration

```
SOLR_SSL_OPTS="-Djavax.net.ssl.keyStore=etc/solr-ssl.keystore.jks \
  -Djavax.net.ssl.keyStorePassword=secret \
  -Djavax.net.ssl.trustStore=etc/solr-ssl.keystore.jks \
  -Djavax.net.ssl.trustStorePassword=secret"
```

When you start Solr, the `bin/solr` script includes the settings in `bin/solr.in.sh` and will pass these SSL-related system properties to the JVM.

Similarly, when you start Solr on Windows, the `bin\solr.cmd` script includes the settings in `bin\solr.in.cmd` - uncomment and update the `SOLR_SSL_OPTS` variable to pass these SSL-related system properties to the JVM:

bin\solr.in.cmd example SOLR_SSL_OPTS configuration

```
set SOLR_SSL_OPTS=-Djavax.net.ssl.keyStore=etc\solr-ssl.keystore.jks ^
  -Djavax.net.ssl.keyStorePassword=secret ^
  -Djavax.net.ssl.trustStore=etc\solr-ssl.keystore.jks ^
  -Djavax.net.ssl.trustStorePassword=secret
```

Run Single Node Solr using SSL

Start Solr using the command shown below; by default clients will not be required to authenticate:

***nix command**

```
bin/solr -p 8984
```

Windows command

```
bin\solr.cmd -p 8984
```

Alternatively, to require clients to authenticate, you can set the `jetty.ssl.clientAuth` system property to `true` (default is `false`):

***nix command**

```
bin/solr -p 8984 -Djetty.ssl.clientAuth=true
```

Windows command

```
bin\solr.cmd -p 8984 -Djetty.ssl.clientAuth=true
```

Notice that Java system properties set using the `-Dproperty=value` syntax are passed through to the JVM by the `bin/solr` (or `bin\solr.cmd`) script.

SolrCloud

This section describes how to run a two-node SolrCloud cluster with no initial collections and a single-node external ZooKeeper. The commands below assume you have already created the keystore described above.

Configure ZooKeeper

> ZooKeeper does not support encrypted communication with clients like Solr. There are several related JIRA tickets where SSL support is being planned/worked on: ZOOKEEPER-235; ZOOKEEPER-236; ZOOKEEPER-733; and ZOOKEEPER-1000.

Before you start any SolrCloud nodes, you must configure your solr cluster properties in ZooKeeper, so that Solr nodes know to communicate via SSL.

This section assumes you have created and started a single-node external ZooKeeper on port 2181 on localhost

- see Setting Up an External ZooKeeper Ensemble

The `urlScheme` cluster-wide property needs to be set to `https` before any Solr node starts up. The example below uses the `zkcli.sh` client that comes with the binary Solr distribution to do this:

***nix command**

```
server/scripts/cloud-scripts/zkcli.sh -zkhost localhost:2181 -cmd put
/clusterprops.json '{"urlScheme":"https"}'
```

Windows command

```
server\scripts\cloud-scripts\zkcli.bat -zkhost localhost:2181 -cmd put
/clusterprops.json "{""urlScheme"":""https""}"
```

If you have set up your ZooKeeper cluster to use a chroot for Solr, make sure you place the `clusterprops.json` file there instead: `... -cmd put /my_chroot/clusterprops.json '{"urlScheme":"https"}'` (or on Windows: `... -cmd put /my_chroot/clusterprops.json "{""urlScheme"":""https""}"`).

Run SolrCloud with SSL

Create Solr home directories for two nodes

Create two copies of the `server/solr/` directory which will serve as the Solr home directories for each of your two SolrCloud nodes:

***nix commands**

```
mkdir cloud
cp -r server/solr cloud/node1
cp -r server/solr cloud/node2
```

Windows commands

```
mkdir cloud
xcopy /E server\solr cloud\node1\
xcopy /E server\solr cloud\node2\
```

Start the first Solr node

Next, start the first Solr node on port 8984; be sure to stop the standalone server if you started it when working through the previous section on this page:

***nix command**

```
bin/solr -cloud -s cloud/node1 -z localhost:2181 -p 8984
```

Windows command

```
bin\solr.cmd -cloud -s cloud\node1 -z localhost:2181 -p 8984
```

Notice the use of the `-s` option to set the location of the Solr home directory for node1. Moreover, the start script will set the `-Djetty.ssl.port` property to the value of the `-p` option (`8984` in this case). You can override this behavior by setting the `SOLR_SSL_PORT` variable in the include file.

If you created your SSL key without all DNS names/IP addresses on which Solr nodes will run, you can tell Solr to skip hostname verification for inter-Solr-node communications by setting the `solr.ssl.checkPeerName` system property to `false`:

*nix command

```
bin/solr -cloud -s cloud/node1 -z localhost:2181 -p 8984
-Dsolr.ssl.checkPeerName=false
```

Windows command

```
bin\solr.cmd -cloud -s cloud\node1 -z localhost:2181 -p 8984
-Dsolr.ssl.checkPeerName=false
```

Start the second Solr node

Finally, start the second Solr node on port 7574 - again, to skip hostname verification, add `-Dsolr.ssl.checkPeerName=false` (not shown here):

*nix command

```
bin/solr -cloud -s cloud/node2 -z localhost:2181 -p 7574
```

Windows command

```
bin\solr.cmd -cloud -s cloud\node2 -z localhost:2181 -p 7574
```

Example Client Actions

⚠ cURL on OS X Mavericks (10.9) has degraded SSL support. For more information and workarounds to allow 1-way SSL, see http://curl.haxx.se/mail/archive-2013-10/0036.html . cURL on OS X Yosemite (10.10) is improved - 2-way SSL is possible - see http://curl.haxx.se/mail/archive-2014-10/0053.html .

The cURL commands in the following sections will not work with the system `curl` on OS X Yosemite (10.10). Instead, the certificate supplied with the `-E` param must be in PKCS12 format, and the file supplied with the `--cacert` param must contain only the CA certificate, and no key (see above for instructions on creating this file):

```
curl -E solr-ssl.keystore.p12:secret --cacert solr-ssl.cacert.pem ...
```

ⓘ If your operating system does not include cURL, you can download binaries here: http://curl.haxx.se/download.html

Create a SolrCloud collection using `bin/solr`

Create a 2-shard, replicaFactor=1 collection named mycollection using the default configset (data_driven_schema_configs):

***nix command**

```
bin/solr create -c mycollection -shards 2
```

Windows command

```
bin\solr.cmd create -c mycollection -shards 2
```

The `create` action will pass the `SOLR_SSL_OPTS` set in your include file to the SolrJ code used to create the collection.

Retrieve SolrCloud cluster status using cURL

To get the resulting cluster status (again, if you have not enabled client authentication, remove the `-E solr-ssl.pem:secret` option):

```
curl -E solr-ssl.pem:secret --cacert solr-ssl.pem
"https://localhost:8984/solr/admin/collections?action=CLUSTERSTATUS&wt=json&indent=o
n"
```

You should get a response that looks like this:

```
{
 "responseHeader":{
  "status":0,
  "QTime":2041},
 "cluster":{
  "collections":{
   "mycollection":{
    "shards":{
     "shard1":{
      "range":"80000000-ffffffff",
      "state":"active",
      "replicas":{"core_node1":{
        "state":"active",
        "base_url":"https://127.0.0.1:8984/solr",
        "core":"mycollection_shard1_replica1",
        "node_name":"127.0.0.1:8984_solr",
        "leader":"true"}}},
     "shard2":{
      "range":"0-7fffffff",
      "state":"active",
      "replicas":{"core_node2":{
        "state":"active",
        "base_url":"https://127.0.0.1:7574/solr",
        "core":"mycollection_shard2_replica1",
        "node_name":"127.0.0.1:7574_solr",
        "leader":"true"}}}},
    "maxShardsPerNode":"1",
    "router":{"name":"compositeId"},
    "replicationFactor":"1"}},
  "properties":{"urlScheme":"https"}}}
```

Index documents using `post.jar`

Use `post.jar` to index some example documents to the SolrCloud collection created above:

```
cd example/exampledocs
java -Djavax.net.ssl.keyStorePassword=secret
-Djavax.net.ssl.keyStore=../../server/etc/solr-ssl.keystore.jks
-Djavax.net.ssl.trustStore=../../server/etc/solr-ssl.keystore.jks
-Djavax.net.ssl.trustStorePassword=secret
-Durl=https://localhost:8984/solr/mycollection/update -jar post.jar *.xml
```

Query using cURL

Use cURL to query the SolrCloud collection created above, from a directory containing the PEM formatted certificate and key created above (e.g. `example/etc/`) - if you have not enabled client authentication (system property `-Djetty.ssl.clientAuth=true`), then you can remove the `-E solr-ssl.pem:secret` option:

```
curl -E solr-ssl.pem:secret --cacert solr-ssl.pem
"https://localhost:8984/solr/mycollection/select?q=*:*&wt=json&indent=on"
```

Index a document using `CloudSolrClient`

From a java client using Solrj, index a document. In the code below, the `javax.net.ssl.*` system properties are set programmatically, but you could instead specify them on the java command line, as in the `post.jar` example above:

```
System.setProperty("javax.net.ssl.keyStore", "/path/to/solr-ssl.keystore.jks");
System.setProperty("javax.net.ssl.keyStorePassword", "secret");
System.setProperty("javax.net.ssl.trustStore", "/path/to/solr-ssl.keystore.jks");
System.setProperty("javax.net.ssl.trustStorePassword", "secret");
String zkHost = "127.0.0.1:2181";
CloudSolrClient server = new CloudSolrClient(zkHost);
server.setDefaultCollection("mycollection");
SolrInputDocument doc = new SolrInputDocument();
doc.addField("id", "1234");
doc.addField("name", "A lovely summer holiday");
server.add(doc);
server.commit();
```

Backing Up

If you are worried about data loss, and of course you *should* be, you need a way to back up your Solr indexes so that you can recover quickly in case of catastrophic failure.

Making Backups with the Solr Replication Handler

The easiest way to make back-ups in Solr is to take advantage of the Replication Handler, which is described in detail in Index Replication. The Replication Handler's primary purpose is to replicate an index on slave servers for load-balancing, but the Replication Handler can be used to make a back-up copy of a server's index, even if no slave servers are in operation.

Once you have configured the Replication Handler in `solrconfig.xml`, you can trigger a back-up with an HTTP command like this:

`http://`*`master_host`*`/solr/collection_name/replication?command=backup`

For details on configuring the Replication Handler, see Legacy Scaling and Distribution.

Using JMX with Solr

Java Management Extensions (JMX) is a technology that makes it possible for complex systems to be controlled by tools without the systems and tools having any previous knowledge of each other. In essence, it is a standard interface by which complex systems can be viewed and manipulated.

Solr, like any other good citizen of the Java universe, can be controlled via a JMX interface. You can enable JMX support by adding lines to `solrconfig.xml`. You can use a JMX client, like jconsole, to connect with Solr. Check out the Wiki page http://wiki.apache.org/solr/SolrJmx for more information. You may also find the following overview of JMX to be useful: http://docs.oracle.com/javase/7/docs/technotes/guides/management/agent.html.

Configuring JMX

JMX configuration is provided in `solrconfig.xml`. Please see the JMX Technology Home Page for more details.

A `rootName` attribute can be used when configuring `<jmx />` in `solrconfig.xml`. If this attribute is set, Solr uses it as the root name for all the MBeans that Solr exposes via JMX. The default name is "solr" followed by the core name.

> Enabling/disabling JMX and securing access to MBeanServers is left up to the user by specifying appropriate JVM parameters and configuration. Please explore the JMX Technology Home Page for more details.

Configuring an Existing MBeanServer

The command:

```
<jmx />
```

enables JMX support in Solr if and only if an existing MBeanServer is found. Use this if you want to configure JMX with JVM parameters. Remove this to disable exposing Solr configuration and statistics to JMX. If this is specified, Solr will try to list all available MBeanServers and use the first one to register MBeans.

Configuring an Existing MBeanServer with agentId

The command:

```
<jmx agentId="myMBeanServer" />
```

enables JMX support in Solr if and only if an existing MBeanServer is found matching the given agentId. If multiple servers are found, the first one is used. If none is found, an exception is raised and depending on the configuration, Solr may refuse to start.

Configuring a New MBeanServer

The command:

```
<jmx serviceUrl="service:jmx:rmi:///jndi/rmi://localhost:9999/solrjmx" />
```

creates a new MBeanServer exposed for remote monitoring at the specific service URL. If the JMXConnectorServer can't be started (probably because the serviceUrl is bad), an exception is thrown.

Example

Solr's `sample_techproducts_configs` config set uses the simple `<jmx />` configuration option. If you start the example with the necessary JVM system properties to launch an internal MBeanServer, Solr will register with it and you can connect using a tool like `jconsole`:

1. Launch the `techproducts` example with JMX enabled:

   ```
   bin/solr -e techproducts -a '-Dcom.sun.management.jmxremote'
   ```

2. Start `jconsole` (provided with the Sun JDK in the bin directory).
3. Connect to the "`start.jar`" shown in the list of local processes.

4. Switch to the "MBeans" tab. You should be able to see "`solr/techproducts`" listed there, at which point you can drill down and see details of every solr plugin.

Configuring a Remote Connection to Solr JMX

If you want to connect to Solr remotely, you need to pass in some extra parameters, documented here:

http://docs.oracle.com/javase/7/docs/technotes/guides/management/agent.html

> ⚠ Making JMX connections into machines running behind NATs (e.g. Amazon's EC2 service) is not a simple task. The `java.rmi.server.hostname` system property may help, but running `jconsole` on the server itself and using a remote desktop is often the simplest solution. See http://web.archive.org/web/20130525022506/http://jmsbrdy.com/monitoring-java-applications-running-on-ec2-i.

Running Solr on HDFS

Solr has support for writing and reading its index and transaction log files to the HDFS distributed filesystem. This does not use Hadoop Map-Reduce to process Solr data, rather it only uses the HDFS filesystem for index and transaction log file storage.

Basic Configuration

To use HDFS rather than a local filesystem, you must be using Hadoop 2.x and configure `solrconfig.xml` properly.

- You need to use an HdfsDirectoryFactory and a data dir of the form `hdfs://host:port/path`
- You need to specify an UpdateLog location of the form `hdfs://host:port/path`
- You should specify a lock factory type of '`hdfs`' or none.

With the default configuration files, you can start Solr on HDFS with the following command:

```
java -Dsolr.directoryFactory=HdfsDirectoryFactory
     -Dsolr.lock.type=hdfs
     -Dsolr.data.dir=hdfs://host:port/path
     -Dsolr.updatelog=hdfs://host:port/path -jar start.jar
```

SolrCloud Configuration

In SolrCloud mode, it's best to leave the data and update log directories as the defaults Solr comes with and simply specify the solr.hdfs.home. All dynamically created collections will create the appropriate directories automatically under the solr.hdfs.home root directory.

- Set solr.hdfs.home in the form `hdfs://host:port/path`
- You should specify a lock factory type of '`hdfs`' or none.

With the default configuration files, you can start SolrCloud on HDFS with the following command:

```
java -Dsolr.directoryFactory=HdfsDirectoryFactory
     -Dsolr.lock.type=hdfs
     -Dsolr.hdfs.home=hdfs://host:port/path
```

The Block Cache

For performance, the HdfsDirectoryFactory uses a Directory that will cache HDFS blocks. This caching mechanism is meant to replace the standard file system cache that Solr utilizes so much. By default, this cache is allocated off heap. This cache will often need to be quite large and you may need to raise the off heap memory limit for the specific JVM you are running Solr in. For the Oracle/OpenJDK JVMs, the follow is an example command line parameter that you can use to raise the limit when starting Solr:

```
-XX:MaxDirectMemorySize=20g
```

Settings

The HdfsDirectoryFactory has a number of settings.

Solr HDFS Settings

Param	Example Value	Default	Description
`solr.hdfs.home`	hdfs://host:port/path/solr	N/A	A root location in HDFS for Solr to write collection data to. Rather than specifying an HDFS location for the data directory or update log directory, use this to specify one root location and have everything automatically created within this HDFS location.

Block Cache Settings

Param	Default	Description
`solr.hdfs.blockcache.enabled`	true	Enable the blockcache
`solr.hdfs.blockcache.read.enabled`	true	Enable the read cache
`solr.hdfs.blockcache.write.enabled`	true	Enable the write cache
`solr.hdfs.blockcache.direct.memory.allocation`	true	Enable direct memory allocation. If this is false, heap is used
`solr.hdfs.blockcache.slab.count`	1	Number of memory slabs to allocate. Each slab is 128 MB in size.
`solr.hdfs.blockcache.global`	false	Enable/Disable using one global cache for all SolrCores. The settings used will be from the first HdfsDirectoryFactory created.

NRTCachingDirectory Settings

Param	Default	Description
`solr.hdfs.nrtcachingdirectory.enable`	true	Enable the use of NRTCachingDirectory
`solr.hdfs.nrtcachingdirectory.maxmergesizemb`	16	NRTCachingDirectory max segment size for merges
`solr.hdfs.nrtcachingdirectory.maxcachedmb`	192	NRTCachingDirectory max cache size

HDFS Client Configuration Settings

solr.hdfs.confdir pass the location of HDFS client configuration files - needed for HDFS HA for example.

Param	Default	Description
`solr.hdfs.confdir`	N/A	Pass the location of HDFS client configuration files - needed for HDFS HA for example.

Kerberos Authentication Settings

Hadoop can be configured to use the Kerberos protocol to verify user identity when trying to access core services like HDFS. If your HDFS directories are protected using Kerberos, then you need to configure Solr's HdfsDirectoryFactory to authenticate using Kerberos in order to read and write to HDFS. To enable Kerberos authentication from Solr, you need to set the following parameters:

Param	Default	Description
`solr.hdfs.security.kerberos.enabled`	false	Set to true to enable Kerberos authentication
`solr.hdfs.security.kerberos.keytabfile`	N/A	A keytab file contains pairs of Kerberos principals and encrypted keys which allows for password-less authentication when Solr attempts to authenticate with secure Hadoop. This file will need to be present on all Solr servers at the same path provided in this parameter.
`solr.hdfs.security.kerberos.principal`	N/A	The Kerberos principal that Solr should use to authenticate to secure Hadoop; the format of a typical Kerberos V5 principal is: `primary/instance@realm`

Example

```
<directoryFactory name="DirectoryFactory" class="solr.HdfsDirectoryFactory">
  <str name="solr.hdfs.home">hdfs://host:port/solr</str>
  <bool name="solr.hdfs.blockcache.enabled">true</bool>
  <int name="solr.hdfs.blockcache.slab.count">1</int>
  <bool name="solr.hdfs.blockcache.direct.memory.allocation">true</bool>
  <int name="solr.hdfs.blockcache.blocksperbank">16384</int>
  <bool name="solr.hdfs.blockcache.read.enabled">true</bool>
  <bool name="solr.hdfs.blockcache.write.enabled">true</bool>
  <bool name="solr.hdfs.nrtcachingdirectory.enable">true</bool>
  <int name="solr.hdfs.nrtcachingdirectory.maxmergesizemb">16</int>
  <int name="solr.hdfs.nrtcachingdirectory.maxcachedmb">192</int>
</directoryFactory>
```

If using Kerberos, you will need to add the three Kerberos related properties to the `<directoryFactory>` element in solrconfig.xml, such as:

```
<directoryFactory name="DirectoryFactory" class="solr.HdfsDirectoryFactory">
   ...
  <bool name="solr.hdfs.security.kerberos.enabled">true</bool>
  <str name="solr.hdfs.security.kerberos.keytabfile">/etc/krb5.keytab</str>
  <str name="solr.hdfs.security.kerberos.principal">solr/admin@KERBEROS.COM</str>
</directoryFactory>
```

Limitations

You must use an 'append-only' Lucene index codec because HDFS is an append only filesystem. The currently default codec used by Solr is 'append-only' and supported with HDFS.

Automatically Add Replicas in SolrCloud

One benefit to running Solr in HDFS is the ability to automatically add new replicas when the Overseer notices that a shard has gone down. Because the "gone" index shards are stored in HDFS, the a new core will be created and the new core will point to the existing indexes in HDFS.

Collections created using `autoAddReplicas=true` on a shared file system have automatic addition of replicas enabled. The following settings can be used to override the defaults in the `<solrcloud>` section of `solr.xml`.

Param	Default	Description
autoReplicaFailoverWorkLoopDelay	10000	The time (in ms) between clusterstate inspections by the Overseer to detect and possibly act on creation of a replacement replica.
autoReplicaFailoverWaitAfterExpiration	30000	The minimum time (in ms) to wait for initiating replacement of a replica after first noticing it not being live. This is important to prevent false positives while stoping or starting the cluster.
autoReplicaFailoverBadNodeExpiration	60000	The delay (in ms) after which a replica marked as down would be unmarked.

Temporarily disable autoAddReplicas for the entire cluster

When doing offline maintenance on the cluster and for various other use cases where an admin would like to temporarily disable auto addition of replicas, the following APIs will disable and re-enable autoAddReplicas for **all collections in the cluster**:

Disable auto addition of replicas cluster wide by setting the cluster property `autoAddReplicas` to `false`:

```
http://localhost:8983/solr/admin/collections?action=CLUSTERPROP&name=autoAddReplicas
&val=false
```

Re-enable auto addition of replicas (for those collections created with autoAddReplica=true) by unsetting the `autoAddReplicas` cluster property (when no `val` param is provided, the cluster property is unset):

```
http://localhost:8983/solr/admin/collections?action=CLUSTERPROP&name=autoAddReplicas
```

SolrCloud

Apache Solr includes the ability to set up a cluster of Solr servers that combines fault tolerance and high availability. Called **SolrCloud**, these capabilities provide distributed indexing and search capabilities, supporting the following features:

- Central configuration for the entire cluster
- Automatic load balancing and fail-over for queries
- ZooKeeper integration for cluster coordination and configuration.

SolrCloud is flexible distributed search and indexing, without a master node to allocate nodes, shards and replicas. Instead, Solr uses ZooKeeper to manage these locations, depending on configuration files and schemas. Documents can be sent to any server and ZooKeeper will figure it out.

In this section, we'll cover everything you need to know about using Solr in SolrCloud mode. We've split up the details into the following topics:

- Getting Started with SolrCloud
- How SolrCloud Works
    - Nodes, Cores, Clusters and Leaders
    - Shards and Indexing Data in SolrCloud
    - Distributed Requests
    - Read and Write Side Fault Tolerance
    - NRT, Replication, and Disaster Recovery with SolrCloud
- SolrCloud Configuration and Parameters
    - Setting Up an External ZooKeeper Ensemble
    - Using ZooKeeper to Manage Configuration Files
    - ZooKeeper Access Control
    - Collections API
    - Parameter Reference
    - Command Line Utilities
    - SolrCloud with Legacy Configuration Files

You can also find more information on the Solr wiki page on SolrCloud.

Getting Started with SolrCloud

SolrCloud is designed to provide a highly available, fault tolerant environment for distributing your indexed content and query requests across multiple servers. It's a system in which data is organized into multiple pieces, or shards, that can be hosted on multiple machines, with replicas providing redundancy for both scalability and fault tolerance, and a ZooKeeper server that helps manage the overall structure so that both indexing and search requests can be routed properly.

This section explains SolrCloud and its inner workings in detail, but before you dive in, it's best to have an idea of what it is you're trying to accomplish. This page provides a simple tutorial to start Solr in SolrCloud mode, so you can begin to get a sense for how shards interact with each other during indexing and when serving queries. To that end, we'll use simple examples of configuring SolrCloud on a single machine, which is obviously not a real production environment, which would include several servers or virtual machines. In a real production environment, you'll also use the real machine names instead of "localhost" which we've used here.

In this section you will learn how to start a SolrCloud cluster using startup scripts and a specific configset.

This tutorial assumes that you're already familiar with the basics of using Solr. If you need a refresher, please see the Getting Started section to get a grounding in Solr concepts. If you load documents as part of that exercise, you should start over with a fresh Solr installation for these SolrCloud tutorials.

SolrCloud Example

Interactive Startup

The `bin/solr` script makes it easy to get started with SolrCloud as it walks you through the process of launching Solr nodes in cloud mode and adding a collection. To get started, simply do:

```
$ bin/solr -e cloud
```

This starts an interactive session to walk you through the steps of setting up a simple SolrCloud cluster with embedded ZooKeeper. The script starts by asking you how many Solr nodes you want to run in your local cluster, with the default being 2.

```
Welcome to the SolrCloud example!

This interactive session will help you launch a SolrCloud cluster on your local
workstation.
To begin, how many Solr nodes would you like to run in your local cluster? (specify
1-4 nodes) [2]
```

The script supports starting up to 4 nodes, but we recommend using the default of 2 when starting out. These nodes will each exist on a single machine, but will use different ports to mimic operation on different servers.

Next, the script will prompt you for the port to bind each of the Solr nodes to, such as:

```
 Please enter the port for node1 [8983]
```

Choose any available port for each node; the default for the first node is 8983 and 7574 for the second node. The script will start each node in order and shows you the command it uses to start the server, such as:

```
solr start -cloud -s example/cloud/node1/solr -p 8983
```

The first node will also start an embedded ZooKeeper server bound to port 9983. The Solr home for the first node is in `example/cloud/node1/solr` as indicated by the `-s` option.

