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OPEN MARKET DATA INITIATIVE

BLPAPI: Developer's Guide

Version 1.34

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Preface: About this Document

Purpose

This document provides a guide to developing applications using the Bloomberg API.

Audience

This document is intended for developers who use the Bloomberg API.

Document History

Version	Date	Description of Changes
1.0	11/05/09	This is the first release of the Bloomberg API Developer's Guide.
1.23	01/10/11	Updated "Core Services" on page 52 "Authorization and Permissioning Systems" on page 76, and "Schemas" on page 110.
1.24	01/19/11	Updated "Stopping a Subscription" on page 49.
1.25	02/04/11	Updated "Security/Securities" on page 52, "HistoricalDataRequest: Sequence" on page 113 ,and Figure A-1.
1.26	03/02/11	Updated "Creating a Topic" on page 102.
1.27	05/18/11	Added "Conflation and the Interval Option" on page 50 and "Delayed Data" on page 50.
1.28	05/25/11	Add bsid to the Topic Prefix list in "Security/Securities" on page 52. Updated "Authorization Lifetime" on page 77.
1.29	06/27/11	Updated "IntradayTickRequest: Sequence" on page 119 and added "BEQSRequest: Sequence" on page 127.
1.30	08/04/11	Updated "Field Information Request Response" on page 133. Updated "Entitlements" on page 91.
1.31	09/20/11	Fixed code formatting on page 212.
1.32	11/08/11	Added details to "Page Data Service" on page 67.
1.33	01/10/12	Updated "Overrides" on page 54 to specify that 100 overrides can be specified in a single request. Added note to page 47 about creating subscriptions with C#.
1.34	02/13/12	Updated license notice on front page.

1 Introduction to the Bloomberg API

1.1 Overview of the Bloomberg API

The *Bloomberg API* provides developers with 24x7 programmatic access to data from the Bloomberg Data Center for use in customer applications.

The Bloomberg API lets you integrate streaming real-time and delayed data, reference data, historical data, intraday data, and Bloomberg derived data into your own custom and third-party applications. You can choose which data you require down to the individual field level.

The Bloomberg API uses an event-driven model. The interface is thread-safe and thread-aware, giving applications the ability to utilize multiple processors efficiently. The Bloomberg API automatically breaks large results into smaller chunks and can provide conflated streaming data to improve the bandwidth usage and the latency of applications.

The Bloomberg API supports run-time downloadable schemas for the services it provides and provides methods to query these schemas at runtime. This means the Bloomberg API can support additional services without additions to the interface. It also makes writing applications that can adapt to changes in services or entirely new services simple.

1.1.1 Features

Feature	Details
Four Languages, One Interface	API 3.0 provides all new programming interfaces in: ● Java ● C ● C++ ● .Net The Java, .Net and C++ object models are identical, while the C interface provides a C-style version of the object model. You are able to effortlessly port applications among these languages as the needs of your applications change.
Lightweight Interfaces	The API 3.0 programming interface implementations are extremely lightweight. The lightweight design makes the process of receiving data from Bloomberg and delivering it to applications as efficient as possible. It is now possible to get the maximum performance out of the Java, .Net, C, and C++ versions of the interface.
Extensible Service-Oriented Data Model	The new API generically understands the notions of subscription and request-response services. The subscribe method and request method allow you to send requests to different data services with potentially different or overlapping data dictionaries and different response schemas. This, in combination with the new canonical data form, means that Bloomberg can deliver new data services via the API without having to extend the interface to support the new services.
Field Level Subscriptions	You are now able to request updates for only the fields of interest to your application, rather than receiving all trade and quote fields when you establish a subscription. This reduces the overhead of processing unwanted data within both the API and your application, and also reduces network bandwidth consumption between Bloomberg and its customers. For example, if quotes are of no interest to an application, processing and bandwidth consumption can be cut by as much as 90%.

Feature	Details
Summary events	When you subscribe to market data for a security, the API performs two actions: 1. It retrieves a summary of the current state of the security and delivers it to you. A summary is made up of data elements known as fields. The set of summary fields varies depending on the asset class of the requested security. 2. The API streams all market data updates to you as they occur and continues to do so until you cancel the subscription. About 300 market data fields are available via the API subscription interface, most of them derived from trade and quote events.
Interval-based Subscriptions	Many users of API data are interested in subscribing to large sets of streaming data but only need summaries of each requested security to be delivered at periodic intervals. The API subscription model allows you to specify the minimum interval at which to receive streaming updates. This reduces processing and bandwidth consumption by delivering only an updated summary at the interval you define. It is also possible to establish multiple subscriptions such that a summary arrives periodically but other fields, such as traderelated fields are delivered in real-time.
No Request Size Restrictions	API 3.0 allows you to request a potentially unlimited number of securities and fields without having to manage request rates yourself. The API infrastructure manages the distribution of these requests across Bloomberg's back end data servers, which in turn ensure that all arriving data requests are given equal access to the available machine resources.
Canonical Data Format	Each data field returned to an application via the API is now accompanied by an in-memory dictionary element that indicates the data type (for example, integer, double) and provides a description of the field - the data is self-describing. Data elements may be simple, such as a price field, or complex, such as historical prices or bulk fields. All data is represented in the same canonical form and developers do not have to deal with multiple data formats or be exposed to the details of the underlying transport protocol.

Feature	Details
Thread-Safe	All language bindings for the new API are now fully thread-safe. Applications can safely process responses and make requests simultaneously from multiple threads of execution.
32- and 64-bit Programming Support	The Java and .Net API work on both 32- and 64-bit platforms. The C and C++ API libraries come in a 32-bit version with a 64- bit version coming in the future.
Pure Java Implementation	The Java API is implemented entirely in Java. Bloomberg did not use JNI to wrap either our existing C library or the new C++ library.
Fully Introspective data model	An application can discover a service and its attributes at runtime.
Simplified Permissioning Model	Release 3.0 of the Server API provides a simplified permissioning model that allows you to simply provide a user's UUID and IP address. The API returns the permissions to you.

The Bloomberg API is the interface to the following Bloomberg products:

- The Bloomberg Platform
- Managed B-PIPE
- Server API
- Desktop API

1.1.2 The Bloomberg Platform

The Bloomberg Platform is a revolutionary step in market data distribution — a new managed service that extends well beyond traditional industry solutions. Providing real-time delayed, and historical market data, as well as global publishing, trusted entitlements, and much more, the Bloomberg Platform is a complete high-volume, low-latency service to end users, applications, and displays throughout your entire financial firm (see Figure 1-1).

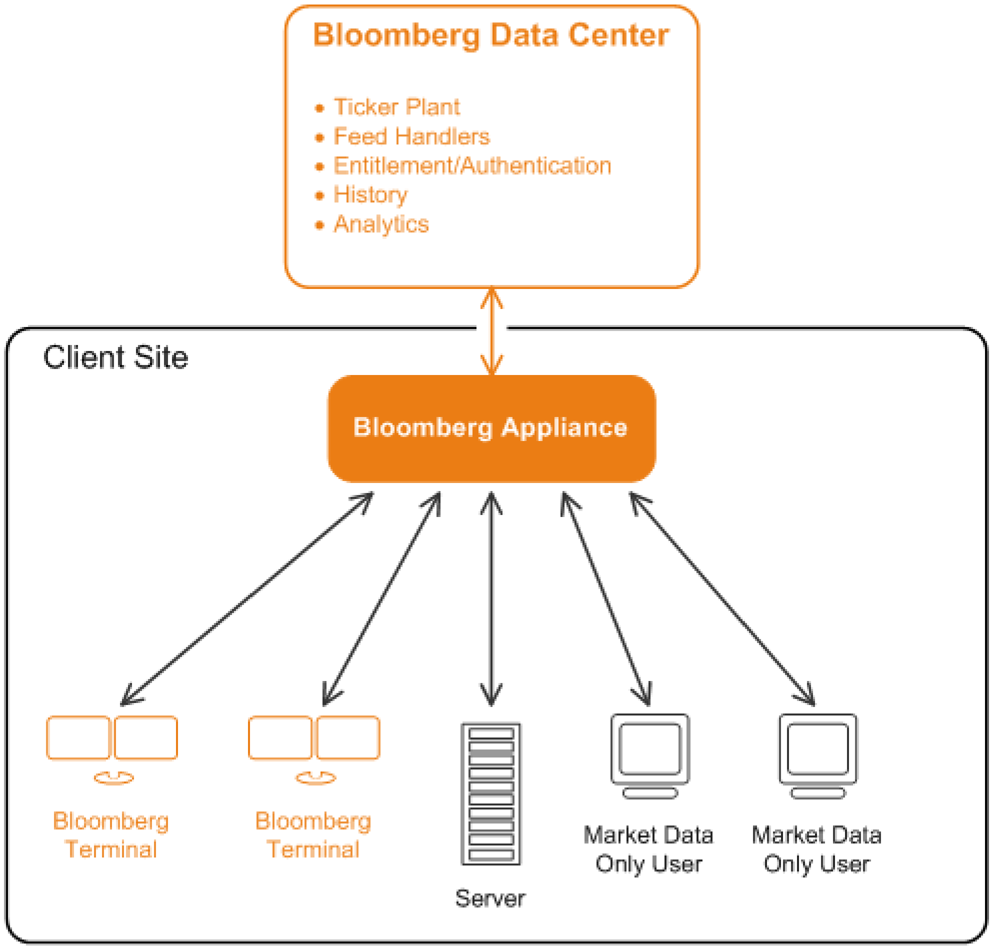

Figure 1-1: The Bloomberg Platform

1.1.3 Managed B-PIPE

Managed B-PIPE leverages the Bloomberg distribution platform and managed entitlements system. Managed B-PIPE allows clients to connect applications providing solutions that work with client proprietary and 3rd party applications. Managed B-PIPE provides the tools to permission data to entitled users only. Client applications will use the Bloomberg entitlements system to ensure distribution of data to only appropriately entitled users (see Figure 1-2).

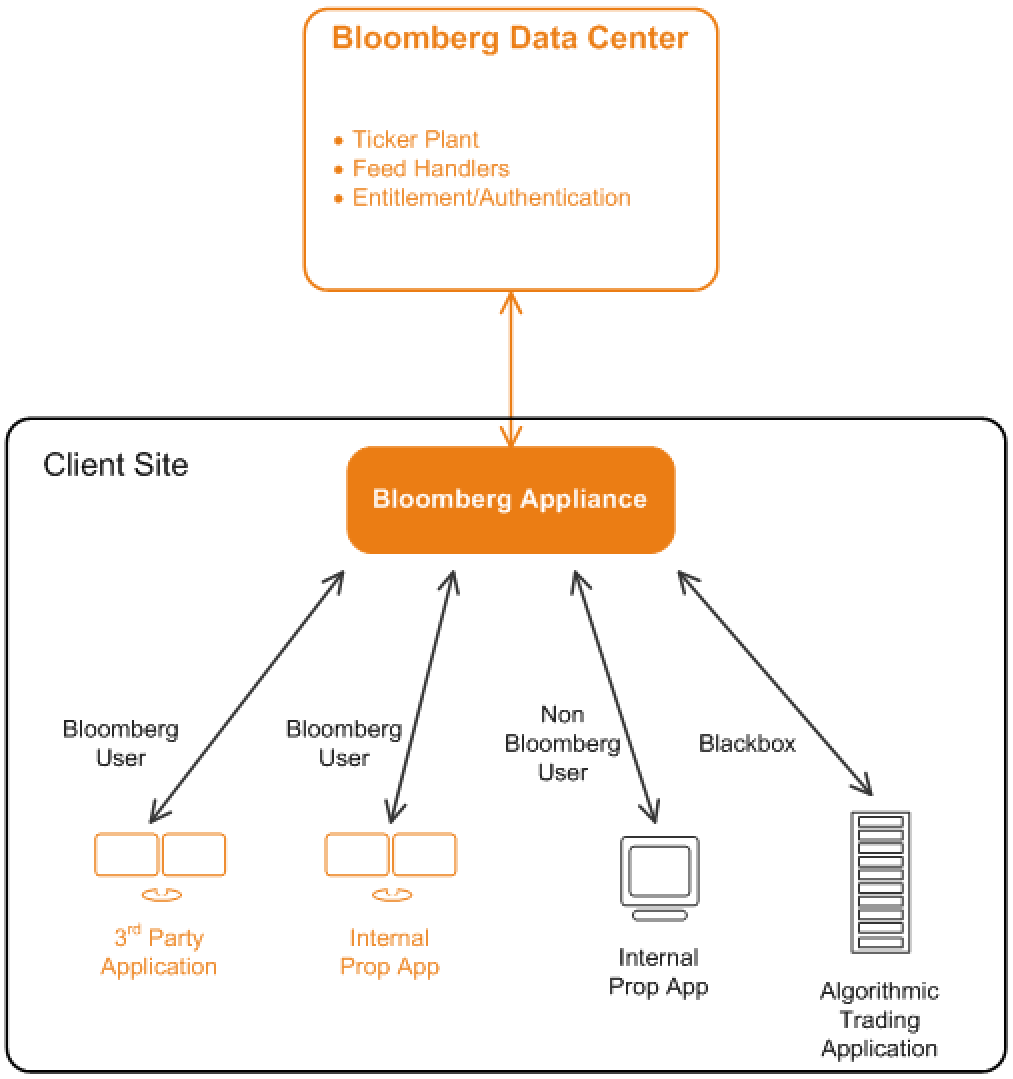

Figure 1-2: Managed B-PIPE

1.1.4 The Desktop API and Server API

The Desktop API and Server API have the same programming interface and behave almost identically. The chief difference is that customer applications using the Server API have some additional responsibilities. Those additional requirements will be detailed later in this document (see Bloomberg API Developer's Guide: Authorization and Permissioning); otherwise, assume the two deployments are identical.

Note that in both deployments, the end-user application and the customer's active BLOOMBERG PROFESSIONAL service share the same display/monitor(s).

The Desktop API

The Desktop API is used when the end-user application resides on the same machine as the installed BLOOMBERG PROFESSIONAL service and connects to the local Bloomberg Communications Server (BBComm) to obtain data from the Bloomberg Data Center (see Figure 1-3).

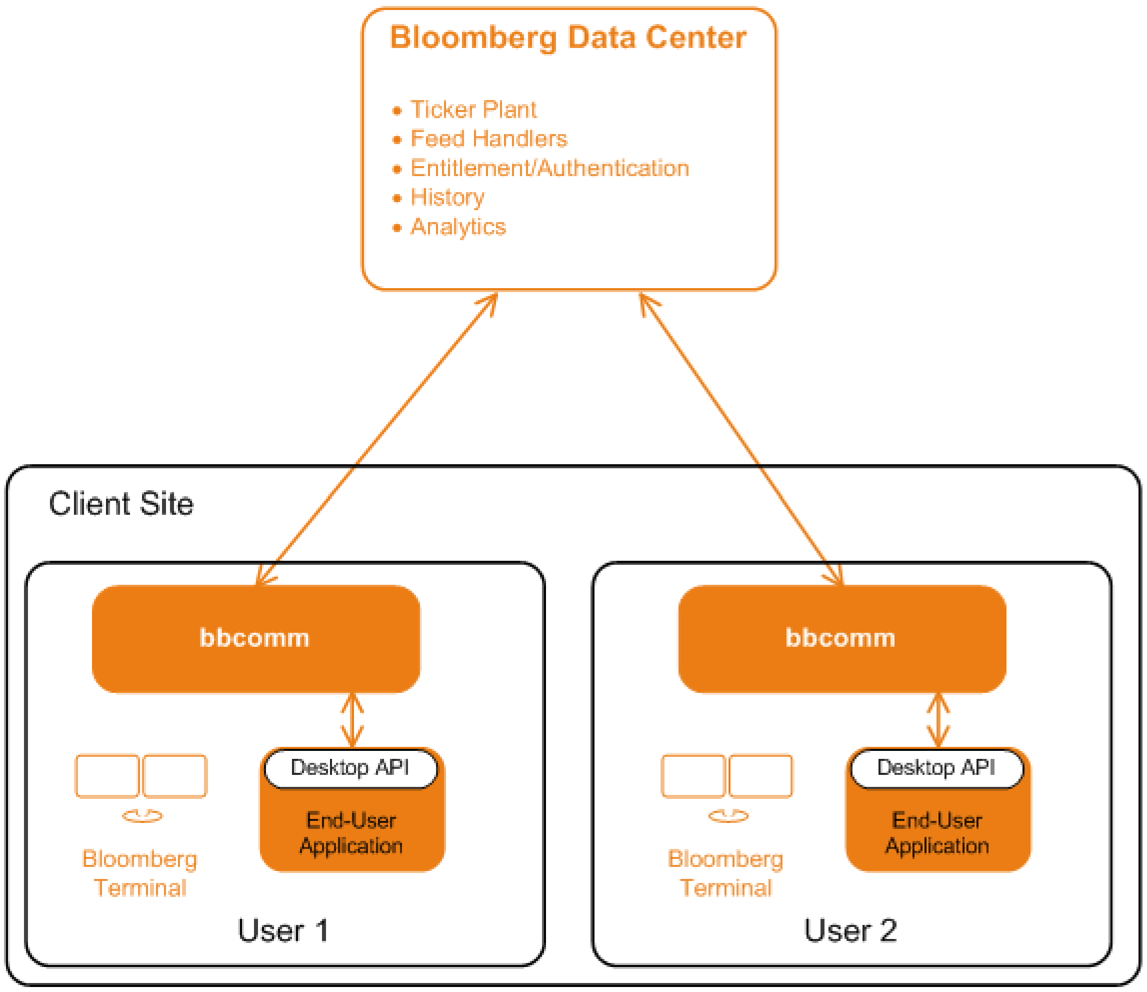

Figure 1-3: The Desktop API

The Server API

The Server API allows customer end-user applications to obtain data from the Bloomberg Data Center via a dedicated process, known as the *Server API process*. Introduction of the Server API process allows, in some circumstances, better use of network resources.

When the end-user applications interact directly with the Server API process they are using the Server API in *User Mode* (see Figure 1-4).

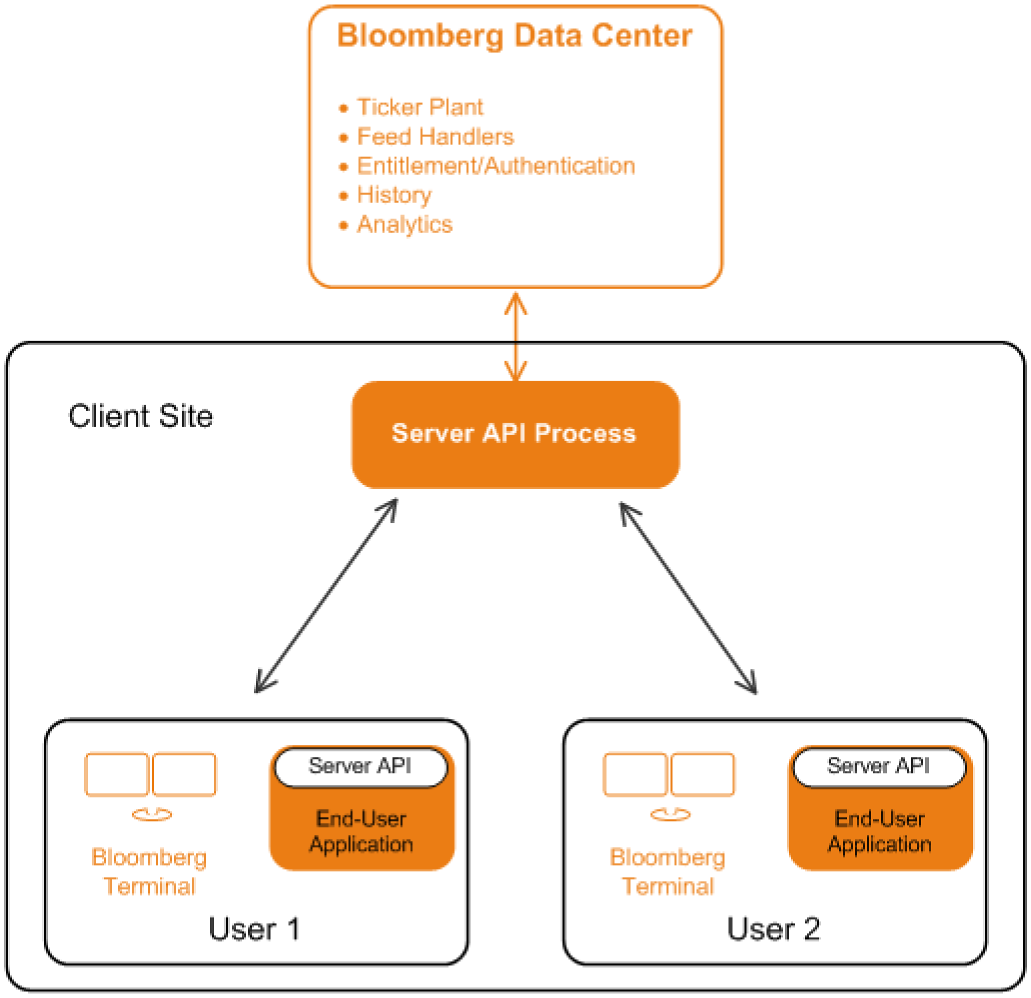

Figure 1-4: The Server API: User Mode

When the customer implements a *Customer Server Application* to interact with the Server API process (see Figure 1-5), the Server API is then being used in *Server Mode* (by the Customer Server Application). Interactions between the Customer Server Application and the Customer End-User Application(s) are handled by an application protocol of the customer's design.

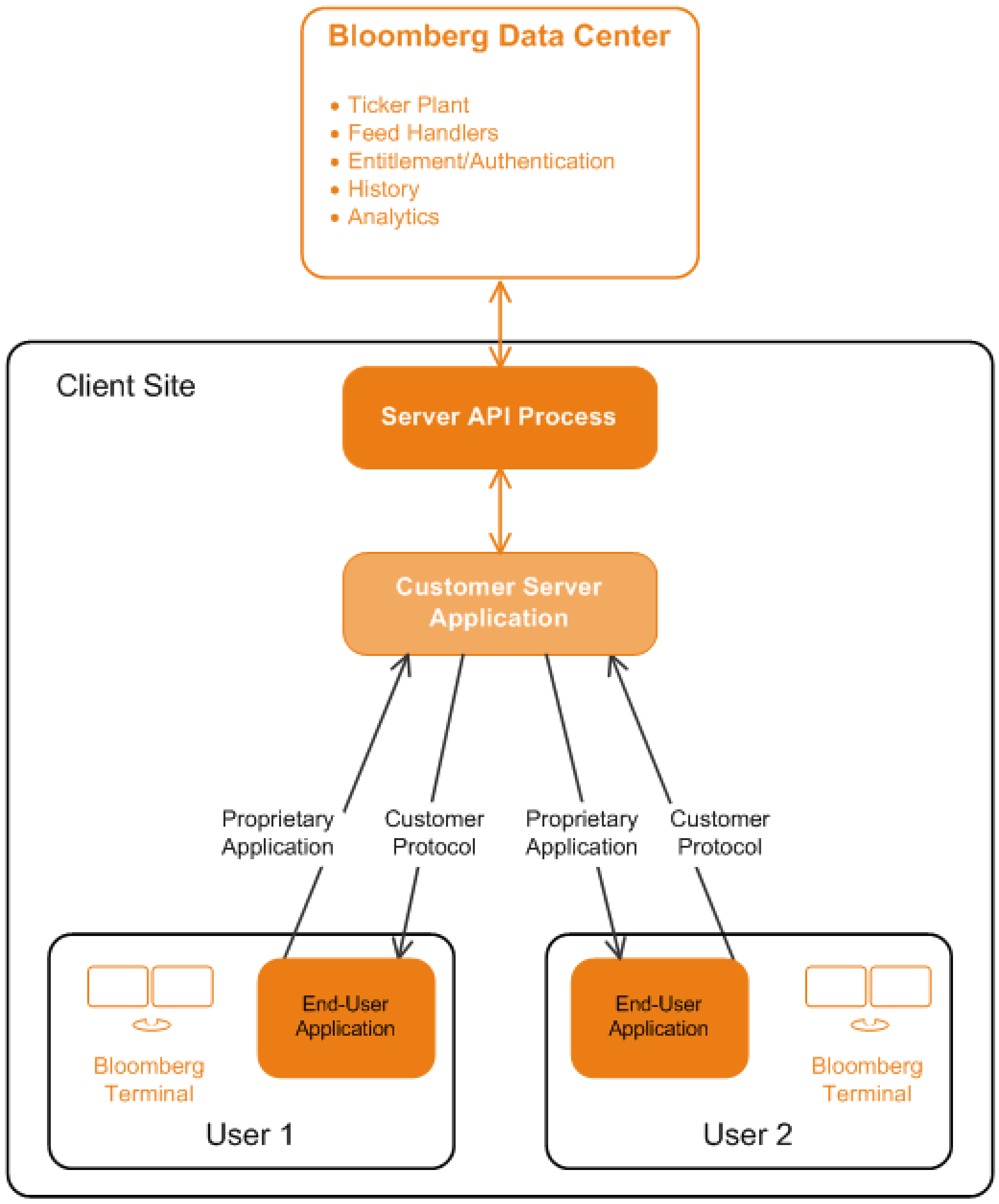

Figure 1-5: The Server API: Server Mode

1.2 The Programming Examples

The Bloomberg API is provided as Java, .Net, C++, and C libraries. The libraries share the same object model, class and method names, and programming paradigm to make it easy for developers to switch languages. In this document, Java is used for the sample code and for the programming interface specification.

Complete, contiguous listings of the Java code examples are provided in "Java Examples" on page 166 and the programming interface specification is found in "Schemas" on page 116.

For the sample programs in the other supported languages see:

- ".Net Examples" on page 198
- "C++ Examples" on page 225
- "C Examples" on page 251

1.3 Typical Application Structure

The Bloomberg API object model contains a small number of key objects which applications use to request, receive and interpret data.

An application creates a `Session` object to manage its connection with the Bloomberg infrastructure. (Some applications may choose to create multiple `Session` objects for redundancy).

Using the `Session` object, an application creates a `Service` object and then "opens' each Bloomberg service that it will use. For example, Bloomberg provides streaming market data and reference data as services.

There are two programming paradigms that can be used with the `Service` object. The client can make individual requests (via a `Request` object) for data or the client can start a subscription (managed via a `Subscription` object) with the service for ongoing data updates. Depending on the services being used, a customer application may be written to handle both paradigms. Whichever paradigm or paradigms are used, the Bloomberg infrastructure replies with events (received at the client as `Event` objects) which the client must handle asynchronously.

Programmatically, the customer application obtains `Event` objects for the `Session` and then extracts from those `Event` objects one or more `Message` objects containing the Bloomberg data.

1.4 Overview of this Guide

The rest of this guide is arranged as follows

- First a small but complete example program is presented to illustrate the most common features of the Bloomberg API. See "Sample Programs in Two Paradigms" on page 20.
- This is followed by detailed descriptions of the key scenarios in using the Bloomberg API: creating a session; opening services; sending requests and processing their responses; subscribing to streaming data and processing the results. See "Sessions and Services" on page 29, "Requests and Responses" on page 37, and "Subscriptions" on page 45.

2 Sample Programs in Two Paradigms

2.1 Overview

This chapter demonstrates the most common usage patterns of the Bloomberg API. The major programming issues are addressed at a high level and working example code is provided as a way to quickly get started with your own applications. Later chapters will provide additional details that are covered lightly here. The Bloomberg API has two different models for providing data (the choice usually depends on the nature of the data): request/response and subscription. Both models are shown in this chapter.

The major steps required of an application are:

- The creation and startup of a `Session` object which the application uses to specify the data it wants and then receive that data.
- Data from the Bloomberg infrastructure is organized into various “services”. The application "opens" the service that can provide the needed data (e.g., reference data, current market data).
- The application asks the service for specific information of interest. For example, the last price for a specific security.
- The application waits for the data to be delivered.

Data from the service will arrive in one or more asynchronously delivered `Event` objects. If an application has several outstanding requests for different data, the data arriving from these multiple requests may be interleaved with each other; however, data related to a specific request always arrives in order.

> **Note:** To assist applications in matching incoming data to requests, the Bloomberg API allows applications to provide a `CorrelationID` object with each request. Subsequently, the Bloomberg infrastructure uses that identifier to tag the events sent in response. On receipt of the `Event` object, the client can use the identifier it supplied to match events to requests.

Even if an application (such as the examples in this chapter) makes only a single request for data, the application must also be prepared to handle status events from the service in addition to the requested data.

The following display provides an outline of the organization used in these examples.

```
import classes
public class Example1 {
    private static void handleDataEvent(Event event) throws Exception
    {
        .........
    }
    private static handleOtherEvent(Event event) throws Exception
    {
        .........
    }
    public static void main(String[] args) throws Exception
    {
        create and start Session

        use Session to open service

        ask service for data
            (provide id for service to label replies)

        loop waiting for data; pass replies to event handlers
    }
}
```

The additional details needed to create a working example are provided below.

2.2 The Two Paradigms

Before exploring the details for requesting and receiving data, we describe the two different paradigms used by the Bloomberg API - Request/Response and Subscription

The Service defines which paradigm is used to access it. For example, the streaming real-time market data service uses the subscription paradigm whereas the reference data service uses the request/response paradigm. See "Core Services" on page 52 for more information on the Core Services provided by the Bloomberg API.

Note: Applications that make heavy use of real-time market data should use the streaming real-time market data service. However, real-time information is available through the reference data service requests where you will get a snapshot of the current value in the response.

2.2.1 Request/Response

In this case, data is requested by issuing a `Request` and is returned in a sequence consisting of zero or more `Event`s of type `PARTIAL_RESPONSE` followed by exactly one `Event` of type `RESPONSE`. The final `RESPONSE` indicates that the `Request` has been completed.

In general, applications written to this paradigm will perform extra processing after receiving the final RESPONSE from a Request.

2.2.2 Subscription

In this case a Subscription is created which results in a stream of updates being delivered in Events of type SUBSCRIPTION_DATA until the Subscription is explicitly cancelled by the application.

2.3 Using the Request/Response Paradigm

A main function for a small but complete example using the Request/Response paradigm is shown below:

```
    public static void main(String[] args) throws Exception {
        SessionOptions sessionOptions = new SessionOptions();
        sessionOptions.setServerHost("localhost"); // default value
        sessionOptions.setServerPort(8194);        // default value
        Session session = new Session(sessionOptions);
        if (!session.start()) {
            System.out.println("Could not start session.");
            System.exit(1);
        }
        if (!session.openService("//blp/refdata")) {
            System.out.println("Could not open service " +
                               "//blp/refdata");
            System.exit(1);
        }

.........
```

```
    … …
         CorrelationID requestID = new CorrelationID(1);
         Service refDataSvc = session.getService("//blp/refdata");
         Request request =
                     refDataSvc.createRequest("ReferenceDataRequest");
         request.append("securities", "IBM US Equity");
         request.append("fields", "PX_LAST");
         session.sendRequest(request, requestID);
         boolean continueToLoop = true;
         while (continueToLoop) {
             Event event = session.nextEvent();
             switch (event.eventType().intValue()) {
             case Event.EventType.Constants.RESPONSE: // final event
                 continueToLoop = false;              // fall through
             case Event.EventType.Constants.PARTIAL_RESPONSE:
                 handleResponseEvent(event);
                 break;
             default:
                   handleOtherEvent(event);
                 break;
             }
         }
     }
```

The major steps are:

- A `Session` is created and started; then that `Session` is used to open a service named "`//blp/refdata`", a service that provides data according to the Request/ Response paradigm.

  In this example, the values explicitly set for host and port correspond to the default values for `Session`; supply the values for your installation. If the default values suffice then `Session` construction can be simplified to:

  ```
  Session session = new Session();
  ```

- The `Session` is used to obtain `refDataSvc`, a handle for the service, which is used to obtain an empty `Request` object for the "`ReferenceDataRequest`" operation.
- The empty request object is customized to the data needed for this application: the security of interest is "`IBM US Equity`", the Bloomberg field of interest is "`PX_LAST`" (last price).
- The request is sent to the service along with `requestID`, an application specified `CorrelationID`. (The value chosen is not important for this example.)
- The application enters a loop that makes a blocking request for `nextEvent` from the `Session`. Each `Event` is handled according to its type.
  - Both `PARTIAL_RESPONSE` and (final) `RESPONSE` events are handled by the user defined `handleResponseEvent` method. The only difference is that

the (final) `RESPONSE` changes the state of `continueToLoop` so that the looping stops and the application terminates.

  - `Event` objects of any other type are handled by a different user defined handler, `handleOtherEvent`.

In this application, the event handlers simply output some information about the received events.

```
    private static void handleResponseEvent(Event event) throws Exception
  {
          System.out.println("EventType =" + event.eventType());
          MessageIterator iter = event.messageIterator();
          while (iter.hasNext()) {
              Message message = iter.next();
              System.out.println("correlationID=" +
                                   message.correlationID());
              System.out.println("messageType  =" +
                                   message.messageType());
              message.print(System.out);
           }
      }
```

This handler outputs the key features of the received `Event`.

- Each `Event` has a type and possibly some associated `Message`s which can be obtained via the `MessageIterator` obtained from the `Event`.
- Each `Message` from these response events shows the same `CorrelationID` that was specified when the `Request` was sent. Additionally, each `Message` has a type.
- Finally, there is a `print` method to output the details of the `Message` in a default format.

Sample output is shown below:

```
EventType =RESPONSE
correlationID=User: 1
messageType  =ReferenceDataResponse
ReferenceDataResponse (choice) = {
    securityData[] = {
        securityData = {
            security = IBM US Equity
            sequenceNumber = 0
            fieldData = {
                PX_LAST = 82.14
            }
        }
    }
}
```

However, this response to our query is not the only output from this program. This application also receives `Event`s of type neither `PARTIAL_RESPONSE` nor `RESPONSE`.

```
EventType=SESSION_STATUS
correlationID=null
messageType=SessionStarted
SessionStarted = {
}
EventType=SERVICE_STATUS
correlationID=Internal: 1
messageType=ServiceOpened
ServiceOpened = {
}
```

This output comes from the event handling function called from the `default` case of the switch statement. The events reported here are returned in response to the applications starting of a session and opening of a service.

```
    private static void handleOtherEvent(Event event) throws Exception
    {
        System.out.println("EventType=" + event.eventType());
        MessageIterator iter = event.messageIterator();
        while (iter.hasNext()) {
            Message message = iter.next();
            System.out.println("correlationID=" +
                                   message.correlationID());
            System.out.println("messageType=" + message.messageType());
            message.print(System.out);
            if (Event.EventType.Constants.SESSION_STATUS ==
                       event.eventType().intValue()
            &&  "SessionTerminated" ==
message.messageType().toString()){
                System.out.println("Terminating: " +
                                       message.messageType());
                System.exit(1);
            }
        }
    }
```

The overall organization of `handleOtherEvent` is quite similar to that of `handleResponseEvent` but there are some notable differences:

- Some messages (e.g., system messages) may not have a `CorrelationID`. The handler must be able to handle such cases.

  Note: The `SERVICE_STATUS` correlation ID has type `Internal` because it was automatically generated. The `RESPONSE` correlation ID that was explicitly specified by the application is typed `User`.

- There may be events that do not arise from application request; for example, an unexpected session shutdown.

2.4 Using the Subscription Paradigm

Our example application requesting subscription data is quite similar to that shown to illustrate the request/response paradigm. The key differences are shown in bold font.

```
public static void main(String[] args) throws Exception {
    Create and start session.
    if (!session.openService("//blp/mktdata")) {
        System.err.println("Could not start session.");
        System.exit(1);
    }

    CorrelationID subscriptionID = new CorrelationID(2);
    SubscriptionList subscriptions  = new SubscriptionList();
    subscriptions.add(new Subscription("AAPL US Equity",
                                       "LAST_PRICE",
                                       subscriptionID));
    session.subscribe(subscriptions);
    int updateCount = 0;
    while (true) {
        Event event = session.nextEvent();
        switch (event.eventType().intValue()) {
        case Event.EventType.Constants.SUBSCRIPTION_DATA:
            handleDataEvent(event, updateCount++);
            break;
        default:
            handleOtherEvent(event);
            break;
        }
    }
}
```

- The service opened by this application has been changed from "`//blp/refdata`" (reference data) a service that follows the request/response paradigm to "`//blp/mktdata`" (market data), a service that follows the subscription paradigm.
- Instead of creating and initializing a `Request`; here we create and initialize a `SubscriptionList` and then subscribe to the contents of that list. In this first example, we subscribe to only one security, "`AAPL US Equity`", and specify only one Bloomberg field of interest, `LAST_PRICE` (the subscription analog for `PX_LAST`, the field used in the request/response example).
- The request/response example had application logic to detect the final event of the request and then break out of the event-wait-loop. Here, there is no final event. A subscription will continue to send update events until cancelled (not done in this example) or until the session shut down (handled, as we did before, in the `handleOtherEvent` method).
- The event type of particular interest is now `SUBSCRIPTION_DATA`. In this example, these events are passed to the `handleEventData` method.

The `handleDataEvent` method is quite similar to `handleResponseMethod`. The additional parameter, `updateCount`, is used in this simple example just to enhance the output.

```
    private static void handleDataEvent(Event event, int updateCount)
                                                    throws Exception
     {
         System.out.println("EventType=" + event.eventType());
         System.out.println("updateCount = " + updateCount);
         MessageIterator iter = event.messageIterator();
         while (iter.hasNext()) {
             Message message = iter.next();
             System.out.println("correlationID = " +
                                   message.correlationID());
             System.out.println("messageType   = " +
                                   message.messageType());
             message.print(System.out);
         }
     }
```

Despite these many similarities, the output from the subscription is considerably different from that of the request/response. Examine the output for a random event in the sequence:

```
EventType=SUBSCRIPTION_DATA
updateCount = 54
correlationID = User: 2
messageType   = MarketDataEvents
MarketDataEvents = {
    LAST_PRICE = 85.71
    VOLUME = 18969874
    LAST_TRADE = 85.71
    LAST_ALL_SESSIONS = 85.71
    EQY_TURNOVER_REALTIME = 1.6440605281984758E9
    ALL_PRICE_SIZE = 100
    ALL_PRICE = 85.71
    SIZE_LAST_TRADE_TDY = 100
    RT_PX_CHG_NET_1D = -4.29
    RT_PX_CHG_PCT_1D = -4.767
    VOLUME_TDY = 18969874
    LAST_PRICE_TDY = 85.71
    LAST2_PRICE = 85.719
    LAST_DIR = -1
    LAST2_DIR = 1
    SIZE_LAST_TRADE = 100
    TIME = 19:06:30.000+00:00
    TRADE_SIZE_ALL_SESSIONS_RT = 100
    EVENT_TIME = 19:06:30.000+00:00
    EID = 14005
    IS_DELAYED_STREAM = false
}
```

Clearly, this subscription event provides much data in addition to `LAST_PRICE`, the specifically requested field (shown in bold above). A later example will demonstrate how a customer application can extract and use the value of interest.

> **Note:** The Bloomberg infrastructure is at liberty to package additional fields in the data returned to a client; however, the client cannot validly expect any data except the requested fields. This sample output shows that the requested field is the first data out of `message`; that is happenstance and cannot be assumed.

The output of the `otherEventHandler` method also shows differences from the first example.

```
EventType=SESSION_STATUS
correlationID=null
messageType=SessionStarted
SessionStarted = {
}
EventType=SERVICE_STATUS
correlationID=Internal: 1
messageType=ServiceOpened
ServiceOpened = {
}

EventType=SUBSCRIPTION_STATUS

correlationID=User: 2

messageType=SubscriptionStarted

SubscriptionStarted = {

}
```

In addition to the events for the start of session and opening of a service, which were seen in the request/response example, we also see here an event signaling that a subscription has been initiated. The empty `SubscriptionStarted` message indicates successful starting of the subscription; otherwise, there would have been error information. The value of the `CorrelationID` informs the customer application which subscription (of possibly many subscription requests) has been successfully started.

3 Sessions and Services

3.1 Sessions

The `Session` object provides the context of a customer application's connection to the Bloomberg infrastructure via the Bloomberg API. Having a `Session` object, customer applications can use them to create `Service` objects for using specific Bloomberg services. Depending on the service, a client can send `Request` objects or start a subscription. In both cases, the Bloomberg infrastructure responds by sending `Event` objects to the customer application.

3.2 Services

All Bloomberg data provided by the Bloomberg API is accessed through a "service" which provides a schema to define the format of requests to the service and the events returned from that service. The customer application's interface to a Bloomberg service is a `Service` object.

Accessing a `Service` is a two step process.

- Open the `Service` using either the `openService` or the `openServiceAsync` methods of the `Session` object.
- Obtain the `Service` object using the `getService` method of the `Session` object.

In both stages above, the service is identified by its "name", an ASCII string formatted as "`//namespace/service`"; for example, "`//blp/refdata`".

Once a service has been successfully opened, it remains available for the lifetime of that `Session` object.

3.3 Event Handling

The Bloomberg API is fundamentally asynchronous - applications initiate operations and subsequently receive `Event` objects to notify them of the results; however, for developer convenience, the `Session` class also provides synchronous versions of some operations. The `start`, `stop`, and `openService` methods seen in earlier examples encapsulate the waiting for the events and make the operations appear synchronous.

The `Session` class also provides two ways of handling events. The simpler of the two is to call the `nextEvent` method to obtain the next available `Event` object. This method will block until an `Event` becomes available and is well-suited for single threaded customer applications.

Alternatively, one can supply an `EventHandler` object when creating a `Session`. In this case, the user-defined `processEvent` method in the supplied `EventHandler` will be called by the Bloomberg API when an `Event` is available. The signature for `processEvent` method is:

```
public void processEvent(Event event, Session session)
                                    // Note: no exceptions are thrown
```

The calls to the `processEvent` method will be executed by a thread owned by the Bloomberg API, thereby making the customer application multi-threaded; consequently customer applications must, in this case, ensure that data structures and code accessed from both its main thread and from the thread running the `EventHandler` object are thread-safe.

The two choices for event handling are mutually exclusive:

- If a `Session` is provided with an `EventHandler` when it is created calling the `nextEvent` method will throw an exception.
- If no `EventHandler` is provided then the only way to retrieve `Event` object is by calling the `nextEvent` method.

3.3.1 Synchronous Event Handling

The following code fragments use synchronous methods on the `Session` and single threaded event handling using the `nextEvent` method.

```
public static void main(String[] args) throws Exception {
    SessionOptions sessionOptions = new SessionOptions();
    sessionOptions.setServerHost("localhost");
    sessionOptions.setServerPort(8194);
    Session session = new Session(sessionOptions);
    if (!session.start()) {
        System.out.println("Could not start session.");
        System.exit(1);
    }
    if (!session.openService("//blp/refdata")) {
        System.out.println("Could not open service " +
                           "//blp/refdata");
        System.exit(1);
    }
    Construct a request
    Send the request via session.
    boolean continueToLoop = true;
    while (continueToLoop) {
        Event event = session.nextEvent();
        switch (event.eventType().intValue()) {
            case Event.EventType.Constants.PARTIAL_RESPONSE:
                Handle Partial Response
                break;
            case Event.EventType.Constants.RESPONSE: // final event
                Handle Final Event
                continueToLoop = false;
                break;
            default:
                Handle Other Events
                break;
        }
    }
    session.stop();
    System.exit(0);
}
```

3.3.2 Asynchronous Event Handling

Use of asynchronous event handling shifts many programmatic details from the `main` function to the event handler.

```
public static void main(String[] args) throws Exception {
    SessionOptions sessionOptions = new SessionOptions();
    sessionOptions.setServerHost("localhost");
    sessionOptions.setServerPort(8194);
    Session session = new Session(sessionOptions,
                                    new MyEventHandler());
    session.startAsync();
      // Wait for events
    Object object = new Object();
    synchronized (object) {
        object.wait();
    }
}
```

The status for starting the asynchronous session will be received as an event and checked in the handler. Also, there is no exit from `main`; logic in the event handler will determine when the process should be terminated.

The `MyEventHandler` class is in this example a non-`public` class (it is used only by `main`) implementing the `EventHandler` interface. The class also defines `dumpEvent`, a "helper" function.

```
class MyEventHandler implements EventHandler {

    void dumpEvent(Event event){
        Output event type.
        For each message, output the type and correlation ID.
    }

    public void processEvent(Event event, Session session) {
        Details below.
    }
}
```

The `processEvent` method is organized to each of the expected events as well as unexpected events:

```
public void processEvent(Event event, Session session) {

    switch (event.eventType().intValue()) {
        case Event.EventType.Constants.SESSION_STATUS: {
            If session started, open service.
        break;
        }

        case Event.EventType.Constants.SERVICE_STATUS: {
            If service opened successfully, send request.
            break;
        }

        case Event.EventType.Constants.PARTIAL_RESPONSE: {
            Handle partial response.
        break;
        }

        case Event.EventType.Constants.RESPONSE:
            Handle final response.
        break;
        }

        default: {
            Handle unexpected response.
        break;
        }

}
```

Each case in `processEvent` will now be examined in greater detail.

We first show the processing of the event returned for starting the session. If successful, the code will attempt to open the needed service. Since the `openServiceAsync` method throws an exception on failure, but `processEvent` is not allowed to emit an exception, that call must be surrounded by a `try`-`catch` block. In event of failure, this simple example chooses to terminate the process.

```
case Event.EventType.Constants.SESSION_STATUS: {
    MessageIterator iter = event.messageIterator();
    while (iter.hasNext()) {
        Message message = iter.next();
        if (message.messageType().equals("SessionStarted")) {
            try {
                session.openServiceAsync("//blp/refdata",
                                         new CorrelationID(99));
            } catch (Exception e) {
                System.err.println(
                             "Could not open //blp/refdata for async");
                System.exit(1);
            }
        } else {
            Handle error.
        }
    }
    break;
}
```

On receipt of a `SERVICE_STATUS` type event, the messages are searched for one indicating that the `openServiceAsync` call was successful: the message type must be "`ServiceOpened`" and the correlation ID must match the value assigned when the request was sent.

If the service was successfully opened, we can create, initialize and send a request as has been shown in earlier examples. The only difference is that the call to `sendRequest` must be guarded against the transmission of exceptions, not a concern until now.

```
case Event.EventType.Constants.SERVICE_STATUS: {
    MessageIterator iter = event.messageIterator();
    while (iter.hasNext()) {
        Message message = iter.next();
        if (message.correlationID().value() == 99
        &&  message.messageType().equals("ServiceOpened")) {
            //Construct and issue a Request
            Service service = session.getService("//blp/refdata");
            Request request =
                         service.createRequest("ReferenceDataRequest");
            request.append("securities", "IBM US Equity");
            request.append("fields", "LAST_PRICE");
            try {
                session.sendRequest(request, new CorrelationID(86));
            } catch (Exception e) {
                System.err.println("Could not send request");
                System.exit(1);
            }
        } else {
            Handle other message types, if expected.
        }
    }
    break;
}
```

The handling of events containing the requested data is quite similar to the examples already seen. One difference is that, in this example, on the final event, we terminate the process from the event handler, not from `main`.

```
case Event.EventType.Constants.PARTIAL_RESPONSE: {
    dumpEvent(event); // Handle Partial Response
    break;
}

case Event.EventType.Constants.RESPONSE: {
    dumpEvent(event); // Handle final response

    // Example complete; shut-down.
    try {
        session.stop(Session.StopOption.ASYNC);
    } catch (InterruptedException e) {
        e.printStackTrace();
    }
    System.out.println("terminate process from handler");
    System.exit(0);
    break;
}
```

Finally, for completeness, there is a `default` case to handle events of unexpected types.

```
default: {
    System.err.println("unexpected Event");
    dumpEvent(event);
    System.exit(1);
    break;
}
```

3.4 Multiple Sessions

Most applications will only use a single `Session`; however, the Bloomberg API allows the creation of multiple `Session` objects. Multiple instances of the `Session` class contend for nothing and thus allow for efficient multi-threading.

For example, a customer application can increase its robustness by using multiple `Session` objects to connect to different instances of the Server API process.

For another example, a customer application may need from a service both large, heavyweight messages that require much processing as well as small messages that can be quickly processed. If both were obtained through the same session, then the processing of the heavy messages would increase latency on the lightweight messages. That situation can be mitigated by handling the two categories of data with different `Session` objects and different threads.

4 Requests and Responses

The examples in earlier chapters have shown how to send requests for data and how to handle the corresponding responses. This chapter examines in greater depth the techniques for composing those requests and for extracting data from the response.

The example to be used here, a variation on those already covered, has the same overall organization.

```
import classes
public class RequestResponseExample {
    private static void handleResponseEvent(Event event) throws
                                                        Exception {
        ………
    }
    private static void handleOtherEvent(Event event) throws Exception {
         ………
    }
    public static void main(String[] args) throws Exception {

        create session; start session; open service

        create and initialize request

        send request

        loop until final response is received
    }
}
```

Our focus will be on the creation and initialization of the request in `main` and, later, on the extraction of data from the response in the user-defined `handleResponseEvent` method.

4.1 The Programming Example

The example explored in this chapter is `RequestResponseMultiple.java`. A complete listing of this example and its output can be found in "Request Response Multiple" on page 178.

Translations of `RequestResponseMultiple.java` to the other supported programming languages are also provided:

- `RequestResponseMultiple.cs` ("Request Response Multiple" on page 213)
- `RequestResponseMultiple.cpp` ("Request Response Multiple" on page 238)
- `RequestResponseMultiple.c` ("Request Response Multiple" on page 271)

4.2 Elements

The services provided by the Bloomberg API collectively accept a great variety of different types of requests which, in turn, often take many different parameters and options. The data returned in response is correspondingly diverse in type and organization. Consequently, requests and responses are composed of `Element` objects: instances of a class with great flexibility in representing data.

- Firstly, an `Element` object can contain a single instance of a primitive type such as an integer or a string. Secondly, `Element` objects can also be combined into hierarchical types by the mechanism of `SEQUENCE` or `CHOICE`.
  - A `SEQUENCE` is an `Element` object that contains one or more `Element` objects, each of which may be of any type, similar to a `struct` in the C language.
  - A `CHOICE` is an `Element` object that contains exactly one `Element` object of a type from a list of possible `Element` types. That list can be composed of any `Element` types, similar to a `union` in the C language.
  - `Element` objects of the `SEQUENCE` and `CHOICE` categories can be nested to arbitrary levels.
- Finally, every `Element` is capable of representing an array of instances of its type.

The `Element` class also provides introspective methods (in addition to the introspective methods provided by the Java language) which allow the programmatic discovery of the structure of an `Element` object and any constituent `Element` objects. However, that level of generality is required in few applications. Most applications can be written to a known structure for request and response, as defined in the schema for a service. Should an application's structural assumptions prove incorrect (e.g., service schemas can be redefined), then an `Exception` is generated at run-time.

Note: Incompatible changes to the schema of a Bloomberg core service are very rare. In fact, so far there have been none. Should such changes ever be necessary, they will be phased in and announced with ample warning.

4.3 Request Details

An earlier example showed how to request a single data item (a Bloomberg "field") for a single security from the Reference Data Service. However, the Reference Data Service accepts more general requests. The service specifies that each "`ReferenceDataRequest`" can contain three `Element` objects:

- a list of fields of interest, each a string type,
- a list of securities of interest, each a string type, and
- a list of overrides, each of type `FieldOverride`, a non-primitive type. This last `Element` is optional and will not be used in this example.

Our present example begins much as before:

- the `Session` is created and started
- the `Service` is opened and a handle to that `Service` is obtained.

These steps are performed by the following code fragment:

```
Session session = new Session();
session.start();
session.openService("//blp/refdata");
Service refDataSvc = session.getService("//blp/refdata");
………
```

Given the handle to the service, here named `refDataSvc`, a `Request` can be created for the request type named "`ReferenceDataRequest`".

```
………
Request request = refDataSvc.createRequest("ReferenceDataRequest");
………
```

As described in the schema, this request consists of three `Element` objects named "`securities`", "`fields`", and "`overrides`", each initially empty. These elements represent arrays of strings so their values can be set by appending strings to them specifying the securities and fields required, respectively.

```
………
request.getElement("securities").appendValue("AAPL US Equity");
request.getElement("securities").appendValue("IBM US Equity");
request.getElement("securities").appendValue("BLAHBLAH US Equity");
request.getElement("fields").appendValue("PX_LAST"); // Last Price
request.getElement("fields").appendValue("DS002");   // Description
request.getElement("fields").appendValue("VWAP_VOLUME");
  // Volume used to calculate the Volume Weighted Average Price (VWAP)
………
```

The request is now ready to be sent. Note that one of the securities was deliberately set to an invalid value; later, we will examine the error returned for that item.

> **Note:** This usage pattern of appending values of arrays of `Element`s occurs so frequently that the `Request` class provides convenience methods that are more concise (but also obscure the `Element` sub-structure):

```
request.append("securities", "AAPL US Equity");
request.append("securities", "IBM US Equity");
request.append("securities", "BLAHBLAH US Equity");
request.append("fields", "PX_LAST");
request.append("fields", "DS002");
request.append("fields", "VWAP_VOLUME");
```

The rest of `main`, specifically the event-loop for the response, is essentially the same as that used in earlier examples. The `main` function is shown in its entirety below;

```
    public static void main(String[] args) throws Exception {
        Session session = new Session();
        session.start();
        session.openService("//blp/refdata");
        Service refDataSvc = session.getService("//blp/refdata");

        Request request = refDataSvc.createRequest("ReferenceDataRequest");

        request.getElement("securities").appendValue("AAPL US Equity");
        request.getElement("securities").appendValue("IBM US Equity");
        request.getElement("securities").appendValue("BLAHBLAH US Equity");
        request.getElement("fields").appendValue("PX_LAST"); // Last Price
        request.getElement("fields").appendValue("DS002");   // Description
        request.getElement("fields").appendValue("VWAP_VOLUME");
          // Volume used to calculate Volume Weighted Average Price (VWAP)

        session.sendRequest(request, new CorrelationID(1));
        boolean continueToLoop = true;
        while (continueToLoop) {
            Event event = session.nextEvent();
            switch (event.eventType().intValue()) {
            case Event.EventType.Constants.RESPONSE:   // final response
                continueToLoop = false;                // fall through
            case Event.EventType.Constants.PARTIAL_RESPONSE:
                handleResponseEvent(event);
               break;
            default:
                handleOtherEvent(event);
               break;
            }
        }
    }
```

4.4 Response Details

The response to a "`ReferenceDataRequest`" request is an element named "`ReferenceDataResponse`", an `Element` object which is a `CHOICE` of an `Element` named "`responseError`" (sent, for example, if the request was completely invalid or if the service is down) or an array of `Element` object named "`securityData`", each containing some requested data. The structure of these responses can be obtained from the service schema, but is also conveniently viewed, as we have done earlier, by printing the response in the response event handler code.

```
ReferenceDataResponse (choice) = {
    securityData[] = {
        securityData = {
            security = AAPL US Equity
            sequenceNumber = 0
            fieldData = {
                PX_LAST = 173.025
                DS002 = APPLE INC
                VWAP_VOLUME = 3.0033325E7
            }
        }
    }
}
```

The fact that the element named "`ReferenceDataResponse`" is an array allows each response event to receive data for several of the requested securities. The Bloomberg API may return a series of `Message` objects (each containing a separate "`ReferenceDataResponse`") within a series of `Event` objects in response to a request. However, each security requested will appear in only one array entry in only one `Message` object.