After starting up all nodes in the cluster, the script prompts you for the name of the collection to create:

```
 Please provide a name for your new collection: [gettingstarted]
```

The suggested default is "gettingstarted" but you might want to choose a name more appropriate for your specific search application.

Next, the script prompts you for the number of shards to distribute the collection across. Sharding is covered in more detail later on, so if you're unsure, we suggest using the default of 2 so that you can see how a collection is distributed across multiple nodes in a SolrCloud cluster.

Next, the script will prompt you for the number of replicas to create for each shard. Replication is covered in more detail later in the guide, so if you're unsure, then use the default of 2 so that you can see how replication is handled in SolrCloud.

Lastly, the script will prompt you for the name of a configuration directory for your collection. You can choose **basic_configs**, **data_driven_schema_configs**, or **sample_techproducts_configs**. The configuration directories are pulled from `server/solr/configsets/` so you can review them beforehand if you wish. The **data_driven_schema_configs** configuration (the default) is useful when you're still designing a schema for your documents and need some flexiblity as you experiment with Solr.

At this point, you should have a new collection created in your local SolrCloud cluster. To verify this, you can run the status command:

```
$ bin/solr status
```

If you encounter any errors during this process, check the Solr log files in `example/cloud/node1/logs` and `example/cloud/node2/logs`.

You can see how your collection is deployed across the cluster by visiting the cloud panel in the Solr Admin UI: http://localhost:8983/solr/#/~cloud. Solr also provides a way to perform basic diagnostics for a collection using the healthcheck command:

```
$ bin/solr healthcheck -c gettingstarted
```

The healthcheck command gathers basic information about each replica in a collection, such as number of docs, current status (active, down, etc), and address (where the replica lives in the cluster).

Documents can now be added to SolrCloud using the Post Tool.

To stop Solr in SolrCloud mode, you would use the `bin/solr` script and issue the `stop` command, as in:

```
$ bin/solr stop -all
```

Starting with -noprompt

You can also get SolrCloud started with all the defaults instead of the interactive session using the following command:

```
$ bin/solr -e cloud -noprompt
```

Restarting Nodes

You can restart your SolrCloud nodes using the `bin/solr` script. For instance, to restart node1 running on port 8983 (with an embedded ZooKeeper server), you would do:

```
$ bin/solr restart -c -p 8983 -s example/cloud/node1/solr
```

To restart node2 running on port 7574, you can do:

```
$ bin/solr restart -c -p 7574 -z localhost:9983 -s example/cloud/node2/solr
```

Notice that you need to specify the ZooKeeper address (-z localhost:9983) when starting node2 so that it can join the cluster with node1.

Adding a node to a cluster

Adding a node to an existing cluster is a bit advanced and involves a little more understanding of Solr. Once you startup a SolrCloud cluster using the startup scripts, you can add a new node to it by:

```
$ mkdir <solr.home for new solr node>
$ cp <existing solr.xml path> <new solr.home>
$ bin/solr start -cloud -s solr.home/solr -p <port num> -z <zk hosts string>
```

Notice that the above requires you to create a Solr home directory and copy `solr.xml` to it.

Example (with directory structure) that adds a node to an example started with "bin/solr -e cloud":

```
$ mkdir -p example/cloud/node3/solr
$ cp server/solr/solr.xml example/cloud/node3/solr
$ bin/solr start -cloud -s example/cloud/node3/solr -p 8987 -z localhost:9983
```

The previous command will start another Solr node on port 8987 with Solr home set to `example/cloud/node3/solr`. The new node will write its log files to `example/cloud/node3/logs`.

Once you're comfortable with how the SolrCloud example works, we recommend using the process described in Taking Solr to Production for setting up SolrCloud nodes in production.

How SolrCloud Works

In this section, we'll discuss generally how SolrCloud works, covering these topics:

- Nodes, Cores, Clusters and Leaders
- Shards and Indexing Data in SolrCloud
- Distributed Requests
- Read and Write Side Fault Tolerance
- NRT, Replication, and Disaster Recovery with SolrCloud

If you are already familiar with SolrCloud concepts and functionality, you can skip to the section covering SolrCloud Configuration and Parameters.

Basic SolrCloud Concepts

On a single node, Solr has a **core** that is essentially a single **index**. If you want multiple indexes, you create multiple cores. With SolrCloud, a single index can span multiple Solr instances. This means that a single index can be made up of multiple cores on different machines.

The cores that make up one logical index are called a **collection**. A collection is a essentially a single index that can span many cores, both for index scaling as well as redundancy. If, for instance, you wanted to move your two-core Solr setup to SolrCloud, you would have 2 collections, each made up of multiple individual cores.

In SolrCloud you can have multiple collections. Collections can be divided into shards. Each **shard** can exist in multiple copies; these copies of the same shard are called replicas. One of the replicas within a shard is the **leader**, designated by a leader-election process. Each **replica** is a physical index, so one replica corresponds to one core.

It is important to understand the distinction between a core and a collection. In classic single node Solr, a core is basically equivalent to a collection in that it presents one logical index. In SolrCloud, the cores on multiple nodes form a collection. This is still just one logical index, but multiple cores host different shards of the full collection. So a core encapsulates a single physical index on an instance. A collection is a combination of all of the cores that together provide a logical index that is distributed across many nodes.

Nodes, Cores, Clusters and Leaders

Nodes and Cores

In SolrCloud, a *node* is Java Virtual Machine instance running Solr, commonly called a server. Each Solr core can also be considered a node. Any node can contain both an instance of Solr and various kinds of data.

A Solr *core* is basically an index of the text and fields found in documents. A single Solr instance can contain multiple "cores", which are separate from each other based on local criteria. It might be that they are going to provide different search interfaces to users (customers in the US and customers in Canada, for example), or they have security concerns (some users cannot have access to some documents), or the documents are really different and just won't mix well in the same index (a shoe database and a dvd database).

When you start a new core in SolrCloud mode, it registers itself with ZooKeeper. This involves creating an Ephemeral node that will go away if the Solr instance goes down, as well as registering information about the core and how to contact it (such as the base Solr URL, core name, etc). Smart clients and nodes in the cluster can use this information to determine who they need to talk to in order to fulfill a request.

New Solr cores may also be created and associated with a collection via CoreAdmin. Additional cloud-related parameters are discussed in the Parameter Reference page. Terms used for the CREATE action are:

- **collection**: the name of the collection to which this core belongs. Default is the name of the core.
- **shard**: the shard id this core represents. (Optional: normally you want to be auto assigned a shard id.)
- **collection.<param>=<value>**: causes a property of `<param>=<value>` to be set if a new collection is being created. For example, use `collection.configName=<configname>` to point to the config for a new collection.

For example:

```
curl  'http://localhost:8983/solr/admin/cores?
     action=CREATE&name=mycore&collection=my_collection&shard=shard2'
```

Clusters

A cluster is set of Solr nodes managed by ZooKeeper as a single unit. When you have a cluster, you can always make requests to the cluster and if the request is acknowledged, you can be sure that it will be managed as a unit and be durable, i.e., you won't lose data. Updates can be seen right after they are made and the cluster can be expanded or contracted.

Creating a Cluster

A cluster is created as soon as you have more than one Solr instance registered with ZooKeeper. The section Getting Started with SolrCloud reviews how to set up a simple cluster.

Resizing a Cluster

Clusters contain a settable number of shards. You set the number of shards for a new cluster by passing a system property, `numShards`, when you start up Solr. The `numShards` parameter must be passed on the first startup of any Solr node, and is used to auto-assign which shard each instance should be part of. Once you have started up more Solr nodes than `numShards`, the nodes will create replicas for each shard, distributing them evenly across the node, as long as they all belong to the same collection.

To add more cores to your collection, simply start the new core. You can do this at any time and the new core will sync its data with the current replicas in the shard before becoming active.

You can also avoid `numShards` and manually assign a core a shard ID if you choose.

The number of shards determines how the data in your index is broken up, so you cannot change the number of shards of the index after initially setting up the cluster.

However, you do have the option of breaking your index into multiple shards to start with, even if you are only using a single machine. You can then expand to multiple machines later. To do that, follow these steps:

1. Set up your collection by hosting multiple cores on a single physical machine (or group of machines). Each of these shards will be a leader for that shard.
2. When you're ready, you can migrate shards onto new machines by starting up a new replica for a given shard on each new machine.
3. Remove the shard from the original machine. ZooKeeper will promote the replica to the leader for that shard.

Leaders and Replicas

The concept of a *leader* is similar to that of *master* when thinking of traditional Solr replication. The leader is responsible for making sure the *replicas* are up to date with the same information stored in the leader.

However, with SolrCloud, you don't simply have one master and one or more "slaves", instead you likely have distributed your search and index traffic to multiple machines. If you have bootstrapped Solr with `numShards=2`, for example, your indexes are split across both shards. In this case, both shards are considered leaders. If you start more Solr nodes after the initial two, these will be automatically assigned as replicas for the leaders.

Replicas are assigned to shards in the order they are started the first time they join the cluster. This is done in a round-robin manner, unless the new node is manually assigned to a shard with the `shardId` parameter during startup. This parameter is used as a system property, as in `-DshardId=1`, the value of which is the ID number of the shard the new node should be attached to.

On subsequent restarts, each node joins the same shard that it was assigned to the first time the node was started (whether that assignment happened manually or automatically). A node that was previously a replica, however, may become the leader if the previously assigned leader is not available.

Consider this example:

- Node A is started with the bootstrap parameters, pointing to a stand-alone ZooKeeper, with the `numShards` parameter set to 2.

- Node B is started and pointed to the stand-alone ZooKeeper.

Nodes A and B are both shards, and have fulfilled the 2 shard slots we defined when we started Node A. If we look in the Solr Admin UI, we'll see that both nodes are considered leaders (indicated with a solid blank circle).

- Node C is started and pointed to the stand-alone ZooKeeper.

Node C will automatically become a replica of Node A because we didn't specify any other shard for it to belong to, and it cannot become a new shard because we only defined two shards and those have both been taken.

- Node D is started and pointed to the stand-alone ZooKeeper.

Node D will automatically become a replica of Node B, for the same reasons why Node C is a replica of Node A.

Upon restart, suppose that Node C starts before Node A. What happens? Node C will become the leader, while Node A becomes a replica of Node C.

Shards and Indexing Data in SolrCloud

When your data is too large for one node, you can break it up and store it in sections by creating one or more **shards**. Each is a portion of the logical index, or core, and it's the set of all nodes containing that section of the index.

A shard is a way of splitting a core over a number of "servers", or nodes. For example, you might have a shard for data that represents each state, or different categories that are likely to be searched independently, but are often combined.

Before SolrCloud, Solr supported Distributed Search, which allowed one query to be executed across multiple shards, so the query was executed against the entire Solr index and no documents would be missed from the search results. So splitting the core across shards is not exclusively a SolrCloud concept. There were, however, several problems with the distributed approach that necessitated improvement with SolrCloud:

1. Splitting of the core into shards was somewhat manual.
2. There was no support for distributed indexing, which meant that you needed to explicitly send documents to a specific shard; Solr couldn't figure out on its own what shards to send documents to.
3. There was no load balancing or failover, so if you got a high number of queries, you needed to figure out where to send them and if one shard died it was just gone.

SolrCloud fixes all those problems. There is support for distributing both the index process and the queries automatically, and ZooKeeper provides failover and load balancing. Additionally, every shard can also have multiple replicas for additional robustness.

In SolrCloud there are no masters or slaves. Instead, there are leaders and replicas. Leaders are automatically elected, initially on a first-come-first-served basis, and then based on the Zookeeper process described at http://zookeeper.apache.org/doc/trunk/recipes.html#sc_leaderElection..

If a leader goes down, one of its replicas is automatically elected as the new leader. As each node is started, it's assigned to the shard with the fewest replicas. When there's a tie, it's assigned to the shard with the lowest shard ID.

When a document is sent to a machine for indexing, the system first determines if the machine is a replica or a leader.

- If the machine is a replica, the document is forwarded to the leader for processing.
- If the machine is a leader, SolrCloud determines which shard the document should go to, forwards the

document the leader for that shard, indexes the document for this shard, and forwards the index notation to itself and any replicas.

Document Routing

Solr offers the ability to specify the router implementation used by a collection by specifying the `router.name` parameter when creating your collection. If you use the "`compositeId`" router, you can send documents with a prefix in the document ID which will be used to calculate the hash Solr uses to determine the shard a document is sent to for indexing. The prefix can be anything you'd like it to be (it doesn't have to be the shard name, for example), but it must be consistent so Solr behaves consistently. For example, if you wanted to co-locate documents for a customer, you could use the customer name or ID as the prefix. If your customer is "IBM", for example, with a document with the ID "12345", you would insert the prefix into the document id field: "IBM!12345". The exclamation mark ('!') is critical here, as it distinguishes the prefix used to determine which shard to direct the document to.

Then at query time, you include the prefix(es) into your query with the `_route_` parameter (i.e., `q=solr&_route_=IBM!`) to direct queries to specific shards. In some situations, this may improve query performance because it overcomes network latency when querying all the shards.

> ⚠ The `_route_` parameter replaces `shard.keys`, which has been deprecated and will be removed in a future Solr release.

The `compositeId` router supports prefixes containing up to 2 levels of routing. For example: a prefix routing first by region, then by customer: "USA!IBM!12345"

If you do not want to influence how documents are stored, you don't need to specify a prefix in your document ID.

If you created the collection and defined the "implicit" router at the time of creation, you can additionally define a `router.field` parameter to use a field from each document to identify a shard where the document belongs. If the field specified is missing in the document, however, the document will be rejected. You could also use the `_route_` parameter to name a specific shard.

Shard Splitting

When you create a collection in SolrCloud, you decide on the initial number shards to be used. But it can be difficult to know in advance the number of shards that you need, particularly when organizational requirements can change at a moment's notice, and the cost of finding out later that you chose wrong can be high, involving creating new cores and re-indexing all of your data.

The ability to split shards is in the Collections API. It currently allows splitting a shard into two pieces. The existing shard is left as-is, so the split action effectively makes two copies of the data as new shards. You can delete the old shard at a later time when you're ready.

More details on how to use shard splitting is in the section on the Collections API.

Ignoring Commits from Client Applications in SolrCloud

In most cases, when running in SolrCloud mode, indexing client applications should not send explicit commit requests. Rather, you should configure auto commits with `openSearcher=false` and auto soft-commits to make recent updates visible in search requests. This ensures that auto commits occur on a regular schedule in the cluster. To enforce a policy where client applications should not send explicit commits, you should update all client applications that index data into SolrCloud. However, that is not always feasible, so Solr provides the IgnoreCommitOptimizeUpdateProcessorFactory, which allows you to ignore explicit commits and/or optimize requests from client applications without having refactor your client application code. To activate this request processor you'll need to add the following to your solrconfig.xml:

```
<updateRequestProcessorChain name="ignore-commit-from-client" default="true">
    <processor class="solr.IgnoreCommitOptimizeUpdateProcessorFactory">
      <int name="statusCode">200</int>
    </processor>
    <processor class="solr.LogUpdateProcessorFactory" />
    <processor class="solr.DistributedUpdateProcessorFactory" />
    <processor class="solr.RunUpdateProcessorFactory" />
  </updateRequestProcessorChain>
```

As shown in the example above, the processor will return 200 to the client but will ignore the commit / optimize request. Notice that you need to wire-in the implicit processors needed by SolrCloud as well, since this custom chain is taking the place of the default chain.

In the following example, the processor will raise an exception with a 403 code with a customized error message:

```
<updateRequestProcessorChain name="ignore-commit-from-client" default="true">
    <processor class="solr.IgnoreCommitOptimizeUpdateProcessorFactory">
      <int name="statusCode">403</int>
      <str name="responseMessage">Thou shall not issue a commit!</str>
    </processor>
    <processor class="solr.LogUpdateProcessorFactory" />
    <processor class="solr.DistributedUpdateProcessorFactory" />
    <processor class="solr.RunUpdateProcessorFactory" />
  </updateRequestProcessorChain>
```

Lastly, you can also configure it to just ignore optimize and let commits pass thru by doing:

```
<updateRequestProcessorChain name="ignore-optimize-only-from-client-403">
    <processor class="solr.IgnoreCommitOptimizeUpdateProcessorFactory">
      <str name="responseMessage">Thou shall not issue an optimize, but commits are
OK!</str>
      <bool name="ignoreOptimizeOnly">true</bool>
    </processor>
    <processor class="solr.RunUpdateProcessorFactory" />
  </updateRequestProcessorChain>
```

Distributed Requests

Limiting Which Shards are Queried

One of the advantages of using SolrCloud is the ability to distribute requests among various shards that may or may not contain the data that you're looking for. You have the option of searching over all of your data or just parts of it.

Querying all shards for a collection should look familiar; it's as though SolrCloud didn't even come into play:

```
http://localhost:8983/solr/gettingstarted/select?q=*:*
```

If, on the other hand, you wanted to search just one shard, you can specify that shard, as in:

```
http://localhost:8983/solr/gettingstarted/select?q=*:*&shards=localhost:7574/solr
```

If you want to search a group of shards, you can specify them together:

```
http://localhost:8983/solr/gettingstarted/select?q=*:*&shards=localhost:7574/solr,lo
calhost:8983/solr
```

Or you can specify a list of servers to choose from for load balancing purposes by using the pipe symbol (|):

```
http://localhost:8983/solr/gettingstarted/select?q=*:*&shards=localhost:7574/solr|lo
calhost:7500/solr
```

(If you have explicitly created your shards using ZooKeeper and have shard IDs, you can use those IDs rather than server addresses.)

Configuring the ShardHandlerFactory

You can directly configure aspects of the concurrency and thread-pooling used within distributed search in Solr. This allows for finer grained control and you can tune it to target your own specific requirements. The default configuration favors throughput over latency.

To configure the standard handler, provide a configuration like this in the solrconfig.xml:

```
<requestHandler name="standard" class="solr.SearchHandler" default="true">
    <!-- other params go here -->
     <shardHandlerFactory class="HttpShardHandlerFactory">
        <int name="socketTimeOut">1000</int>
        <int name="connTimeOut">5000</int>
      </shardHandler>
  </requestHandler>
```

The parameters that can be specified are as follows:

Parameter	Default	Explanation
`socketTimeout`	0 (use OS default)	The amount of time in ms that a socket is allowed to wait.
`connTimeout`	0 (use OS default)	The amount of time in ms that is accepted for binding / connecting a socket
`maxConnectionsPerHost`	20	The maximum number of concurrent connections that is made to each individual shard in a distributed search.
`maxConnections`	`10000`	The total maximum number of concurrent connections in distributed searches.
`corePoolSize`	0	The retained lowest limit on the number of threads used in coordinating distributed search.

`maximumPoolSize`	Integer.MAX_VALUE	The maximum number of threads used for coordinating distributed search.
`maxThreadIdleTime`	5 seconds	The amount of time to wait for before threads are scaled back in response to a reduction in load.
`sizeOfQueue`	-1	If specified, the thread pool will use a backing queue instead of a direct handoff buffer. High throughput systems will want to configure this to be a direct hand off (with -1). Systems that desire better latency will want to configure a reasonable size of queue to handle variations in requests.
`fairnessPolicy`	false	Chooses the JVM specifics dealing with fair policy queuing, if enabled distributed searches will be handled in a First in First out fashion at a cost to throughput. If disabled throughput will be favored over latency.

Configuring statsCache implementation

Document and term statistics are needed in order to calculate relevancy using the vector space model. Solr provides four implementations out of the box when it comes to document stats calculation:

- `LocalStatsCache`: This only uses local term and document statistics to compute relevance. In cases with uniform term distribution across shards, this works reasonably well.
  This option is the default if no `<statsCache>` is configured.
- `ExactStatsCache`: This implementation uses global values for document frequency.
- `ExactSharedStatsCache`: This is exactly like the exact stats cache in it's functionality but the global stats are reused for subsequent requests with the same terms.
- `LRUStatsCache`: This implementation uses an LRU cache to hold global stats, which are shared between requests.

The implementation can be selected by setting `<statsCache>` in `solrconfig.xml`. For example, the following line makes Solr use the `ExactStatsCache` implementation:

```
<statsCache class="org.apache.solr.search.stats.ExactStatsCache"/>
```

Avoiding Distributed Deadlock

Each shard serves top-level query requests and then makes sub-requests to all of the other shards. Care should be taken to ensure that the max number of threads serving HTTP requests is greater than the possible number of requests from both top-level clients and other shards. If this is not the case, the configuration may result in a distributed deadlock.

For example, a deadlock might occur in the case of two shards, each with just a single thread to service HTTP requests. Both threads could receive a top-level request concurrently, and make sub-requests to each other. Because there are no more remaining threads to service requests, the incoming requests will be blocked until the other pending requests are finished, but they will not finish since they are waiting for the sub-requests. By ensuring that Solr is configured to handle a sufficient number of threads, you can avoid deadlock situations like this.

Prefer Local Shards

Solr allows you to pass an optional boolean parameter named `preferLocalShards` to indicate that a distributed query should prefer local replicas of a shard when available. In other words, if a query includes `preferLocalShards=true`, then the query controller will look for local replicas to service the query instead of selecting replicas at random from across the cluster. This is useful when a query requests many fields or large fields to be returned per document because it avoids moving large amounts of data over the network when it is available locally. In addition, this feature can be useful for minimizing the impact of a problematic replica with degraded performance, as it reduces the likelihood that the degraded replica will be hit by other healthy replicas.

Lastly, it follows that the value of this feature diminishes as the number of shards in a collection increases because the query controller will have to direct the query to non-local replicas for most of the shards. In other words, this feature is mostly useful for optimizing queries directed towards collections with a small number of shards and many replicas. Also, this option should only be used if you are load balancing requests across all nodes that host replicas for the collection you are querying, as Solr's CloudSolrClient will do. If not load-balancing, this feature can introduce a hotspot in the cluster since queries won't be evenly distributed across the cluster.

Read and Write Side Fault Tolerance

Read Side Fault Tolerance

With earlier versions of Solr, you had to set up your own load balancer. Now each individual node load balances requests across the replicas in a cluster. You still need a load balancer on the 'outside' that talks to the cluster, or you need a smart client (Solr provides a smart Java Solrj client called CloudSolrClient).

A smart client understands how to read and interact with ZooKeeper and only requests the ZooKeeper ensemble's address to start discovering to which nodes it should send requests.

Each distributed search request is executed against all shards for a collection unless limited by the user with the '`shards`' or '_route_' parameters. If one or more shards queried are unavailable then the default is to fail the request. However, there are many use-cases where partial results are acceptable and so Solr provides a boolean `shards.tolerant` parameter (default '`false`'). If `shards.tolerant=true` then partial results may be returned. If the returned response does not contain results from all the appropriate shards then the response header contains a special flag called '`partialResults`'. The client can specify '`shards.info`' along with the '`shards.tolerant`' parameter to retrieve more fine-grained details.

Example response with `partialResults` flag set to 'true':

Solr Response with partialResults

```
{
  "responseHeader": {
    "status": 0,
    "partialResults": true,
    "QTime": 20,
    "params": {
      "wt": "json"
    }
  },
  "response": {
    "numFound": 77,
    "start": 0,
    "docs": [  ]
  }
}
```

Write Side Fault Tolerance

SolrCloud supports near real-time actions, elasticity, high availability, and fault tolerance. What this means, basically, is that when you have a large cluster, you can always make requests to the cluster, and if a request is acknowledged you are sure it will be durable; i.e., you won't lose data. Updates can be seen right after they are made and the cluster can be expanded or contracted.

Recovery

A Transaction Log is created for each node so that every change to content or organization is noted. The log is used to determine which content in the node should be included in a replica. When a new replica is created, it refers to the Leader and the Transaction Log to know which content to include. If it fails, it retries.

Since the Transaction Log consists of a record of updates, it allows for more robust indexing because it includes redoing the uncommitted updates if indexing is interrupted.

If a leader goes down, it may have sent requests to some replicas and not others. So when a new potential leader is identified, it runs a synch process against the other replicas. If this is successful, everything should be consistent, the leader registers as active, and normal actions proceed. If a replica is too far out of synch, the system asks for a full replication/replay-based recovery.

If an update fails because cores are reloading schemas and some have finished but others have not, the leader tells the nodes that the update failed and starts the recovery procedure.

Achieved Replication Factor

When using a replication factor greater than one, an update request may succeed on the shard leader but fail on one or more of the replicas. For instance, consider a collection with one shard and replication factor of three. In this case, you have a shard leader and two additional replicas. If an update request succeeds on the leader but fails on both replicas, for whatever reason, the update request is still considered successful from the perspective of the client. The replicas that missed the update will sync with the leader when they recover.

Behind the scenes, this means that Solr has accepted updates that are only on one of the nodes (the current leader). Solr supports the optional `min_rf` parameter on update requests that cause the server to return the achieved replication factor for an update request in the response. For the example scenario described above, if the client application included min_rf >= 1, then Solr would return rf=1 in the Solr response header because the request only succeeded on the leader. The update request will still be accepted as the `min_rf` parameter only tells Solr that the client application wishes to know what the achieved replication factor was for the update request. In other words, min_rf does not mean Solr will enforce a minimum replication factor as Solr does not support rolling back updates that succeed on a subset of replicas.