Each element of the "`securityData`" array is a `SEQUENCE` that is also named "`securityData`". Each "`securityData`" `SEQUENCE` contains an assortment of data including values for the fields specified in the request. The reply corresponding to the invalidly named security, "`BLAHBLAH US Equity`", shows that the number and types of fields in a response can vary between entries.

```
ReferenceDataResponse (choice) = {
    securityData[] = {
        securityData = {
            security = BLAHBLAH US Equity
            securityError = {
                source = 100::bbdbs1
                code = 15
                category = BAD_SEC
                message = Unknown/Invalid security [nid:100]
                subcategory = INVALID_SECURITY
            }
            sequenceNumber = 2
            fieldData = {
            }
        }
    }
}
```

This response message has an `Element` not previously seen, named "`securityError`". This `Element` provides details to explain why data could not be provided for this security. Note that sending one unknown security did not invalidate the entire request.

Just printing the response in the default format is educational but to perform any real work with the response the values must be extracted from the received message and assigned elsewhere for use. The following event handler shows how to navigate the `Element` structure of the "`ReferenceDataResponse`".

The `asElement` method of `Message` provides a handle for navigating the contents of the `Message` objects using `Element` methods. If an `Element` object is an array (e.g., `securityDataArray`) then the `numValues` method provides the number of items in the array.

Note: The `Element` class also provides similarly named method, `numElements` (not used in this example), which returns the number of `Element` objects in a `SEQUENCE`.

```
  private static void handleResponseEvent(Event event) throws Exception {
    MessageIterator iter = event.messageIterator();
    while (iter.hasNext()) {
      Message message                = iter.next();
      Element ReferenceDataResponse  = message.asElement();
      if (ReferenceDataResponse.hasElement("responseError")) {
        handle error
      }
      Element securityDataArray =
                          ReferenceDataResponse.getElement("securityData");
      int numItems = securityDataArray.numValues();
      for (int i = 0; i < numItems; ++i) {
        Element securityData = securityDataArray.getValueAsElement(i);
        String  security     = securityData.getElementAsString("security");
        int     sequenceNumber =
                          securityData.getElementAsInt32("sequenceNumber");
        if (securityData.hasElement("securityError")) {
          Element securityError =
                              securityData.getElement("securityError");
          handle error
          return;
        } else {
          Element fieldData   = securityData.getElement("fieldData");
          double  px_last     = fieldData.getElementAsFloat64("PX_LAST");
          String  ds002       = fieldData.getElementAsString("DS002");
          double  vwap_volume = fieldData.getElementAsFloat64(
                                                    "VWAP_VOLUME");

          // Individually output each value
          System.out.println("* security      =" + security);
          System.out.println("* sequenceNumber=" + sequenceNumber);
          System.out.println("* px_last       =" + px_last);
          System.out.println("* ds002         =" + ds002);
          System.out.println("* vwap_volume   =" + vwap_volume);
          System.out.println("");
        }
      }
    }
  }
```

When stepping through the `securityData` array, the requested Bloomberg fields are accessed by the name and type (e.g., `getElementAsFloat64`, `getElementAsInt32`) as specified in the schema. Once values have been assigned to local variables they can be used as needed. In this simple example, they are merely output individually in a distinctive format. The program output is shown below.

```
    * security      =AAPL US Equity
    * sequenceNumber=0
    * px_last       =173.025
    * ds002         =APPLE INC
    * vwap_volume   =3.0033325E7

    * security      =IBM US Equity
    * sequenceNumber=1
    * px_last       =126.46
    * ds002         =INTL BUSINESS MACHINES CORP
    * vwap_volume   =2885962.0

    * security      =BLAHBLAH US Equity
    securityError = {
        source = 100::bbdbs1
        code = 15
        category = BAD_SEC
        message = Unknown/Invalid security [nid:100]
        subcategory = INVALID_SECURITY
    }
```

The `sequenceNumber` is provided to allow the ordering of `PARTIAL_RESPONSE` events from the reference data service.

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5 Subscriptions

Subscriptions are ideal for data that changes frequently and/or at unpredictable intervals. Instead of repeatedly polling for the current value your application gets the latest value as soon as it is available without wasting time and bandwidth when there has been no change.

This chapter contains more details on how you can start, modify, and stop subscriptions as well as what to expect as the result of a subscription and how to handle those results. This chapter uses examples from the "`//blp/mktdata`" service.

Currently, the Bloomberg API services that provide a subscription service are market data and Custom VWAP. In the future, the Bloomberg API may support delivering information other than market data through a subscription service.

5.1 The Programming Example

The example explored in this chapter is `SubscriptionMultiple.java`. A complete listing of this example and its output can be found in "Subscription Multiple" on page 182.

Translations of `SubscriptionMultiple.java` to the other supported programming languages are also provided:

- `SubscriptionMultiple.cs` ("Subscription Multiple" on page 217)
- `SubscriptionMultiple.cpp` ("Subscription Multiple" on page 242)
- `SubscriptionMultiple.c` ("Subscription Multiple" on page 279)

5.2 Starting a Subscription

There are four parts to creating a subscription; however several have default values:

- The *service name* (for example, "`//blp/mktdata`"). If you do not specify the service name the `defaultSubscriptionService` of the `SessionOptions` object is used.
- The topic. In the case of "`//blp/mktdata`" the topic value consists of an optional symbology identifier followed by an instrument identifier. For example, "`/cusip/097023105`" and "`/sedol1/2108601`" include the symbology identifier whereas "`IBM US Equity`" omits the symbology identifier. If you do not specify the symbology identifier then the `defaultTopicPrefix` of the `SessionOptions` object is used.

  Note: The topic's form may be different for different subscription services.
- The *options*. These are qualifiers that can affect the content delivered. Examples in "`//blp/mktdata`" include specifying which fields an application requires or specifying an interval for conflated data.

- The *correlation ID*. Data for each subscription is tagged with a correlation ID (represented as a `CorrelationID` object) which must be unique to the session. The customer application can specify that value when the subscription is created. If the customer application does not specify a correlation ID, the Bloomberg infrastructure will supply a suitable value; however, in practice, the internally generated correlation ID is rarely used. Most customer applications assign meaningful correlation ids that allow the mapping of incoming data to the originating request or subscription.

You can represent any subscription as a single string that includes the service name, topic and options. For example:

- “`//blp/mktdata/cusip/097023105?fields=LAST_PRICE,LAST_TRADE_ACTUAL`" represents a subscription using the market data service to an instrument (BA) specified by CUSIP where any changes to the fields `LAST_PRICE` or `LAST_TRADE_ACTUAL` from the Bloomberg data model should generate an update.
- "`IBM US Equity?fields=BID,ASK&interval=2`" represents a subscription using the market data service to an instrument (IBM) specified by Bloomberg Ticker where any changes to the fields `BID` or `ASK` from the Bloomberg data model should generate an update subject to conflation restriction of at least two seconds between updates. In this case, we are assuming that the `Session` has a `defaultSubscriptionService` of "`//blp/mktdata`" and a `defaultTopicPrefix` of "`ticker/`".

The Bloomberg API provides methods which accept the subscription specification as a single string as well as methods in which the different elements of the subscription are specified as separate parameters. Subscriptions are typically manipulated in groups so the Bloomberg API provides methods that operate on a list of subscriptions. This example shows subscription creation by several of these methods.

```
………
SubscriptionList subscriptions      = new SubscriptionList();
CorrelationID    subscriptionID_IBM = new CorrelationId(10);
subscriptions.add(new Subscription("IBM US Equity",
                                   "LAST_TRADE",
                                   subscriptionID_IBM)));
subscriptions.add(new Subscription("/ticker/GOOG US Equity",
                                   "BID,ASK,LAST_PRICE",
                                   new CorrelationID(20)));
subscriptions.add(new Subscription("MSFT US Equity",
                                   "LAST_PRICE",
                                   "interval=.5",
                                   new CorrelationID(30)));
subscriptions.add(new Subscription(
    "/cusip/097023105?fields=LAST_PRICE&interval=5.0", //BA US Equity
    new CorrelationID(40)));
session.subscribe(subscriptions);
………
```

NOTE: SubscriptionList in C# is simply an alias to System.Collections.Generic.List<Bloomberglp.Blpapi.Subscription>, created with:

```
using SubscriptionList =
          System.Collections.Generic.List<Bloomberglp.Blpapi.Subscription>;
SubscriptionList sl = new SubscriptionList();
sl.Add(new Subscription("4444 US Equity"));
```

Subscribing to this list of subscriptions returns an `Event` of type `SUBSCRIPTION_STATUS` consisting of a `Message` object of type `SubscriptionStarted` for each `CorrelationID`. For example, the user-defined "dump" method used previous examples shows:

```
  eventType=SUBSCRIPTION_STATUS
  messageType=SubscriptionStarted
  CorrelationID=User: 10
  SubscriptionStarted = {
  }
  messageType=SubscriptionStarted
  CorrelationID=User: 20
  SubscriptionStarted = {
  }
  messageType=SubscriptionStarted
  CorrelationID=User: 30
  SubscriptionStarted = {
  }
  messageType=SubscriptionStarted
  CorrelationID=User: 40
  SubscriptionStarted = {
  }
```

In case of an error, there is an `Event` to report the subscriptions that failed. For example, if the specification for MSFT (correlation ID 30) above was mistyped (MSFTT) we would get the event:

```
  eventType=SUBSCRIPTION_STATUS
  messageType=SubscriptionFailure
  CorrelationID=User: 30
  SubscriptionFailure = {
      reason = {
          source = BBDB@p111
          errorCode = 2
          category = BAD_SEC
          description = Invalid security
      }
  }
```

5.3 Receiving Data from a Subscription

Once a subscription has started, the application will receive updates for the requested data in `Message` objects arriving `Event` objects of type `SUBSCRIPTION_DATA`. With each message there is a `CorrelationID` to identify the subscription that requested the data.

The "`//blp/mktdata`" service typically responds with `Message`'s which have more data than was requested for the subscription. In our example, only updates to the `LAST_TRADE` field of IBM were requested in the subscription corresponding to `CorrelationID` 10. Applications must be prepared to extract the data they need and to discard the rest.

See "Core Services" on page 52 for more details on the "`//blp/mktdata`" service.

```
eventType=SUBSCRIPTION_DATA
messageType=MarketDataEvents
CorrelationID=User: 10
MarketDataEvents = {
    IND_BID_FLAG = false
    IND_ASK_FLAG = false
    IS_DELAYED_STREAM = true
    TIME = 14:34:44.000+00:00
    VOLUME = 7589155
    RT_OPEN_INTEREST = 8339549
    RT_PX_CHG_PCT_1D = -0.32
    VOLUME_TDY = 7589155
    LAST_PRICE = 118.15
    HIGH = 118.7
    LOW = 116.6
    LAST_TRADE = 118.15
    OPEN = 117.5
    PREV_SES_LAST_PRICE = 118.53
    EQY_TURNOVER_REALTIME = 8.93027456E8
    RT_PX_CHG_NET_1D = -0.379999
    OPEN_TDY = 117.5
    LAST_PRICE_TDY = 118.15
    HIGH_TDY = 118.7
    LOW_TDY = 116.6
    RT_API_MACHINE = p240
    API_MACHINE = p240
    RT_PRICING_SOURCE = US
    EXCH_CODE_LAST = D
    EXCH_CODE_BID = O
    SES_START = 09:30:00.000+00:00
    SES_END = 16:30:00.000+00:00
}
```

5.4 Modifying an Existing Subscription

Once you have created a subscription you may modify the options (for example, to change the fields you wish to receive) using the `resubscribe` method of `Session`.

Note: Use of the `resubscribe` method is generally preferred to cancelling the subscription (using the `unsubscribe` method) and creating a new subscription because updates might be missed between the `unsubscribe` and `subscribe` calls.

As we saw with the `subscribe` method, the `resubscribe` method takes a `SubscriptionList`. For example, to change the fields reported in the subscription created earlier with the correlation ID of `subscriptionID_IBM` we can use the following code fragment:

```
………
SubscriptionList subscriptions = new SubscriptionList();
subscriptions.add(new Subscription("IBM US Equity",
                                  "BID,ASK",
                                  subscriptionID_IBM));
session.resubscribe(subscriptions);
………
```

The client receives an `Event` object indicating successful re-subscription (or not) before receipt of any data from that subscription.

Note: The behavior is undefined if the topic of the subscription (e.g., the security itself) is changed.

5.5 Stopping a Subscription

The Bloomberg API provides an `unsubscribe` method that will cancel a single subscription (specified by its `CorrelationID`) and another method that will cancel a list of subscriptions. The following code fragment cancels all of the subscriptions created earlier.

```
………
SubscriptionList subscriptions = new SubscriptionList();
for (int id = 10; id <= 40; id += 10) {
    subscriptions.add(new Subscription("IBM US Equity",
                                      new CorrelationID(id)));
            // Note: The topic string is ignored for unsubscribe.
}
session.unsubscribe(subscriptions);
…………
```

Note: No `Event` is generated for `unsubscribe`.

5.6 Overlapping Subscriptions

Your application may make subscriptions that "overlap".

One form of overlap occurs when a single incoming update may be relevant to more than one subscription. For example, two or more subscriptions may specify the updates for the same data item. This can easily happen inadvertently by "topic aliasing": one subscription specifies a security by ticker, the other by CUSIP.

Another form of overlap occurs when separate data items intended for different subscriptions on the customer application process arrive in the same `Message` object.

For example, the Bloomberg infrastructure is at liberty to improve performance by packaging two data items within the same `Message` object. This can occur when a customer's application process has made two separate subscriptions, where one includes a request for "`IBM US Equity`" and "`LAST_TRADE`", while the second one includes "`IBM US Equity`" and "`LAST_TRADE`".

The customer application developer can specify how the Bloomberg API should handle overlapping subscriptions. The behavior is controlled by for the `allowMultipleCorrelatorsPerMsg` option to the `SessionOptions` object accepted by the `Session` constructor.

If the `allowMultipleCorrelatorsPerMsg` option is `false` (the default) then a `Message` object that matches more than one subscription will be returned multiple times from the `MessageIterator`, each time with a single, different `CorrelationID`.

If the `allowMultipleCorrelatorsPerMsg` object is `true` then a `Message` object that matches more than one subscription will be returned just once from the `MessageIterator`. The customer application developer must supply logic to examine the multiple correlation ID values (see the `numCorrelationIds` and `correlationIDAt` methods of the `Message` class) and dispatch the appropriate data to the correct application software.

5.7 Conflation and the Interval Option

The API will conflate data only when requested with the Interval option on a subscription. If multiple subscriptions exist for the same security across a range of intervals then the API will have a single subscription from the Bloomberg cloud which is then "intervalized" as appropriate and distributed to individual subscribers.

5.8 Delayed Data

Delayed Data (data for users / applications that are not explicitly entitled to real-time data) is generally pre-conflated before leaving the Bloomberg cloud for client-side applications.

Please note that Desktop API and Server API will have automatic access to delayed data (where available), whereas Managed B-Pipe requires explicit permission for access.

5.9 Subscription Life Cycle

There are several key points in the life cycle of a subscription:

- *Start-up:* Subscriptions are started by the `subscribe` method of `Session`. An `Event` object is generated to report the successful creation of any subscriptions and separate events for each failure, if any.
- *Data Delivery:* Data is delivered in `Event` objects of type `SUBSCRIPTION_DATA`; each such event has one or more messages; each such `Message` object has one or more correlation IDs to identify the associated subscriptions. Since each `Message` object may contain more data than requested in any individual subscription, the code managing each subscription must be prepared to extract its data of interest from the `Message` object.

  Note: customer applications must not rely on the delivery of data that was not explicitly requested in the subscription.
- *Modification:* A list of subscriptions (each subscription identified by its correlation ID) can be modified by the `resubscribe` method of `Session`.
- *Cancellation:* Subscriptions (each subscription identified by its correlation ID) can be cancelled by the `unsubscribe` method of `Session`.
- *Failure:* A subscription failure (e.g., a server-side failure) is indicated by an `Event` of type `SUBSCRIPTION_STATUS` containing a `Message` to describe the problem.

6 Core Services

There are two core and five additional services for accessing Bloomberg data. Each API service operates with either the subscription or request/response paradigm through following well-defined schema. The schema defines the request and request options, with detailed information in "Appendix A Schemas". This chapter provides an overview of each of these services.

Core:

Reference Data Service	`"//blp/refdata"`
Market Data Service	`"//blp/mktdata"`

Additional:

Custom VWAP Service	`"//blp/mktvwap"`
Market Bar Subscription Service	`"//blp/mktbar"`
API Field Information Service	`"//blp/apiflds"`
Page Data Service	`"//blp/pagedata"`
Technical Analysis Service	`"//blp/tasvc"`
API Authorization	`"//blp/apiauth"`

Important Note: Each Bloomberg data product using the Bloomberg API may vary in the services available and also the entirety of the service available. Please see the specific product overview to determine which services are available.

6.1 Common Concepts

6.1.1 Security/Securities

Where a request allows only a single security to be supplied, the field in the schema is named "security" and is a simple string. Where a single request can handle multiple securities the field in the schema is named "securities" and is defined as an array. For example, each `IntradayTickRequest` can only return information on a single security, whereas `ReferenceDataRequest` can return information on many securities.

Syntax

A security must conform to the following syntax:

```
/[Topic Prefix]/SYMBOLOGY[@Pricing Source][Exchange]
```

Where `[Topic Prefix]` is one of the following:

`ticker`	`cusip`	`wpk`	`isin`	`buid`
`sedol1`	`sedol2`	`sicovam`	`common`	`bsid`
`svm`	`cins`	`cats`	`bbgid`	

The default format for a security is the Bloomberg ticker format, for example, "`IBM US Equity`". This format consists of:

```
SYMBOLOGY [Exchange] <Yellow Key>
```

- `SYMBOLOGY` is required and is the ticker name
- `[Exchange]` is optional and is a two character mnemonic for the exchange where the security is traded. If you do not specify [Exchange] then the default value for the user or for the Server API process will be used.
- `<Yellow Key>` is the text equivalent of one of the Bloomberg yellow function keys.

`Govt`	`Corp`	`Mtge`
`M-Mkt`	`Muni`	`Pfd`
`Equity`	`Comdy`	`Index`
`Curncy`	`Client`	

6.1.2 Pricing Source

Bloomberg allows you to specify a provider's pricing for a specific security or for a universe of securities. However, you must have the providing firm's approval to use their pricing information. If you do not specify a pricing source then the default value for the user of the Server API process is used.

If you wish to specify which pricing source should be used append `@` followed by the pricing source to the security, for example, "`/cusip/912828GM6@BGN`" or "`MSFT@ETPX US Equity`". Note for securities in the `Curncy` Yellow Key use a space instead of `@` to separate the security from the pricing source, for example, "`GBPUSD BAAM Curncy`".

To find what pricing sources are available for a security, load the security then type **PCS<GO>** on your Bloomberg. This will also tell you what your preferences for pricing source are for that class of securities. If a pricing is not listed on this screen, then it is not available through the Bloomberg API.

6.1.3 Fields

Some requests (for example, `ReferenceDataRequest` or `HistoricalDataRequest`) as well as subscriptions require you to specify which fields from the Bloomberg data model you wish to receive. When using the Reference Data Service you can specify fields using either the field mnemonic or the CALCRT ID. Returned values have the same name (field mnemonic or CALCRT ID) specified in the request. However, when creating subscriptions you will only receive the mnemonic, even if you are passing the CALCRT ID. Therefore, you will want to use the mnemonic for subscriptions.

You can retrieve information about available fields programmatically using the Bloomberg API Field Information Service ("`//blp/apiflds`") or you can use **FLDS<GO>** on your BLOOMBERG PROFESSIONAL service.

6.1.4 Overrides

You can use overrides to change the basis on which Bloomberg calculates a derived field. You can use this facility to perform "what if?" analysis. For example, override the bid price of a bond (`PX_BID`) and request the bid yield to maturity (`YLD_YTM_BID`) based on the value you supplied for the bid price.

You can retrieve information about which fields react when a particular field is overridden programmatically by using the Bloomberg API Field Information Service, "`//blp/apiflds`", or you can use **FLDS<GO>** on your BLOOMBERG PROFESSIONAL service.

You can specify up to 100 overrides in a single request. The overrides are specified in the request as an array of name/value pairs.

The value you supply is always represented as a string. If the override field requires:

- A date, then the format is `<YYYY><MM><DD>`, where `<YYYY>` is a 4-digit year, `<MM>` is a 2-digit month and `<DD>` is a 2-digit day. Therefore, August 4, 2010 would be specified as `20100804`.
- A decimal value, then you must always use a "." (period) character as the decimal separator regardless of any preferences you may have set in your operating system.

6.1.5 Relative Dates

The start and end date of a `HistoricalDataRequest` are specified using relative dates. These are represented in a string format and allow a great deal of flexibility.

Syntax

The syntax of the Relative Date is:

```
[A][+/-nCU]
```

where `[A]` is the Anchor Date (details below) and `[+/-nCU]` is the Offset from the Anchor Date (details below). Both parts are optional and the date is the result of applying the specified Offset to the specified Anchor.

- If the Anchor Date is omitted then the current date is used.
- If the Offset is omitted then no offset is applied to the Anchor.
    - An empty string is equal to the current date

In the Offset, `+/-` defines the direction of the offset, `n` is a non-negative integer multiplier, `C` is a Calendar Type, and `U` is a Period Unit. The integer multiplier in the Offset is optional

Anchor

You may specify the Anchor portion in any of the following formats

- `<YYYY><MM><DD>` format. The valid range is from `19000101` to `99991231`.
- The symbol `ED` is only valid in a start date and represents the supplied end date anchor.
- The symbol `SD` is only valid in an end date and represents the supplied start date anchor.
- `<C><U><n><YYYY>`, where:
  - `<C>` represents the calendar type, which can be either `C` (calendar) or `F` (fiscal).
  - `<U>` represents the period unit, which can be either `Q` (quarterly), `S` (semi-annually) or `Y` (yearly).
  - `<n>` represents a valid integer value for the specified period unit. So, for Quarterly, `<n>` must be either 1, 2, 3, or 4. For Semi-annually, `<n>` must be either 1 or 2. For Yearly, <n> must be 1 or it may be omitted.
  - <YYYY> represents the year. The valid range is from 1900 to 9999.

Offset

If you supply an offset it must always be in the form <+|->[n]<C><U>, where:

- The first character is always a plus (`+`) or minus (`-`) sign to indicate the direction of the offset from the Anchor date.
- The second character (`<n>`) is an optional multiplier. It must be between `0` and `32767` and the default if it is not specified is `0`.
- The third character, `<C>` is either `A` (actual), `C` (calendar) or `F` (fiscal).
  - For Actual or Calendar types the fourth character, `<U>` is either `D` (daily), `W` (weekly), `M` (monthly), `Q` (quarterly), `S` (semi-annually), or `Y` (yearly).
  - For Fiscal calendar types the fourth character, `<U>`, is either `Q` (quarterly), `S` (semi-annually) or `Y` (yearly).

If you use the Actual calendar type, the offset is applied precisely with no "rounding". For example, `+2AW` from a Tuesday will result in the Tuesday two weeks hence. `+1AM` from the 16th will result in the 16th of the following month.

If you use the Calendar or Fiscal calendar types, the resulting date is rounded down to the last active date of the previous period. For example, `+1CW` from a Tuesday will result in the Friday of the same week, `+1CM` from the 16th will result in the last active day of that month, `+CM` from the 16th will result in the last active day of the previous month.

If the multiplier is not specified and defaults to 0 the resulting date will be the same as the Anchor if the Actual calendar type is used. If the Anchor is Calendar or Fiscal calendar type then the resulting date will be the end of the prior period.

Examples

- `20080409` represents 9 April 2008.
- `CQ42007` represents 31 December 2007
- `20080409-1AM` represents 9 March 2008 - exactly one month previous to the anchor.
- `20080409-1CM` represents 29 February 2008 - the end of the month prior to 9 March 2008.
- A start date of `20080409-3CM` and an end date of `20080409-CM` will provide a range that covers the three calendar months prior to the anchor date of 9 April 2008 (that is, January, February and March).
- `-3CQ` evaluated on 23 June 2008 represents 29 June 2007 (because 30 June 2007 was a Saturday).
- A start date of `20080409-2AQ` and an end date of `SD+1AD` represents a range from 9 October 2007 to 10 April 2008 (Note that the `SD` refers only to the Anchor part of the start date not the result after adding the offset to the Anchor).

6.2 Reference Data Service //blp/refdata

The reference data service provides the ability to access the following Bloomberg data with the request/response paradigm:

- Reference Data Request

  A Reference Data Request provides a snapshot of the current value of a security/ field pair.
- Historical End-of-Day Data

  A Historical Data Request provides end-of-day data over a defined period of time for a security/field pair.
- Historical Intraday Ticks

  An Intraday Tick Request provides each tick over a defined period of time for a security and event type pair.
- Historical Intraday Bars

  An Intraday Bar Request provides a series of intraday summaries over a defined period of time for a security and event type pair.
- Portfolio Data Request

  The Portfolio Data Request enables retrieval of change information and portfolio positions with respect to a specific date in order to see how current market movements have affected user's portfolio's constituent weights.
- BEQS (Bloomberg Equity Screening) Request

  BEQS (Bloomberg Equity Screening) request returns security data for a selected screen created using the Bloomberg **EQS <GO>** function.

6.2.1 Reference Data Request and Response Overview

The `ReferenceDataRequest` enables a snapshot of the current data available for a security/ field pair. A list of fields is available via the BLOOMBERG PROFESSIONAL service function **FLDS<GO>** or using the API fields service. A `ReferenceDataRequest` must specify at least one or more securities and one or more fields. The API will return data for each security/field pair, or alternatively a message indicating otherwise. This example shows how to construct a `ReferenceDataRequest`:

```
Assume we have already opened the //blp/refdata service
Service refDataService = session.getService("//blp/refdata");
Request request = refDataService.createRequest("ReferenceDataRequest");
request.append("securities", "IBM US Equity");
request.append("securities", "/cusip/912828GM6@BGN");
request.append("fields", "PX_LAST");
request.append("fields", "DS002");
d_cid = session.sendRequest(request, null);
```

Response Overview

A PARTIAL_RESPONSE or RESPONSE message will be returned. For large requests, a PARTIAL_RESPONSE will be provided returning part of the information. A RESPONSE message indicates the request has been fully served. Further information is available in "Appendix A Schemas". This example shows how to process a `ReferenceDataResponse`:.

```
private void processReferenceDataResponse(Message msg) throws Exception
{
  Element securityDataArray = msg.getElement("securityData");

  for (int i = 0; i < securityDataArray.numValues(); ++i) {
    Element securityData = securityDataArray.getValueAsElement(i);
    System.out.println(securityData.getElementAsString("security"));
    Element fieldData = securityData.getElement("fieldData");

    for (int j = 0; j < fieldData.numElements(); ++j) {
      Element field = fieldData.getElementAt(j);
      System.out.println(field.name() + " = " +
field.getValueAsString());
    }
    System.out.println("\n");
  }
}
```

6.2.2 Historical Data Request

The `HistoricalDataRequest` enables the retrieval of end-of-day data for a set of securities and fields over a specified period, which can be set to daily, monthly, quarterly, bi-annually or annually. At least one security and one field are required, along with start and end dates. There are a range of options that can be specified in the request, which are outlined in

"Appendix A Schemas". This example shows how to construct a `HistoricalDataRequest` for monthly last price data for 2010.

```
Service refDataService = session.getService("//blp/refdata");
Request request        =
refDataService.createRequest("HistoricalDataRequest");
request.append("securities", "IBM US Equity");
request.append("securities", "MSFT US Equity");
request.append("fields", "PX_LAST");
request.append("fields", "OPEN");
request.set("startDate", "20100101");
request.set("endDate", "20101231");
request.set("periodicitySelection", "MONTHLY");
```

Response Overview

A successful `HistoricalDataResponse` holds information on a single security. It contains a `HistoricalDataTable` with one `HistoricalDataRow` for each interval returned.

```
private void processHistoricalDataResponse(Message msg) throws
Exception {
  Element securityData   = msg.getElement("securityData");
  Element fieldDataArray = securityData.getElement("fieldData");

  for (int j = 0; j < fieldDataArray.numValues(); ++j) {
    Element fieldData = fieldDataArray.getValueAsElement(j);

    for (int k = 0; k < fieldData.numElements(); ++k) {
      Element field = fieldData.getElementAt(k);
      System.out.println("\t" + field.name() + " = "
                              + field.getValueAsString());
    }
  }
}
```

6.2.3 Intraday Tick Request

Bloomberg maintains a tick-by-tick history going back 140 days for all securities where streaming data is available. This intraday data can be used to draw detailed charts, for technical analysis, or to retrieve the initial data for a monitoring graph function such as the **GIP<GO>** function on the BLOOMBERG PROFESSIONAL service.

The `IntradayTickRequest` enables retrieval of tick-by-tick history for a single security. In addition, the event type(s), interval and date/time start and end-points in UTC must be specified.

This example shows how to construct an `IntradayTickRequest`:

```
Service refDataService = session.getService("//blp/refdata");
Request request        =
refDataService.createRequest("IntradayTickRequest");
request.set("security", "VOD LN Equity");
request.append("eventTypes", "TRADE");
request.append("eventTypes", "AT_TRADE");
request.set("startDateTime", new Datetime(2010, 07, 26, 10, 30, 0, 0));
request.set("endDateTime", new Datetime(2010, 07, 26, 14, 30, 0, 0));
```

Response Overview

A successful `IntradayTickResponse` will contain an array of `IntradayTickData` providing information on each tick in the specified time range. The time taken to respond to this request is influenced by the date and time range of your request and the level of market activity during that period.

```
private void processIntradayTickResponse(Message msg) throws Exception
{
  Element data     = msg.getElement("tickData").getElement("tickData");
  int     numItems = data.numValues();

  for (int i = 0; i < numItems; ++i) {
    Element  item  = data.getValueAsElement(i);
    Datetime time  = item.getElementAsDate("time");
    String   type  = item.getElementAsString("type");
    double   value = item.getElementAsFloat64("value");
    int      size  = item.getElementAsInt32("size");
    String   cc;
    if (item.hasElement("conditionCodes")) {
      cc = item.getElementAsString("conditionCodes");
    }
    Process values
  }
}
```

6.2.4 Intraday Bar Services

Bloomberg maintains a tick-by-tick history going back 140 days for all securities where streaming data is available. This intraday data can be used to draw detailed charts, for technical analysis, or to retrieve the initial data for a monitoring graph function such as the **GIP<GO>** function on the BLOOMBERG PROFESSIONAL service.

The Intraday Bar Request enables retrivial of summary intervals for intraday data covering five event types, TRADE, BID, ASK, BEST_BID, and BEST_ASK, over a period of time. Note that only one event type can be specified per request.

Each bar contains OPEN, HIGH, LOW, CLOSE, VOLUME, and NUMBER_OF_TICKS. The interval size of the bars can be set to as low as 1 minute and to as high as 1440 minutes (24 hours).

Each `IntradayBarRequest` can only submit one single instrument. In addition, the event type, interval, and date/time start and end-points in UTC must be specified. This example shows how to construct an `IntradayBarRequest`.

```
Service refDataService = session.getService("//blp/refdata");
Request request = refDataService.createRequest("IntradayBarRequest");
request.set("security", "IBM US Equity");
request.set("eventType", "TRADE");
request.set("interval", 60); // bar interval in minutes
request.set("startDateTime", new Datetime(2010, 03, 26, 13, 30, 0, 0));
request.set("endDateTime",   new Datetime(2010, 03, 26, 21, 30, 0, 0));
```

Response Overview

A successful `IntradayBarResponse` will contain an array of `BarTickData` each of which contains open, high, low, close, number of events and volume values. Further information is available in "Appendix A Schemas". This example shows how to interpret an `IntradayBarResponse`.

```
private void processIntradayBarResponse(Message msg) throws Exception {
  Element data    = msg.getElement("barData").getElement("barTickData");
  int      numBars = data.numValues();

  for (int i = 0; i < numBars; ++i) {
    Element  bar       = data.getValueAsElement(i);
    Datetime time      = bar.getElementAsDate("time");
    double   open      = bar.getElementAsFloat64("open");
    double   high      = bar.getElementAsFloat64("high");
    double   low       = bar.getElementAsFloat64("low");
    double   close     = bar.getElementAsFloat64("close");
    int      numEvents = bar.getElementAsInt32("numEvents");
    long     volume    = bar.getElementAsInt64("volume");
    Process  values
  }
}
```

6.2.5 Portfolio Data Request

The PortfolioDataRequest enables retrieval of change information and portfolio positions with respect to a specific date in order to see how current market movements have affected their portfolio's constituent weights.

Note: The user's portfolio is identified by its Portfolio ID, which can be found on the upper right hand corner of the toolbar on the portfolio's **PRTU<GO>** page. This information can also be accessed historically by using the REFERENCE_DATE override field and supplying the date in 'YYYYMMDD' format. .

Response Overview

A PARTIAL_RESPONSE or RESPONSE message will be returned. For large requests a PARTIAL_RESPONSE will be provided returning part of the information. A RESPONSE message indicates the request has been fully served. Further information is available in "Appendix A Schemas".

6.2.6 BEQS Request

BEQS (Bloomberg Equity Screening) request returns security data for a selected screen created using the Bloomberg EQS Terminal function.

Response Overview

A PARTIAL_RESPONSE or RESPONSE message will be returned. For large requests a PARTIAL_RESPONSE will be provided returning part of the information. A RESPONSE message indicates the request has been fully served. Further information is available in "Appendix A Schemas".

6.3 Market Data Service //blp/mktdata

The Market Data service enables retrieval of streaming data for securities which are priced intraday, by using the API subscription paradigm. Update messages are pushed to the subscriber once the field value changes at the source. These updates can be real time or delayed, based upon the requestors exchange entitlements or through setting a delayed subscription option. All fields desired must explicitly be listed in the subscription to receive their updates.

Response Overview

Once a subscription is established, the stream will supply messages in SUBSCRIPTION_DATA events. The initial message returned, known as a "SUMMARY" message, will contain a value for all the fields specified in the subscription. Subsequent messages may contain values for some or all of the requested Bloomberg fields. It is possible that a message contains none of the requested Bloomberg fields as the messages are only filtered based on the fields they could contain rather than the fields they actually contain and many fields in the streaming events are optional. The Bloomberg API will ensure all messages that contain any of the fields you have explicitly subscribed for are pushed to your application. Finally the stream may return additional fields in these messages, for which were not included in the subscription. These additional fields are not filtered for the purpose of speed, and their inclusion is subject to change at any time.

Some of the fields that are returned also have a null state. For example the fields BID and ASK have values of type float and usually give positive values that you can use to populate your own caches. However there are times when these fields will be set to a null value. In the case of BID and ASK fields this is usually interpreted as an instruction to clear the values in your caches. Therefore it is important to test to see if the field is null before you try and retrieve a value from it.

This example shows how to subscribe for streaming data.

```
Assume that session already exists and the "//blp/mktdata" service has
been successfully opened.
SubscriptionList subscriptions = new SubscriptionList();
subscriptions.add("IBM US Equity",
                  "LAST_PRICE,BID,ASK",
                  "");
subscriptions.add("/cusip/912828GM6@BGN",
                  LAST_PRICE,BID,ASK,BID_YIELD,ASK_YIELD",
                  "");
session.susbcribe (subscriptions);
```

6.4 Custom VWAP Service //blp/mktvwap

The Custom Volume Weighted Average Price (VWAP) Service provides streaming VWAP values for equities. This service allows for a customized data stream with a series of overrides which are documented in "Appendix A.5 Schema for Market Data and Custom VWAP".

```
Assume that session already exists and the "//blp/mktvwap" service has
been successfully opened.
SubscriptionList subscriptions = new SubscriptionList();
subscriptions.add("//blp/mktvwap/ticker/IBM US Equity" +
                  "?VWAP_START_TIME=10:00&VWAP_END_TIME=16:00",
                  "LAST_PRICE,BID,ASK",
                  "");
session.susbcribe(subscriptions);
```

Response Behavior

The response will return a message containing a selection of VWAP fields.

6.5 Market Bar Subscription Service //blp/mktbar

The Market Bar Service provides streaming (real time and delayed) intraday bars. This service provides the functionality to obtain intraday bars for trade volume, number of ticks, open, close, high, low and time of last trade. The major advantage of the service is for clients wishing to retrieve `HIGH/LOW` prices for a specified time interval in streaming format. A subscription to a market bar requires the service to be explicitly specified in the topic.

For example: "`//blp/mktbar/ticker/VOD LN Equity`"

```
"//blp/mktbar/isin/GB00B16GWD56 LN"
```

The only field that can be submitted for this service is `LAST_PRICE`. The following code snippet shows a subscription to market bars: .

```
Assume that the blp/mktbar service has already been opened successfully.
SubscriptionList  d_subscriptions = new SubscriptionList();
d_subscriptions.add("//blp/mktbar/ticker/VOD LN Equity","LAST_PRICE",
                    "interval=5",CorrelationId(1));
d_session.subscribe(d_subscriptions);
```

Response Behavior

There are three types of messages that can occur in a `SUBSCRIPTION_DATA` event. The first event received is `MarketBarStart`, this occurs at every new bar; therefore the frequency of this will depend upon the interval setting. A `MarketBarStart` will return all fields ("A.4 Market Bar Subscription" on page 145). Subsequently, on every last price update a MarketBarUpdate will be sent. This will only include fields that have updated since the bar start or last update. Fields that are always updated are `VOLUME`, `NUMBER_OF_TICKS`, `TIME` and `CLOSE`. `MarketBarEnd` only occurs when the last market bar has been received - i.e., the end_time has been reached. This message only contains `TIME`.

Please note there is no initial summary returned for streaming intraday bars, a reference data request or a subscription will be required to get an initial snapshot if required.

When a market bar subscription is set to return delayed data, the market bar start message will not be returned until the delayed period has passed.

6.6 API Field Information Service //blp//apiflds

The Field Information service provides details and a search capability on fields in the Bloomberg data model using the API request/response paradigm. Information can be retrieved in three ways:

- Field Information Request

  A Field Information Request provides a description on the specified fields in the request.

- Field Search Request

  A Field Information Request provides the ability to search the Bloomberg data model with a search string for field mnemonics.

- Categorized Field Search Request

  A Categorized Field Search Request provides the ability to search the Bloomberg data model based on categories with a search string for field mnemonics.

6.6.1 Field Information Request

A `FieldInfoRequest` returns a description for the specified fields included in the request. The request requires one or more fields specified as either a mnemonic or an alpha-numeric identifier. It is also possible to specify in the request to return the documentation as per **FLDS<GO>**. This example shows how to construct a `FieldInfoRequest`.

```
Service fieldInfoService = session.getService("//blp/apiflds");
Request request          =
fieldInfoService.createRequest("FieldInfoRequest");
request.append("id", "LAST_PRICE");
request.append("id", "pq005");
request.append("id", "ds002");
request.set("returnFieldDocumentation", true);
request.append("properties", "fieldoverridable");
```

Response Behavior

A successful `FieldResponse` will contain an array of `FieldData`. The `FieldData` contains the field's unique id and information about the field. This example shows how to process a single `FieldResponse`.

```
private void processFieldResponse(Message msg) throws Exception {
  Element fieldDataArray = msg.getElement("fieldData");

  for (int i = 0; i < fieldDataArray.numValues(); ++i) {
    Element fieldData = fieldDataArray.getValueAsElement(i);
    Element fieldInfo = fieldData.getElement("fieldInfo");
    System.out.println(
      fieldData.getElementAsString("id") + " " +
      fieldInfo.getElementAsString("mnemonic") + " (" +
      fieldInfo.getElementAsString("description") + ") " +
      fieldInfo.getElementAsString("datatype"));
  }
}
```

6.6.2 Field Search Request

A `FieldSearchRequest` returns a list of fields matching a specified search criterion. The request specifies a search string and it may also contain criteria used to filter the results. This criterion allows for the filtering by category, product type and field type. Detailed information on these settings is located in "Appendix A Schemas". This example shows how to construct a `FieldSearchRequest`.

```
Service fieldInfoService = session.getService("//blp/apiflds");
Request request          =
fieldInfoService.createRequest("FieldSearchRequest");
request.set("searchSpec", "last price");
Element exclude = request.getElement("exclude");
exclude.setElement("fieldType", "Static")
```

Response Behavior

A `FieldSearchRequest` returns a `FieldResponse` just as a `FieldInfoRequest` does.

6.6.3 Categorized Field Search Request

A `CategorizedFieldSearchRequest` returns a list of fields matching a specified search criterion. The request specifies a search string and it may also contain criteria used to filter the results. This criterion allows for the filtering by category, product type and field type. Detailed information on these settings is located in "Appendix A Schemas". This example shows how to construct a `CategorizedFieldSearchRequest`.

```
Service fieldInfoService = session.getService("//blp/apiflds");
Request request          = fieldInfoService.createRequest(

"CategorizedFieldSearchRequest");
request.set("searchSpec", "last price");
```

Response Behavior

A successful `CategorizedFieldResponse` will contain an array of `CategoryData` that contains a flattened representation of the matching fields arranged by the category tree. This example shows how to process a single `CategorizedFieldResponse`.

```
private void processCategorizedFieldResponse(Message msg) throws
Exception {
  Element categoryArray = msg.getElement("category");

  for (int i = 0; i < categoryArray.numValues(); ++i) {
    Element categoryData = categoryArray.getValueAsElement(i);
    System.out.println(
      "Category:" + categoryData.getElementAsString("categoryName"));
    Element fieldDataArray = categoryData.getElement("fieldData");

    for (int j = 0; j < fieldDataArray.numValues(); ++j) {
      Element fieldData = fieldDataArray.getValueAsElement(i);
      Element fieldInfo = fieldData.getElement("fieldInfo");
      System.out.println(
        fieldData.getElementAsString("id") + " " +
        fieldInfo.getElementAsString("mnemonic") + " (" +
        fieldInfo.getElementAsString("description") + ") " +
        fieldInfo.getElementAsString("datatype"));
      }
    }
  }
}
```

6.7 Page Data Service

The Page Data service of the API provides access to **GPGX** pages and the data they contain. This is a subscription service, where the **GPGX** number, the monitor number, the page number and the required rows (fields) must be provided.

The topic is constructed as follows:-

```
0708/012/0001
```

where:

0708 is the **GPGX** number

012 is the monitor number

0001 is the page number

An array of strings is used to specify the rows on the page that are of interest. These can be specified as individual rows, multiple rows separated by commas, or ranges of rows, as follows:

String	Rows Specified
"1”	The first row on the page
"1,2,3”	Rows 1,2 and 3 on the page
"1,6-10,15,16"	Row 1, rows 6 to 10 and rows 15 and 16

The following example shows how to create a subscription, and demonstrates how the subscription fields are used to pass the rows the user wants to subscribe to.

```
String topic = "0708/012/0001"

List<string> fields = new List<string>();
fields.Add("15-18");   // subscribing to rows 15 to 18

subscriptions.Add(new Subscription("//blp/pagedata/" + topic,
                                   fields,
                                   null,
                                   new CorrelationID(topic)));
```

Response Behaviour

Once a subscription has been created, and the subscription status messages have been processed, two event types might be received:

PageUpdate

A PageUpdate event contains a current view of the entire page. It provides the dimensions of the page, followed by a rowUpdate element for each row on the page. A full page update will be received first (all the rows on the page), regardless of the requested rows, and acts as an initial paint of the page, prior to receiving ongoing updates.

```
PageUpdate = {
    numRows = 23
    numCols = 80
    rowUpdate[] = {
        rowUpdate = {
            rowNum = 1
            spanUpdate[] = {
                spanUpdate = {
                    startCol = 1
                    length = 80
               text =
                    attr[] = {
                    }
                    fgColor = DARKBLUE
                    bgColor = WHITE
                }
            }
        }
.
   .
   .
        rowUpdate = {
            rowNum = 23
            spanUpdate[] = {
                spanUpdate = {
                    startCol = 1
                    length = 80
               text =
                    attr[] = {
                    }
                    fgColor = WHITE
                    bgColor = DARKBLUE
                }
            }
        }
    }
}
```

RowUpdate

A RowUpdate event consists of a row number, and one or more spanUpdate elements. Each spanUpdate element describes the location and size of the data (startCol, length), the data itself (text), any attributes associated with that piece of data, and the foreground and background colors. The RowUpdate event is structured in exactly the same way as the rowUpdate element of the PageUpdate event.

```
RowUpdate = {
    rowNum = 15
    spanUpdate[] = {
        spanUpdate = {
            startCol = 61
            length = 1
            text = 9
            attr[] = {
            }
            fgColor = WHITE
            bgColor = DARKBLUE
        }
    }
}
```

Possible Attribute Values:

- BLINK
- DOUBLEWIDTH
- INTENSIFY
- POINTANDCLICK
- REVERSE
- UNDERLINE

Possible Color Values for foreground and background:

- AMBER
- BLACK
- DARKBLUE
- DARKGREEN
- DEEPBLUE
- FLASHINGBLUE
- FLASHINGRED
- GRAY
- LIGHTBLUE
- LIGHTGREEN
- ORANGE
- PINK
- RED
- VIOLET
- WHITE
- YELLOW

6.8 Technical Analysis Service

Technical Analysis is a method of evaluating securities by analyzing statistics generated by market activity, such as past prices and volume. Technical analysts do not attempt to measure a security's intrinsic value, but instead use charts and other tools to identify patterns that can suggest future activity. The Technical Analysis Service enables you to download this data and bring it into your application using Bloomberg API.

Table 6-1 details the different Technical Analysis data types:

Table 6-1: Data Type Description Table

	Description
Historical End of Day	End-of-day data for a specified period of time in increments of days, weeks, months, quarters, or years.
Intraday	Intraday data for a specified period of time in increments of minutes. Based on Bid, Ask, or Trade events, data such as open, high, low, close, and volume can be retrieved for the interval of time specified.
Real-time	Real-time data and events.

6.8.1 Historical End of Day study request

The Historical study request enables the retrieval of end-of-day technical analysis data for a specified security and study attributes over the specified time periods of daily, weekly, monthly, bi-annually and annually. Each Historical study request can submit only a single instrument.

```
Service tasvcService = session.GetService("//blp/tasvc");
Request request = tasvcService.CreateRequest("studyRequest");
// set security name
request.GetElement("priceSource").
                  GetElement("securityName").SetValue("IBM US Equity");
// set historical price data
request.GetElement("priceSource").
    GetElement("dataRange").SetChoice("historical");
Element historicalEle = request.GetElement("priceSource").
                    GetElement("dataRange").GetElement("historical");
historicalEle.GetElement("startDate").SetValue("20100501"); // set
study start date
historicalEle.GetElement("endDate").SetValue("20100528"); // set study
end date
// DMI study example - set study attributes
request.GetElement("studyAttributes").SetChoice("dmiStudyAttributes");
Element dmiStudyEle = request.GetElement("studyAttributes").
                        GetElement("dmiStudyAttributes");
dmiStudyEle.GetElement("period").SetValue(15); // DMI study interval
// set historical data price sources for study
dmiStudyEle.GetElement("priceSourceLow").SetValue("PX_LOW");
dmiStudyEle.GetElement("priceSourceClose").SetValue("PX_LAST");
```

Response Behaviour

A successful studyResponse holds information on the requested security. It contains a studyDataTable with one studyDataRow for each interval returned.

```
    private void processResponseEvent(Message msg)
    {
            Element security = msg.GetElement(SECURITY_NAME);
            string ticker = security.GetValueAsString();
            System.Console.WriteLine("\nTicker: " + ticker);
            if (security.HasElement("securityError"))
            {
                printErrorInfo("\tSECURITY FAILED: ",
                    security.GetElement(SECURITY_ERROR));
                continue;
            }
            Element fields = msg.GetElement(STUDY_DATA);
            if (fields.NumValues > 0)
            {
                int numValues = fields.NumValues;
                for (int j = 0; j < numValues; ++j)
                {
                    Element field = fields.GetValueAsElement(j);
                    for (int k = 0; k < field.NumElements; k++)
                    {
                        Element element = field.GetElement(k);
                      System.Console.WriteLine("\t" + element.Name + " = " +
                            element.GetValueAsString());
                    }
                    System.Console.WriteLine("");
                }
            }
    }
```

6.8.2 Intraday bar study request

The Intraday Bar type study request enables the retrieval of summary intervals of intraday technical analysis data for a specified study attributes for five event types, TRADE, BID, ASK, BEST_BID, and BEST_ASK, over a period of time. Each Intraday study request can only submit only a single instrument. In addition, the event type, interval and date/time start and end-points in UTC must be specified.

```
Service tasvcService = session.GetService("//blp/tasvc");
Request request = tasvcService.CreateRequest("studyRequest");
// set security name
request.GetElement("priceSource").
                  GetElement("securityName").SetValue("IBM US Equity");
Element intradayEle = request.GetElement("priceSource").
                    GetElement("dataRange").GetElement("intraday");
// set intraday price data
intradayEle.GetElement ("eventType").SetValue("TRADE"); // intraday
event type
intradayEle.GetElement("interval").SetValue(60); // intraday interval
intradayEle.GetElement("startDate").SetValue("2010-05-26T13:30:00"); //
set study start date
intradayEle.GetElement("endDate").SetValue("2010-05-27T13:30:00"); //
set study end date
// smavg study example - set study attributes
request.GetElement("studyAttributes").SetChoice("smavgStudyAttributes")
;
Element smavgStudyEle = request.GetElement("studyAttributes").
                        GetElement("smavgStudyAttributes");
smavgStudyEle.GetElement("period").SetValue(15); // SMAVG study
interval
smavgStudyEle.GetElement("priceSourceClose").SetValue("close");
```

Response Behaviour

A successful studyResponse holds information on the requested security. It contains a studyDataTable with one studyDataRow for each bar interval returned.

```
private void processResponseEvent(Message msg)
{
        Element security = msg.GetElement(SECURITY_NAME);
        string ticker = security.GetValueAsString();
        System.Console.WriteLine("\nTicker: " + ticker);
        if (security.HasElement("securityError"))
        {
            printErrorInfo("\tSECURITY FAILED: ",
                security.GetElement(SECURITY_ERROR));
            continue;
        }
        Element fields = msg.GetElement(STUDY_DATA);
        if (fields.NumValues > 0)
        {
            int numValues = fields.NumValues;
            for (int j = 0; j < numValues; ++j)
            {
                Element field = fields.GetValueAsElement(j);
                for (int k = 0; k < field.NumElements; k++)
                {
                    Element element = field.GetElement(k);
                  System.Console.WriteLine("\t" + element.Name + " = " +
                        element.GetValueAsString());
                }
            }
        }
}
```

6.8.3 Realtime study request

The Real time study request provides the ability to subscribe to real time technical analysis data points for a specified study field attributes and period. Each Real time study subscription can only subscribe to a single study field.

Assume that session already exists and the "//blp/tasvc" service hasbeen successfully opened.

```
SubscriptionList subscriptions = new SubscriptionList();
subscriptions.Add(new Subscription("//blp/tasvc/ticker/IBM US
Equity?fields=WLPR&" +
                    "priceSourceClose=LAST_PRICE&" +
                    "priceSourceHigh=HIGH&" +
                    "priceSourceLow=LOW&" +
                    "periodicitySelection=DAILY&" +
                    "period=14", new CorrelationID("IBM US
Equity_WLPR")));
 session.susbcribe (subscriptions);
```

Response Behaviour

Once a subscription is established, the stream will supply messages in SUBSCRIPTION_DATA events. Apart from study field subscribed, you may receive additional study fields in these messages which were not subscribed. These additional fields are not filtered for the purpose of speed and their inclusion is subject to change at any time.

6.9 API Authorization

The Authorization service enables an application to handle the Bloomberg concept of Permissioning, by checking authorization and entitlement through the creation of Identities which represent users and/or applications. These Identities contain the entitlement identifiers for data enabled under the user/application. The entitlements are then used in combination with those retrieved from market or reference data to decide whether the entity is allowed to view the data. Detailed explanation is documented in "Authorization and Permissioning Systems" on page 76.

Response Behaviour

The response message indicates a pass or fail.

7 Authorization and Permissioning Systems

7.1 Overview

It is necessary to restrict access to data to users who are entitled to view it. With the Bloomberg API data products this is essentially a three step process.

Authentication

Who is the consumer?

Authorization

What data is the consumer entitled to see?

Permissioning

The process of enforcing data distribution to only entitled consumer.

7.2 Underlying Concepts

7.2.1 EIDs

EIDs are integers that represent the entitlement for a security's source (e.g. a level 1 entitlement for MSFT UQ Equity would have an EID of 14005, level 2 data would be additional EIDs).

Instruments from a common source (e.g., NASDAQ) will share an EID; for example, MSFT UQ Equity and INTC UQ Equity both come from NASDAQ and so have EID 14005 (if requested by someone with level 1 access).

Users and applications can have EIDs associated with them to represent their entitlements. For a BLOOMBERG PROFESSIONAL service user, this is the same as the entitlements on the BLOOMBERG PROFESSIONAL service.

7.2.2 Requirement for the Terminal

The licence for distribution of data to existing BLOOMBERG PROFESSIONAL service users requires that they are logged into the Bloomberg Terminal in order to view the data. In this respect the data products can be seen, for Bloomberg users, as an extension of the Terminal product and thus sharing entitlements and exchange fees with their Terminal account.

Authentication in Bloomberg's data products for Bloomberg users is performed by identifying a user as being logged into the Terminal. The Terminal's use of a biometric device will have already proven the identity of the logged in user.

Please note that the Terminal is not a requirement for Managed B-PIPE's non-BPS (Market Data) users or applications.

7.2.3 The //blp/apiauth service

The authentication and permissioning systems of Server API and Managed B-PIPE require use of the `//blp/apiauth` service. This defines the requests and responses that will come from the API.

7.2.4 The V3 Identity Object

V3 permissioning, on both Server API and Managed B-PIPE, revolves around the use of a class called the `Identity`. These objects represent a user (or an application in Managed B-PIPE) and can be used to check that a user is entitled for data, is logged onto a terminal, switches terminals, and can be passed with a request to receive data permissioned just for that user or application.

7.2.5 V3 Permissioning Models

The V3 API provides a couple of permissioning models for developers to follow.

User mode

When user mode permissioning is used, an `Identity` is passed as a parameter when sending a request. This means that all data returned will be already permissioned for that `Identity`, but is only for distribution to that particular user or application represented by the `Identity`.