On the client side, if the achieved replication factor is less than the acceptable level, then the client application can take additional measures to handle the degraded state. For instance, a client application may want to keep a log of which update requests were sent while the state of the collection was degraded and then resend the updates once the problem has been resolved. In short, `min_rf` is an optional mechanism for a client application to be warned that an update request was accepted while the collection is in a degraded state.

NRT, Replication, and Disaster Recovery with SolrCloud

SolrCloud and Replication

Replication ensures redundancy for your data, and enables you to send an update request to any node in the shard. If that node is a replica, it will forward the request to the leader, which then forwards it to all existing replicas, using versioning to make sure every replica has the most up-to-date version. This architecture enables you to be certain that your data can be recovered in the event of a disaster, even if you are using Near Real Time searching.

Near Real Time Searching

If you want to use the NearRealtimeSearch support, enable auto soft commits in your `solrconfig.xml` file before storing it into Zookeeper. Otherwise you can send explicit soft commits to the cluster as you need.

SolrCloud doesn't work very well with separated data clusters connected by an expensive pipe. The root problem is that SolrCloud's architecture sends documents to all the nodes in the cluster (on a per-shard basis), and that architecture is really dictated by the NRT functionality.

Imagine that you have a set of servers in China and one in the US that are aware of each other. Assuming 5 replicas, a single update to a shard may make multiple trips over the expensive pipe before it's all done, probably slowing indexing speed unacceptably.

So the SolrCloud recommendation for this situation is to maintain these clusters separately; nodes in China don't even know that nodes exist in the US and vice-versa. When indexing, you send the update request to one node in the US and one in China and all the node-routing after that is local to the separate clusters. Requests can go to any node in either country and maintain a consistent view of the data.

However, if your US cluster goes down, you have to re-synchronize the down cluster with up-to-date information from China. The process requires you to replicate the index from China to the repaired US installation and then get everything back up and working.

Disaster Recovery for an NRT system

Use of Near Real Time (NRT) searching affects the way that systems using SolrCloud behave during disaster recovery.

The procedure outlined below assumes that you are maintaining separate clusters, as described above. Consider, for example, an event in which the US cluster goes down (say, because of a hurricane), but the China cluster is intact. Disaster recovery consists of creating the new system and letting the intact cluster create a replicate for each shard on it, then promoting those replicas to be leaders of the newly created US cluster.

Here are the steps to take:

1. Take the downed system offline to all end users.
2. Take the indexing process offline.
3. Repair the system.
4. Bring up one machine per shard in the repaired system as part of the ZooKeeper cluster on the good system, and wait for replication to happen, creating a replica on that machine. (SoftCommits will not be repeated, but data will be pulled from the transaction logs if necessary.)

   > ✓ SolrCloud will automatically use old-style replication for the bulk load. By temporarily having only one replica, you'll minimize data transfer across a slow connection.

5. Bring the machines of the repaired cluster down, and reconfigure them to be a separate Zookeeper cluster again, optionally adding more replicas for each shard.
6. Make the repaired system visible to end users again.
7. Start the indexing program again, delivering updates to both systems.

SolrCloud Configuration and Parameters

In this section, we'll cover the various configuration options for SolrCloud.

The following sections cover these topics:

- Setting Up an External ZooKeeper Ensemble
- Using ZooKeeper to Manage Configuration Files
- ZooKeeper Access Control
- Collections API
- Parameter Reference
- Command Line Utilities
- SolrCloud with Legacy Configuration Files

Setting Up an External ZooKeeper Ensemble

Although Solr comes bundled with Apache ZooKeeper, you should consider yourself discouraged from using this internal ZooKeeper in production, because shutting down a redundant Solr instance will also shut down its ZooKeeper server, which might not be quite so redundant. Because a ZooKeeper ensemble must have a quorum of more than half its servers running at any given time, this can be a problem.

The solution to this problem is to set up an external ZooKeeper ensemble. Fortunately, while this process can seem intimidating due to the number of powerful options, setting up a simple ensemble is actually quite straightforward. The basic steps are as follows:

Download Apache ZooKeeper

The first step in setting up Apache ZooKeeper is, of course, to download the software. It's available from http://zookeeper.apache.org/releases.html.

> When using stand-alone ZooKeeper, you need to take care to keep your version of ZooKeeper updated with the latest version distributed with Solr. Since you are using it as a stand-alone application, it does not get upgraded when you upgrade Solr.
>
> Solr currently uses Apache ZooKeeper v3.4.6.

Setting Up a Single ZooKeeper

Create the instance

Creating the instance is a simple matter of extracting the files into a specific target directory. The actual directory itself doesn't matter, as long as you know where it is, and where you'd like to have ZooKeeper store its internal data.

Configure the instance

The next step is to configure your ZooKeeper instance. To do that, create the following file: `<ZOOKEEPER_HOME>/conf/zoo.cfg`. To this file, add the following information:

```
tickTime=2000
dataDir=/var/lib/zookeeper
clientPort=2181
```

The parameters are as follows:

tickTime: Part of what ZooKeeper does is to determine which servers are up and running at any given time, and the minimum session time out is defined as two "ticks". The `tickTime` parameter specifies, in miliseconds, how long each tick should be.

dataDir: This is the directory in which ZooKeeper will store data about the cluster. This directory should start out empty.

clientPort: This is the port on which Solr will access ZooKeeper.

Once this file is in place, you're ready to start the ZooKeeper instance.

Run the instance

To run the instance, you can simply use the `ZOOKEEPER_HOME/bin/zkServer.sh` script provided, as with this command: `zkServer.sh start`

Again, ZooKeeper provides a great deal of power through additional configurations, but delving into them is beyond the scope of this tutorial. For more information, see the ZooKeeper Getting Started page. For this example, however, the defaults are fine.

Point Solr at the instance

Pointing Solr at the ZooKeeper instance you've created is a simple matter of using the `-z` parameter when using the bin/solr script. For example, in order to point the Solr instance to the ZooKeeper you've started on port 2181, this is what you'd need to do:

Starting `cloud` example with Zookeeper already running at port 2181 (with all other defaults):

```
bin/solr start -e cloud -z localhost:2181 -noprompt
```

Add a node pointing to an existing ZooKeeper at port 2181:

```
bin/solr start -cloud -s <path to solr home for new node> -p 8987 -z localhost:2181
```

NOTE: When you are not using an example to start solr, make sure you upload the configuration set to zookeeper before creating the collection.

Shut down ZooKeeper

To shut down ZooKeeper, use the zkServer script with the "stop" command: `zkServer.sh stop`.

Setting up a ZooKeeper Ensemble

With an external ZooKeeper ensemble, you need to set things up just a little more carefully as compared to the Getting Started example.

The difference is that rather than simply starting up the servers, you need to configure them to know about and talk to each other first. So your original `zoo.cfg` file might look like this:

```
dataDir=/var/lib/zookeeperdata/1
clientPort=2181
initLimit=5
syncLimit=2
server.1=localhost:2888:3888
server.2=localhost:2889:3889
server.3=localhost:2890:3890
```

Here you see three new parameters:

initLimit: Amount of time, in ticks, to allow followers to connect and sync to a leader. In this case, you have 5 ticks, each of which is 2000 milliseconds long, so the server will wait as long as 10 seconds to connect and sync with the leader.

syncLimit: Amount of time, in ticks, to allow followers to sync with ZooKeeper. If followers fall too far behind a leader, they will be dropped.

server.X: These are the IDs and locations of all servers in the ensemble, the ports on which they communicate with each other. The server ID must additionally stored in the `<dataDir>/myid` file and be located in the `dataDir` of each ZooKeeper instance. The ID identifies each server, so in the case of this first instance, you would create the file `/var/lib/zookeeperdata/1/myid` with the content "1".

Now, whereas with Solr you need to create entirely new directories to run multiple instances, all you need for a new ZooKeeper instance, even if it's on the same machine for testing purposes, is a new configuration file. To complete the example you'll create two more configuration files.

The `<ZOOKEEPER_HOME>/conf/zoo2.cfg` file should have the content:

```
tickTime=2000
dataDir=c:/sw/zookeeperdata/2
clientPort=2182
initLimit=5
syncLimit=2
server.1=localhost:2888:3888
server.2=localhost:2889:3889
server.3=localhost:2890:3890
```

You'll also need to create `<ZOOKEEPER_HOME>/conf/zoo3.cfg`:

```
tickTime=2000
dataDir=c:/sw/zookeeperdata/3
clientPort=2183
initLimit=5
syncLimit=2
server.1=localhost:2888:3888
server.2=localhost:2889:3889
server.3=localhost:2890:3890
```

Finally, create your `myid` files in each of the `dataDir` directories so that each server knows which instance it is. The id in the `myid` file on each machine must match the "server.X" definition. So, the ZooKeeper instance (or machine) named "server.1" in the above example, must have a `myid` file containing the value "1". The `myid` file can be any integer between 1 and 255, and must match the server IDs assigned in the `zoo.cfg` file.

To start the servers, you can simply explicitly reference the configuration files:

```
cd <ZOOKEEPER_HOME>
bin/zkServer.sh start zoo.cfg
bin/zkServer.sh start zoo2.cfg
bin/zkServer.sh start zoo3.cfg
```

Once these servers are running, you can reference them from Solr just as you did before:

```
bin/solr start -e cloud -z localhost:2181,localhost:2182,localhost:2183 -noprompt
```

For more information on getting the most power from your ZooKeeper installation, check out the ZooKeeper Administrator's Guide.

Using ZooKeeper to Manage Configuration Files

With SolrCloud your configuration files (particularly `solrconfig.xml` and `schema.xml`) are kept in ZooKeeper. These files are uploaded in either of the following cases:

- When you start a SolrCloud example using the bin/solr script.
- When you create a collection using the bin/solr script.
- Manually upload a configuration set to ZooKeeper.

Startup Bootstrap

When you try SolrCloud for the first time using the `bin/solr -e cloud`, the related configset gets uploaded to zookeeper automatically and is linked with the newly created collection.

The below command would start SolrCloud with the default collection name (gettingstarted) and default configset (data_driven_schema_configs) uploaded and linked to it.

```
$ bin/solr -e cloud -noprompt
```

You can also explicitly upload a configuration directory when creating a collection using the `bin/solr` script with the `-d` option, such as:

```
$ bin/solr create -c mycollection -d data_driven_schema_configs
```

The create command will upload a copy of the `data_driven_schema_configs` configuration directory to ZooKeeper under `/configs/mycollection`. Refer to the Solr Start Script Reference page for more details about the create command for creating collections.

Once a configuration directory has been uploaded to ZooKeeper, you can update them using the ZooKeeper Command Line Interface (zkCLI).

> It's a good idea to keep these files under version control.

Uploading configs using zkcli or SolrJ

In production situations, Config Sets can also be uploaded to ZooKeeper independent of collection creation using either Solr's zkcli.sh script, or the CloudSolrClient.uploadConfig java method.

The below command can be used to upload a new configset using the zkcli script.

```
$  sh zkcli.sh -cmd upconfig -zkhost  <host:port> -confname <name for configset>
-solrhome <solrhome> -confdir <path to directory with configset>
```

Managing Your SolrCloud Configuration Files

To update or change your SolrCloud configuration files:

1. Download the latest configuration files from ZooKeeper, using the source control checkout process.
2. Make your changes.
3. Commit your changed file to source control.
4. Push the changes back to ZooKeeper.
5. Reload the collection so that the changes will be in effect.

More information about the ZooKeeper Command Line Utility to help manage changes to configuration files, can be found in the section on Command Line Utilities.

> By default, `solr.xml` is not one of the Solr configuration files managed by ZooKeeper. If you would like to keep your `solr.xml` in ZooKeeper, you can push it to ZooKeeper with the `zkcli.sh` utility (using the `putfile` command). See the section Command Line Utilities for more information.

ZooKeeper Access Control

This page describes using ZooKeeper access control lists (ACLs) with Solr. For information about ZooKeeper ACLs, see http://zookeeper.apache.org/doc/r3.4.6/zookeeperProgrammers.html#sc_ZooKeeperAccessControl

Motivation/Scope

SolrCloud uses ZooKeeper for shared information and for coordination.

This section describes how to configure Solr to add more restrictive ACLs to the ZooKeeper content it creates, and how to tell Solr about the credentials required to access the content in ZooKeeper. You will have to activate it to use this functionality because by default Solr behavior is still open-unsafe ACL everywhere, using no credentials.

Changing Solr-related content in ZooKeeper might damage a SolrCloud cluster. For example:

- Changing configuration might cause Solr to fail or behave in an unintended way.
- Changing cluster state information into something wrong or inconsistent might very well make a SolrCloud cluster behave strangely.
- Adding a delete-collection job to be carried out by the Overseer will cause data to be deleted from the cluster.

You may want to enable ZooKeeper ACLs with Solr if you grant access to your ZooKeeper ensemble to entities you do not trust, or if you want to reduce risk of bad actions resulting from, e.g.:

- Malware that found its way into your system.
- Other systems using the same ZooKeeper ensemble (a "bad thing" might be done by accident).

You might even want to limit read-access, if you think there is stuff in ZooKeeper that not everyone should know about. Or you might just in general work on need-to-know-basis.

Protecting ZooKeeper itself could mean many different things. **This section is about protecting Solr content in ZooKeeper**. ZooKeeper content basically lives persisted on disk and (partly) in memory of the ZooKeeper processes. **This section is not about protecting ZooKeeper data at storage or ZooKeeper process levels** - that's for ZooKeeper to deal with.

But this content is also available to "the outside" via the ZooKeeper API. Outside processes can connect to ZooKeeper and create/update/delete/read content; for example, a Solr node in a SolrCloud cluster wants to create/update/delete/read, and a SolrJ client wants to read from the cluster. It is the responsibility of the outside processes that create/update content to setup ACLs on the content. ACLs describe who is allowed to read, update, delete, create, etc. Each piece of information (znode/content) in ZooKeeper has its own set of ACLs, and inheritance or sharing is not possible. The default behavior in Solr is to add one ACL on all the content it creates - one ACL that gives anyone the permission to do anything (in ZooKeeper terms this is called "the open-unsafe ACL").

How it works

We want to be able to:

1. Control the credentials Solr uses for its ZooKeeper connections. The credentials are used to get permission to perform operations in ZooKeeper.
2. Control which ACLs Solr will add to znodes (ZooKeeper files/folders) it creates in ZooKeeper.

3. Control it "from the outside", so that you do not have to modify and/or recompile Solr code to turn this on.

Solr nodes, clients and tools (like e.g. ZkCLI) always uses a java class called `SolrZkClient` to deal with their ZooKeeper stuff. The implementation of the solution described here is all about changing `SolrZkClient`. If you "stole" and use `SolrZkClient` in your application, the descriptions below will be true for your application too.

Controlling credentials

You control which credentials will be used by setting the "`defaultZkCredentialsProvider`" system property to the name of a class (on the classpath) implementing the following interface:

```
package org.apache.solr.common.cloud;
public interface ZkCredentialsProvider {
  public class ZkCredentials {
    String scheme;
    byte[] auth;

    public ZkCredentials(String scheme, byte[] auth) {
      super();
      this.scheme = scheme;
      this.auth = auth;
    }
    String getScheme() {
      return scheme;
    }
    byte[] getAuth() {
      return auth;
    }
  }
  Collection<ZkCredentials> getCredentials();
}
```

`SolrZkClient` determines which credentials to use by calling (once per `SolrZkClient`) the `getCredentials()` method of the class named by the "`defaultZkCredentialsProvider`" system property. If the system property hasn't been set, or if the named class implementing the interface can't be found on the classpath, `SolrZkClient` uses the default implementation.

Out of the box implementations

You can always make you own implementation, but Solr comes with:

- `org.apache.solr.common.cloud.DefaultZkCredentialsProvider`

  Its `getCredentials()` returns a list of length zero - no credentials used. This is the default and is used if you do not set the "`defaultZkACLProvider`" system property.

- `org.apache.solr.common.cloud.VMParamsSingleSetCredentialsDigestZkCredentialsProvider`

  This one lets you define your credentials using system properties. It supports at most one set of credentials.

  - The schema is "digest". The username and password are defined by system properties "`zkDigestUsername`" and "`zkDigestPassword`", respectively. This set of credentials will be added to the list of credentials returned by `getCredentials()` if both username and password are provided.

    - If the one set of credentials above is not added to the list, this implementation will fall back to default behavior and use the (empty) credentials list from `DefaultZkCredentialsProvider`.

Controlling ACLs

You control which ACLs will be added by setting the "`defaultZkACLProvider`" system property to the name of a class (on the classpath) implementing the following interface:

```
package org.apache.solr.common.cloud;

public interface ZkACLProvider {
  List<ACL> getACLsToAdd(String zNodePath);
}
```

When `SolrZkClient` wants to create a new znode, it determines which ACLs to put on the znode by calling the `getACLsToAdd()` method of the class named by the "`defaultZkACLProvider`" system property. If the system property has not been set, or if it does not name a class on the classpath implementing the interface, the default implementation is used.

Out of the box implementations

You can always make you own implementation, but Solr comes with:

- `org.apache.solr.common.cloud.DefaultZkACLProvider`

  It returns a list of length one for all `zNodePath`-s. The single ACL entry in the list is "open-unsafe". This is the default and is used if you do not set the "`defaultZkACLProvider`" system property.

- `org.apache.solr.common.cloud.VMParamsAllAndReadonlyDigestZkACLProvider`

  This one lets you define your ACLs using system properties. Its `getACLsToAdd()` implementation does not use `zNodePath` for anything, so all znodes will get the same set of ACLs. It supports adding one or both of:

    - A user that is allowed to do everything.
        - The permission is "`ALL`" (corresponding to all of `CREATE`, `READ`, `WRITE`, `DELETE` and `ADMIN`), and the schema is "digest". The username and password are defined by system properties "`zkDigestUsername`" and "`zkDigestPassword`", respectively. This ACL will not be added to the list of ACLs unless both username and password are provided.
    - A user that is only allowed to perform read operations.
        - The permission is "`READ`" and the schema is "digest". The username and password are defined by system properties "`zkDigestReadonlyUsername`" and "`zkDigestReadonlyPassword`", respectively. This ACL will not be added to the list of ACLs unless both username and password are provided.

  If neither of the above ACLs is added to the list, the (empty) ACL list of `DefaultZkACLProvider` will be used by default.

Notice the overlap in system property names with credentials provider `VMParamsSingleSetCredentialsDigestZkCredentialsProvider` (described above). This is to let the two providers collaborate in a nice and perhaps common way: we always protect access to content by limiting to two users - an admin-user and a readonly-user - AND we always connect with credentials corresponding to this same admin-user, basically so that we can do anything to the content/znodes we create ourselves.

You can give the readonly credentials to "clients" of your SolrCloud cluster - e.g. to be used by SolrJ clients. They will be able to read whatever is necessary to run a functioning SolrJ client, but they will not be able to modify any content in ZooKeeper.

Example usages

Let's say that you want all Solr-related content in ZooKeeper protected. You want an "admin" user that is able to do anything to the content in ZooKeeper - this user will be used for initializing Solr content in ZooKeeper and for server-side Solr nodes. You also want a "readonly" user that is only able to read content from ZooKeeper - this user will be handed over to "clients".

In the examples below:

- The "admin" user's username/password is admin-user/admin-password.
- The "readonly" user's username/password is readonly-user/readonly-password.

To use ZkCLI:

```
SOLR_ZK_PROVIDERS="-DdefaultZkCredentialsProvider=org.apache.solr.common.cloud.VMPar
amsSingleSetCredentialsDigestZkCredentialsProvider \
-DdefaultZkACLProvider=org.apache.solr.common.cloud.VMParamsAllAndReadonlyDigestZkAC
LProvider"

SOLR_ZK_CREDS_AND_ACLS="-DzkDigestUsername=admin-user
-DzkDigestPassword=admin-password \
-DzkDigestReadonlyUsername=readonly-user
-DzkDigestReadonlyPassword=readonly-password"

java ... $SOLR_ZK_PROVIDERS $SOLR_ZK_CREDS_AND_ACLS ... org.apache.solr.cloud.ZkCLI
-cmd ...
```

For operations using **`bin/solr`**, add the following at the bottom of **`bin/solr.in.sh`**:

```
SOLR_ZK_PROVIDERS="-DdefaultZkCredentialsProvider=org.apache.solr.common.cloud.VMPar
amsSingleSetCredentialsDigestZkCredentialsProvider \
-DdefaultZkACLProvider=org.apache.solr.common.cloud.VMParamsAllAndReadonlyDigestZkAC
LProvider"

SOLR_ZK_CREDS_AND_ACLS="-DzkDigestUsername=admin-user
-DzkDigestPassword=admin-password \
-DzkDigestReadonlyUsername=readonly-user
-DzkDigestReadonlyPassword=readonly-password"

SOLR_OPTS="$SOLR_OPTS $SOLR_ZK_PROVIDERS $SOLR_ZK_CREDS_AND_ACLS"
```

For operations using **`bin\solr.cmd`**, add the following at the bottom of **`bin\solr.in.cmd`**:

```
set
SOLR_ZK_PROVIDERS=-DdefaultZkCredentialsProvider=org.apache.solr.common.cloud.VMPara
msSingleSetCredentialsDigestZkCredentialsProvider ^
-DdefaultZkACLProvider=org.apache.solr.common.cloud.VMParamsAllAndReadonlyDigestZkAC
LProvider

set SOLR_ZK_CREDS_AND_ACLS=-DzkDigestUsername=admin-user
-DzkDigestPassword=admin-password ^
-DzkDigestReadonlyUsername=readonly-user
-DzkDigestReadonlyPassword=readonly-password

set SOLR_OPTS=%SOLR_OPTS% %SOLR_ZK_PROVIDERS% %SOLR_ZK_CREDS_AND_ACLS%
```

To start your own "clients" (using SolrJ):

```
SOLR_ZK_PROVIDERS="-DdefaultZkCredentialsProvider=org.apache.solr.common.cloud.VMPar
amsSingleSetCredentialsDigestZkCredentialsProvider"

SOLR_ZK_CREDS_AND_ACLS="-DzkDigestUsername=readonly-user
-DzkDigestPassword=readonly-password"

java ... $SOLR_ZK_PROVIDERS $SOLR_ZK_CREDS_AND_ACLS ...
```

Or since you yourself are writing the code creating the `SolrZkClient`-s, you might want to override the provider implementations at the code level instead.

Collections API

The Collections API is used to enable you to create, remove, or reload collections, but in the context of SolrCloud you can also use it to create collections with a specific number of shards and replicas.

API Entry Points

The base URL for all API calls below is `http://<hostname>:<port>/solr`.