Content based

When content based permissioning is used, the entitlement identifiers (EIDs) of incoming pieces of data is taken and the data is only distributed to users whose `Identity` contains the same EIDs as the data.

7.2.6 Authorization Lifetime

Before designing and developing your Server API or Managed B-PIPE application, it is important that you understand the following guidelines concerning the authorization lifetime of a Bloomberg user:

1. An application requires only one `Identity` object per session per Bloomberg user. This means that your application is not required to authorize the user each time the user makes a request for data.

2. A Bloomberg user's authorization remains valid until that user logs out from Bloomberg Professional service and logs in from another host. At that time, your application will receive an event of type AUTHORIZATION_STATUS, containing a message of type *AuthorizationRevoked*.

   This is the *only* time that an `Identity` must be re-established.

   Simply logging out or logging back in from the same host will *not* invalidate a user's authorization.
3. User Authorization is needed when the session is destroyed or when the authorization is revoked.
4. If any entitlements change for the user, the *existing* `Identity` object is automaticaly updated by Bloomberg's infrastructure and SDK.
5. Failiure to observe these practices will result in exceeding the maximum authorizations limit for a user, thereby resulting in further authorizations failing with error code MAX_AUTHORIZATIONS_EXCEEDED.

7.3 Server API Authorization

7.3.1 Authorization by IP Address

Authorization by IP address consists of sending to the Bloomberg infrastructure an authorization request containing a user identify (UUID) and the IP address of the host where that user is believed to be using the BLOOMBERG PROFESSIONAL service. If that user indeed has a Bloomberg session at that IP address, the authorization is successful.

When the customer application has a User Mode deployment, the authorization request is submitted by the end-user application.

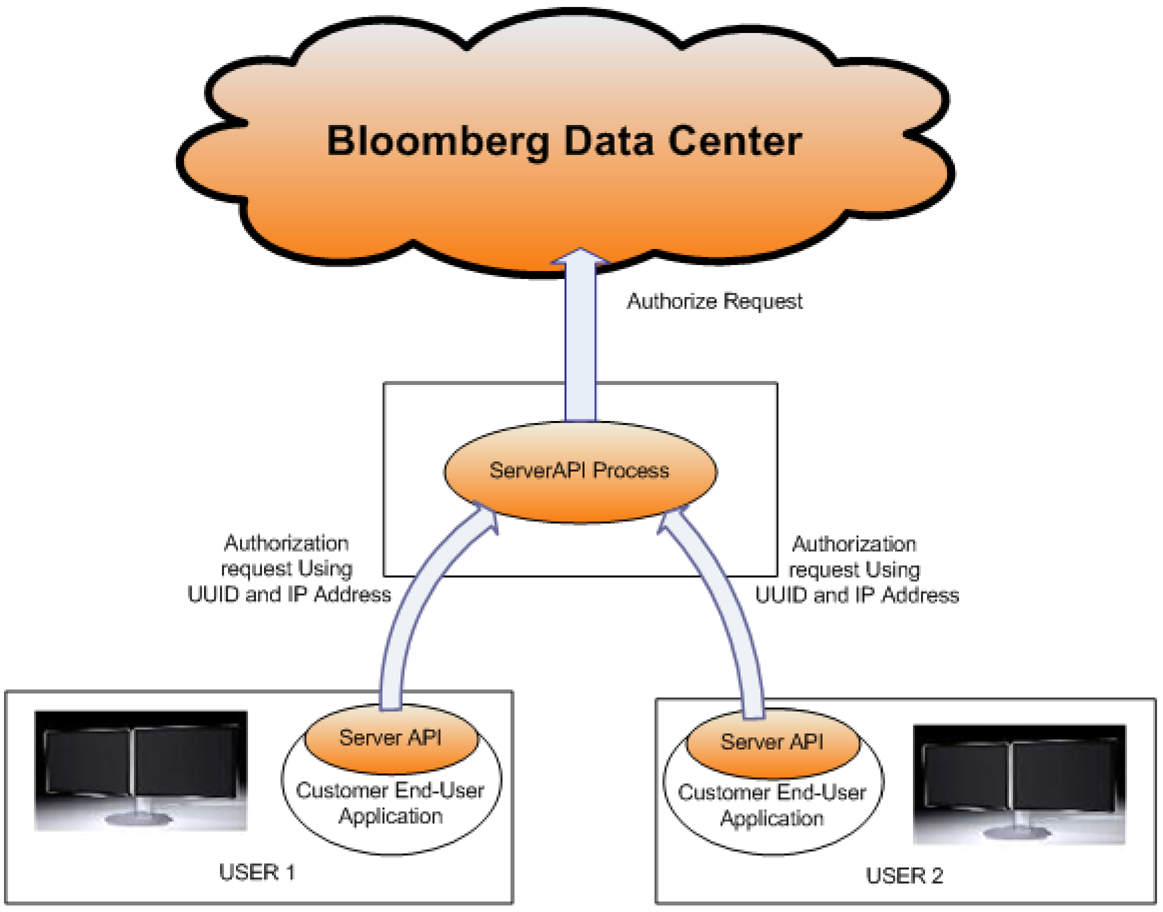

Bloomberg Data Center
Authorize Request
ServerAPI Process
Authorization request Using UUID and IP Address
Authorization request Using UUID and IP Address
Server API
Customer End-User Application
USER 1
Server API
Customer End-User Application
USER 2

Figure 7-1: Server API: User Mode: Authorization by IP Address

When the customer application has a Server Mode deployment, the authorization request is submitted by the customer server application using values obtained by the end-user applications by some customer defined protocol.

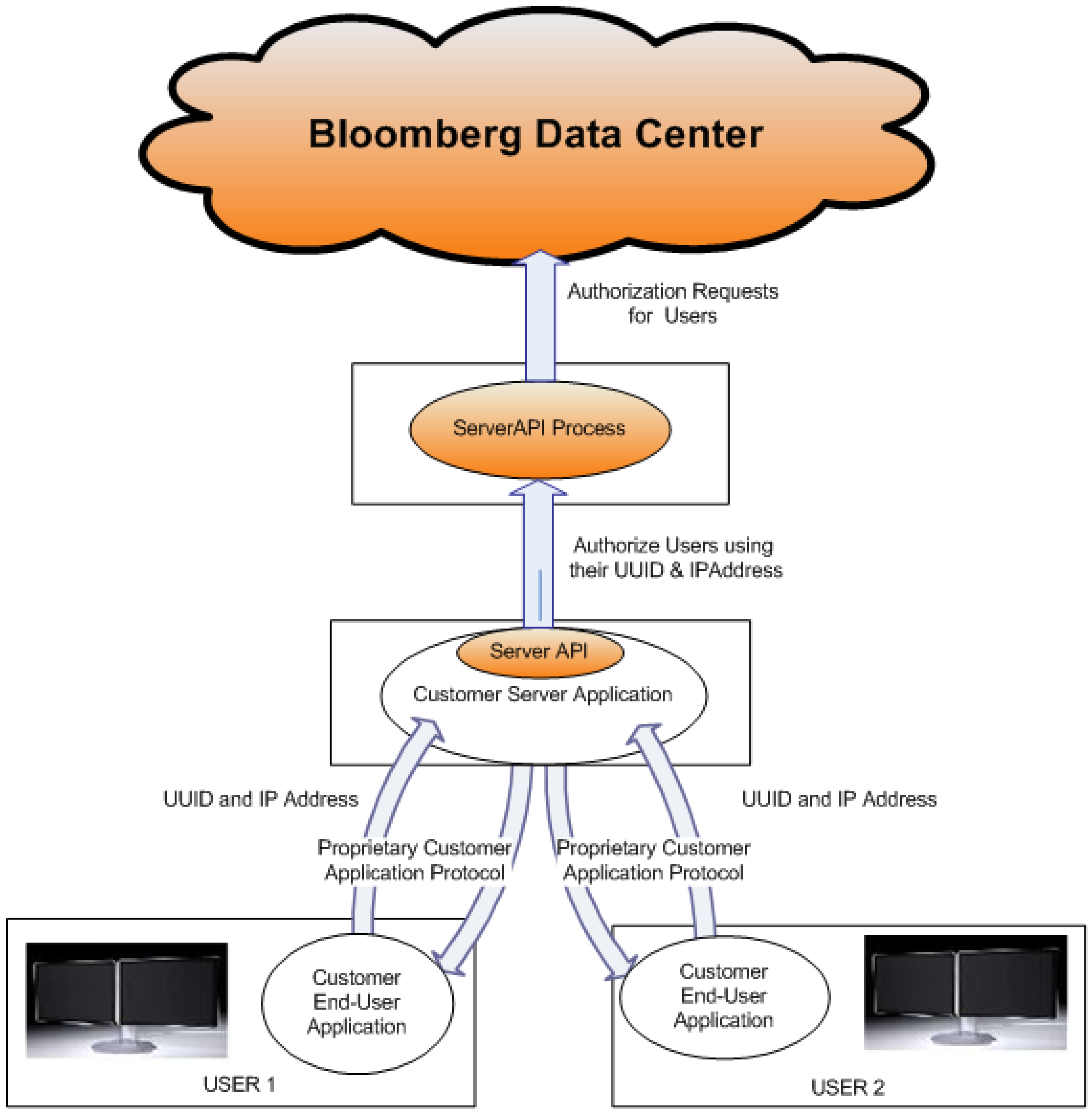

Bloomberg Data Center
Authorization Requests for Users
ServerAPI Process
Authorize Users using their UUID & IPAddress
Server API
Customer Server Application
UUID and IP Address
Proprietary Customer Application Protocol
UUID and IP Address
Proprietary Customer Application Protocol
Customer End-User Application
USER 1
Customer End-User Application
USER 2

Figure 7-2: Server API: Server Mode: Authorization by IP Address

The above diagram does not show the subordinate customer application that will be receiving the Bloomberg data. That application must report its user's UUID and IP address to the customer application using the Server API. The customer application developer must define the protocol for transferring that information.

To authorize a UUID/IP address pair, open `"//blp/apiauth"`, the authorization service, and send an authorization request. The following code fragment shows how to create such a request and one method for blocking until receipt of the corresponding response.

```
<Java>

int uuid = ………; // Obtain UUID for user of interest.
String ipAddress = ………; // Obtain IP address for user of interest.

……… Create and start 'session'. ………

if (!session.openService("//blp/apiauth"))
{
     System.out.println("Could not open service " + "//blp/apiauth");
     System.exit(1);
}
Service apiAuthSvc = session.getService("//blp/apiauth");

Request authorizationRequest = apiAuthSvc.createAuthorizationRequest();

authorizationRequest.set("uuid", uuid);
authorizationRequest.set("ipAddress", ipAddress);

Identity identity = session.createIdentity();
CorrelationID authorizationRequestID = new CorrelationID(10);

session.sendAuthorizationRequest(authorizationRequest, identity,
                                             authorizationRequestID);

System.out.println("sent Authorization Request using ipAddress");

// Wait for 'AuthorizationSuccess' message which indicates
// that 'identity' can be used.
```

```
for (boolean continueToLoop = true; continueToLoop; )
{
 Event event = session.nextEvent();
 switch (event.eventType().intValue())
 {
 case Event.EventType.Constants.RESPONSE:
     if (!handleAuthenticationResponseEvent(event))
     {
         System.out.println("Authorization Failed");
         System.exit(1);
     }
     continueToLoop = false;
     break;
 default:
     handleOtherEvent(event);
     break;
 }
}
………
```

The "helper" method, `handleAuthenticationResponseEvent`, examines the received messages for one of type `"AuthorizationSuccess"`, `"AuthorizationFailure"`, etc.

```
  <Java>

static private boolean handleAuthenticationResponseEvent(Event event)
 throws IOException
{
 if (hasMessageType(event, "AuthorizationSuccess"))
 {
     System.out.println("Authorization OK");
     return true;
 }
 else if (hasMessageType(event, "AuthorizationFailure"))
 {
     System.out.println("Authorization Problem");
     dumpEvent(event);
 }
 else
 {
     System.out.println("Authorization: Other Problem");
     dumpEvent(event);
 }
 return false;
}
```

For a valid UUID/IP address pair, the program output is:

```
sent Authorization Request using ipAddress
EventType=SESSION_STATUS
correlationID=null
messageType=SessionStarted
SessionStarted = {
}
EventType=SERVICE_STATUS
correlationID=Internal: 1
messageType=ServiceOpened
ServiceOpened = {
}
Authorization OK
………
```

Successful authorization loads `identity` with information (i.e., entitlement data) later used in the Permissioning phase.

However, if incorrect data is given, say an incorrect IP address, the output is:

```
sent Authorization Request using ipAddress
EventType=SESSION_STATUS
correlationID=null
messageType=SessionStarted
SessionStarted = {
}
EventType=SERVICE_STATUS
correlationID=Internal: 1
messageType=ServiceOpened
ServiceOpened = {
}
Authorization Problem
eventType=RESPONSE
messageType=AuthorizationFailure
CorrelationID=User: 10
AuthorizationFailure = {
 reason = {
     code = 102
     message = User not logged on to the Bloomberg Professional Service
     category = NO_AUTH
     subcategory = NOT_LOGGED_IN
     source = [nydsmeter1]
 }
}
Authorization Failed
```

7.4 Managed B-PIPE Authorization

Note: Managed B-PIPE requires an `Identity` to be passed with every subscription and data request; this can either be a User or an Application.

Managed B-PIPE Authorization requires prior administrative action to enable each user and/or application.

Please contact your firm's Bloomberg **EMRS** administrator.

There are two programmatic stages to Managed B-PIPE Authorization:

- "Authentication" of identity. This can be by user and/or by application
- "Authorization" which is the process of obtaining the entitlements of the authenticated user and/or application

Managed B-PIPE authentication and authorization is displayed in Figure 7-3.

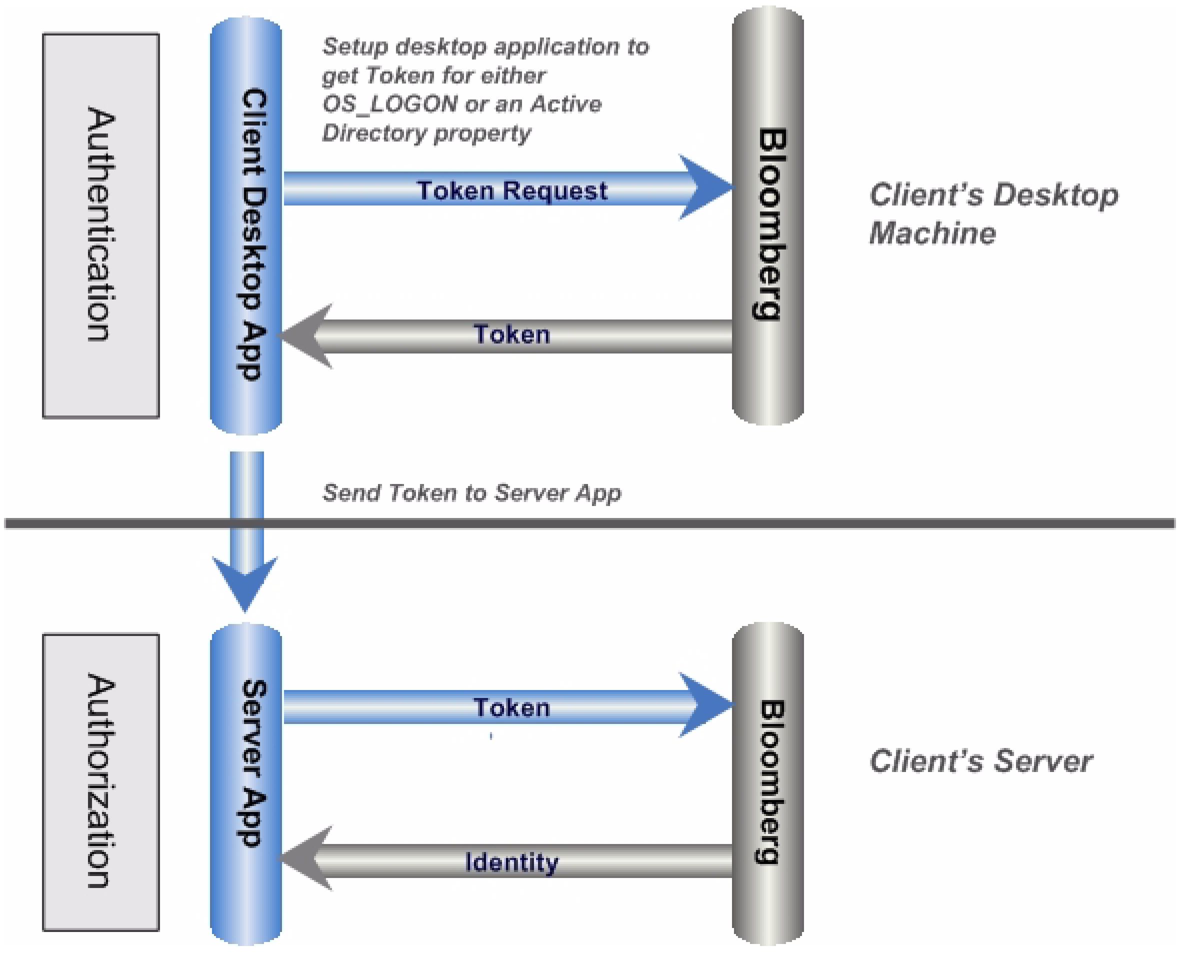


Figure 7-3: Obtaining a User's Identity in Managed B-PIPE

Figure 7-3 shows the procedure for the user authorization system. It is important to note that the "authentication" section of the diagram MUST be performed on the user's desktop machine. The "authorization" section can be performed on the server-side application or on the user's desktop, depending on the application.

For an application authorization system, the OS_LOGIN or DIRECTORY_SERVICE request is replaced with one for the Application Name as defined on **EMRS** and this can be run on any machine.

For a combined application and user authorization system both the user authentication and the application authentication occurs in a single call and this must be run on the user desktop machine.

7.4.1 Authentication

The first stage of authentication is creating an Authentication Options string. This is attached to the SessionOptions object and thus passed into the session when it is created.

For a User

A user's identity can be authenticated by the user's Window's logon identity or a value from the Active Directory (e.g., email address) associated with the login. The correct authentication value for each user is made known to the Bloomberg Data Center using the **EMRS<GO>** function.

The client application specifies this choice using the setAuthenticationOptions method of the SessionOptions class. Note that neither option requires the user to input or even be aware of the value that is used for authentication.

The two options are OS_LOGON and DIRECTORY_SERVICE.

An example of their use is as follows:

```
const char *authenticationOptions = "AuthenticationType=OS_LOGON"

const char *authenticationOptions = "AuthenticationType=DIRECTORY_SERVICE;

                                             DirSvcProperty=mail";
```

"mail" is the property name to lookup under Active Directory rather than the value itself. The libraries will obtain the value from Active Directory using this property name for the currently logged in user.

A code example demonstrating the use of these can be found below in Token Generation.

For an Application

An application "authenticates" in much the same way as a user. However, instead of using Active Directory or a Logon, an application name is used as defined in **EMRS <GO>**.

Rather than using OS_LOGON and DIRECTORY_SERVICE with the `AuthenticationType` parameter of the authentication options string, we introduce two new parameters; **AuthenticationMode** and **ApplicationAuthentication**.

AuthenticationMode will take the value APPLICATION_ONLY and **ApplicationAuthentication** will take the value APPNAME_AND_KEY.

Finally we use the parameter **ApplicationName**. The value for this parameter will be the value stored on EMRS for that application.

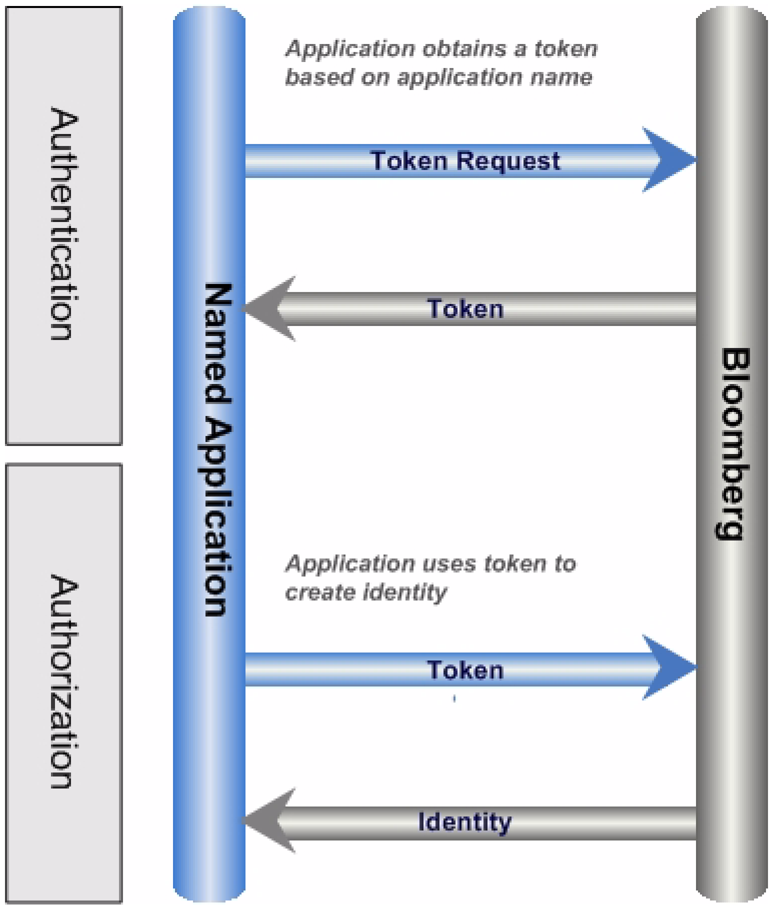
```
const char *authenticationOptions =  "AuthenticationMode=APPLICATION_ONLY;

ApplicationAuthenticationType=APPNAME_AND_KEY;

ApplicationName=TestApplication"
```

The above code snippet can be inserted in the following code example to generate a token for an application registered on **EMRS** as "TestApplication".

After the token is generated, it should then be used to generate an `Identity` in the same way that a user has an identity created using a token.


Authentication
Authorization
Named Application
Bloomberg
Application obtains a token based on application name
Token Request
Token
Application uses token to create identity
Token
Identity

There is one last possible value for **AuthenticationMode**: USER_AND_APPLICATION.

This allows use of the **AuthenticationType** parameter with OS_LOGON and DIRECTORY_SERVICE alongside the **AuthenticationMode**, **ApplicationAuthenticationType**, and **ApplicationName** parameters.

```
const char *authenticationOptions =
                                "AuthenticationMode=USER_AND_APPLICATION;
                                 ApplicationAuthenticationType=APPNAME_AND_KEY;
                                 ApplicationName=TestApplication;
                                 AuthenticationType=OS_LOGON"
```

Typically this will be used for authorizing specific users for specific applications and will return the intersection of the entitlements of the application and the user.

7.4.2 Token Generation

The authentication occurs when the client application requests the generation of a "token". A failure to authenticate is indicated by a message of type "TokenGenerationFailure". If a "TokenGenerationSuccess" message is received, the application can extract a token for use in the subsequent Authorization stage. By passing the Authentication Options string in as part of the session options, the call to `session.generateToken` will submit a token generation request.

```
<C++>

// ManagedBpipeAuthorization.cpp
………
using namespace BloombergLP;
using namespace blpapi;
………
const char *authenticationOptions
 = useLogon
     ? "AuthenticationType=OS_LOGON"
     : "AuthenticationType=DIRECTORY_SERVICE;DirSvcProperty=mail";

SessionOptions sessionOptions;
sessionOptions.setServerHost("localhost"); //default
sessionOptions.setServerPort(8194); //default

sessionOptions.setAuthenticationOptions(authenticationOptions);

Session session(sessionOptions);

if (!session.start())
{
 std::cerr << "Failed to start session" << std::endl;
 return 1;
}

CorrelationId tokenGenerationId(99);
EventQueue tokenEventQueue;
session.generateToken(tokenGenerationId, &tokenEventQueue);
std::string token;

Event tokenEvent = tokenEventQueue.nextEvent(); // blocking
```

```
    for (MessageIterator messageIterator(tokenEvent);
            messageIterator.next(); )
    {
     Message message = messageIterator.message();
     if (TOKEN_FAILURE == message.messageType())
     {
         std::cerr << "Failed to obtain token" << std::endl;
         return 1;
     }
     assert(TOKEN_SUCCESS == message.messageType());
     token.assign(message.getElementAsString("token"));
     break;
    }

    ………authorization stage………
```

The token is a long alphanumeric string that has a limited lifespan for validity and needs to be used in an Authorization request before it expires.

7.5 Authorization

For Managed B-PIPE Authorization, the client application must set as an attribute of the Authorization request the token obtained during Authentication. Then, as in the other cases, an "AuthorizationFailure" message indicates failure (with details) and an "AuthorizationSuccess" message indicates that the identity has been set with the user's or application's entitlements.

The `Identity` is then used in the same way as it would be in Permissioning in Server API.

Please note that for an application that has been named in **EMRS**, all requests for data must have the `Identity` passed with it, so that only the securities that the application is entitled for are accessible rather than everything associated with the Managed B-PIPE.

```
<C++>

………authentication stage………

const char *authorizationServicePath = "//blp/apiauth";
if (!session.openService(authorizationServicePath))
{
 std::cerr << "Failed to open "
     << authorizationServicePath
     << std::endl;
 return 1;
}

Service authorizationService =
 session.getService(authorizationServicePath);

Identity identity = session.createIdentity();
Request authorizationRequest =
        authorizationService.createAuthorizationRequest();
authorizationRequest.set("token", token.c_str());

CorrelationId authorizationRequestId(98);

EventQueue authorizationEventQueue;

session.sendAuthorizationRequest(authorizationRequest,
        &identity,
        authorizationRequestId,
        &authorizationEventQueue);
Event authorizationEvent = authorizationEventQueue.nextEvent();

for (MessageIterator messageIterator(authorizationEvent);
    messageIterator.next(); )
{
 Message message = messageIterator.message();

 if (AUTHORIZATION_FAILURE == message.messageType())
     std::cerr << "Failed authorization" << std::endl;
     return 1;
 }

 assert(AUTHORIZATION_SUCCESS == message.messageType());
 break;
}

………rest of client application………
```

7.6 Permissioning

7.6.1 Entitlements

Entitlement Identifiers (EIDs) are numeric values associated with data provided by Bloomberg. The following table contains some EID examples:

Table 1:

EID	Description	Source	Examples
14005	NASDAQ Level 1	NASDAQ	MSFT UQ Equity,
INTC UQ Equity[a]			
[b]	BGN	Bloomberg Generic	CT2@BGN Govt
23599	U.S. Treasures	Merrill Lynch	CT2@ML Govt
14014, 14076[c]	London Stock Exchange Level 1 & 2	LSE	VOD LN Equity

a. In the example above, MSFT UQ Equity and INTC UQ Equity are both NASDAQ Level 1, and have the same EID.
b. There can be cases where there are no entitlements associated with the associated instrument. In such cases the data is to be considered free for all BBA users. Bloomberg Generic Pricing has no EID and is therefore, free for all Bloomberg users.
c. In the example above, we show that separate EIDs are used to represent London Stock Exchange Level 1 and Level 2.

The user's EIDs (in the first row, above) are returned in the AuthorizationResponse and are held in an "`Identity`". Each Message contained in a SUBSCRIPTION_DATA, PARTIAL_RESPONSE or RESPONSE Event may contain an EID field.

Note that for reference data, EIDs are currently assigned at the instrument level, not at the field level. However, for subscription data, EIDs are currently assigned at the instrument and field level.

The following code fragments show how the entitlements loaded into the `Identity` during the authorization stage and can be used to check a user's eligibility to receive given data.