`/admin/collections?action=CREATE`: create a collection
`/admin/collections?action=RELOAD`: reload a collection
`/admin/collections?action=SPLITSHARD`: split a shard into two new shards
`/admin/collections?action=CREATESHARD`: create a new shard
`/admin/collections?action=DELETESHARD`: delete an inactive shard
`/admin/collections?action=CREATEALIAS`: create or modify an alias for a collection
`/admin/collections?action=DELETEALIAS`: delete an alias for a collection
`/admin/collections?action=DELETE`: delete a collection
`/admin/collections?action=DELETEREPLICA`: delete a replica of a shard
`/admin/collections?action=ADDREPLICA`: add a replica of a shard
`/admin/collections?action=CLUSTERPROP`: Add/edit/delete a cluster-wide property
`/admin/collections?action=MIGRATE`: Migrate documents to another collection
`/admin/collections?action=ADDROLE`: Add a specific role to a node in the cluster
`/admin/collections?action=REMOVEROLE`: Remove an assigned role
`/admin/collections?action=OVERSEERSTATUS`: Get status and statistics of the overseer

`/admin/collections?action=CLUSTERSTATUS`: Get cluster status
`/admin/collections?action=REQUESTSTATUS`: Get the status of a previous asynchronous request
`/admin/collections?action=LIST`: List all collections
`/admin/collections?action=ADDREPLICAPROP`: Add an arbitrary property to a replica specified by collection/shard/replica
`/admin/collections?action=DELETEREPLICAPROP`: Delete an arbitrary property from a replica specified by collection/shard/replica
`/admin/collections?action=BALANCESHARDUNIQUE`: Distribute an arbitrary property, one per shard, across the nodes in a collection
`/admin/collections?action=REBALANCELEADERS`: Distribute leader role based on the "preferredLeader" assignments

Create a Collection

`/admin/collections?action=CREATE&name=`*`name`*`&numShards=`*`number`*`&replicationFactor=`*`number`*`&maxShardsPerNode=`*`number`*`&createNodeSet=`*`nodelist`*`&collection.configName=`*`configname`*

Input

Query Parameters

Key	Type	Required	Default	Description
name	string	Yes		The name of the collection to be created.
router.name	string	No	compositeId	The router name that will be used. The router defines how documents will be distributed among the shards. The value can be either **implicit**, which uses an internal default hash, or **compositeId**, which allows defining the specific shard to assign documents to. When using the 'implicit' router, the `shards` parameter is required. When using the 'compositeId' router, the `numShards` parameter is required. For more information, see also the section Document Routing.
numShards	integer	No	empty	The number of shards to be created as part of the collection. This is a required parameter when using the 'compositeId' router.
shards	string	No	empty	A comma separated list of shard names, e.g., shard-x,shard-y,shard-z . This is a required parameter when using the 'implicit' router.
replicationFactor	integer	No	1	The number of replicas to be created for each shard.

maxShardsPerNode	integer	No	1	When creating collections, the shards and/or replicas are spread across all available (i.e., live) nodes, and two replicas of the same shard will never be on the same node. If a node is not live when the CREATE operation is called, it will not get any parts of the new collection, which could lead to too many replicas being created on a single live node. Defining `maxShardsPerNode` sets a limit on the number of replicas CREATE will spread to each node. If the entire collection can not be fit into the live nodes, no collection will be created at all.
createNodeSet	string	No	empty	Allows defining the nodes to spread the new collection across. If not provided, the CREATE operation will create shard-replica spread across all live Solr nodes. The format is a comma-separated list of node_names, such as `localhost:8983_solr,` `localhost:8984_solr,` `localhost:8985_solr`.
createNodeSet.shuffle	boolean	No	true	Controls wether or not the shard-replicas created for this collection will be assigned to the nodes specified by the createNodeSet in a sequential manner, or if the list of nodes should be shuffled prior to creating individual replicas. A 'false' value makes the results of a collection creation predictible and gives more exact control over the location of the individual shard-replicas, but 'true' can be a better choice for ensuring replicas are distributed evenly across nodes. Ignored if createNodeSet is not also specified.
collection.configName	string	No	empty	Defines the name of the configurations (which must already be stored in ZooKeeper) to use for this collection. If not provided, Solr will default to the collection name as the configuration name.

router.field	string	No	empty	If this field is specified, the router will look at the value of the field in an input document to compute the hash and identify a shard instead of looking at the `uniqueKey` field. If the field specified is null in the document, the document will be rejected. Please note that RealTime Get or retrieval by id would also require the parameter `_route_` (or `shard.keys`) to avoid a distributed search.
property.*name*=*value*	string	No		Set core property *name* to *value*. See the section Defining core.properties for details on supported properties and values.
autoAddReplicas	boolean	No	false	When set to true, enables auto addition of replicas on shared file systems. See the section autoAddReplicas Settings for more details on settings and overrides.
async	string	No		Request ID to track this action which will be processed asynchronously.

Output

Output Content

The response will include the status of the request and the new core names. If the status is anything other than "success", an error message will explain why the request failed.

Examples

Input

```
http://localhost:8983/solr/admin/collections?action=CREATE&name=newCollection&numShards=2&replicationFactor=1
```

Output

```
<response>
  <lst name="responseHeader">
    <int name="status">0</int>
    <int name="QTime">3764</int>
  </lst>
  <lst name="success">
    <lst>
      <lst name="responseHeader">
        <int name="status">0</int>
        <int name="QTime">3450</int>
      </lst>
      <str name="core">newCollection_shard1_replica1</str>
    </lst>
    <lst>
      <lst name="responseHeader">
        <int name="status">0</int>
        <int name="QTime">3597</int>
      </lst>
      <str name="core">newCollection_shard2_replica1</str>
    </lst>
  </lst>
</response>
```

Reload a Collection

`/admin/collections?action=RELOAD&name=` *`name`*

The RELOAD action is used when you have changed a configuration in ZooKeeper.

Input

Query Parameters

Key	Type	Required	Description
name	string	Yes	The name of the collection to reload.

Output

Output Content

The response will include the status of the request and the cores that were reloaded. If the status is anything other than "success", an error message will explain why the request failed.

Examples

Input

```
http://localhost:8983/solr/admin/collections?action=RELOAD&name=newCollection
```

Output

```
<response>
  <lst name="responseHeader">
    <int name="status">0</int>
    <int name="QTime">1551</int>
  </lst>
  <lst name="success">
    <lst name="10.0.1.6:8983_solr">
      <lst name="responseHeader">
        <int name="status">0</int>
        <int name="QTime">761</int>
      </lst>
    </lst>
    <lst name="10.0.1.4:8983_solr">
      <lst name="responseHeader">
        <int name="status">0</int>
        <int name="QTime">1527</int>
      </lst>
    </lst>
  </lst>
</response>
```

Split a Shard

`/admin/collections?action=SPLITSHARD&collection=name&shard=shardID`

Splitting a shard will take an existing shard and break it into two pieces which are written to disk as two (new) shards. The original shard will continue to contain the same data as-is but it will start re-routing requests to the new shards. The new shards will have as many replicas as the original shard. A soft commit is automatically issued after splitting a shard so that documents are made visible on sub-shards. An explicit commit (hard or soft) is not necessary after a split operation because the index is automatically persisted to disk during the split operation.

This command allows for seamless splitting and requires no downtime. A shard being split will continue to accept query and indexing requests and will automatically start routing them to the new shards once this operation is complete. This command can only be used for SolrCloud collections created with "numShards" parameter, meaning collections which rely on Solr's hash-based routing mechanism.

The split is performed by dividing the original shard's hash range into two equal partitions and dividing up the documents in the original shard according to the new sub-ranges.

One can also specify an optional 'ranges' parameter to divide the original shard's hash range into arbitrary hash range intervals specified in hexadecimal. For example, if the original hash range is 0-1500 then adding the parameter: ranges=0-1f4,1f5-3e8,3e9-5dc will divide the original shard into three shards with hash range 0-500, 501-1000 and 1001-1500 respectively.

Another optional parameter 'split.key' can be used to split a shard using a route key such that all documents of the specified route key end up in a single dedicated sub-shard. Providing the 'shard' parameter is not required in this case because the route key is enough to figure out the right shard. A route key which spans more than one shard is not supported. For example, suppose split.key=A! hashes to the range 12-15 and belongs to shard 'shard1' with range 0-20 then splitting by this route key would yield three sub-shards with ranges 0-11, 12-15 and 16-20. Note that the sub-shard with the hash range of the route key may also contain documents for other route keys whose hash ranges overlap.

Shard splitting can be a long running process. In order to avoid timeouts, you should run this as an asynchronous call.

Input

Query Parameters

Key	Type	Required	Description
collection	string	Yes	The name of the collection that includes the shard to be split.
shard	string	Yes	The name of the shard to be split.
ranges	string	No	A comma-separated list of hash ranges in hexadecimal e.g. ranges=0-1f4,1f5-3e8,3e9-5dc
split.key	string	No	The key to use for splitting the index
property.*name*=*value*	string	No	Set core property *name* to *value*. See the section Defining core.properties for details on supported properties and values.
async	string	No	Request ID to track this action which will be processed asynchronously

Output

Output Content

The output will include the status of the request and the new shard names, which will use the original shard as their basis, adding an underscore and a number. For example, "shard1" will become "shard1_0" and "shard1_1". If the status is anything other than "success", an error message will explain why the request failed.

Examples

Input

Split shard1 of the "anotherCollection" collection.

```
http://localhost:8983/solr/admin/collections?action=SPLITSHARD&collection=anotherCollection&shard=shard1
```

Output

```
<response>
  <lst name="responseHeader">
    <int name="status">0</int>
    <int name="QTime">6120</int>
  </lst>
  <lst name="success">
    <lst>
      <lst name="responseHeader">
        <int name="status">0</int>
        <int name="QTime">3673</int>
      </lst>
      <str name="core">anotherCollection_shard1_1_replica1</str>
    </lst>
    <lst>
      <lst name="responseHeader">
        <int name="status">0</int>
        <int name="QTime">3681</int>
      </lst>
      <str name="core">anotherCollection_shard1_0_replica1</str>
    </lst>
    <lst>
      <lst name="responseHeader">
        <int name="status">0</int>
        <int name="QTime">6008</int>
      </lst>
    </lst>
    <lst>
      <lst name="responseHeader">
        <int name="status">0</int>
        <int name="QTime">6007</int>
      </lst>
    </lst>
    <lst>
      <lst name="responseHeader">
        <int name="status">0</int>
        <int name="QTime">71</int>
      </lst>
    </lst>
    <lst>
      <lst name="responseHeader">
        <int name="status">0</int>
        <int name="QTime">0</int>
      </lst>
      <str name="core">anotherCollection_shard1_1_replica1</str>
      <str name="status">EMPTY_BUFFER</str>
    </lst>
    <lst>
      <lst name="responseHeader">
        <int name="status">0</int>
        <int name="QTime">0</int>
      </lst>
      <str name="core">anotherCollection_shard1_0_replica1</str>
      <str name="status">EMPTY_BUFFER</str>
    </lst>
  </lst>
</response>
```

Create a Shard

Shards can only created with this API for collections that use the 'implicit' router. Use SPLITSHARD for collections using the 'compositeId' router. A new shard with a name can be created for an existing 'implicit' collection.

`/admin/collections?action=CREATESHARD&shard=`*`shardName`*`&collection=`*`name`*

Input

Query Parameters

Key	Type	Required	Description
collection	string	Yes	The name of the collection that includes the shard that will be splitted.
shard	string	Yes	The name of the shard to be created.
createNodeSet	string	No	Allows defining the nodes to spread the new collection across. If not provided, the CREATE operation will create shard-replica spread across all live Solr nodes. The format is a comma-separated list of node_names, such as `localhost:8983_solr`, `localhost:8984_solr`, `localhost:8985_solr`.
property.*name*=*value*	string	No	Set core property *name* to *value*. See the section Defining core.properties for details on supported properties and values.

Output

Output Content

The output will include the status of the request. If the status is anything other than "success", an error message will explain why the request failed.

Examples

Input

Create 'shard-z' for the "anImplicitCollection" collection.

```
http://localhost:8983/solr/admin/collections?action=CREATESHARD&collection=anImplicitCollection&shard=shard-z
```

Output

```
<response>
   <lst name="responseHeader">
      <int name="status">0</int>
      <int name="QTime">558</int>
   </lst>
</response>
```

Delete a Shard

Deleting a shard will unload all replicas of the shard and remove them from `clusterstate.json`. It will only remove shards that are inactive, or which have no range given for custom sharding.

/admin/collections?action=DELETESHARD&shard=*shardID*&collection=*name*

Input

Query Parameters

Key	Type	Required	Description
collection	string	Yes	The name of the collection that includes the shard to be deleted.
shard	string	Yes	The name of the shard to be deleted.

Output

Output Content

The output will include the status of the request. If the status is anything other than "success", an error message will explain why the request failed.

Examples

Input

Delete 'shard1' of the "anotherCollection" collection.

```
http://localhost:8983/solr/admin/collections?action=DELETESHARD&collection=anotherCo
llection&shard=shard1
```

Output

```
<response>
   <lst name="responseHeader">
      <int name="status">0</int>
      <int name="QTime">558</int>
   </lst>
   <lst name="success">
      <lst name="10.0.1.4:8983_solr">
         <lst name="responseHeader">
            <int name="status">0</int>
            <int name="QTime">27</int>
         </lst>
      </lst>
   </lst>
</response>
```

Create or modify an Alias for a Collection

The `CREATEALIAS` action will create a new alias pointing to one or more collections. If an alias by the same name already exists, this action will replace the existing alias, effectively acting like an atomic "MOVE" command.

/admin/collections?action=CREATEALIAS&name=*name*&collections=*collectionlist*

Input

Query Parameters

Key	Type	Required	Description

name	string	Yes	The alias name to be created.
collections	string	Yes	The list of collections to be aliased, separated by commas.

Output

Output Content

The output will simply be a responseHeader with details of the time it took to process the request. To confirm the creation of the alias, you can look in the Solr Admin UI, under the Cloud section and find the `aliases.json` file.

Examples

Input

Create an alias named "testalias" and link it to the collections named "anotherCollection" and "testCollection".

```
http://localhost:8983/solr/admin/collections?action=CREATEALIAS&name=testalias&colle
ctions=anotherCollection,testCollection
```

Output

```
<response>
  <lst name="responseHeader">
    <int name="status">0</int>
    <int name="QTime">122</int>
  </lst>
</response>
```

Delete a Collection Alias

`/admin/collections?action=DELETEALIAS&name=`*`name`*

Input

Query Parameters

Key	Type	Required	Description
name	string	Yes	The name of the alias to delete.

Output

Output Content

The output will simply be a responseHeader with details of the time it took to process the request. To confirm the removal of the alias, you can look in the Solr Admin UI, under the Cloud section, and find the `aliases.json` file .

Examples

Input

Remove the alias named "testalias".

```
http://localhost:8983/solr/admin/collections?action=DELETEALIAS&name=testalias
```

Output

```
<response>
  <lst name="responseHeader">
    <int name="status">0</int>
    <int name="QTime">117</int>
  </lst>
</response>
```

Delete a Collection

`/admin/collections?action=DELETE&name=`*`collection`*

Input

Query Parameters

Key	Type	Required	Description
name	string	Yes	The name of the collection to delete.

Output

Output Content

The response will include the status of the request and the cores that were deleted. If the status is anything other than "success", an error message will explain why the request failed.

Examples

Input

Delete the collection named "newCollection".

```
http://localhost:8983/solr/admin/collections?action=DELETE&name=newCollection
```

Output

```
<response>
  <lst name="responseHeader">
    <int name="status">0</int>
    <int name="QTime">603</int>
  </lst>
  <lst name="success">
    <lst name="10.0.1.6:8983_solr">
      <lst name="responseHeader">
        <int name="status">0</int>
        <int name="QTime">19</int>
      </lst>
    </lst>
    <lst name="10.0.1.4:8983_solr">
      <lst name="responseHeader">
        <int name="status">0</int>
        <int name="QTime">67</int>
      </lst>
    </lst>
  </lst>
</response>
```

Delete a Replica

/admin/collections?action=DELETEREPLICA&collection=*collection*&shard=*shard*&replica=*replica*

Delete a replica from a given collection and shard. If the corresponding core is up and running the core is unloaded and the entry is removed from the clusterstate. If the node/core is down , the entry is taken off the clusterstate and if the core comes up later it is automatically unregistered.

Input

Query Parameters

Key	Type	Required	Description
collection	string	Yes	The name of the collection.
shard	string	Yes	The name of the shard that includes the replica to be removed.
replica	string	Yes	The name of the replica to remove.
onlyIfDown	boolean	no	When set to 'true' will not take any action if the replica is active. Default 'false'

Examples

Input

```
http://localhost:8983/solr/admin/collections?action=DELETEREPLICA&collection=test2&shard=shard2&replica=core_node3
```

Output

Output Content

```
<response>
   <lst name="responseHeader"><int name="status">0</int><int name="QTime">110</int></lst>
</response>
```

Add Replica

/admin/collections?action=ADDREPLICA&collection=*collection*&shard=*shard*&node=*solr_node_name*

Add a replica to a shard in a collection. The node name can be specified if the replica is to be created in a specific node

Input

Query Parameters

Key	Type	Required	Description
collection	string	Yes	The name of the collection.

shard	string	Yes*	The name of the shard to which replica is to be added. If shard is not specified, then _route_ must be.
route	string	No*	If the exact shard name is not known, users may pass the _route_ value and the system would identify the name of the shard. Ignored if the shard param is also specified.
node	string	No	The name of the node where the replica should be created
instanceDir	string	No	The instanceDir for the core that will be created
dataDir	string	No	The directory in which the core should be created
property.*name*=*value*	string	No	Set core property *name* to *value*. See Defining core.properties.
async	string	No	Request ID to track this action which will be processed asynchronously

Examples

Input

```
http://localhost:8983/solr/admin/collections?action=ADDREPLICA&collection=test2&shar
d=shard2&node=192.167.1.2:8983_solr
```

Output

Output Content

```
<response>
  <lst name="responseHeader">
    <int name="status">0</int>
    <int name="QTime">3764</int>
  </lst>
  <lst name="success">
    <lst>
      <lst name="responseHeader">
        <int name="status">0</int>
        <int name="QTime">3450</int>
      </lst>
      <str name="core">test2_shard2_replica4</str>
    </lst>
</response>
```

Cluster Properties

/admin/collections?action=CLUSTERPROP&name=*propertyName*&val=*propertyValue*

Add, edit or delete a cluster-wide property.

Input

Query Parameters

Key	Type	Required	Description
name	string	Yes	The name of the property. The two supported properties names are `urlScheme` and `autoAddReplicas`. Other names are rejected with an error.
val	string	Yes	The value of the property. If the value is empty or null, the property is unset.

Output

Output Content

The response will include the status of the request and the properties that were updated or removed. If the status is anything other than "0", an error message will explain why the request failed.

Examples

Input

```
http://localhost:8983/solr/admin/collections?action=CLUSTERPROP&name=urlScheme&val=https
```

Output

```
<response>
   <lst name="responseHeader">
      <int name="status">0</int>
      <int name="QTime">0</int>
   </lst>
</response>
```

Migrate Documents to Another Collection

`/admin/collections?action=MIGRATE&collection=`*`name`*`&split.key=`*`key1!`*`&target.collection=`*`target_collection`*`&forward.timeout=60`

The MIGRATE command is used to migrate all documents having the given routing key to another collection. The source collection will continue to have the same data as-is but it will start re-routing write requests to the target collection for the number of seconds specified by the forward.timeout parameter. It is the responsibility of the user to switch to the target collection for reads and writes after the ‘migrate’ command completes.

The routing key specified by the ‘split.key’ parameter may span multiple shards on both the source and the target collections. The migration is performed shard-by-shard in a single thread. One or more temporary collections may be created by this command during the ‘migrate’ process but they are cleaned up at the end automatically.

This is a synchronous operation and therefore keeping a large read timeout on the invocation is advised. The request may still timeout due to inherent limitations of the Collection APIs but that doesn’t necessarily mean that the operation has failed. Users should check logs, cluster state, source and target collections before invoking the operation again.

This command works only with collections having the compositeId router. The target collection must not receive any writes during the time the migrate command is running otherwise some writes may be lost.

Please note that the migrate API does not perform any de-duplication on the documents so if the target collection contains documents with the same uniqueKey as the documents being migrated then the target collection will end up with duplicate documents.

Input

Query Parameters

Key	Type	Required	Description
collection	string	Yes	The name of the source collection from which documents will be split.
target.collection	string	Yes	The name of the target collection to which documents will be migrated.
split.key	string	Yes	The routing key prefix. For example, if uniqueKey is a!123, then you would use `split.key=a!`.
forward.timeout	int	No	The timeout, in seconds, until which write requests made to the source collection for the given `split.key` will be forwarded to the target shard. The default is 60 seconds.
property.*name*=*value*	string	No	Set core property *name* to *value*. See the section Defining core.properties for details on supported properties and values.
async	string	No	Request ID to track this action which will be processed asynchronously.

Output

Output Content

The response will include the status of the request.

Examples

Input

```
http://localhost:8983/solr/admin/collections?action=MIGRATE&collection=test1&split.k
ey=a!&target.collection=test2
```

Output

```
<response>
  <lst name="responseHeader">
    <int name="status">0</int>
    <int name="QTime">19014</int>
  </lst>
  <lst name="success">
    <lst>
      <lst name="responseHeader">
        <int name="status">0</int>
        <int name="QTime">1</int>
      </lst>
      <str name="core">test2_shard1_0_replica1</str>
      <str name="status">BUFFERING</str>
    </lst>
    <lst>
      <lst name="responseHeader">
        <int name="status">0</int>
        <int name="QTime">2479</int>
      </lst>
      <str name="core">split_shard1_0_temp_shard1_0_shard1_replica1</str>
    </lst>
    <lst>
      <lst name="responseHeader">
        <int name="status">0</int>
        <int name="QTime">1002</int>
      </lst>
    </lst>
    <lst>
      <lst name="responseHeader">
        <int name="status">0</int>
        <int name="QTime">21</int>
      </lst>
    </lst>
    <lst>
      <lst name="responseHeader">
        <int name="status">0</int>
        <int name="QTime">1655</int>
      </lst>
      <str name="core">split_shard1_0_temp_shard1_0_shard1_replica2</str>
    </lst>
    <lst>
      <lst name="responseHeader">
        <int name="status">0</int>
        <int name="QTime">4006</int>
      </lst>
    </lst>
    <lst>
      <lst name="responseHeader">
        <int name="status">0</int>
        <int name="QTime">17</int>
      </lst>
    </lst>
    <lst>
      <lst name="responseHeader">
        <int name="status">0</int>
        <int name="QTime">1</int>
      </lst>
      <str name="core">test2_shard1_0_replica1</str>
      <str name="status">EMPTY_BUFFER</str>
    </lst>
    <lst name="192.168.43.52:8983_solr">
      <lst name="responseHeader">
        <int name="status">0</int>
        <int name="QTime">31</int>
      </lst>
    </lst>
    <lst name="192.168.43.52:8983_solr">
      <lst name="responseHeader">
        <int name="status">0</int>
        <int name="QTime">31</int>
      </lst>
    </lst>
    <lst>
      <lst name="responseHeader">
        <int name="status">0</int>
        <int name="QTime">1</int>
      </lst>
      <str name="core">test2_shard1_1_replica1</str>
      <str name="status">BUFFERING</str>
    </lst>
    <lst>
      <lst name="responseHeader">
        <int name="status">0</int>
        <int name="QTime">1742</int>
      </lst>
      <str name="core">split_shard1_1_temp_shard1_1_shard1_replica1</str>
    </lst>
    <lst>
      <lst name="responseHeader">
        <int name="status">0</int>
        <int name="QTime">1002</int>
      </lst>
    </lst>
    <lst>
      <lst name="responseHeader">
        <int name="status">0</int>
        <int name="QTime">15</int>
      </lst>
    </lst>
    <lst>
      <lst name="responseHeader">
        <int name="status">0</int>
        <int name="QTime">1917</int>
      </lst>
      <str name="core">split_shard1_1_temp_shard1_1_shard1_replica2</str>
    </lst>
    <lst>
      <lst name="responseHeader">
        <int name="status">0</int>
        <int name="QTime">5007</int>
      </lst>
    </lst>
    <lst>
      <lst name="responseHeader">
        <int name="status">0</int>
        <int name="QTime">8</int>
      </lst>
    </lst>
    <lst>
      <lst name="responseHeader">
        <int name="status">0</int>
        <int name="QTime">1</int>
      </lst>
      <str name="core">test2_shard1_1_replica1</str>
      <str name="status">EMPTY_BUFFER</str>
    </lst>
    <lst name="192.168.43.52:8983_solr">
      <lst name="responseHeader">
        <int name="status">0</int>
        <int name="QTime">30</int>
      </lst>
    </lst>
    <lst name="192.168.43.52:8983_solr">
      <lst name="responseHeader">
        <int name="status">0</int>
        <int name="QTime">30</int>
      </lst>
    </lst>
  </lst>
</response>
```

Add Role

/admin/collections?action=ADDROLE&role=*roleName*&node=*nodeName*

Assign a role to a given node in the cluster. The only supported role as of 4.7 is 'overseer' . Use this API to dedicate a particular node as Overseer. Invoke it multiple times to add more nodes. This is useful in large clusters where an Overseer is likely to get overloaded . If available, one among the list of nodes which are assigned the 'overseer' role would become the overseer. The system would assign the role to any other node if none of the designated nodes are up and running

Input

Query Parameters

Key	Type	Required	Description
role	string	Yes	The name of the role. The only supported role as of now is *overseer*.
node	string	Yes	The name of the node. It is possible to assign a role even before that node is started.

Output

Output Content

The response will include the status of the request and the properties that were updated or removed. If the status is anything other than "0", an error message will explain why the request failed.

Examples

Input

```
http://localhost:8983/solr/admin/collections?action=ADDROLE&role=overseer&node=192.1
67.1.2:8983_solr
```

Output

```
<response>
   <lst name="responseHeader">
      <int name="status">0</int>
      <int name="QTime">0</int>
   </lst>
</response>
```

Remove Role

/admin/collections?action=REMOVEROLE&role=*roleName*&node=*nodeName*

Remove an assigned role. This API is used to undo the roles assigned using ADDROLE operation

Input

Query Parameters

Key	Type	Required	Description
role	string	Yes	The name of the role. The only supported role as of now is *overseer*.
node	string	Yes	The name of the node.

Output

Output Content

The response will include the status of the request and the properties that were updated or removed. If the status is anything other than "0", an error message will explain why the request failed.

Examples

Input

```
http://localhost:8983/solr/admin/collections?action=REMOVEROLE&role=overseer&node=19
2.167.1.2:8983_solr
```

Output

```
<response>
   <lst name="responseHeader">
      <int name="status">0</int>
      <int name="QTime">0</int>
   </lst>
</response>
```

Overseer status and statistics

`/admin/collections?action=OVERSEERSTATUS`

Returns the current status of the overseer, performance statistics of various overseer APIs as well as last 10 failures per operation type.

Examples

Input:

```
http://localhost:8983/solr/admin/collections?action=OVERSEERSTATUS&wt=json
```

```
{
  "responseHeader":{
    "status":0,
    "QTime":33},
  "leader":"127.0.1.1:8983_solr",
  "overseer_queue_size":0,
  "overseer_work_queue_size":0,
  "overseer_collection_queue_size":2,
  "overseer_operations":[
    "createcollection",{
      "requests":2,
      "errors":0,
      "totalTime":1.010137,
      "avgRequestsPerMinute":0.7467088842794136,
      "5minRateRequestsPerMinute":7.525069023276674,
      "15minRateRequestsPerMinute":10.271274280947182,
      "avgTimePerRequest":0.5050685,
      "medianRequestTime":0.5050685,
      "75thPctlRequestTime":0.519016,
      "95thPctlRequestTime":0.519016,
      "99thPctlRequestTime":0.519016,
      "999thPctlRequestTime":0.519016},
    "removeshard",{
      "requests":1,
      "errors":0,
      "totalTime":0.26784,
      "avgRequestsPerMinute":0.4639267176178192,
      "5minRateRequestsPerMinute":8.179027994326175,
      "15minRateRequestsPerMinute":10.560587086130052,
      "avgTimePerRequest":0.26784,
      "medianRequestTime":0.26784,
      "75thPctlRequestTime":0.26784,
      "95thPctlRequestTime":0.26784,
      "99thPctlRequestTime":0.26784,
      "999thPctlRequestTime":0.26784},
    "updateshardstate",{
      "requests":1,
      "errors":0,
      "totalTime":0.609256,
      "avgRequestsPerMinute":0.43725644039684236,
      "5minRateRequestsPerMinute":8.043840552427673,
      "15minRateRequestsPerMinute":10.502079828515368,
      "avgTimePerRequest":0.609256,
      "medianRequestTime":0.609256,
      "75thPctlRequestTime":0.609256,
      "95thPctlRequestTime":0.609256,
      "99thPctlRequestTime":0.609256,
      "999thPctlRequestTime":0.609256},
    "state",{
      "requests":29,
      "errors":0,
      "totalTime":25.777765,
      "avgRequestsPerMinute":8.911471494053579,
      "5minRateRequestsPerMinute":16.77961791015292,
      "15minRateRequestsPerMinute":21.299616774565774,
      "avgTimePerRequest":0.888888448275862,
      "medianRequestTime":0.646322,
      "75thPctlRequestTime":0.7662585,
      "95thPctlRequestTime":4.9277995,
      "99thPctlRequestTime":6.687749,
      "999thPctlRequestTime":6.687749},
    "createshard",{
      "requests":2,
      "errors":0,
      "totalTime":0.328155,
      "avgRequestsPerMinute":0.8384528317300947,
      "5minRateRequestsPerMinute":15.560264184036232,
      "15minRateRequestsPerMinute":20.772071869612244,
      "avgTimePerRequest":0.1640775,
      "medianRequestTime":0.1640775,
      "75thPctlRequestTime":0.198494,
      "95thPctlRequestTime":0.198494,
      "99thPctlRequestTime":0.198494,
      "999thPctlRequestTime":0.198494},
    "leader",{
      "requests":15,
      "errors":0,
      "totalTime":1.850757,
      "avgRequestsPerMinute":4.664791390089222,
      "5minRateRequestsPerMinute":15.267394345445812,
      "15minRateRequestsPerMinute":20.61365640511346,
      "avgTimePerRequest":0.1233838,
      "medianRequestTime":0.095369,
      "75thPctlRequestTime":0.190858,
      "95thPctlRequestTime":0.245846,
      "99thPctlRequestTime":0.245846,
      "999thPctlRequestTime":0.245846},
    "deletecore",{
      "requests":2,
      "errors":0,
      "totalTime":0.1644,
      "avgRequestsPerMinute":0.9277190814105167,
      "5minRateRequestsPerMinute":16.35805598865235,
      "15minRateRequestsPerMinute":21.121174172260105,
      "avgTimePerRequest":0.0822,
      "medianRequestTime":0.0822,
      "75thPctlRequestTime":0.114723,
      "95thPctlRequestTime":0.114723,
      "99thPctlRequestTime":0.114723,
      "999thPctlRequestTime":0.114723}],
  "collection_operations":[
    "overseerstatus",{
      "requests":5,
      "errors":0,
      "totalTime":16.602856,
      "avgRequestsPerMinute":1.8002951096636433,
      "5minRateRequestsPerMinute":7.878245556506509,
      "15minRateRequestsPerMinute":10.39984320341109,
      "avgTimePerRequest":3.3205712000000003,
      "medianRequestTime":3.42046,
      "75thPctlRequestTime":4.0594019999999995,
      "95thPctlRequestTime":4.563145,
      "99thPctlRequestTime":4.563145,
      "999thPctlRequestTime":4.563145},
    "createalias",{
      "requests":1,
      "errors":0,
      "totalTime":101.364917,
      "avgRequestsPerMinute":8.304550290288862,
      "5minRateRequestsPerMinute":12.0,
      "15minRateRequestsPerMinute":12.0,
      "avgTimePerRequest":101.364917,
      "medianRequestTime":101.364917,
      "75thPctlRequestTime":101.364917,
      "95thPctlRequestTime":101.364917,
      "99thPctlRequestTime":101.364917,
      "999thPctlRequestTime":101.364917},
    "splitshard",{
      "requests":1,
      "errors":1,
      "recent_failures":[{
          "request":{
            "operation":"splitshard",
            "shard":"shard2",
            "collection":"example1"},
          "response":[
            "Operation splitshard caused
exception:","org.apache.solr.common.SolrException:org.apache.solr.common.SolrExcepti
on: No shard with the specified name exists: shard2",
            "exception",{
              "msg":"No shard with the specified name exists: shard2",
              "rspCode":400}]}],
      "totalTime":5905.432835,
      "avgRequestsPerMinute":0.8198143044809885,
      "5minRateRequestsPerMinute":8.043840552427673,
      "15minRateRequestsPerMinute":10.502079828515368,
      "avgTimePerRequest":2952.7164175,
      "medianRequestTime":2952.7164175000003,
      "75thPctlRequestTime":5904.384052,
      "95thPctlRequestTime":5904.384052,
      "99thPctlRequestTime":5904.384052,
      "999thPctlRequestTime":5904.384052},
    "createcollection",{
      "requests":2,
      "errors":0,
      "totalTime":6294.35359,
      "avgRequestsPerMinute":0.7466431055563431,
      "5minRateRequestsPerMinute":7.5271593686145355,
      "15minRateRequestsPerMinute":10.271591296400848,
      "avgTimePerRequest":3147.176795,
      "medianRequestTime":3147.1767950000003,
      "75thPctlRequestTime":3387.162793,
      "95thPctlRequestTime":3387.162793,
      "99thPctlRequestTime":3387.162793,
      "999thPctlRequestTime":3387.162793},
    "deleteshard",{
      "requests":1,
      "errors":0,
      "totalTime":320.071335,
      "avgRequestsPerMinute":0.4637771550349566,
      "5minRateRequestsPerMinute":8.179027994326175,
      "15minRateRequestsPerMinute":10.560587086130052,
      "avgTimePerRequest":320.071335,
      "medianRequestTime":320.071335,
      "75thPctlRequestTime":320.071335,
      "95thPctlRequestTime":320.071335,
      "99thPctlRequestTime":320.071335,
      "999thPctlRequestTime":320.071335}],
  "overseer_queue":[
    "peek_wait100",{
      "totalTime":2775.554755,
      "avgRequestsPerMinute":12.440395120289685,
      "5minRateRequestsPerMinute":18.487470843855192,
      "15minRateRequestsPerMinute":22.052847430688917,
      "avgTimePerRequest":69.388868875,
      "medianRequestTime":101.1499165,
      "75thPctlRequestTime":101.43390225,
      "95thPctlRequestTime":101.9976678,
      "99thPctlRequestTime":102.037032,
      "999thPctlRequestTime":102.037032},
    "peek_wait_forever",{
      "totalTime":63247.861899,
      "avgRequestsPerMinute":11.64420509572364,
      "5minRateRequestsPerMinute":31.572546097788198,
      "15minRateRequestsPerMinute":41.688934561096204,
      "avgTimePerRequest":1664.4174183947368,
      "medianRequestTime":636.5281970000001,
      "75thPctlRequestTime":1629.3317682499999,
      "95thPctlRequestTime":13220.58495709999,
      "99thPctlRequestTime":16293.17735,
      "999thPctlRequestTime":16293.17735},
    "remove",{
      "totalTime":92.528385,
      "avgRequestsPerMinute":15.979782864505227,
      "5minRateRequestsPerMinute":33.37988956147563,
      "15minRateRequestsPerMinute":42.49548598991928,
      "avgTimePerRequest":1.7793920192307693,
      "medianRequestTime":1.769479,
      "75thPctlRequestTime":2.22114175,
      "95thPctlRequestTime":3.148778999999998,
      "99thPctlRequestTime":4.393077,
      "999thPctlRequestTime":4.393077},
    "poll",{
      "totalTime":94.686248,
      "avgRequestsPerMinute":15.97973186166097,
      "5minRateRequestsPerMinute":33.37988956147563,
      "15minRateRequestsPerMinute":42.49548598991928,
      "avgTimePerRequest":1.8208893846153844,
      "medianRequestTime":1.819817,
      "75thPctlRequestTime":2.266558,
      "95thPctlRequestTime":3.2130298999999978,
      "99thPctlRequestTime":4.433906,
      "999thPctlRequestTime":4.433906}],
  "overseer_internal_queue":[
    "peek",{
      "totalTime":0.516668,
      "avgRequestsPerMinute":0.30642572162118586,
      "5minRateRequestsPerMinute":6.696421749240565,
      "15minRateRequestsPerMinute":9.879502985109362,
      "avgTimePerRequest":0.516668,
      "medianRequestTime":0.516668,
      "75thPctlRequestTime":0.516668,
      "95thPctlRequestTime":0.516668,
      "99thPctlRequestTime":0.516668,
      "999thPctlRequestTime":0.516668},
    "offer",{
      "totalTime":51.784521,
      "avgRequestsPerMinute":15.979724576198302,
      "5minRateRequestsPerMinute":33.37988956147563,
      "15minRateRequestsPerMinute":42.49548598991928,
      "avgTimePerRequest":0.9958561730769231,
      "medianRequestTime":0.8628875,
      "75thPctlRequestTime":1.1464622500000001,
      "95thPctlRequestTime":1.6499188,
      "99thPctlRequestTime":6.091519,
      "999thPctlRequestTime":6.091519},
    "remove",{
      "totalTime":143.130248,
      "avgRequestsPerMinute":27.6584163855513,
      "5minRateRequestsPerMinute":64.95243565926378,
      "15minRateRequestsPerMinute":84.18442055101546,
      "avgTimePerRequest":1.5903360888888889,
      "medianRequestTime":1.660893,
      "75thPctlRequestTime":2.35234925,
      "95thPctlRequestTime":3.19950245,
      "99thPctlRequestTime":5.01803,
      "999thPctlRequestTime":5.01803},
    "poll",{
      "totalTime":147.837065,
      "avgRequestsPerMinute":27.65837219382363,
      "5minRateRequestsPerMinute":64.95243565926378,
      "15minRateRequestsPerMinute":84.18442055101546,
      "avgTimePerRequest":1.6426340555555554,
      "medianRequestTime":1.6923249999999999,
      "75thPctlRequestTime":2.40090275,
      "95thPctlRequestTime":3.2569366,
      "99thPctlRequestTime":5.062005,
      "999thPctlRequestTime":5.062005}],
  "collection_queue":[
    "remove_event",{
      "totalTime":37.638197,
      "avgRequestsPerMinute":3.9610733603305124,
      "5minRateRequestsPerMinute":9.122591857306068,
      "15minRateRequestsPerMinute":10.928990808126446,
      "avgTimePerRequest":3.421654272727273,
      "medianRequestTime":3.411283,
      "75thPctlRequestTime":4.212892,
      "95thPctlRequestTime":4.720874,
      "99thPctlRequestTime":4.720874,
      "999thPctlRequestTime":4.720874},
    "peek_wait_forever",{
      "totalTime":183048.91735,
      "avgRequestsPerMinute":3.677073912023291,
      "5minRateRequestsPerMinute":1.5867138429776346,
      "15minRateRequestsPerMinute":0.6561136902644256,
      "avgTimePerRequest":15254.076445833334,
      "medianRequestTime":6745.20675,
      "75thPctlRequestTime":27662.958113499997,
      "95thPctlRequestTime":49871.380589,
      "99thPctlRequestTime":49871.380589,
      "999thPctlRequestTime":49871.380589}]}
```

Cluster Status

`/admin/collections?action=CLUSTERSTATUS`

Fetch the cluster status including collections, shards, replicas as well as collection aliases and cluster properties.

Input

Query Parameters

Key	Type	Required	Description
collection	string	No	The collection name for which information is requested. If omitted, information on all collections in the cluster will be returned.
shard	string	No	The shard(s) for which information is requested. Multiple shard names can be specified as a comma separated list.

Output

Output Content

The response will include the status of the request and the cluster status.

Examples

Input

```
http://localhost:8983/solr/admin/collections?action=clusterstatus&wt=json
```

Output

```
{
  "responseHeader":{
    "status":0,
    "QTime":333},
  "cluster":{
    "collections":{
      "collection1":{
        "shards":{
          "shard1":{
            "range":"80000000-ffffffff",
            "state":"active",
            "replicas":{
              "core_node1":{
                "state":"active",
                "core":"collection1",
                "node_name":"127.0.1.1:8983_solr",
                "base_url":"http://127.0.1.1:8983/solr",
                "leader":"true"},
              "core_node3":{
                "state":"active",
                "core":"collection1",
                "node_name":"127.0.1.1:8900_solr",
                "base_url":"http://127.0.1.1:8900/solr"}}},
          "shard2":{
            "range":"0-7fffffff",
            "state":"active",
            "replicas":{
              "core_node2":{
                "state":"active",
                "core":"collection1",
                "node_name":"127.0.1.1:7574_solr",
                "base_url":"http://127.0.1.1:7574/solr",
                "leader":"true"},
              "core_node4":{
                "state":"active",
                "core":"collection1",
                "node_name":"127.0.1.1:7500_solr",
                "base_url":"http://127.0.1.1:7500/solr"}}}},
        "maxShardsPerNode":"1",
        "router":{"name":"compositeId"},
        "replicationFactor":"1",
        "autoCreated":"true",
        "aliases":["both_collections"]},
      "collection2":{
        "shards":{
          "shard1":{
            "range":"80000000-d554ffff",
            "state":"active",
            "replicas":{"core_node1":{
                "state":"active",
                "core":"collection2_shard1_replica1",
                "node_name":"127.0.1.1:8983_solr",
                "base_url":"http://127.0.1.1:8983/solr",
                "leader":"true"}}},
          "shard2":{
            "range":"d5550000-2aa9ffff",
            "state":"active",
            "replicas":{"core_node2":{
                "state":"active",
                "core":"collection2_shard2_replica1",
                "node_name":"127.0.1.1:7500_solr",
                "base_url":"http://127.0.1.1:7500/solr",
                "leader":"true"}}},
          "shard3":{
            "range":"2aaa0000-7fffffff",
            "state":"active",
            "replicas":{"core_node3":{
                "state":"active",
                "core":"collection2_shard3_replica1",
                "node_name":"127.0.1.1:8900_solr",
                "base_url":"http://127.0.1.1:8900/solr",
                "leader":"true"}}}},
        "maxShardsPerNode":"1",
        "router":{"name":"compositeId"},
        "replicationFactor":"1",
        "autoAddReplicas":"false",
        "aliases":["both_collections"]}},
    "aliases":{"both_collections":"collection1,collection2"},
    "roles":{"overseer":["127.0.1.1:8983_solr",
        "127.0.1.1:7574_solr"]},
    "live_nodes":["127.0.1.1:7574_solr",
      "127.0.1.1:7500_solr",
      "127.0.1.1:8983_solr",
      "127.0.1.1:8900_solr"]}}
```

Request Status

`/admin/collections?action=REQUESTSTATUS&requestid=`*`request-id`*

Request the status of an already submitted Asynchronous Collection API call. This call is also used to clear up the stored statuses (See below).

Input

Query Parameters

Key	Type	Required	Description
requestid	string	Yes	The user defined request-id for the request. This can be used to track the status of the submitted asynchronous task. -1 is a special request id which is used to cleanup the stored states for all of the already completed/failed tasks.

Examples

Input: Valid Request Status

```
http://localhost:8983/solr/admin/collections?action=REQUESTSTATUS&requestid=1000
```

Output

```
<response>
  <lst name="responseHeader">
    <int name="status">0</int>
    <int name="QTime">1</int>
  </lst>
  <lst name="status">
    <str name="state">completed</str>
    <str name="msg">found 1000 in completed tasks</str>
  </lst>
</response>
```

Input: Invalid RequestId

```
http://localhost:8983/solr/admin/collections?action=REQUESTSTATUS&requestid=1004
```

Output

```
<response>
  <lst name="responseHeader">
    <int name="status">0</int>
    <int name="QTime">1</int>
  </lst>
  <lst name="status">
    <str name="state">notfound</str>
    <str name="msg">Did not find taskid [1004] in any tasks queue</str>
  </lst>
</response>
```

Input: Clearing up all the stored statuses

```
http://localhost:8983/solr/admin/collections?action=REQUESTSTATUS&requestid=-1
```

List Collections

`/admin/collections?action=LIST`

Fetch the names of the collections in the cluster.

Example

Input

```
http://localhost:8983/solr/admin/collections?action=LIST&wt=json
```

Output

```
{
  "responseHeader":{
    "status":0,
    "QTime":2011},
  "collections":["collection1",
    "example1",
    "example2"]}
```

Add Replica Property

`/admin/collections?action=ADDREPLICAPROP&collection=collectionName&shard=shardName&replica=replicaName&property=propertyName&property.value=value`

Assign an arbitrary property to a particular replica and give it the value specified. If the property already exists, it will be overwritten with the new value.

Input

Query Parameters

Key	Type	Required	Description
collection	string	Yes	The name of the collection this replica belongs to.

shard	string	Yes	The name of the shard the replica belongs to.
replica	string	Yes	The replica, e.g. core_node1.

property (1)	string	Yes	The property to add. Note: this will have the literal 'property.' prepended to distinguish it from system-maintained properties. So these two forms are equivalent:
			property=special
			and
			property=property.special

property.value	string	Yes	The value to assign to the property.
shardUnique (1)	Boolean	No	default: false. If true, then setting this property in one replica will remove the property from all other replicas in that shard.

(1) There is one pre-defined property "preferredLeader" for which shardUnique is forced to 'true' and an error returned if shardUnique is explicitly set to 'false'. PreferredLeader is a boolean property, any value assigned that is not equal (case insensitive) to 'true' will be interpreted as 'false' for preferredLeader.

Output

Output Content

The response will include the status of the request. If the status is anything other than "0", an error message will explain why the request failed.

Examples

Input: This command would set the preferredLeader (property.preferredLeader) to true on core_node1, and remove that property from any other replica in the shard.

```
http://localhost:8983/solr/admin/collections?action=ADDREPLICAPROP&shard=shard1&coll
ection=collection1&replica=core_node1&property=preferredLeader&property.value=true
```

Output

```
<response>
  <lst name="responseHeader">
    <int name="status">0</int>
    <int name="QTime">46</int>
  </lst>
</response>
```

Input: This pair of commands will set the "testprop" (property.testprop) to 'value1' and 'value2' respectively for two nodes in the same shard.

```
http://localhost:8983/solr/admin/collections?action=ADDREPLICAPROP&shard=shard1&coll
ection=collection1&replica=core_node1&property=testprop&property.value=value1

http://localhost:8983/solr/admin/collections?action=ADDREPLICAPROP&shard=shard1&coll
ection=collection1&replica=core_node3&property=property.testprop&property.value=valu
e2
```

Input: This pair of commands would result in core_node_3 having the testprop (property.testprop) value set because the second command specifies shardUnique=true, which would cause the property to be removed from core_node_1.

```
http://localhost:8983/solr/admin/collections?action=ADDREPLICAPROP&shard=shard1&coll
ection=collection1&replica=core_node1&property=testprop&property.value=value1

http://localhost:8983/solr/admin/collections?action=ADDREPLICAPROP&shard=shard1&coll
ection=collection1&replica=core_node3&property=testprop&property.value=value2&shardU
nique=true
```

Delete Replica Property

`/admin/collections?action=DELETEREPLICAPROP&collection=collectionName&shard=`*`shardName`*`&replica=`*`replicaName`*`&property=`*`propertyName`*

Deletes an arbitrary property from a particular replica.

Input

Query Parameters

Key	Type	Required	Description
collection	string	Yes	The name of the collection this replica belongs to
shard	string	Yes	The name of the shard the replica belongs to.
replica	string	Yes	The replica, e.g. core_node1.

property	string	Yes	The property to add. Note: this will have the literal 'property.' prepended to distinguish it from system-maintained properties. So these two forms are equivalent:
			property=special
			and
			property=property.special

Output

Output Content

The response will include the status of the request. If the status is anything other than "0", an error message will explain why the request failed.

Examples

Input: This command would delete the preferredLeader (property.preferredLeader) from core_node1.

```
http://localhost:8983/solr/admin/collections?action=DELETEREPLICAPROP&shard=shard1&c
ollection=collection1&replica=core_node1&property=preferredLeader
```

Output:

```
<response>
  <lst name="responseHeader">
    <int name="status">0</int>
    <int name="QTime">9</int>
  </lst>
</response>
```

Balance a Property

`/admin/collections?action=BALANCESHARDUNIQUE&collection=`*`collectionName`*`&property=`*`propertyName`*

Insures that a particular property is distributed evenly amongst the physical nodes that make up a collection. If the property already exists on a replica, every effort is made to leave it there. If the property is *not* on any replica on a shard one is chosen and the property is added.

Input

Query Parameters

Key	Type	Required	Description
collection	string	Yes	The name of the collection to balance the property in.
property	string	Yes	The property to balance. The literal "property." is prepended to this property if not specified explicitly.
onlyactivenodes	boolean	No	Defaults to true. Normally, the property is instantiated on active nodes only. If this parameter is specified as "false", then inactive nodes are also included for distribution.
shardUnique	boolean	No	Something of a safety valve. There is one pre-defined property (preferredLeader) that defaults this value to "true". For all other properties that are balanced, this must be set to "true" or an error message is returned.

Output

Output Content

The response will include the status of the request. If the status is anything other than "0", an error message will explain why the request failed.

Examples

Input: Either of these commands would put the "preferredLeader" property on one replica in every shard in the "collection1" collection.

```
http://localhost:8983/solr/admin/collections?action=BALANCEUNIQUE&collection=collect
ion1&property=preferredLeader

http://localhost:8983/solr/admin/collections?action=BALANCEUNIQUE&collection=collect
ion1&property=property.preferredLeader
```

Output:

```
<response>
  <lst name="responseHeader">
    <int name="status">0</int>
    <int name="QTime">9</int>
  </lst>
</response>
```

Examining the clusterstate after issuing this call should show exactly one replica in each shard that has this property.

Rebalance Leaders

Reassign leaders in a collection according to the preferredLeader property across active nodes.

`/admin/collections?action=REBALANCELEADERS&collection=collectionName`

Assigns leaders in a collection according to the preferredLeader property on active nodes. This command should be run after the preferredLeader property has been assigned via the BALANCESHARDUNIQUE or ADDREPLICAPROP commands. NOTE: it is not *required* that all shards in a collection have a preferredLeader property. Rebalancing will only attempt to reassign leadership to those replicas that have the preferredLeader property set to "true" *and* are not currently the shard leader *and* are currently active.

Input

Query Parameters

Key	Type	Required	Description
collection	string	Yes	The name of the collection to rebalance preferredLeaders on.
maxAtOnce	string	No	The maximum number of reassignments to have queue up at once. Values <=0 are use the default value Integer.MAX_VALUE. When this number is reached, the process waits for one or more leaders to be successfully assigned before adding more to the queue.
maxWaitSeconds	string	No	Defaults to 60. This is the timeout value when waiting for leaders to be reassigned. NOTE: if maxAtOnce is less than the number of reassignments that will take place, this is the maximum interval that any *single* wait for at least one reassignment. For example, if 10 reassignments are to take place and maxAtOnce is 1 and maxWaitSeconds is 60, the upper bound on the time that the command may wait is 10 minutes.

Output

Output Content

The response will include the status of the request. If the status is anything other than "0", an error message will explain why the request failed.