First, the data request must be modified to request that entitlement identifiers be included with the returned data. For example:

```
<Java>

………
Service refDataSvc = session.getService("//blp/refdata");
Request request = refDataSvc.createRequest("ReferenceDataRequest");
request.append("securities", "VOD LN Equity");
request.append("fields", "PX_LAST");
request.append("fields", "DS002");
request.append("fields", "VWAP_VOLUME");
request.set("returnEids", true); // new
CorrelationID requestID = new CorrelationID(20);
session.sendRequest(request, requestID);
………
```

Then, the handler for the resulting events can be modified to use the identity acquired during authorization:

```
<Java>

private static void handleResponseEvent(Event event, Identity identity)
        throws IOException
{
 MessageIterator iter = event.messageIterator();
 while (iter.hasNext())
 {
     Message message = iter.next();
     Element ReferenceDataResponse = message.asElement();
     if (ReferenceDataResponse.hasElement("responseError"))
     {
         handle error
     }
     Element securityDataArray =
         ReferenceDataResponse.getElement("securityData");
     int numItems = securityDataArray.numValues();
     for (int i = 0; i < numItems; ++i)
     {
         Element securityData =
         securityDataArray.getValueAsElement(i);
         String security =
         securityData.getElementAsString("security");
         int sequenceNumber =
         securityData.getElementAsInt32("sequenceNumber");
         if (securityData.hasElement("securityError"))
         {
         handle error
         }
         ArrayList missingEntitlements = new ArrayList();
         Element neededEntitlements =
         securityData.hasElement("eidData")
         ? securityData.getElement("eidData")
         : null;
         if (null == neededEntitlements)
         {
         forward data to the user
         }
         else if (identity.hasEntitlements(neededEntitlements,
         message.service(),
         missingEntitlements))
         {
         forward data to the user
         }
         else
         {
            do not forward data to the user
            }
        }
    }
   }
```

In this example, data is forwarded to a user who has the entitlements for the security, or if the security has no entitlements.

7.6.2 User Mode

In User-Mode permissioning, each request or subscription is accompanied by the `Identity` object, which was obtained when authorizing the user or application. This is the model that must be followed when requesting data as a named Application.

Data received as a result of requests and subscriptions must be carefully segregated by the application both in memory and in any permanent storage to ensure it is only available to the user whose `Identity` object was used in the request or subscription. Thus, the requirements here are much more complicated than in the earlier models.

Since, in this scenario, a request can be made on behalf of only one user, the User-Mode model may require creation of multiple requests (or subscriptions) that might have been coalesced into a single request (or subscription) under the other models.

Fortunately, the Bloomberg infrastructure improves efficiency by bundling its replies for subscriptions. (Note that this is not done for requests.) Furthermore, although the replies may be bundled, the customer application is (by default) presented with that data presented multiple times, each with a single `CorrelationId`. If the customer application wishes to handle fewer albeit more complicated responses, the allow`MultipleCorrelationsPerMsg` option of `SessionOptions` should be set to true.

One implication of User-Mode permissioning is that there is no way for an application to retrieve data when none of its users are using the BLOOMBERG PROFESSIONAL service.

Whereas, when using Application-Mode / Server-Mode permissioning, it is possible to retrieve data when none of an application's users are logged in.

7.6.3 Content Based

In this approach, the customer application retrieves and stores the entitlements of each of its users. The customer application makes requests and subscriptions using the `Identity` of the Application. All data returned from the Bloomberg infrastructure is requested to be tagged with the Entitlement Identifiers (EIDs) for that data.

For example,

```
<Java>

………create and open 'session'………
Service refDataSvc = session.getService("//blp/refdata");
Request request = refDataSvc.createRequest("ReferenceDataRequest");
request.append("securities", "VOD LN Equity");
request.append("fields", "PX_LAST");
request.append("fields", "DS002");
request.append("fields", "VWAP_VOLUME");
request.set("returnEids", true);
………
```

When the response arrives, the customer application must check that EID against the entitlements of a user before actually delivering the data to that user. A user's entitlements can be checked by using the hasEntitlements method of the `Identity` object.

```
<Java>

………Extract 'securityData' from response message………

ArrayList missingEntitlements = new ArrayList();
Element neededEntitlements =
        securityData.hasElement("eidData")
        ? securityData.getElement("eidData")
        : null;
if (null == neededEntitlements)
{
 forward data to the user
}
else if (identity.hasEntitlements(neededEntitlements,
        message.service(),
        missingEntitlements))
{
 forward data to the user
}
else
{
 do not forward data to the user
}

………
```

Of course, using this strategy, some requests may be satisfied and other rejected.

7.7 Specific Application Types (Managed B-PIPE only)

Managed B-PIPE introduced the concepts of Named Applications. These are setup on **EMRS <GO>** and allow an application to be given entitlements and services to consume. Using the Application authentication system described earlier will result in an `Identity` that represents the Application and can be used in a user mode style to get data based on the **EMRS** records.

7.7.1 Single-User

Single-User applications are Desktop applications that take a user identity which has been authorized using the USER_AND_APPLICATION authorization mode. This is used in a User Mode style and results are passed directly back to the specific user.

7.7.2 Multi-User

Multi-User applications are typically Client-Server (N-tier, etc.) architectures and can either follow the user mode or content-based permissioning models. User Identities would be again created using the USER_AND_APPLICATION authorization mode (which also checks to see if the user is entitled to use that application according to records on **EMRS**).

The application could then either send the user identities with separate requests and correlation IDs to get data for individual users, or it can use its own `Identity` (created just for the application) to request data (the application `Identity` is the parameter to the request or subscription function). EIDs could be extracted from the returned data and thus can be used in a Server-mode style by distributing to entitled users.

7.7.3 Derived Data / Non-Display

Use of Derived Data and Non-display applications carries a fee. These are essentially applications where users will never see the raw data going into them. The application would simply make requests using its own `Identity` and the raw incoming data would never be sent to users.

Derived Data applications may pass "resultant data" to users, and the definition of this "resultant data" is clearly defined in the contract.

7.8 V2 Authorization and Permissioning Models

If you have previously worked with prior versions of the API (the pre-V3 C and .NET API) then it is important to note the changes between pre-V3 and V3 style permissioning.

7.8.1 User Mode

Pre-V3 user mode was tied to an application.

In the C API this involved using the **bb_connect_server_user** call which set the entire application as tied to that user. All requests would be processed using that user's entitlements and settings.

.NET used configuration files (or XmlNode objects) with the ServerApiLicense node to determine the credentials of the user on whose behalf the application was to connect. After MarketDataAdapter.Startup() was called, all requests would have been serviced as that user.

V3 avoids the issue of having to dedicate the entire program to a single user and instead allows multiple users in the same application by using Identities as parameters to requests and subscriptions. The same distribution restrictions as pre-V3 still apply, data downloaded on behalf of a single user cannot be distributed to another user.

7.8.2 All-or-None

All-or-none permissioning simply compared the set of entitlements of a user against the set of entitlements of the server. If the user had all of the entitlements of the server then that user was permitted to receive any data from the server without further checks.

Pre-V3 provided calls to check this.

The C API used the **bb_get_authorization** function to check this. If any EIDs were returned then that user did not match the Server on those EIDs and thus would have to be denied access to all data from the server application.

The .NET API used the **LicenseManager.GetRestrictions** call. If it returned EIDs then the user had to be denied access to all data.

V3 removes support for all-or-none systems as these are not considered to be flexible enough. In addition problems were caused by entitlements sometimes being applied to users non-homogenously.

7.8.3 Content-Based / Per-Product / Per-Security

The pre-V3 implementation of the content-based, originally known as per-product or per-security, permisisoning system involved downloading lists of EIDs for each user and for each security. When data was to be passed to users the application developer was responsible for checking that the security's EIDs were a subset of the user's.

In the C API, the EIDs for securities and users were retrieved via the **bb_get_security_entitlements** and **bb_get_user_entitlements** function calls.

In .NET this was performed using the **LicenseManager.GetSecurityEntitlements** and **LicenseManager.GetUserEntitlements** methods.

This is implemented in the V3 system with some minor changes; the logon check and the user entitlements retrieval are now combined into the request to populate an `Identity`. This request currently differs between Server API and Managed B-PIPE and these processes are detailed later in this document.

7.8.4 Validating Logon Status

In the pre-V3 API it was necessary to perform a separate check to see if a user was logged into the terminal on at a specified IP address.

The C API used the **bb_validate_blbg_logon** function and took the user's UUID, SID, SID Instance, Terminal SID, Terminal SID Instance, and the IP address of the user's terminal as parameters.

The .NET API worked the same way using the TerminalMonitor.GetLogonStatus method.

In V3 this is implemented as part of the authorization process that eventually populates an `Identity`. In Server API the user's UUID and IP address of the terminal is passed as part of the authorization request. In Managed B-PIPE, the operating system logon, or Active Directory property, is used to match a user against values stored in the **EMRS** administrative function on the terminal in order to obtain a Token to pass in instead of the UUID and IP address.

8 Publishing

8.1 Overview

The Bloomberg API allows customer applications to publish data as well as consume it. Customer data can be published for distribution within the customer's enterprise, contributed to the Bloomberg infrastructure, distributed to others, or used for warehousing.

Publishing applications might simply broadcast data or they can be "interactive", responding to feedback from the infrastructure about the currently active subscriptions from data consumers. This chapter will illustrate both paradigms.

8.2 The Programming Examples

The two examples explored in this chapter are `BroadcastOneTopic.cpp` and `InteractivePublisher.cpp`.

8.3 Simple Broadcast

In a simple broadcast, the publishing application sends data but has no indication if anyone is consuming that data. In this simple example, data will be produced for a single topic. The major stages are:

- Creating a session.
- Obtaining authorization.
- Creating the topic.
- Publishing events for the topic to the designated service.

Each of these stages will now be examined in detail.

8.3.1 Creating a Session

Sessions for publication are created in the same manner as those for consuming data. The key difference is that they are managed by an instance of `ProviderSession` instead of `Session`.

```
// BroadcastOneTopic.cpp
… …
int main()
{
    SessionOptions sessionOptions;
    sessionOptions.setServerHost("platform");
    sessionOptions.setServerPort(8195);

sessionOptions.setAuthenticationOptions("AuthenticationType=OS_LOGON");
    MyEventHandler myEventHandler;

    ProviderSession session(sessionOptions, &myEventHandler, 0);
    if (!session.start()) {
        std::cerr <<"Failed to start session." << std::endl;
        return 1;
    }… …
}
```

The event handler plays no significant role in this example and will not be examined.

8.3.2 Authorization

The authorization stage, if successful, provides a valid `Identity` object which is required for later operations. Authorization is done by the "`//blp/apiauth`" service on receipt of an authorization request.

See for "Authorization and Permissioning Systems" on page 76 details.

```
        Name TOKEN("token");
        Name TOKEN_SUCCESS("TokenGenerationSuccess");
        Name TOKEN_FAILURE("TokenGenerationFailure");
        Name AUTHORIZATION_SUCCESS("AuthorizationSuccess");
        EventQueue tokenEventQueue;
        session.generateToken(CorrelationId(), &tokenEventQueue);
        std::string token;
        Event event = tokenEventQueue.nextEvent();
        if (event.eventType() == Event::TOKEN_STATUS) {
            MessageIterator iter(event);
            while (iter.next()) {
                Message msg = iter.message();
                msg.print(std::cout);
                if (msg.messageType() == TOKEN_SUCCESS) {
                    token = msg.getElementAsString(TOKEN);
                }
                else if (msg.messageType() == TOKEN_FAILURE) {
                    break;
                }
            }
        }
        if (token.length() == 0) {
            std::cout << "Failed to get token" << std::endl;
        }

        session.openService("//blp/apiauth");
        Service authService = session.getService("//blp/apiauth");
        Request authRequest = authService.createAuthorizationRequest();
        authRequest.set(TOKEN, token.c_str());

        EventQueue authQueue;
        Identity providerIdentity = session.createIdentity();
        session.sendAuthorizationRequest(
            authRequest, &providerIdentity, CorrelationId(), &authQueue);
```

```
else if (event.eventType() == EventType.RESPONSE
          || event.eventType() == EventType.PARTIAL_RESPONSE
        || event.eventType() == EventType.REQUEST_STATUS) {
 for (Message msg: event) {
     if (msg.correlationID().equals(d_authorizationResponseCorrelationId)) {
        Object authorizationResponseMonitor =
                                         msg.correlationID().object();
        synchronized (authorizationResponseMonitor) {
        if (msg.messageType() == AUTHORIZATION_SUCCESS) {
        d_authorizationResponse = Boolean.TRUE;
        authorizationResponseMonitor.notifyAll();
        }
        else if (msg.messageType() == AUTHORIZATION_FAILURE) {
        d_authorizationResponse = Boolean.FALSE;
        System.err.println("Not authorized: " +
                               msg.getElement("reason"));
        }
        else {
        assert d_authorizationResponse == Boolean.TRUE;
        System.out.println("Permissions updated");
        }
        }
        }
    }
}
```

8.3.3 Creating a Topic

Before publishing data, the application must create a Topic object on the appropriate service. This example uses synchronous method `createTopics()` of the ProviderSession to create a Topic on `//blp/test` service from a topic string "`testtopic`".

.

```
         … …
        const std::string myService = "//blp/test";
        const std::string  myTopic  = "testtopic";
        TopicList topicList;
        topicList.add((myService + "/ticker/" + myTopic).c_str(),
            CorrelationId((long long)1));

        session.createTopics(
            &topicList,
            ProviderSession::AUTO_REGISTER_SERVICES,
            providerIdentity);

        Topic topic;
        for (size_t i = 0; i < topicList.size(); ++i) {
            if (topicList.statusAt(i) == TopicList::CREATED) {
                topic = session.getTopic(topicList.messageAt(i));
            }
        }

   … …
```

8.3.4 Publishing

In this example, data is published by sending events to the designated service, `"//blp/test"`. Event objects are obtained from the service and populated with the topic and the application specific data. In this simple example, each event contains a single data message; however, in general, each event can contain multiple messages.

In this simple example, the data is just an integer value that is incremented and published every ten seconds.

```
     … …
    Name messageType ("MyMessageType");
    Name fieldType ("MyFieldType");

    Service service = session.getService(myService.c_str());
    for (int value = 1; true; ++value, sleep(10)) {
        Event event = service.createPublishEvent();
        EventFormatter eventFormatter(event);
        eventFormatter.appendMessage(messageType, topic);
        eventFormatter.setElement(fieldName, value);


        session.publish(event);
    }

    session.stop();

    return 0;
}
```

Note: The standard C library 'sleep' function is used above. The argument specifies the number of seconds to sleep.

8.4 Interactive Publication

The Bloomberg infrastructure can send events to provider applications when data is needed for a given topic. These events allow the customer applications to "interact" with the Bloomberg infrastructure. Data for a topic need be published only when it is known to have subscribers.

In this simple example, data is published, only as needed, for a set of topics on a single service. The major steps are:

- Creating a session.
- Obtaining authorization.
- Registering for subscription start and stop messages.
- Handling subscription start and stop events, which add and remove topics to the active publication set.
- Creating a topic.
- Publishing events for the active topics of the designated service.

The details for creating a session, obtaining a provider identity, and authorization are the same as in the earlier example; they will not be detailed again.

This design requires the management of a collection of "active" topics for publication. That collection will be populated (and depopulated) by event handling threads and accessed for periodic publication by the main thread. A map will be used to store pairs of topic/CUSIP pairs (keyed on topic). The topics are provided in the start and stop messages, and CUSIPs are obtained by requesting resolution of the received topics.

The multiple threads of this application must not concurrently access the collection; STL containers are not thread-safe in that respect. Since there is only one "reading" thread in this application, a simple mutex suffices. A pthread mutex was chosen because it is familiar to many readers.

```
// InteractivePublisher.cpp
… …
int main(int argc, char **argv)
{
    Publications activePublications;
    pthread_mutex_t activePublicationsMutex;
    pthread_mutex_init(&activePublicationsMutex, NULL);
    MyEventHandler myEventHandler(&activePublications,
                                  &activePublicationsMutex);

    SessionOptions sessionOptions;
    sessionOptions.setServerHost("192.168.9.155");
    sessionOptions.setServerPort(8195);
    //sessionOptions.setAuthenticationOptions("AuthenticationType=OS_LOGON");


sessionOptions.setAuthenticationOptions("AuthenticationMode=APPLICATION_ONLY;

ApplicationAuthenticationType=APPNAME_AND_KEY;ApplicationName=blp:APP_BBOX");

    ProviderSession session(sessionOptions, &myEventHandler, 0);
    if (!session.start()) {
        std::cerr << "Failed to start session." << std::endl;
        return -1;
    }
```

As we will see later, the event handler is designed to hold pointers to the collection of active topics and to the mutex that manages access to that collection.

8.4.1 Registration

On completion of service registration, the application can expect subscription start and subscription stop messages in the context of subscription status events.

```
      … … create ’activePublication’ collection, the managing mutex,
          and the event handler … …
      … … create ’session’ and obtain ’Identity’… …

      const char *myService = "//blp/mktdata8";
      if (!session.registerService(myService, providerIdentity)) {
          std::cerr <<"Failed to register " << myService << std::endl;
          return -1;
      }
  … …
  }
```

8.4.2 Event Handling

The event handler in this example is detailed below. The relevant event type is `TOPIC_STATUS`. The `TOPIC_STATUS` event has three message types of interest: `TOPIC_CREATED`, `TOPIC_SUBSCRIBED`, and `TOPIC_UNSUBSCRIBED`.

On receipt of "started" type messages, the event handler adds the topic to a set of topics that require asynchronous topic creation. Once all of the messages in the event have been examined, that list (if non-empty) is sent for resolution. Use of the session’s `createTopicsAsync` method means that the operation does not block. Rather, the result is returned in a separate event of type `TOPIC_CREATED`.

When messages indicating successful topic creation are received, the event handler extracts the topic and the corresponding string, creates an item, and adds that item to the collection of active publications. Since a topic may have received a "stop" message while it was being created, there is first a check to see if the topic is still in the "needed" set before it is added to the "active" collection.

On receipt of a "stopped" type, the event handler extracts the topic from the message and deletes the corresponding item in the collection of active publications or the collection of topics needing creation.

Note that all operations use the provided mutex to provide exclusive access for each other.

```
bool MyEventHandler::processEvent(const Event& event, ProviderSession*
session)
{
    switch (event.eventType()) {
      case Event::TOPIC_STATUS: {
        TopicList topicList;
        MessageIterator iter(event);
        while (iter.next()) {
            Message msg = iter.message();
            std::cout << msg << std::endl;
            if (msg.messageType() == TOPIC_SUBSCRIBED) {
                Topic topic;
                try {
                    topic = session->getTopic(msg);
                }
                catch (blpapi::Exception &) {
                }
                if (!topic.isValid()) {
                    topicList.add(msg);
                }
               else if (d_actPub_p->find(topic) == d_actPub_p->end()) {
                    std::string topicStr =
msg.getElementAsString("topic");
                    pthread_mutex_lock(d_actMutex_p);
                    PublicationItem publicationItem(topic, topicStr);
                    d_actPub_p->insert(publicationItem);
                    pthread_mutex_unlock(d_actMutex_p);
                }
            }
           else if (msg.messageType() == TOPIC_UNSUBSCRIBED) {
                Topic topic;
                try {
                    topic = session->getTopic(msg);

                    pthread_mutex_lock(d_actMutex_p);
                   Publications::iterator it = d_actPub_p->find(topic);
                    if (it != d_actPub_p->end()) {
                        d_actPub_p->erase(it);
                    }
                    pthread_mutex_unlock(d_actMutex_p);
                }
                catch (blpapi::Exception &) {
                }
            }
```

```
                else if (msg.messageType() == TOPIC_CREATED) {
                 try {
                     Topic topic = session->getTopic(msg);
                   std::string topicStr = msg.getElementAsString("topic");
                     pthread_mutex_lock(d_actMutex_p);
                     PublicationItem publicationItem(topic, topicStr);
                     d_actPub_p->insert(publicationItem);
                     pthread_mutex_unlock(d_actMutex_p);
                 } catch (blpapi::Exception &e) {
                     std::cerr
                         << "Exception in Session::getTopic(): "
                         << e.description()
                         << std::endl;
                     continue;
                 }
             }
         }
         if (topicList.size()) {
             session->createTopicsAsync(topicList);
         }
       } break;
       default:
         printMessages(event);
     }

     return true;
 }
```

8.4.3 Publication

The publication loop in this example is, in many ways, similar to that used in the first example. There is a value that is incremented every ten seconds and is used to create an event for publication.

```
    Service service = session.getService(myService);

    Name messageType("MyMessageType");
    Name fieldName("MyFieldName");
    for (int value = 1; true; ++ value, sleep(10)) {
        pthread_mutex_lock(&activePublicationsMutex);

        if (0 == activePublications.size()) {
            continue;
        }

        Event event = service.createPublishEvent();
        EventFormatter eventFormatter(event);
        for (Publications::iterator iter = activePublications.begin();
                                    iter != activePublications.end();
                                    ++iter) {
            const std::string& cusip = iter->second;
            eventFormatter.appendMessage(messageType, iter->first);
            eventFormatter.setElement(fieldName, myValueFor(cusip,
value));
        }
        pthread_mutex_unlock(&activePublicationsMutex);

        session.publish(event);
    }

    session.stop();

    return 0;
}
```

Note: The standard C library 'sleep' function is used above. The argument specifies the number of seconds to sleep.

However, there are some differences (highlighted above):

- Rather than a single fixed topic, publication is made for all of the topics in the collection of active publications.
- Note that the mutex is acquired before iterating over that collection.
- There is at most one published event per cycle. Each event may have multiple messages, each with data for a specific topic.
- Although sending an empty event would not be harmful, if the collection of active publications is empty, no event is published for that cycle.
- The published data might vary by topic. Details of the `myValueFor` function are not important and, therefore, not shown.

Bloomberg

A Schemas

A.1 Overview

Each of the following sections provides an overview of the request options and response structure for each request type within each of the Bloomberg API services. A service is defined by a request and a response schema. In the following sections the request schema is broken into tables detailing all options and arguments and example syntax. The response schema is represented graphically.

A.2 Reference Data Service //blp/refdata

Note: Managed B-PIPE supports only the ReferenceDataRequest type on the Reference Data Service. All other request types on the ReferencefDataService are not supported by Managed B-PIPE.

A.2.1 Operations

Operation Name	Request Type	Response Type	Description
HistoricalDataRequest	HistoricalDataRequest	HistoricalDataResponse	Request Historical Data
IntraDayTickRequest	IntraDayTickRequest	IntraDayTickResponse	Request Intraday TIck Data
IntraDayBarRequest	IntraDayBarRequest	IntraDayBarResponse	Request Intraday Bar Data
ReferenceDataRequest	ReferenceDataRequest	ReferenceDataResponse	Request Reference Data
PortfolioDataRequest	PortfolioDataRequest	PortfolioDataResponse	Request Portfolio Data
BeqsRequest	BeqsRequest	BeqsResponse	Request EQS Screen Data

A.2.2 ReferenceDataRequest: Sequence

Securities: A stock or bond.

Element	Element Value	Type	Description
securities	string array	string	See “Security/Securities” on page 52 for additional details.

Example Syntax: `Element securities = request.GetElement("securities");`
`securities.AppendValue("VOD LN Equity");`

Fields: the reference fields desired which correspond to data points. See **FLDS<GO>** for a list of more information.

Element	Element Value	Type	Description
fields		string	See “Fields” on page 53 for additional details.

Example Syntax:
```
Element fields = request.GetElement("fields");
fields.AppendValue("PX_LAST");
```

Overrides: Append overrides to modify the calculation

Element	Element Value	Type	Description
fieldID		string	field mnemonic, PRICING_SOURCE, or field alpha-numeric, PR092. Review **FLDS<GO>** for list of possible overrides.
value		string	the desired override value

Example Syntax:
```
Element overrides = request["overrides"];
Element override1 = overrides.AppendElement();
override1.SetElement("fieldId", "PRICING_SOURCE");
override1.SetElement("value", "CG");
```

Return Entitlements: returns the entitlement identifiers associated with security.

Element	Element Value	Type	Description
returnEids	TRUE or FALSE	Boolean	Setting this to true will populate fieldData with an extra element containing a name and value for the EID date.

Example Syntax: `request.Set("returnEids", true);`

Return Formatted Value: returns all data as a data type string

Element	Element Value	Type	Description
returnFormattedValue	TRUE or FALSE	Boolean	Setting to true will force all data to be returned as a string.

Example Syntax: `request.Set("returnFormattedValue", true);`

Use UTC Time: return date and time values as Coordinated Universal Time (UTC) values

Element	Element Value	Type	Description
useUTCTime	TRUE or FALSE	Boolean	Setting to true returns values in UTC. Setting this to false will default to the **TZDF<GO>** settings of the requestor.

Example Syntax: `request.Set("useUTCTime", true);`

Forced Delay: returns the latest reference data up to the delay period.

Element	Element Value	Type	Description
forcedDelay	TRUE or FALSE	Boolean	Setting to true will return the latest data up to the delay period specified by the exchange for this security. For example requesting VOD LN Equity and PX_LAST will return a snapshot of the last price from 15mins ago.

Example Syntax: `request.Set("forcedDelay", true);`

A.2.3 ReferenceDataResponse: Choice

Figure A-1 provides the structure of a ReferenceDataResponse. See "Reference Data Service Response" on page 129 for more information.