Examples

Input: Either of these commands would cause all the active replicas that had the "preferredLeader" property set and were *not* already the preferred leader to become leaders.

```
http://localhost:8983/solr/admin/collections?action=REBALANCELEADERS&collection=collection1
http://localhost:8983/solr/admin/collections?action=REBALANCELEADERS&collection=collection1&maxAtOnce=5&maxWaitSeconds=30
```

Output: In this example, two replicas in the "alreadyLeaders" section already had the leader assigned to the same node as the preferredLeader property so no action was taken. The replica in the "inactivePreferreds" section had the preferredLeader property set but the node was down and no action was taken. The three nodes in the "successes" section were made leaders because they had the preferredLeader property set but were not leaders and they were active.

```
<response>
  <lst name="responseHeader">
    <int name="status">0</int>
    <int name="QTime">123</int>
  </lst>
  <lst name="alreadyLeaders">
    <lst name="core_node1">
      <str name="status">success</str>
      <str name="msg">Already leader</str>
      <str name="nodeName">192.168.1.167:7400_solr</str>
    </lst>
    <lst name="core_node17">
      <str name="status">success</str>
      <str name="msg">Already leader</str>
      <str name="nodeName">192.168.1.167:7600_solr</str>
    </lst>
  </lst>
  <lst name="inactivePreferreds">
    <lst name="core_node4">
      <str name="status">skipped</str>
      <str name="msg">Node is a referredLeader, but it's inactive. Skipping</str>
      <str name="nodeName">192.168.1.167:7500_solr</str>
    </lst>
  </lst>
  <lst name="successes">
    <lst name="_collection1_shard3_replica1">
      <str name="status">success</str>
      <str name="msg">
        Assigned 'Collection: 'collection1', Shard: 'shard3', Core:
'collection1_shard3_replica1', BaseUrl:
        'http://192.168.1.167:8983/solr'' to be leader
      </str>
    </lst>
    <lst name="_collection1_shard5_replica3">
      <str name="status">success</str>
      <str name="msg">
        Assigned 'Collection: 'collection1', Shard: 'shard5', Core:
'collection1_shard5_replica3', BaseUrl:
        'http://192.168.1.167:7200/solr'' to be leader
      </str>
    </lst>
    <lst name="_collection1_shard4_replica2">
      <str name="status">success</str>
      <str name="msg">
        Assigned 'Collection: 'collection1', Shard: 'shard4', Core:
'collection1_shard4_replica2', BaseUrl:
        'http://192.168.1.167:7300/solr'' to be leader
      </str>
    </lst>
  </lst>
</response>
```

Examining the clusterstate after issuing this call should show that every live node that has the "preferredLeader" property should also have the "leader" property set to *true*.

Asynchronous Calls

Since some collection API calls can be long running tasks e.g. Shard Split, you can optionally have the calls run asynchronously. Specifying *async=<request-id>* enables you to make an asynchronous call, the status of which can be, at any point requested using the REQUESTSTATUS call.

As of now, the REQUESTSTATUS does not automatically cleanup the tracking data structures i.e. the status of completed/failed tasks stays stored in ZooKeeper unless cleared manually. Sending a REQUESTSTATUS call with *requestid* of ***-1*** clears the stored statuses.

Example

Input

```
http://localhost:8983/solr/admin/collections?action=SPLITSHARD&collection=collection
1&shard=shard1&async=1000
```

Output

```
<response>
  <lst name="responseHeader">
    <int name="status">0</int>
    <int name="QTime">99</int>
  </lst>
  <str name="requestid">1000</str>
</response>
```

Parameter Reference

Cluster Parameters

`numShards`	Defaults to 1	The number of shards to hash documents to. There must be one leader per shard and each leader can have N replicas.

SolrCloud Instance Parameters

These are set in `solr.xml`, but by default the `host` and `hostContext` parameters are set up to also work with system properties.

`host`	Defaults to the first local host address found	If the wrong host address is found automatically, you can override the host address with this parameter.
`hostPort`	Defaults to the port specified via `bin/solr -p <port>`, or 8983 if not specified.	The port that Solr is running on. This value is only used when `-DzkRun` is specified without a value (see below), to calculate the default port on which embedded ZooKeeper will run. In the `solr.xml` shipped with Solr, the `hostPort` system property is not referenced, and so is ignored. If you want to run Solr on a non-default port, use `bin/solr -p <port>` rather than specifying `-DhostPort`.

`hostContext`	Defaults to `solr`	The context path for the Solr web application.

SolrCloud Instance ZooKeeper Parameters

`zkRun`	Defaults to `localhost:<hostPort+1000>`	Causes Solr to run an embedded version of ZooKeeper. Set to the address of ZooKeeper on this node; this allows us to know who you are in the list of addresses in the `zkHost` connect string. Use `-DzkRun` (with no value) to get the default value.
`zkHost`	No default	The host address for ZooKeeper. Usually this is a comma-separated list of addresses to each node in your ZooKeeper ensemble.
`zkClientTimeout`	Defaults to 15000	The time a client is allowed to not talk to ZooKeeper before its session expires.

`zkRun` and `zkHost` are set up using system properties. `zkClientTimeout` is set up in `solr.xml` by default, but can also be set using a system property.

SolrCloud Core Parameters

`shardId`	Defaults to being automatically assigned based on numShards	Allows you to specify the id used to group cores into shards.

`shardId` can be configured in `solr.xml` for each core element as an attribute.

Additional cloud related parameters are discussed in Solr Cores and solr.xml.

Command Line Utilities

Solr's Administration page (found by default at `http://hostname:8983/solr/`), provides a section with menu items for monitoring indexing and performance statistics, information about index distribution and replication, and information on all threads running in the JVM at the time. There is also a section where you can run queries, and an assistance area.

In addition, SolrCloud provides its own administration page (found at http://localhost:8983/solr/#/~cloud), as well as a few tools available via a ZooKeeper Command Line Utility (CLI). The CLI scripts found in `server/scripts/cloud-scripts` let you upload configuration information to ZooKeeper, in the same two ways that were shown in the examples in Parameter Reference. It also provides a few other commands that let you link collection sets to collections, make ZooKeeper paths or clear them, and download configurations from ZooKeeper to the local filesystem.

⚠ **Solr's zkcli.sh vs ZooKeeper's zkCli.sh**
The `zkcli.sh` provided by Solr is not the same as the `zkCli.sh` included in ZooKeeper distributions.

ZooKeeper's `zkCli.sh` provides a completely general, application-agnostic shell for manipulating data in ZooKeeper. Solr's `zkcli.sh` – discussed in this section – is specific to Solr, and has command line arguments specific to dealing with Solr data in ZooKeeper.

Using Solr's ZooKeeper CLI

Both `zkcli.sh` (for Unix environments) and `zkcli.bat` (for Windows environments) support the following command line options:

Short	Parameter Usage	Meaning
	`-cmd <arg>`	CLI Command to be executed: `bootstrap`, `upconfig`, `downconfig`, `linkconfig`, `makepath`, `get`, `getfile`, `put`, `putfile`, `list` or `clear`. This parameter is **mandatory**
`-z`	`-zkhost <locations>`	ZooKeeper host address. This parameter is **mandatory** for all CLI commands.
`-c`	`-collection <name>`	For `linkconfig`: name of the collection.
`-d`	`-confdir <path>`	For `upconfig`: a directory of configuration files.
`-h`	`-help`	Display help text.
`-n`	`-confname <arg>`	For `upconfig`, `linkconfig`: name of the configuration set.
`-r`	`-runzk <port>`	Run ZooKeeper internally by passing the Solr run port; only for clusters on one machine.
`-s`	`-solrhome <path>`	For `bootstrap` or when using `-runzk`: the **mandatory** solrhome location.

The short form parameter options may be specified with a single dash (eg: `-c mycollection`).
The long form parameter options may be specified using either a single dash (eg: `-collection mycollection`) or a double dash (eg: `--collection mycollection`)

ZooKeeper CLI Examples

Below are some examples of using the `zkcli.sh` CLI which assume you have already started the SolrCloud example (`bin/solr -e cloud -noprompt`)

If you are on Windows machine, simply replace `zkcli.sh` with `zkcli.bat` in these examples.

Upload a configuration directory

```
./server/scripts/cloud-scripts/zkcli.sh -zkhost 127.0.0.1:9983 \
   -cmd upconfig -confname my_new_config -confdir
server/solr/configsets/basic_configs/conf
```

Put arbitrary data into a new ZooKeeper file

```
./server/scripts/cloud-scripts/zkcli.sh -zkhost 127.0.0.1:9983 \
   -cmd put /my_zk_file.txt 'some data'
```

Put a local file into a new ZooKeeper file

```
./server/scripts/cloud-scripts/zkcli.sh -zkhost 127.0.0.1:9983 \
   -cmd putfile /my_zk_file.txt /tmp/my_local_file.txt
```

Link a collection to a configuration set

```
./server/scripts/cloud-scripts/zkcli.sh -zkhost 127.0.0.1:9983 \
   -cmd linkconfig -collection gettingstarted -confname my_new_config
```

SolrCloud with Legacy Configuration Files

All of the required configuration is already set up in the sample configurations shipped with Solr. You only need to add the following if you are migrating old configuration files. Do not remove these files and parameters from a new Solr instance if you intend to use Solr in SolrCloud mode.

These properties exist in 3 files: `schema.xml`, `solrconfig.xml`, and `solr.xml`.

1. In `schema.xml`, you must have a `_version_` field defined:

```
<field name="_version_" type="long" indexed="true" stored="true"
multiValued="false"/>
```

2. In `solrconfig.xml`, you must have an `UpdateLog` defined. This should be defined in the `updateHandler` section.

```
<updateHandler>
  ...
  <updateLog>
    <str name="dir">${solr.data.dir:}</str>
  </updateLog>
  ...
</updateHandler>
```

3. The DistributedUpdateProcessor is part of the default update chain and is automatically injected into any of your custom update chains, so you don't actually need to make any changes for this capability. However, should

you wish to add it explicitly, you can still add it to the `solrconfig.xml` file as part of an `updateRequestProcessorChain`. For example:

```
<updateRequestProcessorChain name="sample">
  <processor class="solr.LogUpdateProcessorFactory" />
  <processor class="solr.DistributedUpdateProcessorFactory"/>
  <processor class="my.package.UpdateFactory"/>
  <processor class="solr.RunUpdateProcessorFactory" />
</updateRequestProcessorChain>
```

If you do not want the DistributedUpdateProcessFactory auto-injected into your chain (for example, if you want to use SolrCloud functionality, but you want to distribute updates yourself) then specify the `NoOpDistributingUpdateProcessorFactory` update processor factory in your chain:

```
<updateRequestProcessorChain name="sample">
  <processor class="solr.LogUpdateProcessorFactory" />
  <processor class="solr.NoOpDistributingUpdateProcessorFactory"/>
  <processor class="my.package.MyDistributedUpdateFactory"/>
  <processor class="solr.RunUpdateProcessorFactory" />
</updateRequestProcessorChain>
```

In the update process, Solr skips updating processors that have already been run on other nodes.

Legacy Scaling and Distribution

This section describes how to set up distribution and replication in Solr. It is considered "legacy" behavior, since while it is still supported in Solr, the SolrCloud functionality described in the previous chapter is where the current development is headed. However, if you don't need all that SolrCloud delivers, search distribution and index replication may be sufficient.

This section covers the following topics:

Introduction to Scaling and Distribution: Conceptual information about distribution and replication in Solr.

Distributed Search with Index Sharding: Detailed information about implementing distributed searching in Solr.

Index Replication: Detailed information about replicating your Solr indexes.

Combining Distribution and Replication: Detailed information about replicating shards in a distributed index.

Merging Indexes: Information about combining separate indexes in Solr.

Introduction to Scaling and Distribution

Both Lucene and Solr were designed to scale to support large implementations with minimal custom coding. This section covers:

- distributing an index across multiple servers
- replicating an index on multiple servers
- merging indexes

If you need full scale distribution of indexes and queries, as well as replication, load balancing and failover, you may want to use SolrCloud. Full details on configuring and using SolrCloud is available in the section SolrCloud.

What Problem Does Distribution Solve?

If searches are taking too long or the index is approaching the physical limitations of its machine, you should consider distributing the index across two or more Solr servers.

To distribute an index, you divide the index into partitions called shards, each of which runs on a separate machine. Solr then partitions searches into sub-searches, which run on the individual shards, reporting results collectively. The architectural details underlying index sharding are invisible to end users, who simply experience faster performance on queries against very large indexes.

What Problem Does Replication Solve?

Replicating an index is useful when:

- You have a large search volume which one machine cannot handle, so you need to distribute searches across multiple read-only copies of the index.
- There is a high volume/high rate of indexing which consumes machine resources and reduces search performance on the indexing machine, so you need to separate indexing and searching.
- You want to make a backup of the index (see Backing Up).

Distributed Search with Index Sharding

It is highly recommended that you use SolrCloud when needing to scale up or scale out. The setup described below is legacy and was used prior to the existence of SolrCloud. SolrCloud provides for a truly distributed set of features with support for things like automatic routing, leader election, optimistic concurrency and other sanity checks that are expected out of a distributed system.

Everything on this page is specific to legacy setup of distributed search. Users trying out SolrCloud should not follow any of the steps or information below.

Update reorders (i.e., replica A may see update X then Y, and replica B may see update Y then X). **deleteByQuery** also handles reorders the same way, to ensure replicas are consistent. All replicas of a shard are consistent, even if the updates arrive in a different order on different replicas.

Distributing Documents across Shards

When not using SolrCloud, it is up to you to get all your documents indexed on each shard of your server farm. Solr supports distributed indexing (routing) in it's true form only in the SolrCloud mode.

In the legacy distributed mode, Solr does not calculate universal term/doc frequencies. For most large-scale implementations, it is not likely to matter that Solr calculates TD/IDF at the shard level. However, if your collection is heavily skewed in its distribution across servers, you may find misleading relevancy results in your searches. In general, it is probably best to randomly distribute documents to your shards.

Executing Distributed Searches with the `shards` Parameter

If a query request includes the `shards` parameter, the Solr server distributes the request across all the shards listed as arguments to the parameter. The `shards` parameter uses this syntax:

`host : port / base_url [, host : port / base_url ]*`

For example, the `shards` parameter below causes the search to be distributed across two Solr servers: **solr1** and **solr2**, both of which are running on port 8983:

```
http://localhost:8983/solr/core1/select?shards=solr1:8983/solr/core1,solr2:8983/solr/core1&indent=true&q=ipod+solr
```

Rather than require users to include the shards parameter explicitly, it is usually preferred to configure this parameter as a default in the RequestHandler section of `solrconfig.xml`.

> ⚠ Do not add the `shards` parameter to the standard requestHandler; otherwise, search queries may enter an infinite loop. Instead, define a new requestHandler that uses the `shards` parameter, and pass distributed search requests to that handler.

Currently, only query requests are distributed. This includes requests to the standard request handler (and subclasses such as the DisMax RequestHandler), and any other handler (`org.apache.solr.handler.component.searchHandler`) using standard components that support distributed search.

As in SolrCloud mode, when `shards.info=true`, distributed responses will include information about the shard (where each shard represents a logically different index or physical location)

The following components support distributed search:

- The **Query** component, which returns documents matching a query
- The **Facet** component, which processes facet.query and facet.field requests where facets are sorted by count (the default).

- The **Highlighting** component, which enables Solr to include "highlighted" matches in field values.
- The **Stats** component, which returns simple statistics for numeric fields within the DocSet.
- The **Debug** component, which helps with debugging.

Limitations to Distributed Search

Distributed searching in Solr has the following limitations:

- Each document indexed must have a unique key.
- If Solr discovers duplicate document IDs, Solr selects the first document and discards subsequent ones.
- The index for distributed searching may become momentarily out of sync if a commit happens between the first and second phase of the distributed search. This might cause a situation where a document that once matched a query and was subsequently changed may no longer match the query but will still be retrieved. This situation is expected to be quite rare, however, and is only possible for a single query request.
- The number of shards is limited by number of characters allowed for GET method's URI; most Web servers generally support at least 4000 characters, but many servers limit URI length to reduce their vulnerability to Denial of Service (DoS) attacks.
- TF/IDF computations are per shard. This may not matter if content is well (randomly) distributed.
- Shard information can be returned with each document in a distributed search by including `fl=id, [shard]` in the search request. This returns the shard URL.
- In a distributed search, the data directory from the core descriptor overrides any data directory in `solrconfig.xml`.
- Update commands may be sent to any server with distributed indexing configured correctly. Document adds and deletes are forwarded to the appropriate server/shard based on a hash of the unique document id. **commit** commands and **deleteByQuery** commands are sent to every server in `shards`.

Avoiding Distributed Deadlock

Like in SolrCloud mode, inter-shard requests could lead to a distributed deadlock. It can be avoided by following the instructions here.

Testing Index Sharding on Two Local Servers

For simple functionality testing, it's easiest to just set up two local Solr servers on different ports. (In a production environment, of course, these servers would be deployed on separate machines.)

1. Make two Solr home directories:

```
mkdir example/nodes
mkdir example/nodes/node1
# Copy solr.xml into this solr.home
cp server/solr/solr.xml example/nodes/node1/.
# Repeat the above steps for the second node
mkdir example/nodes/node2
cp server/solr/solr.xml example/nodes/node2/.
```

2. Start the two Solr instances

```
# Start first node on port 8983
bin/solr start -s example/nodes/node1 -p 8983

# Start second node on port 8984
bin/solr start -s example/nodes/node2 -p 8984
```

3. Create a core on both the nodes with the sample_techproducts_configs.

   ```
   bin/solr create_core -c core1 -p 8983 -d sample_techproducts_configs
   # Create a core on the Solr node running on port 8984
   bin/solr create_core -c core1 -p 8984 -d sample_techproducts_configs
   ```

4. In the third window, index an example document to each of the server:

   ```
   bin/post -c core1 example/exampledocs/monitor.xml -port 8983

   bin/post -c core1 example/exampledocs/monitor2.xml -port 8984
   ```

5. Search on the node on port 8983:

   ```
   curl http://localhost:8983/solr/core1/select?q=*:*&wt=xml&indent=true
   ```

   This should bring back one document.

   Search on the node on port 8984:

   ```
   curl http://localhost:8984/solr/core1/select?q=*:*&wt=xml&indent=true
   ```

   This should also bring back a single document.

   Now do a distributed search across both servers with your browser or `curl.` In the example below, an extra parameter 'fl' is passed to restrict the returned fields to id and name.

   ```
   curl
   http://localhost:8983/solr/core1/select?q=*:*&indent=true&shards=localhost:898
   3/solr/core1,localhost:8984/solr/core1&fl=id,name
   ```

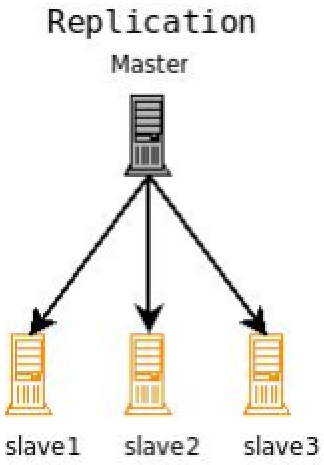
   This should contain both the document as shown below:

```
<response>
<lst name="responseHeader">
  <int name="status">0</int>
  <int name="QTime">8</int>
  <lst name="params">
    <str name="q">*:*</str>
    <str
name="shards">localhost:8983/solr/core1,localhost:8984/solr/core1</str>
    <str name="indent">true</str>
    <str name="fl">id,name</str>
    <str name="wt">xml</str>
  </lst>
</lst>
<result name="response" numFound="2" start="0" maxScore="1.0">
  <doc>
    <str name="id">3007WFP</str>
    <str name="name">Dell Widescreen UltraSharp 3007WFP</str>
  </doc>
  <doc>
    <str name="id">VA902B</str>
    <str name="name">ViewSonic VA902B - flat panel display - TFT - 19"</str>
  </doc>
</result>
</response>
```

Index Replication

Index Replication distributes complete copies of a master index to one or more slave servers. The master server continues to manage updates to the index. All querying is handled by the slaves. This division of labor enables Solr to scale to provide adequate responsiveness to queries against large search volumes.

The figure below shows a Solr configuration using index replication. The master server's index is replicated on the slaves.



A Solr index can be replicated across multiple slave servers, which then process requests.

Topics covered in this section:

- Index Replication in Solr
- Replication Terminology
- Configuring the ReplicationHandler

Index Replication in Solr

Solr includes a Java implementation of index replication that works over HTTP:

- The configuration affecting replication is controlled by a single file, `solrconfig.xml`
- Supports the replication of configuration files as well as index files
- Works across platforms with same configuration
- No reliance on OS-dependent file system features (eg: hard links)
- Tightly integrated with Solr; an admin page offers fine-grained control of each aspect of replication
- The Java-based replication feature is implemented as a request handler. Configuring replication is therefore similar to any normal request handler.

> **Replication In SolrCloud**
> Although there is no explicit concept of "master/slave" nodes in a SolrCloud cluster, the `ReplicationHandler` discussed on this page is still used by SolrCloud as needed to support "shard recovery" – but this is done in a peer to peer manner. When using SolrCloud, the `ReplicationHandler` must be available via the `/replication` path. Solr does this implicitly unless overridden explicitly in your `solrconfig.xml`, but If you wish to override the default behavior, make certain that you do not explicitly set any of the "master" or "slave" configuration options mentioned below, or they will interfere with normal SolrCloud operation.

Replication Terminology

The table below defines the key terms associated with Solr replication.

Term	Definition
Index	A Lucene index is a directory of files. These files make up the searchable and returnable data of a Solr Core.
Distribution	The copying of an index from the master server to all slaves. The distribution process takes advantage of Lucene's index file structure.
Inserts and Deletes	As inserts and deletes occur in the index, the directory remains unchanged. Documents are always inserted into newly created files. Documents that are deleted are not removed from the files. They are flagged in the file, deletable, and are not removed from the files until the index is optimized.

Master and Slave	A Solr replication master is a single node which receives all updates initially and keeps everything organized. Solr replication slave nodes receive no updates directly, instead all changes (such as inserts, updates, deletes, etc.) are made against the single master node. Changes made on the master are distributed to all the slave nodes which service all query requests from the clients.
Update	An update is a single change request against a single Solr instance. It may be a request to delete a document, add a new document, change a document, delete all documents matching a query, etc. Updates are handled synchronously within an individual Solr instance.
Optimization	A process that compacts the index and merges segments in order to improve query performance. Optimization should only be run on the master nodes. An optimized index may give query performance gains compared to an index that has become fragmented over a period of time with many updates. Distributing an optimized index requires a much longer time than the distribution of new segments to an un-optimized index.
Segments	A self contained subset of an index consisting of some documents and data structures related to the inverted index of terms in those documents.
mergeFactor	A parameter that controls the number of segments in an index. For example, when mergeFactor is set to 3, Solr will fill one segment with documents until the limit maxBufferedDocs is met, then it will start a new segment. When the number of segments specified by mergeFactor is reached (in this example, 3) then Solr will merge all the segments into a single index file, then begin writing new documents to a new segment.
Snapshot	A directory containing hard links to the data files of an index. Snapshots are distributed from the master nodes when the slaves pull them, "smart copying" any segments the slave node does not have in snapshot directory that contains the hard links to the most recent index data files.

Configuring the ReplicationHandler

In addition to `ReplicationHandler` configuration options specific to the master/slave roles, there are a few special configuration options that are generally supported (even when using SolrCloud).

- `maxNumberOfBackups` an integer value dictating the maximum number of backups this node will keep on disk as it receives `backup` commands.
- Similar to most other request handlers in Solr you may configure a set of "defaults, invariants, and/or appends" parameters corresponding with any request parameters supported by the `ReplicationHandler` when processing commands.

Configuring the Replication RequestHandler on a Master Server

Before running a replication, you should set the following parameters on initialization of the handler:

Name	Description
replicateAfter	String specifying action after which replication should occur. Valid values are commit, optimize, or startup. There can be multiple values for this parameter. If you use "startup", you need to have a "commit" and/or "optimize" entry also if you want to trigger replication on future commits or optimizes.

backupAfter	String specifying action after which a backup should occur. Valid values are commit, optimize, or startup. There can be multiple values for this parameter. It is not required for replication, it just makes a backup.
maxNumberOfBackups	Integer specifying how many backups to keep. This can be used to delete all but the most recent N backups.
confFiles	The configuration files to replicate, separated by a comma.
commitReserveDuration	If your commits are very frequent and your network is slow, you can tweak this parameter to increase the amount of time taken to download 5Mb from the master to a slave. The default is 10 seconds.

The example below shows a possible 'master' configuration for the `ReplicationHandler`, including a fixed number of backups and an invariant setting for the `maxWriteMBPerSec` request parameter to prevent slaves from saturating it's network interface

```
<requestHandler name="/replication" class="solr.ReplicationHandler" >
    <lst name="master">
        <str name="replicateAfter">optimize</str>
        <str name="backupAfter">optimize</str>
        <str name="confFiles">schema.xml,stopwords.txt,elevate.xml</str>
        <str name="commitReserveDuration">00:00:10</str>
    </lst>
    <int name="maxNumberOfBackups">2</int>
    <lst name="invariants">
      <str name="maxWriteMBPerSec">16</str>
    </lst>
</requestHandler>
```

Replicating ***`solrconfig.xml`***

In the configuration file on the master server, include a line like the following:

```
<str name="confFiles">solrconfig_slave.xml:solrconfig.xml,x.xml,y.xml</str>
```

This ensures that the local configuration `solrconfig_slave.xml` will be saved as `solrconfig.xml` on the slave. All other files will be saved with their original names.

On the master server, the file name of the slave configuration file can be anything, as long as the name is correctly identified in the `confFiles` string; then it will be saved as whatever file name appears after the colon ':'.

Configuring the Replication RequestHandler on a Slave Server

The code below shows how to configure a ReplicationHandler on a slave.

```
<requestHandler name="/replication" class="solr.ReplicationHandler" >
    <lst name="slave">

        <!--fully qualified url for the replication handler of master. It is
possible to pass on this as
            a request param for the fetchindex command-->

        <str
name="masterUrl">http://remote_host:port/solr/core_name/replication</str>

        <!--Interval in which the slave should poll master .Format is HH:mm:ss . If
this is absent slave does not
            poll automatically.

         But a fetchindex can be triggered from the admin or the http API -->

        <str name="pollInterval">00:00:20</str>

        <!-- THE FOLLOWING PARAMETERS ARE USUALLY NOT REQUIRED-->

        <!--to use compression while transferring the index files. The possible
values are internal|external
         if the value is 'external' make sure that your master Solr has the settings
to honor the
         accept-encoding header.
         See here for details: http://wiki.apache.org/solr/SolrHttpCompression
         If it is 'internal' everything will be taken care of automatically.
         USE THIS ONLY IF YOUR BANDWIDTH IS LOW . THIS CAN ACTUALLY SLOWDOWN
REPLICATION IN A LAN-->

        <str name="compression">internal</str>

        <!--The following values are used when the slave connects to the master to
download the index files.
         Default values implicitly set as 5000ms and 10000ms respectively. The user
DOES NOT need to specify
         these unless the bandwidth is extremely low or if there is an extremely
high latency-->

        <str name="httpConnTimeout">5000</str>
        <str name="httpReadTimeout">10000</str>

        <!-- If HTTP Basic authentication is enabled on the master, then the slave
can be
             configured with the following -->

        <str name="httpBasicAuthUser">username</str>
        <str name="httpBasicAuthPassword">password</str>
     </lst>
</requestHandler>
```

Setting Up a Repeater with the ReplicationHandler

A master may be able to serve only so many slaves without affecting performance. Some organizations have deployed slave servers across multiple data centers. If each slave downloads the index from a remote data center, the resulting download may consume too much network bandwidth. To avoid performance degradation in cases like this, you can configure one or more slaves as repeaters. A repeater is simply a node that acts as both a master and a slave.

- To configure a server as a repeater, the definition of the Replication `requestHandler` in the `solrconfig.xml` file must include file lists of use for both masters and slaves.
- Be sure to set the `replicateAfter` parameter to commit, even if `replicateAfter` is set to optimize on the main master. This is because on a repeater (or any slave), a commit is called only after the index is downloaded. The optimize command is never called on slaves.
- Optionally, one can configure the repeater to fetch compressed files from the master through the compression parameter to reduce the index download time.

Here is an example of a ReplicationHandler configuration for a repeater:

```
<requestHandler name="/replication" class="solr.ReplicationHandler">
    <lst name="master">
      <str name="replicateAfter">commit</str>
      <str name="confFiles">schema.xml,stopwords.txt,synonyms.txt</str>
    </lst>
    <lst name="slave">
      <str
name="masterUrl">http://master.solr.company.com:8983/solr/core_name/replication</str
>
      <str name="pollInterval">00:00:60</str>
    </lst>
  </requestHandler>
```

Commit and Optimize Operations

When a commit or optimize operation is performed on the master, the RequestHandler reads the list of file names which are associated with each commit point. This relies on the `replicateAfter` parameter in the configuration to decide which types of events should trigger replication.

Setting on the Master	Description
commit	Triggers replication whenever a commit is performed on the master index.
optimize	Triggers replication whenever the master index is optimized.
startup	Triggers replication whenever the master index starts up.

The replicateAfter parameter can accept multiple arguments. For example:

```
<str name="replicateAfter">startup</str>
<str name="replicateAfter">commit</str>
<str name="replicateAfter">optimize</str>
```

Slave Replication

The master is totally unaware of the slaves. The slave continuously keeps polling the master (depending on the `pollInterval` parameter) to check the current index version of the master. If the slave finds out that the master has a newer version of the index it initiates a replication process. The steps are as follows:

- The slave issues a `filelist` command to get the list of the files. This command returns the names of the files as well as some metadata (for example, size, a lastmodified timestamp, an alias if any).

- The slave checks with its own index if it has any of those files in the local index. It then runs the filecontent command to download the missing files. This uses a custom format (akin to the HTTP chunked encoding) to download the full content or a part of each file. If the connection breaks in between, the download resumes from the point it failed. At any point, the slave tries 5 times before giving up a replication altogether.
- The files are downloaded into a temp directory, so that if either the slave or the master crashes during the download process, no files will be corrupted. Instead, the current replication will simply abort.
- After the download completes, all the new files are moved to the live index directory and the file's timestamp is same as its counterpart on the master.
- A commit command is issued on the slave by the Slave's ReplicationHandler and the new index is loaded.

Replicating Configuration Files

To replicate configuration files, list them using using the `confFiles` parameter. Only files found in the `conf` directory of the master's Solr instance will be replicated.

Solr replicates configuration files only when the index itself is replicated. That means even if a configuration file is changed on the master, that file will be replicated only after there is a new commit/optimize on master's index.

Unlike the index files, where the timestamp is good enough to figure out if they are identical, configuration files are compared against their checksum. The `schema.xml` files (on master and slave) are judged to be identical if their checksums are identical.

As a precaution when replicating configuration files, Solr copies configuration files to a temporary directory before moving them into their ultimate location in the conf directory. The old configuration files are then renamed and kept in the same `conf/` directory. The ReplicationHandler does not automatically clean up these old files.

If a replication involved downloading of at least one configuration file, the ReplicationHandler issues a core-reload command instead of a commit command.

Resolving Corruption Issues on Slave Servers

If documents are added to the slave, then the slave is no longer in sync with its master. However, the slave will not undertake any action to put itself in sync, until the master has new index data. When a commit operation takes place on the master, the index version of the master becomes different from that of the slave. The slave then fetches the list of files and finds that some of the files present on the master are also present in the local index but with different sizes and timestamps. This means that the master and slave have incompatible indexes. To correct this problem, the slave then copies all the index files from master to a new index directory and asks the core to load the fresh index from the new directory.

HTTP API Commands for the ReplicationHandler

You can use the HTTP commands below to control the ReplicationHandler's operations.

Command	Description
http://*master_host:port*/solr/*core_name*/replication?command=enablereplication	Enables replication on the master for all its slaves.
http://*master_host:port*/solr/*core_name*/replication?command=disablereplication	Disables replication on the master for all its slaves.

http://*host:port*/solr/*core_name*/replication?command=indexversion	Returns the version of the latest replicatable index on the specified master or slave.
http://*slave_host:port*/solr/*core_name*/replication?command=fetchindex	Forces the specified slave to fetch a copy of the index from its master. If you like, you can pass an extra attribute such as masterUrl or compression (or any other parameter which is specified in the `<lst name="slave">` tag) to do a one time replication from a master. This obviates the need for hard-coding the master in the slave.
http://*slave_host:port*/solr/*core_name*/replication?command=abortfetch	Aborts copying an index from a master to the specified slave.
http://*slave_host:port*/solr/*core_name*/replication?command=enablepoll	Enables the specified slave to poll for changes on the master.
http://*slave_host:port*/solr/*core_name*/replication?command=disablepoll	Disables the specified slave from polling for changes on the master.
http://*slave_host:port*/solr/*core_name*/replication?command=details	Retrieves configuration details and current status.
http://*host:port*/solr/*core_name*/replication?command=filelist&indexversion=<*index-version-number*>	Retrieves a list of Lucene files present in the specified host's index. You can discover the version number of the index by running the `indexversion` command.
http://*master_host:port*/solr/*core_name*/replication?command=backup	Creates a backup on master if there are committed index data in the server; otherwise, does nothing. This command is useful for making periodic backups. supported request parameters: • `numberToKeep:` request parameter can be used with the backup command unless the `maxNumberOfBackups` initialization parameter has been specified on the handler – in which case `maxNumberOfBackups` is always used and attempts to use the `numberToKeep` request parameter will cause an error. • `name` : (optional) Backup name . The snapshot will be created in a directory called snapshot.<name> within the data directory of the core . By default the name is generated using date in `yyyyMMddHHmmssSSS` format. If `location` parameter is passed , that would be used instead of the data directory • `location` : Backup location

http:// *master_host:port* /solr/*core_name*/replication?command=deletebackup	Delete any backup created using the `backup` command . request parameters: • name: The name of the snapshot . A snapshot with the name snapshot.<name> must exist .If not, an error is thrown • location: Location where the snapshot is created

Distribution and Optimization

Optimizing an index is not something most users should generally worry about - but in particular users should be aware of the impacts of optimizing an index when using the `ReplicationHandler`.

The time required to optimize a master index can vary dramatically. A small index may be optimized in minutes. A very large index may take hours. The variables include the size of the index and the speed of the hardware.

Distributing a newly optimized index may take only a few minutes or up to an hour or more, again depending on the size of the index and the performance capabilities of network connections and disks. During optimization the machine is under load and does not process queries very well. Given a schedule of updates being driven a few times an hour to the slaves, we cannot run an optimize with every committed snapshot.

Copying an optimized index means that the **entire** index will need to be transferred during the next snappull. This is a large expense, but not nearly as huge as running the optimize everywhere. Consider this example: on a three-slave one-master configuration, distributing a newly-optimized index takes approximately 80 seconds *total*. Rolling the change across a tier would require approximately ten minutes per machine (or machine group). If this optimize were rolled across the query tier, and if each slave node being optimized were disabled and not receiving queries, a rollout would take at least twenty minutes and potentially as long as an hour and a half. Additionally, the files would need to be synchronized so that the *following* the optimize, snappull would not think that the independently optimized files were different in any way. This would also leave the door open to independent corruption of indexes instead of each being a perfect copy of the master.

Optimizing on the master allows for a straight-forward optimization operation. No query slaves need to be taken out of service. The optimized index can be distributed in the background as queries are being normally serviced. The optimization can occur at any time convenient to the application providing index updates.

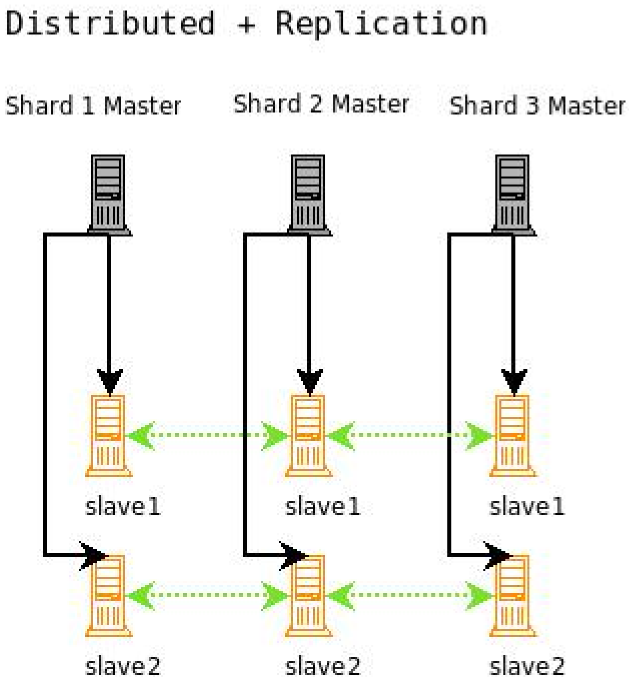
While optimizing may have some benefits in some situations, a rapidly changing index will not retain those benefits for long, and since optimization is an intensive process, it may be better to consider other options, such as lowering the merge factor (discussed in the section on Index Configuration).

Combining Distribution and Replication

When your index is too large for a single machine and you have a query volume that single shards cannot keep up with, it's time to replicate each shard in your distributed search setup.

The idea is to combine distributed search with replication. As shown in the figure below, a combined distributed-replication configuration features a master server for each shard and then 1-*n* slaves that are replicated from the master. As in a standard replicated configuration, the master server handles updates and optimizations without adversely affecting query handling performance.

Query requests should be load balanced across each of the shard slaves. This gives you both increased query handling capacity and fail-over backup if a server goes down.



A Solr configuration combining both replication and master-slave distribution.

None of the master shards in this configuration know about each other. You index to each master, the index is replicated to each slave, and then searches are distributed across the slaves, using one slave from each master/slave shard.

For high availability you can use a load balancer to set up a virtual IP for each shard's set of slaves. If you are new to load balancing, HAProxy (http://haproxy.1wt.eu/) is a good open source software load-balancer. If a slave server goes down, a good load-balancer will detect the failure using some technique (generally a heartbeat system), and forward all requests to the remaining live slaves that served with the failed slave. A single virtual IP should then be set up so that requests can hit a single IP, and get load balanced to each of the virtual IPs for the search slaves.

With this configuration you will have a fully load balanced, search-side fault-tolerant system (Solr does not yet support fault-tolerant indexing). Incoming searches will be handed off to one of the functioning slaves, then the slave will distribute the search request across a slave for each of the shards in your configuration. The slave will issue a request to each of the virtual IPs for each shard, and the load balancer will choose one of the available slaves. Finally, the results will be combined into a single results set and returned. If any of the slaves go down, they will be taken out of rotation and the remaining slaves will be used. If a shard master goes down, searches can still be served from the slaves until you have corrected the problem and put the master back into production.

Merging Indexes

If you need to combine indexes from two different projects or from multiple servers previously used in a distributed configuration, you can use either the IndexMergeTool included in `lucene-misc` or the `CoreAdminHandler`.

To merge indexes, they must meet these requirements:

- The two indexes must be compatible: their schemas should include the same fields and they should analyze fields the same way.

- The indexes must not include duplicate data.

Optimally, the two indexes should be built using the same schema.

Using `IndexMergeTool`

To merge the indexes, do the following:

1. Find the lucene-core and lucene-misc JAR files that your version of Solr is using. You can do this by copying your `solr.war` file somewhere and unpacking it (`jar xvf solr.war`). These two JAR files should be in `WEB-INF/lib`. They are probably called something like `lucene-core-VERSION.jar` and `lucene-misc-VERSION.jar`.
2. Copy them somewhere easy to find.
3. Make sure that both indexes you want to merge are closed.
4. Issue this command:

   ```
   java -cp /path/to/lucene-core-VERSION.jar:/path/to/lucene-misc-VERSION.jar
    org/apache/lucene/misc/IndexMergeTool
    /path/to/newindex
    /path/to/old/index1
    /path/to/old/index2
   ```

   This will create a new index at `/path/to/newindex` that contains both index1 and index2.
5. Copy this new directory to the location of your application's solr index (move the old one aside first, of course) and start Solr.

   For example:

   ```
   java -cp /tmp/lucene-core-4.4.0.jar:
   /tmp/lucene-misc-4.4.0.jar org/apache/lucene/misc/IndexMergeTool
    ./newindex
    ./solr_home/core1/data/index
    ./solr_home/core2/data/index
   ```

Using CoreAdmin

The `MERGEINDEXES` command of the CoreAdminHandler can be used to merge indexes into a new core – either from one or more arbitrary `indexDir` directories or by merging from one or more existing `srcCore` core names.

See the CoreAdminHandler section for details.

Client APIs

This section discusses the available client APIs for Solr. It covers the following topics:

Introduction to Client APIs: A conceptual overview of Solr client APIs.

Choosing an Output Format: Information about choosing a response format in Solr.

Using JavaScript: Explains why a client API is not needed for JavaScript responses.

Using Python: Information about Python and JSON responses.

Client API Lineup: A list of all Solr Client APIs, with links.

Using SolrJ: Detailed information about SolrJ, an API for working with Java applications.

Using Solr From Ruby: Detailed information about using Solr with Ruby applications.

MBean Request Handler: Describes the MBean request handler for programmatic access to Solr server statistics and information.

Introduction to Client APIs

At its heart, Solr is a Web application, but because it is built on open protocols, any type of client application can use Solr.

HTTP is the fundamental protocol used between client applications and Solr. The client makes a request and Solr does some work and provides a response. Clients use requests to ask Solr to do things like perform queries or index documents.

Client applications can reach Solr by creating HTTP requests and parsing the HTTP responses. Client APIs encapsulate much of the work of sending requests and parsing responses, which makes it much easier to write client applications.

Clients use Solr's five fundamental operations to work with Solr. The operations are query, index, delete, commit, and optimize.

Queries are executed by creating a URL that contains all the query parameters. Solr examines the request URL, performs the query, and returns the results. The other operations are similar, although in certain cases the HTTP request is a POST operation and contains information beyond whatever is included in the request URL. An index operation, for example, may contain a document in the body of the request.

Solr also features an EmbeddedSolrServer that offers a Java API without requiring an HTTP connection. For details, see Using SolrJ.

Choosing an Output Format

Many programming environments are able to send HTTP requests and retrieve responses. Parsing the responses is a slightly more thorny problem. Fortunately, Solr makes it easy to choose an output format that will be easy to handle on the client side.

Specify a response format using the `wt` parameter in a query. The available response formats are documented in Response Writers.

Most client APIs hide this detail for you, so for many types of client applications, you won't ever have to specify a `wt` parameter. In JavaScript, however, the interface to Solr is a little closer to the metal, so you will need to add this parameter yourself.

Client API Lineup

The Solr Wiki contains a list of client APIs at http://wiki.apache.org/solr/IntegratingSolr.

Here is the list of client APIs, current at this writing (November 2011):

Name	Environment	URL
SolRuby	Ruby	https://github.com/rsolr/rsolr
DelSolr	Ruby	https://github.com/avvo/delsolr
acts_as_solr	Rails	http://acts-as-solr.rubyforge.org/, http://rubyforge.org/projects/background-solr/
Flare	Rails	http://wiki.apache.org/solr/Flare
SolPHP	PHP	http://wiki.apache.org/solr/SolPHP
SolrJ	Java	http://wiki.apache.org/solr/SolJava
Python API	Python	http://wiki.apache.org/solr/SolPython
PySolr	Python	http://code.google.com/p/pysolr/
SolPerl	Perl	http://wiki.apache.org/solr/SolPerl
Solr.pm	Perl	http://search.cpan.org/~garafola/Solr-0.03/lib/Solr.pm
SolrForrest	Forrest/Cocoon	http://wiki.apache.org/solr/SolrForrest
SolrSharp	C#	http://www.codeplex.com/solrsharp
SolColdfusion	ColdFusion	http://solcoldfusion.riaforge.org/
SolrNet	.NET	http://code.google.com/p/solrnet/
AJAX Solr	AJAX	http://github.com/evolvingweb/ajax-solr/wiki

Using JavaScript

Using Solr from JavaScript clients is so straightforward that it deserves a special mention. In fact, it is so straightforward that there is no client API. You don't need to install any packages or configure anything.

HTTP requests can be sent to Solr using the standard `XMLHttpRequest` mechanism.

Out of the box, Solr can send JavaScript Object Notation (JSON) responses, which are easily interpreted in JavaScript. Just add `wt=json` to the request URL to have responses sent as JSON.

For more information and an excellent example, read the SolJSON page on the Solr Wiki:

http://wiki.apache.org/solr/SolJSON

Using Python

Solr includes an output format specifically for Python, but JSON output is a little more robust.

Simple Python

Making a query is a simple matter. First, tell Python you will need to make HTTP connections.

```
from urllib2 import *
```

Now open a connection to the server and get a response. The `wt` query parameter tells Solr to return results in a format that Python can understand.

```
connection = urlopen(

'http://localhost:8983/solr/collection_name/select?q=cheese&wt=python')
response = eval(connection.read())
```

Now interpreting the response is just a matter of pulling out the information that you need.

```
print response['response']['numFound'], "documents found."

# Print the name of each document.

for document in response['response']['docs']:
  print "  Name =", document['name']
```

Python with JSON

JSON is a more robust response format, but you will need to add a Python package in order to use it. At a command line, install the simplejson package like this:

```
$ sudo easy_install simplejson
```

Once that is done, making a query is nearly the same as before. However, notice that the wt query parameter is now json, and the response is now digested by `simplejson.load()`.

```
from urllib2 import *
import simplejson
connection =
urlopen('http://localhost:8983/solr/collection_name/select?q=cheese&wt=json')
response = simplejson.load(connection)
print response['response']['numFound'], "documents found."

# Print the name of each document.

for document in response['response']['docs']:
  print "  Name =", document['name']
```

Using SolrJ

SolrJ is an API that makes it easy for Java applications to talk to Solr. SolrJ hides a lot of the details of connecting to Solr and allows your application to interact with Solr with simple high-level methods.

The center of SolrJ is the `org.apache.solr.client.solrj` package, which contains just five main classes. Begin by creating a `SolrClient`, which represents the Solr instance you want to use. Then send `SolrRequests` or `SolrQuerys` and get back SolrResponses.

`SolrClient` is abstract, so to connect to a remote Solr instance, you'll actually create an instance of either `HttpSolrClient`, or `CloudSolrClient` . Both communicate with Solr via HTTP, the difference is that `HttpSolrClient` is configured using an explicit Solr URL, while `CloudSolrClient` is configured using the zkHost String for a SolrCloud cluster

Single node Solr client

```
String urlString = "http://localhost:8983/solr/techproducts";
SolrClient solr = new HttpSolrClient(urlString);
```

SolrCloud client

```
String zkHostString = "zkServerA:2181,zkServerB:2181,zkServerC:2181/solr";
SolrClient solr = new CloudSolrClient(zkHostString);
```

Once you have a `SolrClient`, you can use it by calling methods like `query()`, `add()`, and `commit()`.

Building and Running SolrJ Applications

The SolrJ API is included with Solr, so you do not have to download or install anything else. However, in order to build and run applications that use SolrJ, you have to add some libraries to the classpath.

At build time, the examples presented with this section require `solr-solrj-x.y.z.jar` to be in the classpath.

At run time, the examples in this section require the libraries found in the 'dist/solrj-lib' directory.

The Ant script bundled with this sections' examples includes the libraries as appropriate when building and running.

You can sidestep a lot of the messing around with the JAR files by using Maven instead of Ant. All you will need to do to include SolrJ in your application is to put the following dependency in the project's `pom.xml`:

```
<dependency>
  <groupId>org.apache.solr</groupId>
  <artifactId>solr-solrj</artifactId>
  <version>x.y.z</version>
</dependency>
```

If you are worried about the SolrJ libraries expanding the size of your client application, you can use a code obfuscator like ProGuard to remove APIs that you are not using.

Setting XMLResponseParser

SolrJ uses a binary format, rather than XML, as its default format. Users of earlier Solr releases who wish to continue working with XML must explicitly set the parser to the XMLResponseParser, like so:

```
server.setParser(new XMLResponseParser());
```

Performing Queries

Use `query()` to have Solr search for results. You have to pass a `SolrQuery` object that describes the query, and you will get back a QueryResponse (from the `org.apache.solr.client.solrj.response` package).

`SolrQuery` has methods that make it easy to add parameters to choose a request handler and send parameters to it. Here is a very simple example that uses the default request handler and sets the `q` parameter:

```
SolrQuery parameters = new SolrQuery();
parameters.set("q", mQueryString);
```

To choose a different request handler, for example, just set the `qt` parameter like this:

```
parameters.set("qt", "/spellCheckCompRH");
```

Once you have your `SolrQuery` set up, submit it with `query()`:

```
QueryResponse response = solr.query(parameters);
```

The client makes a network connection and sends the query. Solr processes the query, and the response is sent and parsed into a `QueryResponse`.

The `QueryResponse` is a collection of documents that satisfy the query parameters. You can retrieve the documents directly with `getResults()` and you can call other methods to find out information about highlighting or facets.

```
SolrDocumentList list = response.getResults();
```

Indexing Documents

Other operations are just as simple. To index (add) a document, all you need to do is create a `SolrInputDocument` and pass it along to the `SolrClient`'s `add()` method. This example assumes that the SolrClient object called 'solr' is already created based on the examples shown earlier.

```
SolrInputDocument document = new SolrInputDocument();
document.addField("id", "552199");
document.addField("name", "Gouda cheese wheel");
document.addField("price", "49.99");
UpdateResponse response = solr.add(document);

// Remember to commit your changes!

solr.commit();
```

Uploading Content in XML or Binary Formats

SolrJ lets you upload content in XML and binary formats instead of the default XML format. Use the following to upload using binary format, which is the same format SolrJ uses to fetch results.

```
server.setRequestWriter(new BinaryRequestWriter());
```

Using the ConcurrentUpdateSolrClient

When implementing java applications that will be bulk loading a lot of documents at once, `ConcurrentUpdateSolrClient` is an alternative to consider instead of using `HttpSolrClient`. The `ConcurrentUpdateSolrClient` buffers all added documents and writes them into open HTTP connections. This class is thread safe. Although any SolrClient request can be made with this implementation, it is only recommended to use the `ConcurrentUpdateSolrClient` for `/update` requests.

EmbeddedSolrServer

The `EmbeddedSolrServer` class provides an implementation of the `SolrClient` client API talking directly to an micro-instance of Solr running directly in your Java application. This embedded approach is not recommended in most cases and fairly limited in the set of features it supports – in particular it can not be used with SolrCloud or Index Replication. `EmbeddedSolrServer` exists primarily to help facilitate testing.

For information on how to use `EmbeddedSolrServer` please review the SolrJ JUnit tests in the `org.apache.solr.client.solrj.embedded` package of the Solr source release.