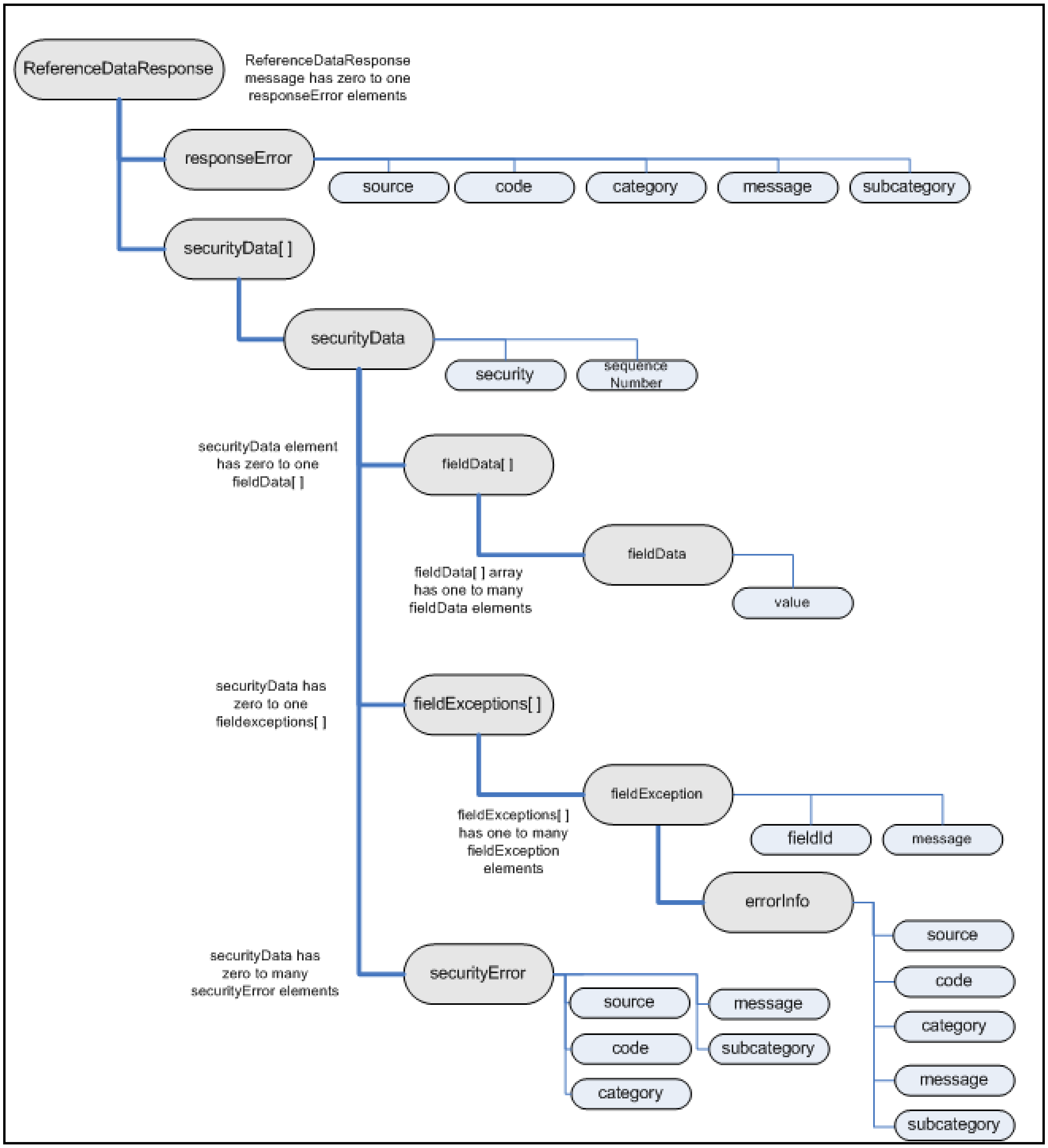

ReferenceDataResponse
ReferenceDataResponse message has zero to one responseError elements
responseError
source
code
category
message
subcategory
securityData[ ]
securityData
security
sequence Number
securityData element has zero to one fieldData[ ]
fieldData[ ]
fieldData
fieldData[ ] array has one to many fieldData elements
value
securityData has zero to one fieldexceptions[ ]
fieldExceptions[ ]
fieldException
fieldExceptions[ ] has one to many fieldException elements
fieldId
message
errorInfo
source
code
category
message
subcategory
securityData has zero to many securityError elements
securityError
source
code
category
message
subcategory

Figure A-1: Reference Data Request Response

A.2.4 HistoricalDataRequest: Sequence

Securities: A stock or bond.

Element	Element Value	Type	Description
securities		string	See "Security/Securities" on page 52 for additional details.

Example Syntax: `Element securities = request.GetElement("securities");`
`securities.AppendValue("VOD LN Equity");`

Fields: the reference fields desired which correspond to data points. See **FLDS<GO>** for a list of more information.

Element	Element Value	Type	Description
fields		string array	See "Fields" on page 53 for additional details.

Example Syntax:
```
Element fields = request.GetElement("fields");
fields.AppendValue("PX_LAST");
```

Start Date: the first date of the period to retrieve data

Element	Element Value	Type	Description
startDate	yyyymmdd	string	The start date in a year/month/day format.

Example Syntax: `request.Set("startDate", "20090601");`

End Date: the end date of the period to retrieve data

Element	Element Value	Type	Description
endDate	yyyymmdd	string	The end date in a year/month/day format. This will default to the current day if not specified.

Example Syntax: `request.Set("endDate", "20100601");`

Period Adjustment: Determine the frequency and calendar type of the output. To be used in conjunction with Period Selection.

Element	Element Value	Type	Description
periodicityAdjustment	ACTUAL	string	These revert to the actual date from today (if the end date is left blank) or from the End Date
	CALENDAR	string	For pricing fields, these revert to the last business day of the specified calendar period. Calendar Quarterly (CQ), Calendar Semi-Annually (CS) or Calendar Yearly (CY).
	FISCAL	string	These periods revert to the fiscal period end for the company - Fiscal Quarterly (FQ), Fiscal Semi-Annually (FS) and Fiscal Yearly (FY) only

Example Syntax: `request.Set("periodicityAdjustment", "ACTUAL");`

Period Selection: Determine the frequency of the output. To be used in conjunction with Period Adjustment.

Element	Element Value	Type	Description
periodicitySelection	DAILY	string	Returns one data point per day
	WEEKLY	string	Returns one data point per week
	MONTHLY	string	Returns one data point per month
	QUARTERLY	string	Returns one data point per quarter
	SEMI_ANNUALLY	string	Returns one data point per half year
	YEARLY	string	Returns one data point per year

Example Syntax: `request.Set("periodicitySelection", "DAILY");`

Currency: Amends the value from local to desired currency

Element	Element Value	Type	Description
currency	Currency of the ISO code, e.g., USD, GBP	string	The 3 letter ISO code. View **WCV<GO>** on the BLOOMBERG PROFESSIONAL service for a list of currencies.

Example Syntax: `request.Set("currency", "USD");`

Override Options: Indicates whether to use the average or the closing price in quote calculation.

Element	Element Value	Type	Description
overrideOption	OVERRIDE_OPTION_CLOSE	string	Use the closing price in quote calculation
	OVERRIDE_OPTION_GPA	string	Use the average price in quote calculation

Example Syntax: `request.Set("overrideOption", "OVERRIDE_OPTION_GPA");`

Pricing Options: Sets quote to Price or Yield for a debt instrument whose default value is quoted in yield (depending on pricing source).

Element	Element Value	Type	Description
pricingOption	PRICING_OPTION_PRICE	string	Set quote to price
	PRICING_OPTION_YIELD	string	Set quote to yield

Example Syntax: `request.Set("pricingOption", "PRICING_OPTION_PRICE");`

Non Trading Day Fill Option: Sets to include/exclude non trading days where no data was generated.

Element	Element Value	Type	Description
nonTradingDayFillOption	NON_TRADING_WEEKDAYS	string	Include all weekdays (Monday to Friday) in the data set
	ALL_CALENDAR_DAYS	string	Include all days of the calendar in the data set returned
	ACTIVE_DAYS_ONLY	string	Include only active days (days where the instrument and field pair updated) in the data set returned

Example Syntax: `request.Set("nonTradingDayFillOption", "NON_TRADING_WEEKDAYS");`

Non Trading Day Fill Method: If data is to be displayed for non trading days what is the data to be returned.

Element	Element Value	Type	Description
nonTradingDayFillMethod	PREVIOUS_VALUE	string	Search back and retrieve the previous value available for this security field pair. The search back period is up to one month.
	NIL_VALUE	string	Returns blank for the "value" value within the data element for this field.

Example Syntax: `request.Set("nonTradingDayFillMethod", "PREVIOUS_VALUE");`

Max Data Points: the maximum number of data points to return.

Element	Element Value	Type	Description
maxDataPoints		integer	The response will contain up to X data points, where X is the integer specified. If the original data set is larger than X, the response will be a subset, containing the last X data points. Hence the first range of data points will be removed.

Example Syntax: `request.Set("maxDataPoints", 100);`

Return Entitlements: returns the entitlement identifiers associated with security.

Element	Element Value	Type	Description
returnEids	TRUE or FALSE	Boolean	Setting this to TRUE will populate fieldData with an extra element containing a name and value for the EID date.

Example Syntax: `request.Set("returnEIDs", true);`

Return Relative Date: returns data with a relative date.

Element	Element Value	Type	Description
returnRelativeDate	TRUE or FALSE	Boolean	Setting this to true will populate fieldData with an extra element containing a name and value for the relative date. For example RELATIVE_DATE = 2002 Q2

Example Syntax: `request.Set("returnRelativeDate", true);`

Adjustment Normal: Adjust for "change on day"

Element	Element Value	Type	Description
adjustmentNormal	TRUE or FALSE	Boolean	Adjust historical pricing to reflect: Regular Cash, Interim, 1st Interim, 2nd Interim, 3rd Interim, 4th Interim, 5th Interim, Income, Estimated, Partnership Distribution, Final, Interest on Capital, Distribution, Prorated.

Example Syntax: `request.Set("adjustmentNormal", true);`

Adjustment Abnormal: Adjusts for Anormal Cash Dividends			
Element	**Element Value**	**Type**	**Description**
adjustmentAbnormal	TRUE or FALSE	Boolean	Adjust historical pricing to reflect: Special Cash, Liquidation, Capital Gains, Long-Term Capital Gains, Short-Term Capital Gains, Memorial, Return of Capital, Rights Redemption, Miscellaneous, Return Premium, Preferred Rights Redemption, Proceeds/Rights, Proceeds/Shares, Proceeds/ Warrants.
Example Syntax: `request.Set("adjustmentAbnormal", true);`			

Adjustment Split: Capital Changes Defaults			
Element	**Element Value**	**Type**	**Description**
adjustmentSplit	TRUE or FALSE	Boolean	Adjust historical pricing and/or volume to reflect: Spin-Offs, Stock Splits/Consolidations, Stock Dividend/Bonus, Rights Offerings/ Entitlement.
Example Syntax: `request.Set("adjustmentSplit", true);`			

Adjustment Follow DPDF: Follow the BLOOMBERG PROFESSIONAL service function **DPDF<GO>**			
Element	**Element Value**	**Type**	**Description**
adjustmentFollowDPDF	TRUE or FALSE	Boolean	Setting to true will follow the **DPDF<GO>** BLOOMBERG PROFESSIONAL service function. True is the default setting for this option.
Example Syntax: `request.Set("adjustmentFollowDPDF", true);`			

Calendar Code Override: Returns the data based on the calendar of the specified country, exchange, or religion.			
Element	**Element Value**	**Type**	**Description**
calendarCodeOverride	CDR <GO> calendar type	String	Returns the data based on the calendar of the specified country, exchange, or religion from **CDR<GO>**. Taking a two character calendar code null terminated string. This will cause the data to be aligned according to the calendar and including calendar holidays. Only applies only to DAILY requests.
Example Syntax: `request.Set("calendarCodeOverride", "US");`			

Overrides: Append overrides to modify the calculation.			
Element	**Element Value**	**Type**	**Description**
fieldID		string	Specify a field mnemonic or alpha-numeric, such as PR092 or PRICING_SOURCE. Review **FLDS<GO>** for list of possible overrides.
value		string	The desired override value
Example Syntax:	`Element overrides = request["overrides"];` `Element override1 = overrides.AppendElement();` `override1.SetElement("fieldId", "BEST_DATA_SOURCE_OVERRIDE");` `override1.SetElement("value", "BLI");`		

A.2.5 HistoricalDataResponse: Choice

Figure A-2 provides the structure of a Historical Data Response. See “Reference Data Service Response” on page 129 for more information.

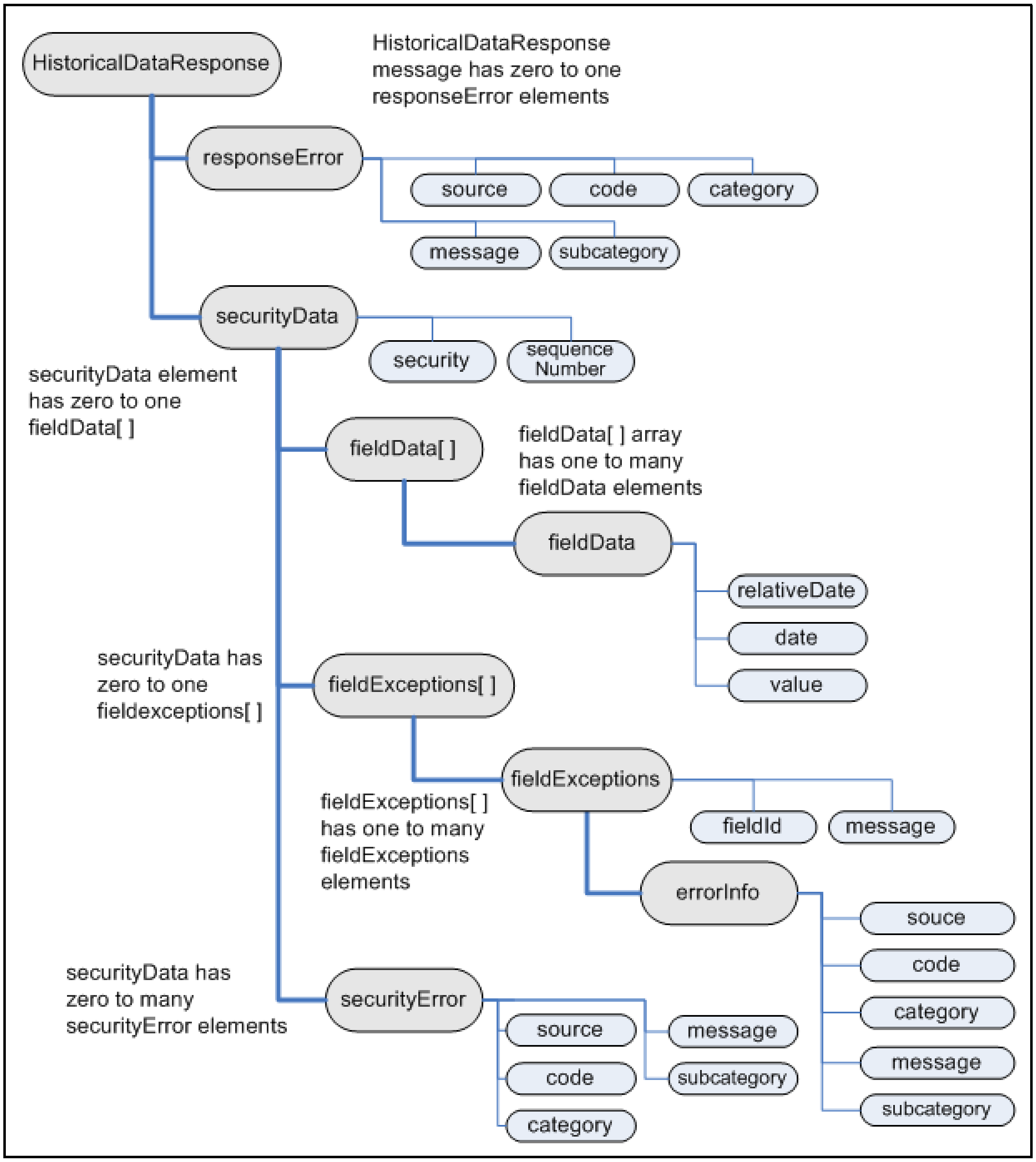

HistoricalDataResponse
HistoricalDataResponse message has zero to one responseError elements
responseError
source
code
category
message
subcategory
securityData
security
sequence Number
securityData element has zero to one fieldData[ ]
fieldData[ ]
fieldData[ ] array has one to many fieldData elements
fieldData
relativeDate
date
value
securityData has zero to one fieldexceptions[ ]
fieldExceptions[ ]
fieldExceptions
fieldExceptions[ ] has one to many fieldExceptions elements
fieldId
message
errorInfo
souce
code
category
message
subcategory
securityData has zero to many securityError elements
securityError
source
code
category
message
subcategory

Figure A-2: Historical Data Response

A.2.6 IntradayTickRequest: Sequence

Securities: A stock or bond.

Element	Element Value	Type	Description
securities		string	See “Security/Securities” on page 52 for additional details.

Example Syntax: `Element securities = request.GetElement("securities");`
`request.Set("security", "VOD LN Equity");`

Start Date: the first date of the period to retrieve data

Element	Element Value	Type	Description
startDateTime	yyyy-mm-dd Thh:mm:ss	string	The start date and time.

Example Syntax: `request.Set("startDateTime", "2010-04-27T15:55:00");`

End Date: the end date of the period to retrieve data

Element	Element Value	Type	Description
endDateTime	yyyy-mm-dd Thh:mm:ss	string	The end date and time.

Example Syntax: `request.Set("endDateTime", "2010-04-27T16:00:00");`

Event Type: The requested data event type

Element	Element Value	Type	Description
eventType	TRADE	string	Corresponds to LAST_PRICE
	BID	string	Depending on the exchange bid ticks will be returned as BID, BID_BEST or BEST_BID.
	ASK	string	Depending on the exchange ask ticks will be returned as ASK, ASK_BEST or BEST_ASK.
	BID_BEST	string	Depending on the exchange bid ticks will be returned as BID, BID_BEST or BEST_BID.
	ASK_BEST	string	Depending on the exchange ask ticks will be returned as ASK, ASK_BEST or BEST_ASK.
	MID_PRICE	string	Corresponds to MID as per **FLDS<GO>**.
	AT_TRADE	string	Automatic trade for London Sets stocks.
	BEST_BID	string	Depending on the exchange bid ticks will be returned as BID, BID_BEST or BEST_BID.
	BEST_ASK	string	Depending on the exchange ask ticks will be returned as ASK, ASK_BEST or BEST_ASK.

Example Syntax: `request.Set("eventType", "TRADE");`

Include Condition Codes: return any condition codes that may be associated to a tick, which identifies extraordinary trading and quoting circumstances.			
Element	**Element Value**	**Type**	**Description**
includeConditionCodes	TRUE or FALSE	Boolean	A comma delimited list of exchange condition codes associated with the event. Review **QR<GO>** for more information on each code returned.
Example Syntax: `request.Set("includeConditionCodes", true);`			

Include Non Plottable Events: return ticks in the response that have condition codes			
Element	**Element Value**	**Type**	**Description**
includeNonPlottable Events	TRUE or FALSE	Boolean	Returns all ticks, including those with condition codes.
Example Syntax: `request.Set("includeNonPlottableEvents", true);`			

Include Exchange Codes: return the exchange code of the trade			
Element	**Element Value**	**Type**	**Description**
includeExchangeCodes	TRUE or FALSE	Boolean	The exchange code where this tick originated. Review **QR<GO>** for more information.
Example Syntax: `request.Set("includeExchangeCodes", true);`			

Return Entitlements: returns the entitlement identifiers associated with security.			
Element	**Element Value**	**Type**	**Description**
returnEids	TRUE or FALSE	Boolean	Option on whether to return EIDs for the security.
Example Syntax: `request.Set("returnEids", true);`			

Include Broker Codes: return the broker code of the trade			
Element	**Element Value**	**Type**	**Description**
includeBrokerCodes	TRUE or FALSE	Boolean	The broker code for Canadian, Finnish, Mexican, Philippine, and Swedish equities only. The Market Maker Lookup screen, **MMTK<GO>**, displays further information on market makers and their corresponding codes.
Example Syntax: `request.Set("includeBrokerCodes", true);`			

Include Reporting Party Side Codes: return transaction codes			
Element	**Element Value**	**Type**	**Description**
includeRpsCodes	TRUE or FALSE	Boolean	The Reporting Party Side. The following values appear: -B: A customer transaction where the dealer purchases securities from the customer. -S: A customer transaction where the dealer sells securities to the customer. -D: An inter-dealer transaction (always from the sell side).
Example Syntax: `request.Set("includeRpsCodes", true);`			

A.2.7 IntradayTickResponse: Choice

Figure A-3 provides the structure of an Intraday Tick Response. See "Reference Data Service Response" on page 129 for more information.

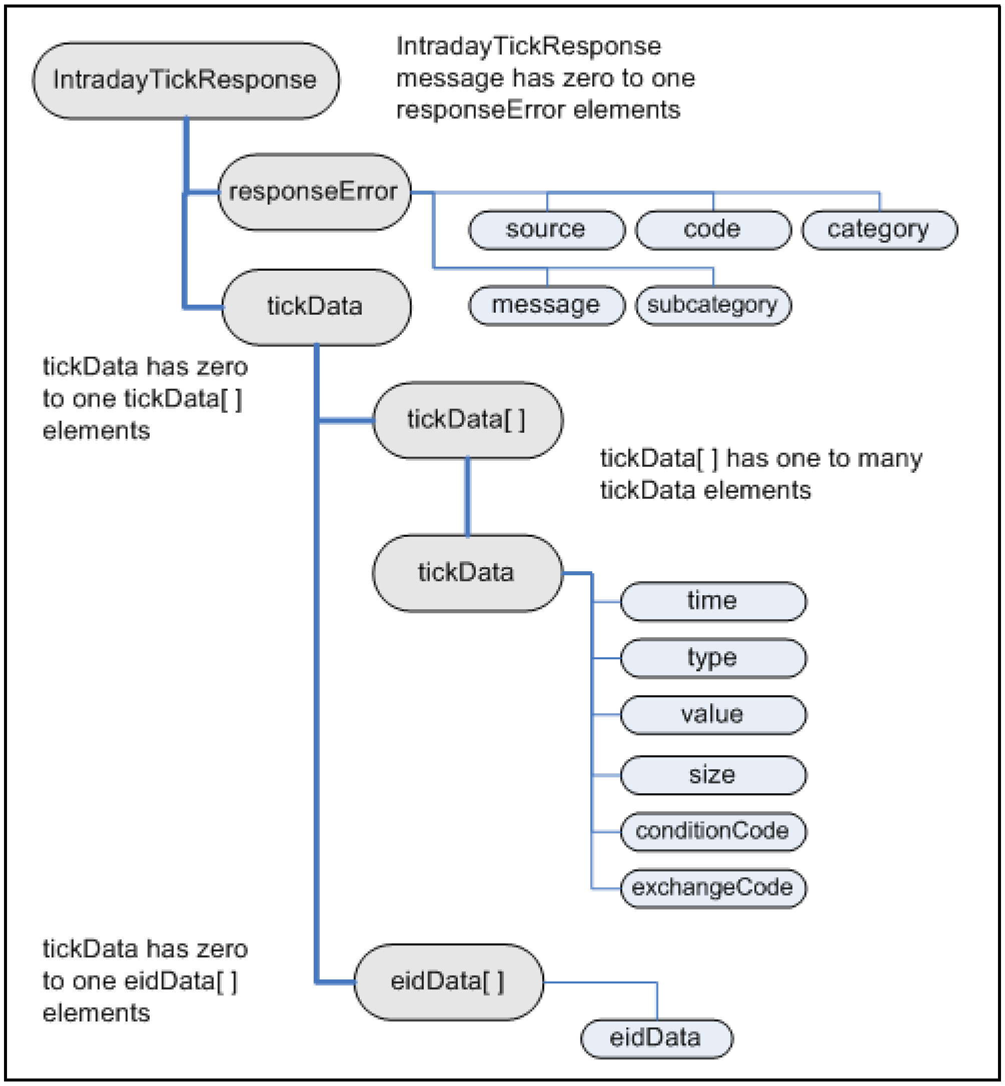

IntradayTickResponse
IntradayTickResponse message has zero to one responseError elements
responseError
source
code
category
message
subcategory
tickData
tickData has zero to one tickData[ ] elements
tickData[ ]
tickData[ ] has one to many tickData elements
tickData
time
type
value
size
conditionCode
exchangeCode
tickData has zero to one eidData[ ] elements
eidData[ ]
eidData

Figure A-3: IntradayTickResponse

A.2.8 IntradayBarRequest: Sequence

Securities: A stock or bond.

Element	Element Value	Type	Description
securities		string	See "Security/Securities" on page 52 for additional details.

Example Syntax: `Element securities = request.GetElement("securities"); request.Set("security", "VOD LN Equity");`

Start Date: the first date of the period to retrieve data

Element	Element Value	Type	Description
startDateTime	yyyy-mm-dd Thh:mm:ss	string	The start date and time.

Example Syntax: `request.Set("startDateTime", "2010-04-27T15:55:00");`

End Date: the end date of the period to retrieve data

Element	Element Value	Type	Description
endDateTime	yyyy-mm-dd Thh:mm:ss	string	The end date and time.

Example Syntax: `request.Set("endDateTime", "2010-04-27T16:00:00");`

Event Type: The requested data event type

Element	Element Value	Type	Description
eventType	TRADE	string	Corresponds to LAST_PRICE
	BID	string	Depending on the exchange bid ticks will be returned as BID, BID_BEST or BEST_BID.
	ASK	string	Depending on the exchange ask ticks will be returned as ASK, ASK_BEST or BEST_ASK.
	BID_BEST	string	Depending on the exchange bid ticks will be returned as BID, BID_BEST or BEST_BID.
	ASK_BEST	string	Depending on the exchange ask ticks will be returned as ASK, ASK_BEST or BEST_ASK.
	BEST_BID	string	Depending on the exchange bid ticks will be returned as BID, BID_BEST or BEST_BID.
	BEST_ASK	string	Depending on the exchange ask ticks will be returned as ASK, ASK_BEST or BEST_ASK.

Example Syntax: `request.Set("eventType", "TRADE");`

Interval: the length of each bar returned

Element	Element Value	Type	Description
interval	1...1440	integer	Sets the length of each time bar in the response. Entered as a whole number, between 1 and 1440 in minutes. If omitted, the request will default to one minute. One minute is the lowest possible granularity.

Example Syntax: `request.Set("interval", 60);`

Gap Fill Initial Bar: populate an empty bar with previous value

Element	Element Value	Type	Description
gapFillInitialBar	TRUE or FALSE	Boolean	When set to true, a bar contains the previous bar values if there was no tick during this time interval.

Example Syntax: `request.Set("gapFillInitialBar", true);`

Return Entitlements: returns the entitlement identifiers associated with security.

Element	Element Value	Type	Description
returnEids	TRUE or FALSE	Boolean	Option on whether to return EIDs for the security.

Example Syntax: `request.Set("returnEids", true);`

Return Relative Date: returns data with a relative date.

Element	Element Value	Type	Description
returnRelativeDate	TRUE or FALSE	Boolean	Setting this to true will populate fieldData with an extra element containing a name and value for the relative date. For example RELATIVE_DATE = 2002 Q2

Example Syntax: `request.Set("returnRelativeDate", true);`

Adjustment Normal: Adjust "change on day"

Element	Element Value	Type	Description
adjustmentNormal	TRUE or FALSE	Boolean	Adjust historical pricing to reflect: Regular Cash, Interim, 1st Interim, 2nd Interim, 3rd Interim, 4th Interim, 5th Interim, Income, Estimated, Partnership Distribution, Final, Interest on Capital, Distribution, Prorated.

Example Syntax: `request.Set("adjustmentNormal", true);`

Adjustment Abnormal: Adjust for Abnormal Cash Dividends

Element	Element Value	Type	Description
adjustmentAbnormal	TRUE or FALSE	Boolean	Adjust historical pricing to reflect: Special Cash, Liquidation, Capital Gains, Long-Term Capital Gains, Short-Term Capital Gains, Memorial, Return of Capital, Rights Redemption, Miscellaneous, Return Premium, Preferred Rights Redemption, Proceeds/Rights, Proceeds/Shares, Proceeds/Warrants.

Example Syntax: `request.Set("adjustmentAbnormal", true);`

Adjustment Split: Capital Changes Defaults

Element	Element Value	Type	Description
adjustmentSplit	TRUE or FALSE	Boolean	Adjust historical pricing and/or volume to reflect: Spin-Offs, Stock Splits/Consolidations, Stock Dividend/Bonus, Rights Offerings/ Entitlement.

Example Syntax: `request.Set("adjustmentSplit", true);`

Adjustment Follow DPDF: Follow the BLOOMBERG PROFESSIONAL service function **DPDF<GO>**			
Element	**Element Value**	**Type**	**Description**
adjustmentFollowDPDF	TRUE or FALSE	Boolean	Setting to true will follow the **DPDF<GO>** BLOOMBERG PROFESSIONAL service function. True is the default setting for this option..
Example Syntax: `request.Set("adjustmentFollowDPDF", true);`			

A.2.9 IntradayBarResponse: Choice

Figure A-4 provides the structure of an Intraday Bar Response. See “Reference Data Service Response” on page 129 for more information.