Related Topics

- SolrJ API documentation
- Solr Wiki page on SolrJ
- Indexing and Basic Data Operations

Using Solr From Ruby

Solr has an optional Ruby response format that extends its JSON output in the following ways to allow the response to be safely eval'd by Ruby's interpreter:

- Ruby's single quoted strings are used to prevent possible string exploits
  - \ and ' are the only two characters escaped...
  - unicode escapes not used... data is written as raw UTF-8
- nil used for null
- => used as the key/value separator in maps

Here's an example Ruby response from Solr, for http://localhost:8983/solr/techproducts/select?q=iPod&wt=ruby&indent=on (with Solr launching using `bin/solr start -e techproducts`):

```
{
  'responseHeader'=>{
    'status'=>0,
    'QTime'=>0,
    'params'=>{
      'q'=>'iPod',
      'indent'=>'on',
      'wt'=>'ruby'}},
  'response'=>{'numFound'=>3,'start'=>0,'docs'=>[
      {
        'id'=>'IW-02',
        'name'=>'iPod & iPod Mini USB 2.0 Cable',
        'manu'=>'Belkin',
        'manu_id_s'=>'belkin',
        'cat'=>['electronics',
          'connector'],
        'features'=>['car power adapter for iPod, white'],
        'weight'=>2.0,
        'price'=>11.5,
        'price_c'=>'11.50,USD',
        'popularity'=>1,
        'inStock'=>false,
        'store'=>'37.7752,-122.4232',
        'manufacturedate_dt'=>'2006-02-14T23:55:59Z',
        '_version_'=>1491038048794705920},
      {
        'id'=>'F8V7067-APL-KIT',
        'name'=>'Belkin Mobile Power Cord for iPod w/ Dock',
        'manu'=>'Belkin',
        'manu_id_s'=>'belkin',
        'cat'=>['electronics',
          'connector'],
        'features'=>['car power adapter, white'],
        'weight'=>4.0,
        'price'=>19.95,
        'price_c'=>'19.95,USD',
        'popularity'=>1,
        'inStock'=>false,
        'store'=>'45.18014,-93.87741',
        'manufacturedate_dt'=>'2005-08-01T16:30:25Z',
        '_version_'=>1491038048792608768},
      {
        'id'=>'MA147LL/A',
        'name'=>'Apple 60 GB iPod with Video Playback Black',
        'manu'=>'Apple Computer Inc.',
        'manu_id_s'=>'apple',
        'cat'=>['electronics',
          'music'],
        'features'=>['iTunes, Podcasts, Audiobooks',
          'Stores up to 15,000 songs, 25,000 photos, or 150 hours of video',
          '2.5-inch, 320x240 color TFT LCD display with LED backlight',
          'Up to 20 hours of battery life',
          'Plays AAC, MP3, WAV, AIFF, Audible, Apple Lossless, H.264 video',
          'Notes, Calendar, Phone book, Hold button, Date display, Photo wallet,
Built-in games, JPEG photo playback, Upgradeable firmware, USB 2.0 compatibility,
Playback speed control, Rechargeable capability, Battery level indication'],
        'includes'=>'earbud headphones, USB cable',
        'weight'=>5.5,
        'price'=>399.0,
        'price_c'=>'399.00,USD',
        'popularity'=>10,
        'inStock'=>true,
        'store'=>'37.7752,-100.0232',
        'manufacturedate_dt'=>'2005-10-12T08:00:00Z',
        '_version_'=>1491038048799948800}]
  }}
```

Here is a simple example of how one may query Solr using the Ruby response format:

```
require 'net/http'

h = Net::HTTP.new('localhost', 8983)
http_response = h.get('/solr/techproducts/select?q=iPod&wt=ruby')
rsp = eval(http_response.body)

puts 'number of matches = ' + rsp['response']['numFound'].to_s
#print out the name field for each returned document
rsp['response']['docs'].each { |doc| puts 'name field = ' + doc['name'] }
```

For simple interactions with Solr, this may be all you need! If you are building complex interactions with Solr, then consider the libraries mentioned at https://wiki.apache.org/solr/Ruby%20Response%20Format

MBean Request Handler

The MBean Request Handler offers programmatic access to the information provided on the Plugin/Stats page of the Admin UI.

The MBean Request Handler accepts the following parameters:

Parameter	Type	Default	Description
key	multivalued	all	Restricts results by object key.
cat	multivalued	all	Restricts results by category name.
stats	boolean	false	Specifies whether statistics are returned with results. You can override the `stats` parameter on a per-field basis.
wt	multivalued	xml	The output format. This operates the same as the `wt` parameter in a query.

Examples

The following examples assume you are running Solr's `techproducts` example configuration:

```
bin/solr start -e techproducts
```

To return information about the CACHE category only:

`http://localhost:8983/solr/techproducts/admin/mbeans?cat=CACHE`

To return information and statistics about the CACHE category only, formatted in JSON:

`http://localhost:8983/solr/techproducts/admin/mbeans?stats=true&cat=CACHE&indent=true&wt=json`

To return information for everything, and statistics for everything except the `fieldCache`:

```
http://localhost:8983/solr/techproducts/admin/mbeans?stats=true&f.fieldCache.stats
=false
```

To return information and statistics for the `fieldCache` only:

```
http://localhost:8983/solr/techproducts/admin/mbeans?key=fieldCache&stats=true
```

Further Assistance

There is a very active user community around Solr and Lucene. The solr-user mailing list, and #solr IRC channel are both great resource for asking questions.

To view the mailing list archives, subscribe to the list, or join the IRC channel, please see https://lucene.apache.org/solr/resources#community

Solr Glossary

Where possible, terms are linked to relevant parts of the Solr Reference Guide for more information.

Jump to a letter:

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A

Atomic updates

An approach to updating only one or more fields of a document, instead of reindexing the entire document.

B

Boolean operators

These control the inclusion or exclusion of keywords in a query by using operators such as AND, OR, and NOT.

C

Cluster

In Solr, a cluster is a set of Solr nodes managed as a unit. They may contain many cores, collections, shards, and/or replicas. See also #SolrCloud.

Collection

In Solr, one or more documents grouped together in a single logical index. A collection must have a single schema, but can be spread across multiple cores.

In #ZooKeeper, a group of cores managed together as part of a SolrCloud installation.

Commit

To make document changes permanent in the index. In the case of added documents, they would be searchable after a *commit*.

Core

An individual Solr instance (represents a logical index). Multiple cores can run on a single node. See also #SolrCloud.

Core reload

To re-initialize Solr after changes to `schema.xml`, `solrconfig.xml` or other configuration files.

D

Distributed search

Distributed search is one where queries are processed across more than one shard.

Document

A group of fields and their values. Documents are the basic unit of data in a collection. Documents are assigned to shards using standard hashing, or by specifically assigning a shard within the document ID. Documents are versioned after each write operation.

E

Ensemble

A #ZooKeeper term to indicate multiple ZooKeeper instances running simultaneously.

F

Facet

The arrangement of search results into categories based on indexed terms.

Field

The content to be indexed/searched along with metadata defining how the content should be processed by Solr.

I

Inverse document frequency (IDF)

A measure of the general importance of a term. It is calculated as the number of total Documents divided by the number of Documents that a particular word occurs in the collection. See http://en.wikipedia.org/wiki/Tf-idf and the Lucene TFIDFSimilarity javadocs for more info on TF-IDF based scoring and Lucene scoring in particular. See also #Term frequency.

Inverted index

A way of creating a searchable index that lists every word and the documents that contain those words, similar to an index in the back of a book which lists words and the pages on which they can be found. When performing keyword searches, this method is considered more efficient than the alternative, which would be to create a list of documents paired with every word used in each document. Since users search using terms they expect to be in documents, finding the term before the document saves processing resources and time.

L

Leader

The main node for each shard that routes document adds, updates, or deletes to other replicas in the same shard - this is a transient responsibility assigned to a node via an election, if the current Shard Leader goes down, a new node will be elected to take it's place. See also #SolrCloud.

M

Metadata

Literally, *data about data*. Metadata is information about a document, such as it's title, author, or location.

N

Natural language query

A search that is entered as a user would normally speak or write, as in, "What is aspirin?"

Node

A JVM instance running Solr. Also known as a Solr server.

O

Optimistic concurrency

Also known as "optimistic locking", this is an approach that allows for updates to documents currently in the index while retaining locking or version control.

Overseer

A single node in SolrCloud that is responsible for processing actions involving the entire cluster. It keeps track of the state of existing nodes and shards, and assigns shards to nodes - this is a transient responsibility assigned to a node via an election, if the current Overseer goes down, a new node will be elected to take it's place. See also #SolrCloud.

Q

Query parser

A query parser processes the terms entered by a user.

R

Recall

The ability of a search engine to retrieve *all* of the possible matches to a user's query.

Relevance

The appropriateness of a document to the search conducted by the user.

Replica

A copy of a shard or single logical index, for use in failover or load balancing.

Replication

A method of copying a master index from one server to one or more "slave" or "child" servers.

RequestHandler

Logic and configuration parameters that tell Solr how to handle incoming "requests", whether the requests are to return search results, to index documents, or to handle other custom situations.

S

SearchComponent

Logic and configuration parameters used by request handlers to process query requests. Examples of search components include faceting, highlighting, and "more like this" functionality.

Shard

In SolrCloud, a logical section of a single collection. This may be spread across multiple nodes. See also #SolrCloud.

SolrCloud

Umbrella term for a suite of functionality in Solr which allows managing a cluster of Solr servers for scalability, fault tolerance, and high availability.

Solr Schema (schema.xml)

The Apache Solr index schema. The schema defines the fields to be indexed and the type for the field (text, integers, etc.) The schema is stored in schema.xml and is located in the Solr home conf directory.

SolrConfig (solrconfig.xml)

The Apache Solr configuration file. Defines indexing options, RequestHandlers, highlighting, spellchecking and various other configurations. The file, solrconfig.xml is located in the Solr home conf directory.

Spell Check

The ability to suggest alternative spellings of search terms to a user, as a check against spelling errors causing few or zero results.

Stopwords

Generally, words that have little meaning to a user's search but which may have been entered as part of a natural language query. Stopwords are generally very small pronouns, conjunctions and prepositions (such as, "the", "with", or "and")

Suggester

Functionality in Solr that provides the ability to suggest possible query terms to users as they type.

Synonyms

Synonyms generally are terms which are near to each other in meaning and may substitute for one another. In a search engine implementation, synonyms may be abbreviations as well as words, or terms that are not consistently hyphenated. Examples of synonyms in this context would be "Inc." and "Incorporated" or "iPod" and "i-pod".

T

Term frequency

The number of times a word occurs in a given document. See http://en.wikipedia.org/wiki/Tf-idf and the Lucene

TFIDFSimilarity javadocs for more info on TF-IDF based scoring and Lucene scoring in particular.
See also #Inverse document frequency (IDF).

Transaction log

An append-only log of write operations maintained by each node. This log is only required with SolrCloud implementations and is created and managed automatically by Solr.

W

Wildcard

A wildcard allows a substitution of one or more letters of a word to account for possible variations in spelling or tenses.

Z

ZooKeeper

Also known as Apache ZooKeeper. The system used by SolrCloud to keep track of configuration files and node names for a cluster. A ZooKeeper cluster is used as the central configuration store for the cluster, a coordinator for operations requiring distributed synchronization, and the system of record for cluster topology. See also #Solr Cloud.

Major Changes from Solr 4 to Solr 5

There are some major changes in Solr 5 to consider before starting to migrate your configurations and indexes. There are many hundreds of changes, so a thorough review of the Upgrading Solr section as well as the CHANGES.txt file in your Solr instance will help you plan your migration to Solr 5. This section attempts to highlight some of the major changes you should be aware of.

Topics discussed in this section:

Highlights of New Features in Solr 5

Some of the major improvements in Solr 5 include:

Ease Of Use

- Improved `bin/solr` and new `bin/post` scripts
- New, and restructured, example Config Sets available by default
- SolrJ now has first class support for the Collections API
- Implicit registration of `/replication`, `/get`, and `/admin/*` request handlers

Operational Support

- Scripts to support installing and running Solr as a service on Linux
- Logging improvements:
  - Transaction log replay status is now logged
  - Optional logging of slow requests.
- Config API that supports paramsets for easily configuring Solr parameters for request handlers and editing common `solrconfig.xml` options.
- New Blob Store API with support for uploading and distributing plugin jars.

SolrCloud & Distributed Requests

- Splitting of clusterstate to per-collection enables scalability improvement in SolrCloud
- Distributed IDF Support
- Option to configure max bandwidth usage by `ReplicationHandler`

New Search Functionality

- `pivot.facet` results can now include nested `stats.field` results constrained by those pivots
- `stats.field` can be used to generate statistics over the results of arbitrary numeric functions
- A new `DateRangeField` has been added for indexing date ranges, especially multi-valued ones
- Spatial fields that used to require `units=degrees` now take `distanceUnits=degrees/kilometers` miles instead
- `MoreLikeThis` query parser allows requesting for documents similar to an existing document

- `timeAllowed` is now used to prematurely terminate requests during query expansion and SolrClient request retry

Solr is Now a Standalone Server

Beginning with Solr 5.0, Solr is no longer distributed as a "war" (Web Application Archive) suitable for deployment in any Servlet Container. Solr is now distributed as a stand alone java server application, including start and stop scripts for use on Unix and MS-Windows platforms, as well as an installation script for setting up a "production" installation of Solr on *nix platforms managed via `/etc/init.d`.

The Upgrading a Solr 4.x Cluster to Solr 5.0 section of this guide provides detailed steps for existing users to upgrade their clusters regardless of what servlet container they were using with Solr 4.

> ⓘ Internally, Solr is still implemented via Servlet APIs and is powered by Jetty -- but this is simply an implementation detail. Deployment as a "webapp" to other Servlet Containers (or other instances of Jetty) is not supported, and may not work in future 5.x versions of Solr when additional changes are likely to be made to Solr internally to leverage custom networking stack features.

Index Format

Solr 5 has no support for reading Lucene/Solr 3.x and earlier indexes. Be sure to run the Lucene `IndexUpgrader` included with Solr 4.10 if you might still have old 3x formatted segments in your index. Alternatively: fully optimize your index with Solr 4.10 to make sure it consists only of one up-to-date index segment.

solr.xml Format

Solr 4.4 introduced a new format for the `solr.xml` file, eliminating the need for each `<core>` to be explicitly listed. Instead a process known as "Core Discovery" was introduced relying on `core.properties` files in each SolrCore instance directory.

Solr 5.0 has eliminated all support for the older `solr.xml` format, and moved entirely to core discovery. See the Moving to the New solr.xml Format section for more details.

Collections API

Solr 5.0 only supports creating and removing SolrCloud collections through the Collections API, unlike previous versions. While not using the collections API may still work in 5.0, it is unsupported, not recommended, and the behavior will change in a 5.x release.

SolrJ changes

Many SolrJ methods that were marked deprecated in Solr 4.10 have been removed. Please consult the Solr 4.10 javadocs for the SolrJ package for information regarding the new supported methods.

In addition, the `SolrServer` family of classes are now deprecated, and developers are encouraged to instead use the `SolrClient` family of classes.

Moving to the New solr.xml Format

If you have an existing `solr.xml` file that contains a `<cores>` section, it is no longer supported and you will need to manually convert it to the currently supported "core discovery" format before you can upgrade to the latests version of Solr.

Migration from this older style of `solr.xml` to core discovery is very straightforward.

Moving `<core>` definitions

To migrate to discovery-based `solr.xml`, You should start by removing all of the `<core>` elements and the enclosing `<cores>` element from `solr.xml`. The individual `<core>` elements should be replaced with `core.properties` files in the instanceDir for each of your existing SolrCores. The `instanceDir` property must be removed as it is now defined by the location of the file, but all other existing `<core>` attributes can be specified in the new `core.properties` file. These property files can be empty if all defaults are acceptable, In particular: the `dataDir` will be a sub-directory of the `instanceDir` named `data` , and the `name` of the core is assumed to be the name of the `instanceDir` in which the `core.properties` file was discovered.

Individual attributes on the `<cores>` element of your older `solr.xml` file should be added as new child elements of a new `<solrcloud>` element, using the appropriate type specific element name (eg: `<str>`, `<int>` , etc...). Note that `adminPath`, and `defaultCoreName` are no longer supported and should be removed.

`<solr>` and `<shardHandlerFactory>` definitions

Individual attributes on the `<solr>` element of your older `solr.xml` file should be replaced with new child elements of the `<solr>` element, using the appropriate type specific element name (eg: `<str>`, `<int>`, etc...). Note that `persist` is no longer supported since re-writing the `solr.xml` is no longer necessary to support dynamic creation of cores.

If you have a `<shardHandlerFactory>` configured in your existing `solr.xml`, it should continue to work with out any modifications in your new `solr.xml` file.

Example

Here's an example of what a legacy `solr.xml` file might look like and the equivalent discovery-based `solr.xml` and `core.properties` files:

```
<solr persistent="${solr.xml.persist:false}">
  <cores adminPath="/admin/cores" defaultCoreName="collection1" host="127.0.0.1"
hostPort="${hostPort:8983}"
         hostContext="${hostContext:solr}"
zkClientTimeout="${solr.zkclienttimeout:30000}" shareSchema="${shareSchema:false}"
         genericCoreNodeNames="${genericCoreNodeNames:true}">
    <core name="core1" instanceDir="core1" shard="${shard:}"
collection="${collection:core1}" config="${solrconfig:solrconfig.xml}"
schema="${schema:schema.xml}" coreNodeName="${coreNodeName:}"/>
    <core name="core2" instanceDir="core2" />
    <shardHandlerFactory name="shardHandlerFactory" class="HttpShardHandlerFactory">
      <int name="socketTimeout">${socketTimeout:120000}</int>
      <int name="connTimeout">${connTimeout:15000}</int>
    </shardHandlerFactory>
  </cores>
</solr>
```

The new-style `solr.xml` might look like what is below.

```
<solr>
  <solrcloud>
    <str name="host">127.0.0.1</str>
    <int name="hostPort">${hostPort:8983}</int>
    <str name="hostContext">${hostContext:solr}</str>
    <int name="zkClientTimeout">${solr.zkclienttimeout:30000}</int>
    <str name="shareSchema">${shareSchema:false}</str>
    <bool name="genericCoreNodeNames">${genericCoreNodeNames:true}</bool>
  </solrcloud>

  <shardHandlerFactory name="shardHandlerFactory" class="HttpShardHandlerFactory">
    <int name="socketTimeout">${socketTimeout:120000}</int>
    <int name="connTimeout">${connTimeout:15000}</int>
  </shardHandlerFactory>
</solr>
```

In each of "core1" and "core2" directories, there would be a `core.properties` file that might look like these.

core1:

```
name=core1
shard=${shard:}
collection=${collection:core1}
config=${solrconfig:solrconfig.xml}
schema=${schema:schema.xml}
coreNodeName=${coreNodeName:}
```

core2:

```
name=core2
```

In fact, the core2 `core.properties` file could even be empty and the name would default to the directory in which the `core.properties` file was found.

Upgrading a Solr 4.x Cluster to Solr 5.0

This page covers how to upgrade an existing Solr 4.x cluster running on Linux platforms to Solr 5.0.

Planning Your Upgrade

Here is a checklist of things you need to prepare before starting the upgrade process:

1. Examine the Upgrading Solr page to determine if any changes in Solr 5 will affect your installation.
2. If not using replication, then you should make a backup of each collection. If all of your collections use replication, then you don't technically need to make a backup since you will be upgrading and verifying each node individually.
3. Determine which Solr node is hosting the Overseer leader process in SolrCloud, as you should upgrade this node last. To determine the Overseer, use the Overseer Status API, see: Collections API.
4. Plan to perform your upgrade during a system maintenance window if possible. You'll be doing a rolling restart of your cluster (each node, one-by-one), but we still recommend doing the upgrade when system usage is minimal.
5. Verify the cluster is currently healthy and all replicas are active, as you should not perform an upgrade on a degraded cluster.
6. Ensure your existing cluster is not using the legacy `solr.xml` format. If you are, then you need to migrate your existing cluster to use the new `solr.xml` format before proceeding, see: Moving to the New solr.xml Format.
7. Re-build all custom server-side components against Solr 5.0 JAR files.
8. Determine the values of the following variables that are used by the Solr 5 start scripts:

    - `ZK_HOST`: The ZooKeeper connection string your current SolrCloud nodes use to connect to ZooKeeper; this value will be the same for all nodes in the cluster.
    - `SOLR_HOST`: The hostname each Solr node used to register with ZooKeeper when joining the SolrCloud cluster; this value will be used to set the **host** Java system property when starting the new Solr 5 process.
    - `SOLR_PORT`: The port each Solr node is listening on, such as 8983.
    - `SOLR_HOME`: The absolute path to the Solr home directory for each Solr node; this directory must contain a `solr.xml` file. This value will be passed to the new Solr 5 process using the `solr.solr.home` system property, see: Solr Cores and solr.xml

You should now be ready to upgrade your cluster. Please verify this process in a test / staging cluster before doing it in production.

Upgrade Process

The approach we recommend is to perform the upgrade of each Solr node, one-by-one. In other words, you will need to stop a node, upgrade it to 5.0, and restart it before moving on to the next node. This means that for a short period of time, there will be a mix of Solr 4.x and Solr 5.0 nodes running in your cluster. We also assume that you will point the new Solr 5 node to your existing Solr home directory where the Lucene index files are managed for each collection on the node. This means that you won't need to move any index files around to perform the upgrade. This also implies that you can apply this process to an existing install even if your current cluster runs on something other than the default Jetty container shipped with Solr 4.x. For instance, if your current cluster runs on Tomcat, you can still use this process to migrate to Solr 5 because you will simply point the new Solr 5 process at the existing Solr home used by Tomcat.

Step 1: Stop Solr

Begin by stopping the Solr node you want to upgrade. After stopping the node, if using replication, verify that all leaders hosted on the downed node have successfully migrated to other replicas; you can do this by visiting the Cloud panel in the Solr Admin UI. If not using replication, then any collections hosted on the downed node will be temporarily off-line.

Step 2: Install Solr 5 as a Service

Please follow the instructions to install Solr as a Service on Linux documented at Taking Solr to Production. After running the install script, the new Solr 5 node will be running, so please stop it by doing: `sudo service solr stop`. You need to update the `/var/solr/solr.in.sh` include file to complete the upgrade process.

Step 3: Set Environment Variable Overrides

Open `/var/solr/solr.in.sh` with a text editor and set the following variables at the bottom of the include file:

```
ZK_HOST=
SOLR_MODE=solrcloud
SOLR_HOST=
SOLR_PORT=
SOLR_HOME=
```

You must set `SOLR_HOME` to an absolute path on your system and ***not*** use a path that includes a symbolic link due to a limitation in the `/etc/init.d/solr` script. Also, make sure the user you plan to own the Solr process is the owner of the `SOLR_HOME` directory. For instance, if you plan to run Solr as the "solr" user and `SOLR_HOME` is `/var/solr/data`, then you would do: `sudo chown -R solr: /var/solr/data`

> ⚠ **SOLR_MODE=solrcloud**
> Due to a limitation in the `bin/solr` start script, you need to set the `SOLR_MODE` variable to "solrcloud", i.e. `SOLR_MODE=solrcloud`

Step 4: Start Solr 5

You are now ready to start the upgraded Solr 5 node by doing: `sudo service solr start`. The upgraded instance will join the existing cluster because you're using the same `SOLR_HOME`, `SOLR_PORT`, and `SOLR_HOST` settings used by the old Solr 4.x node; thus, the new server will look like the old node to the running cluster. Be sure to look in `/var/solr/logs/solr.log` for errors during startup.

Step 5: Run Healthcheck

You should run the Solr **healthcheck** command for all collections that are hosted on the upgraded node before proceeding to upgrade the next node in your cluster. For instance, if the newly upgraded node hosts a replica for the **MyDocuments** collection, then you can run the following command (replace ZK_HOST with the ZooKeeper connection string):

```
$ /opt/solr/bin/solr healthcheck -c MyDocuments -z ZK_HOST
```

Look for any problems reported about any of the replicas for the collection.

Lastly, repeat Steps 1-5 for all nodes in your cluster.

Errata

Errata For This Documentation

Any mistakes found in this documentation after its release will be listed on the on-line version of this page:

https://cwiki.apache.org/confluence/display/solr/Errata

Errata For Past Versions of This Documentation

Any known mistakes in past releases of this documentation will be noted below.

Using copyField directives with suggester: Previous versions of this guide advocated using copyField directives to accumulate the contents on multiple fields into a single field to be used with Solr suggester components. This will not work previous to Solr 5.1; attempting to build the suggester will result in errors being reported in the logs if the field is multiValued. As a work-around, indexing clients should accumulate all of the contents into the field before sending the documents to Solr, and any fields used with the suggesters should have multiValued="false".

The ***variable*** **facet.range.gap parameter** was included in documentation even though the patch was not committed. As of yet there is no ability to specify variable gaps via a comma-separated list for facet.range.gap. Some of this functionality can be achieved by interval faceting, see SOLR-6216