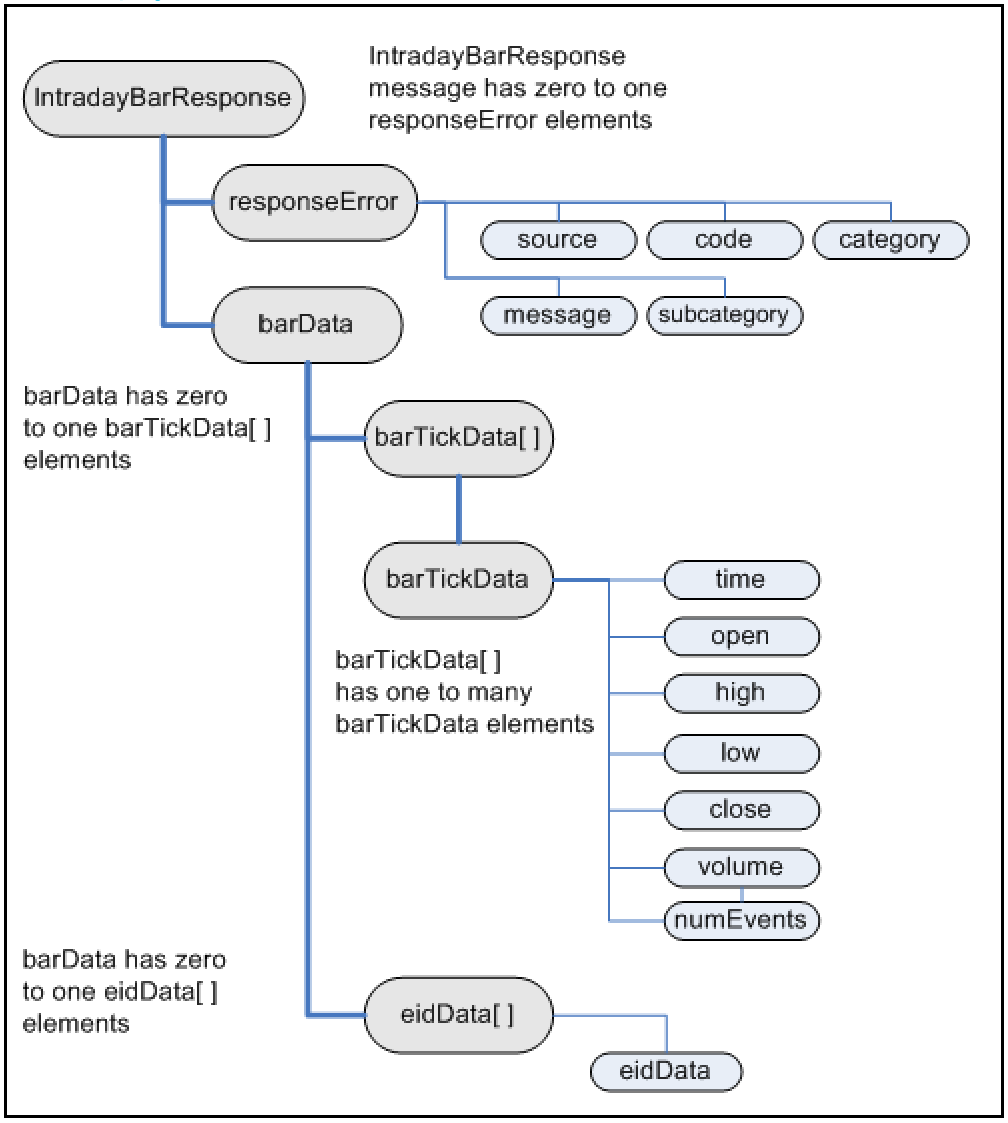

IntradayBarResponse
IntradayBarResponse message has zero to one responseError elements
responseError
source
code
category
message
subcategory
barData
barData has zero to one barTickData[ ] elements
barTickData[ ]
barTickData
time
open
high
low
close
volume
numEvents
barTickData[ ] has one to many barTickData elements
barData has zero to one eidData[ ] elements
eidData[ ]
eidData

Figure A-4: IntradayBarResponse

A.2.10 PortfolioDataRequest: Sequence

Securities: A Portfolio ID			
Element	**Element Value**	**Type**	**Description**
securities	string array	string	The users portfolio is identified by it's Portfolio ID, which can be found on the upper right hand corner of the settings tab on the portfolio's **PRTU<GO>** page on the BLOOMBERG PROFESSIONAL service.
Example Syntax: `Element securities = request.GetElement("securities"); securities.AppendValue("UXXXXXXX-X Client");`			

Fields: The desired reference fields.			
Element	**Element Value**	**Type**	**Description**
fields		string	The fields that can be used are PORTFOLIO_MEMBER PORTFOLIO_MPOSITION, PORTFOLIO_MWEIGHT & PORTFOLIO_DATA.
Example Syntax: `Element fields = request.GetElement("fields"); fields.AppendValue("PORTFOLIO_MEMBER ");`			

Overrides: The Portfolio information can also be accessed historically by using the REFERENCE_DATE override field by supplying the date in 'yyyymmdd' format.			
Element	**Element Value**	**Type**	**Description**
fieldId		string	Field mnemonic "REFERENCE_DATE"
value		string	The date in 'yyyymmdd' format.
Example Syntax: `Element overrides = request["overrides"]; Element override1 = overrides.AppendElement(); override1.SetElement("fieldId", "REFERENCE_DATE"); override1.SetElement("value", "20100111");`			

A.2.11 PortfolioDataResponse: Choice

Figure A-5 provides the structure of a PortfolioDataResponse. See "Reference Data Service Response" on page 129 for more information.

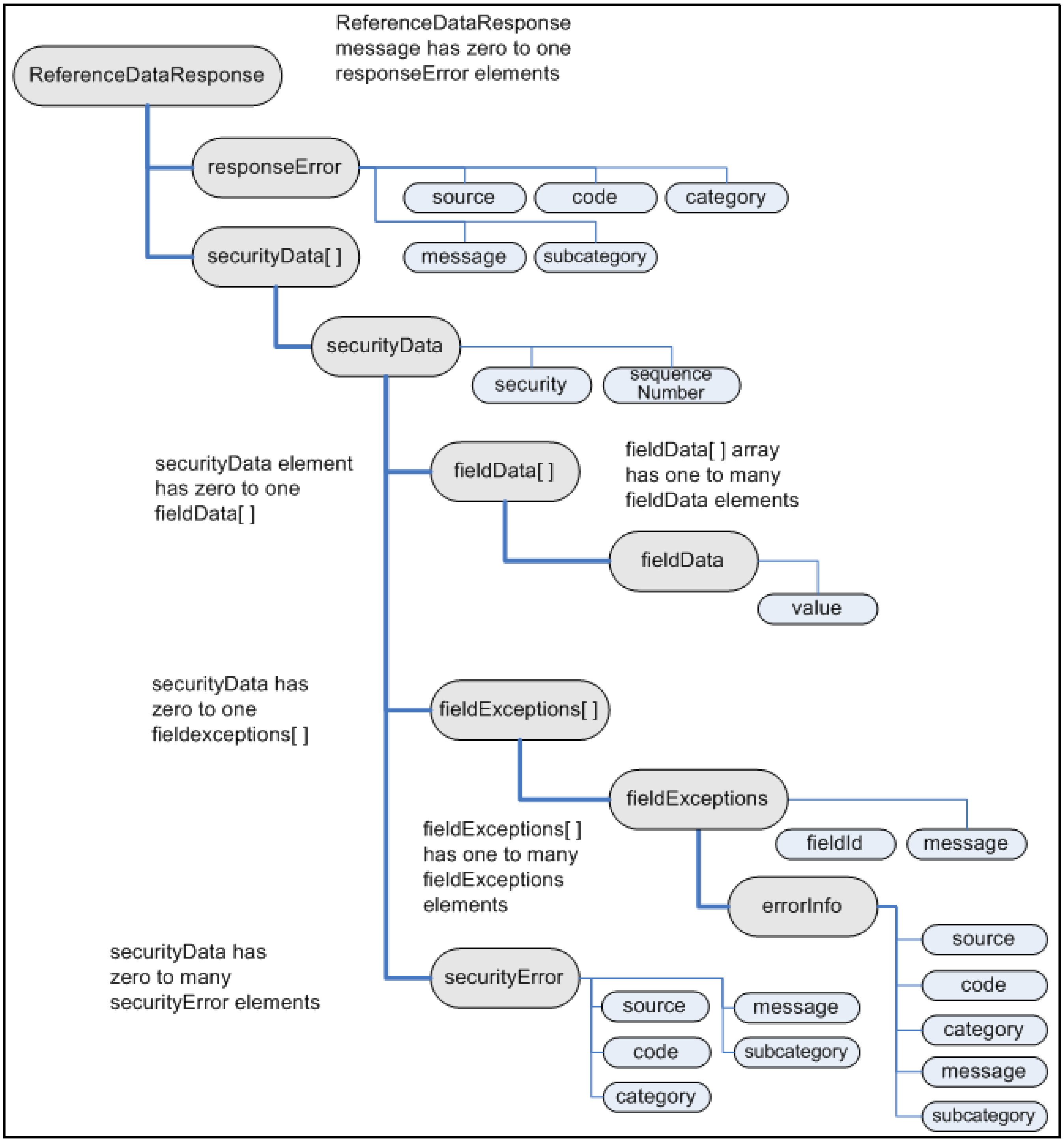

ReferenceDataResponse message has zero to one responseError elements
ReferenceDataResponse
responseError
source
code
category
message
subcategory
securityData[ ]
securityData
security
sequence Number
securityData element has zero to one fieldData[ ]
fieldData[ ]
fieldData[ ] array has one to many fieldData elements
fieldData
value
securityData has zero to one fieldexceptions[ ]
fieldExceptions[ ]
fieldExceptions
fieldId
message
fieldExceptions[ ] has one to many fieldExceptions elements
errorInfo
source
code
category
message
subcategory
securityData has zero to many securityError elements
securityError
source
code
category
message
subcategory

Figure A-5: Portfolio Data Request Response

A.2.12 BEQSRequest: Sequence

screenName: An EQS screen name

Element	Element Value	Type	Description
screenName	string	string	(Required) The name of the screen to execute. It can be a user defined EQS screen or one of the Bloomberg Example screens on **EQS <GO>** on the BLOOMBERG PROFESSIONAL service.

Example Syntax: `request.Set("screenName", "Global Volume Surges");`

screenType: Screen Type.

Element	Element Value	Type	Description
screenType	PRIVATE or GLOBAL	string	Use PRIVATE for user-defined EQS screen. Use GLOBAL for Bloomberg EQS screen.

Example Syntax: `request.Set("screenType", "GLOBAL");`

languageId: Specify the language for field names to be returned for screen data

Element	Element Value	Type	Description
languageId (optional)		string	The following languages are supported: ENGLISH, KANJI, FRENCH, GERMAN, SPANISH, PORTUGUESE, ITALIAN, CHINESE_TRA, KOREAN, CHINESE_SIM, THAI, SWED, FINNISH, DUTCH, MALAY, RUSSIAN, GREEK, POLISH, DANISH, FLEMISH, ESTONIAN, TURKISH, NORWEGIAN, LATVIAN, LITHUANIAN, INDONESIAN

Example Syntax: `request.Set("languageId", "FRENCH");`

Group: Specify group name.

Element	Element Value	Type	Description
Group (optional)		string	Screen folder name here as defined in **EQS<GO>**.

Example Syntax: `request.Set("Group", "Global Emerging Markets");`

A.2.13 BEQSResponse: Choice

Figure A-1 provides the structure of a BEQSResponse. See “Reference Data Service Response” on page 129 for more information.

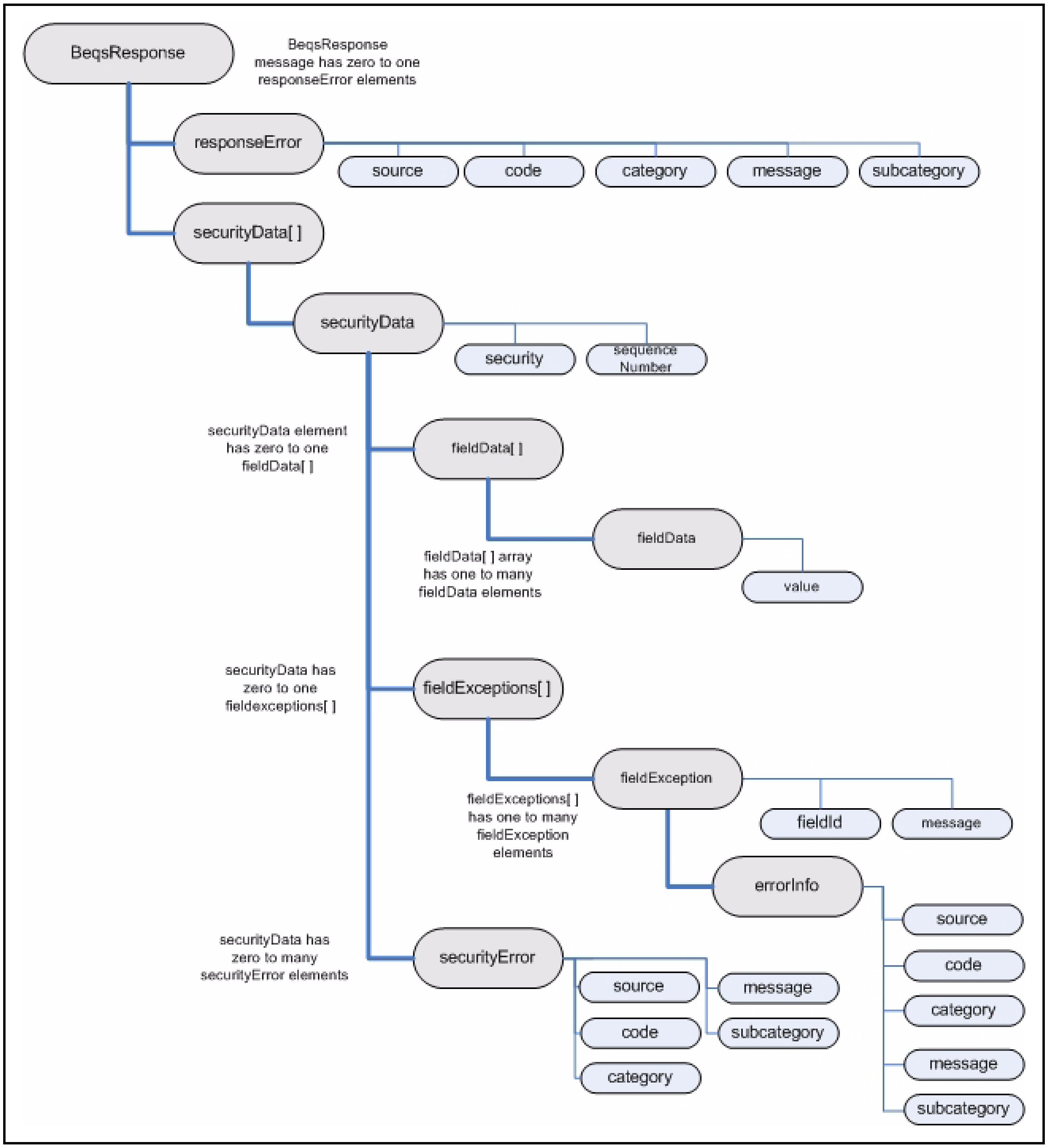

BeqsResponse
BeqsResponse message has zero to one responseError elements
responseError
source
code
category
message
subcategory
securityData[ ]
securityData
security
sequence Number
securityData element has zero to one fieldData[ ]
fieldData[ ]
fieldData
value
fieldData[ ] array has one to many fieldData elements
securityData has zero to one fieldexceptions[ ]
fieldExceptions[ ]
fieldException
fieldExceptions[ ] has one to many fieldException elements
fieldId
message
errorInfo
source
code
category
message
subcategory
securityData has zero to many securityError elements
securityError
source
code
category
message
subcategory

Figure A-6: BEQS Response

A.2.14 Reference Data Service Response

Table A-1 and Table A-2 provides descriptions of the individual elements received in a reference data response. Please view pages 112, 118, 121, 124, and 128 for information on the structure of each response.

Table A-1: Reference Data Service Response Elements

Element	Description
responseError	Returned when a request cannot be completed for any reason. It is an errorInfo element.
securityData[ ]	Contains an array of securityData elements
securityData	Contains the response data for a specific security from a ReferenceDataRequest or a HistoricalDataRequest. It provides the security string specified in the request, the sequence number and can include fieldData[ ], fieldsExceptions[ ] and securityError elements.
barData	Contains the response data for an IntradayBarRequest. It can provide a barTickData[ ] element and/or an eidData array element.
barTickData[ ]	Contains an array of barTickData elements
barTickData	Contains values associated to the bar, including time, open, high, low, close, volume, numEvents.
tickData	Contains the response data for an IntradayTickRequest. It can provide a tickData[ ] element and/or an eidData array element.
tickData[ ]	Contains an array of tickData elements
tickData[ ] :: tickData	Contains values associated to the eventType, including time, type, value, size, condition code, and exchange code.
eidData[ ]	Contains a list of eidData values associated to the securities requested. If the requestor does not have the entitlement as per EXCH<GO> then the identifiers will not be returned.
securityError	Returned when a request cannot be completed for any reason. It is an errorInfo element.
fieldExceptions[ ]	Contains an array of fieldExceptions.
fieldExceptions	Contains a field identifier, message and errorInfo element.
fieldData[ ]	Contains an array of fieldData values
fieldData	**Reference Data Request:** element with the fieldId and value **Historical Data Request:** element with the relativeDate, Date, fieldId and value
errorInfo	Contains values about the error which has occurred, including the source, code, category, message, and subcategory.

Table A-2: Reference Data Service Response Values

Element	Type	Description
security	String	The security requested. See "Security/Securities" on page 52 for additional details..
eidData	Integer	Entitlement identifier (EID) associated to the requested security.
sequenceNumber	Integer	Security sequence number, specifying the position of the security in the request.
fieldId	String	Requested field represented as an alphanumeric or a Mnemonic, i.e. PR005 or PX_LAST.
relativeDate	String	Relative date string associated with this historical data-point. This field will only be returned if "returnRelativeDate" historical data request option is specified as "true".
Date	Date	Date associated with this historical data-point
Time	DateTime	Tick time for an intraday tick request
Type	String	The event type for an intraday tick
Value	Integer	Value of an eventType or field.
	Double	
	String	
	Date	
	Time	
	Datetime	
Size	Integer	Size of an event for intraday tick data (for example, number of shares).
conditionCode	String	A comma delimited list of exchange condition codes associated with the event.
exchangeCode	String	Single character indicating exchange tick event origin.
Source	String	Bloomberg internal error source information.
Code	Integer	Bloomberg internal error code.
Category	String	Bloomberg error classification. Used to determine the general classification of the failure.
message	String	Human readable description of the failure.
subcategory	String	Bloomberg sub-error classification. Used to determine the specific classification of the failure.

Table A-2: Reference Data Service Response Values

rpsCode	String	Transaction code.The following values appear: -B: A customer transaction where the dealerpurchases securities from the customer. -S: A customer transaction where the dealersells securities to the customer. -D: An inter-dealer transaction (always from the sell side).
brokerBuyCode	String	The broker code for Canadian, Finnish, Mexican, Philippine, and Swedish equities only. The Market Maker Lookup screen, **MMTK** on the BLOOMBERG PROFESSIONAL service, displays further information on market makers and their corresponding codes. To display the broker's name, enter: **MMID {market maker code} <GO>**.
brokerSellCode	String	
micCode	String	The BIC, or Bank Identifier Code, as a 4-character unique identifier for each bank that executed and reported the OTC trade, as required by MiFID. BICs are assigned and maintained by SWIFT (Society for Worldwide Interbank Financial Telecommunication). The MIC is the Market Identifier Code, and this indicates the venue on which the trade was executed.

A.3 Schema for API Field Service //blp//apiflds

A.3.1 Requests: Choice

Top level request to the service.

Element	Type	Description
fieldInfoRequest	FieldInfoRequest	Request for field information.
fieldSearchRequest	FieldSearchRequest	Field search information.
categorizedFieldSearchRequest	CategorizedFieldSearch Request	See "Categorized Field Search Request" on page 138.

A.3.2 Responses: Choice

Top level request to the service.

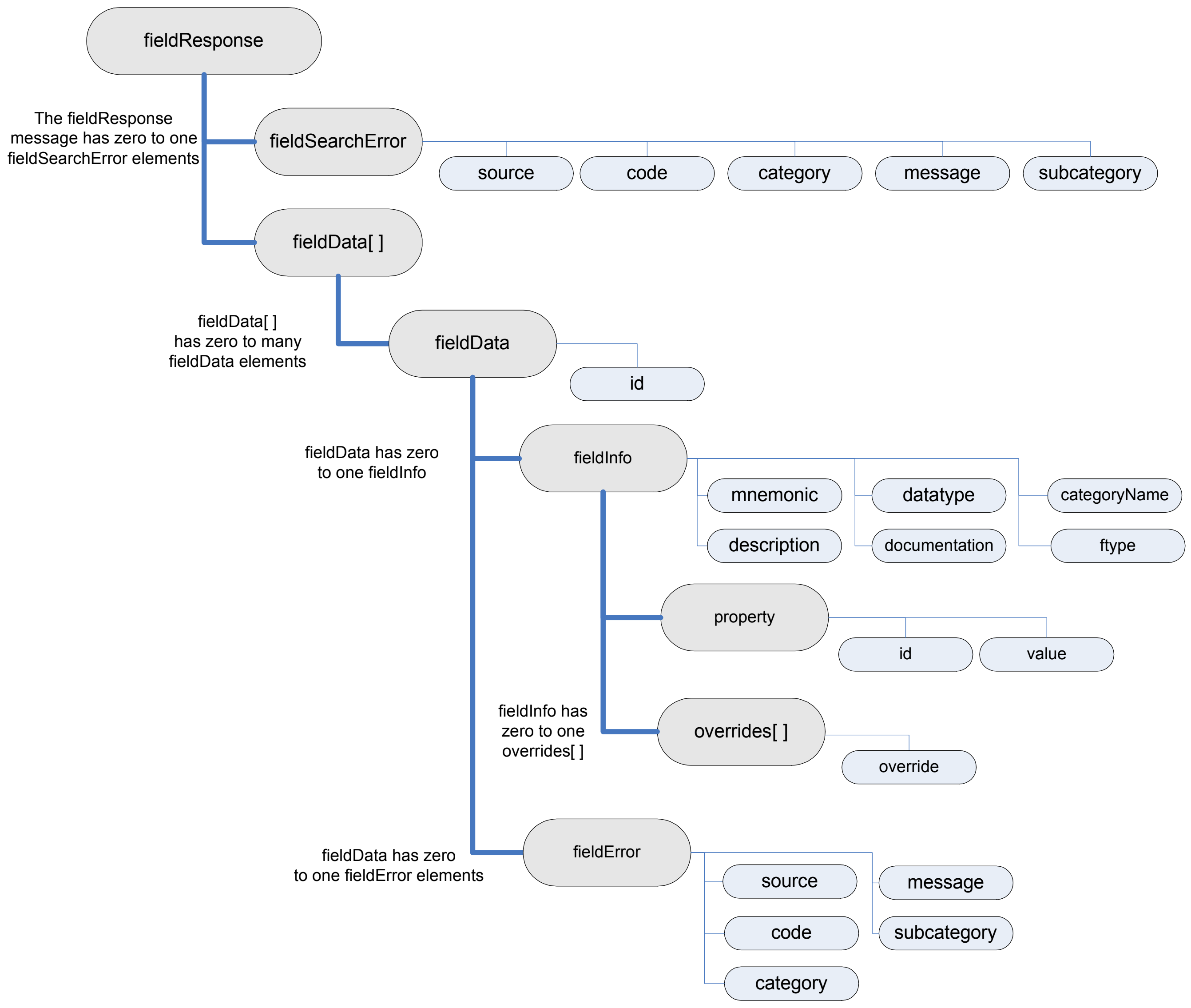
Element	Type	Description
fieldResponse	FieldResponse	Field response information.
categorizedFieldResponse	CategorizedFieldResponse	See "Categorized Field Search Request Response" on page 139.

A.3.3 Field Information Request

Identifier: the reference or streaming fields desired.			
Element	**Element Value**	**Type**	**Description**
id		string	See "Fields" on page 53 for additional details. Fields can be specified as a alpha numeric or mnemonic.
Example Syntax: `Element idList = request.GetElement("id");` `request.Append("id", "LAST_PRICE");` `request.Append("id", "pq005");`			
Return field documenation:			
Element	**Element Value**	**Type**	**Description**
returnFieldDocumentation	TRUE or FALSE	Boolean	Returns a description about the field as seen on FLDS<GO>. Default value is false.
Example Syntax: `request.Set("returnFieldDocumentation", true);`			

A.3.3.1 Field Information Request Response

See “Field Service Response Elements” on page 143 and “Field Service Response Values” on page 144 for more information.



A.3.4 Field Search Request

Identifier: the reference or streaming fields desired.			
Element	**Element Value**	**Type**	**Description**
searchSpec		String	The string argument to search through mnemonics, descriptions and definitions. It is also able to 'intelligently' expand works, i.e. mkt ==> market.

Example Syntax: `request.Set("searchSpec", "mutual fund");`

Include options:			
Element	**Element Value**	**Type**	**Description**
category	New Fields Analysis Corporate Actions Custom Fields Descriptive Earnings Estimates Fundamentals Market Activity Metadata Ratings Trading Systems	String	Categories for fields
productType	All	String	The results will be filtered by fields that are avaliable for this yellow key (security type).
	Govt	String	
	Corp	String	
	Mtge	String	
	M-Mkt	String	
	Muni	String	
	Pfd	String	
	Equity	String	
	Cmdty	String	
	Index	String	
	Curncy	String	

fieldType	All	String	Results include fields that are both streaming (real-time and delayed) and reference (static)
	Realtime	String	Results include fields that provide streaming data (real-time and delayed)
	Static	String	Results include fields that provide reference data (static).

```
Element element = request.getElement ("include");
                  element.setElement("productType", "Equity");
                  element.setElement("fieldType", "Static");
                  Element element1 = element.GetElement("category");
                  element1.AppendValue("Ratings");
                  element1.AppendValue("Analysis");
```

Exclude options:

Element	Element Value	Type	Description
category	New Fields Analysis Corporate Actions Custom Fields Descriptive Earnings Estimates Fundamentals Market Activity Metadata Ratings Trading Systems	String	Categories for fields
productType	All	String	The results will be filtered by fields that are avaliable for this yellow key (security type).
	Govt	String	
	Corp	String	
	Mtge	String	
	M-Mkt	String	
	Muni	String	
	Pfd	String	
	Equity	String	
	Cmdty	String	
	Index	String	
	Curncy	String	

fieldType	All	String	Results include fields that are both streaming (real-time and delayed) and reference (static)
	Realtime	String	Results include fields that provide streaming data (real-time and delayed)
	Static	String	Results include fields that provide reference data (static).

```
Example Syntax:  Element element = request.getElement ("exclude");
                 element.setElement("productType", "Equity");
                 element.setElement("fieldType", "Static");
                 Element element1 = element.GetElement("category");
                 element1.AppendValue("Ratings");
                 element1.AppendValue("Analysis");
```

Return field documenation:

Element	**Element Value**	**Type**	**Description**
returnFieldDocumentatio n	TRUE or FALSE	Boolean	Returns a description about the field as seen on FLDS<GO>. Default value is false.

Example Syntax: `request.Set("returnFieldDocumentation", true);`

A.3.4.1 Field Search Request Response

See “Field Service Response Elements” on page 143 and “Field Service Response Values” on page 144 for more information.

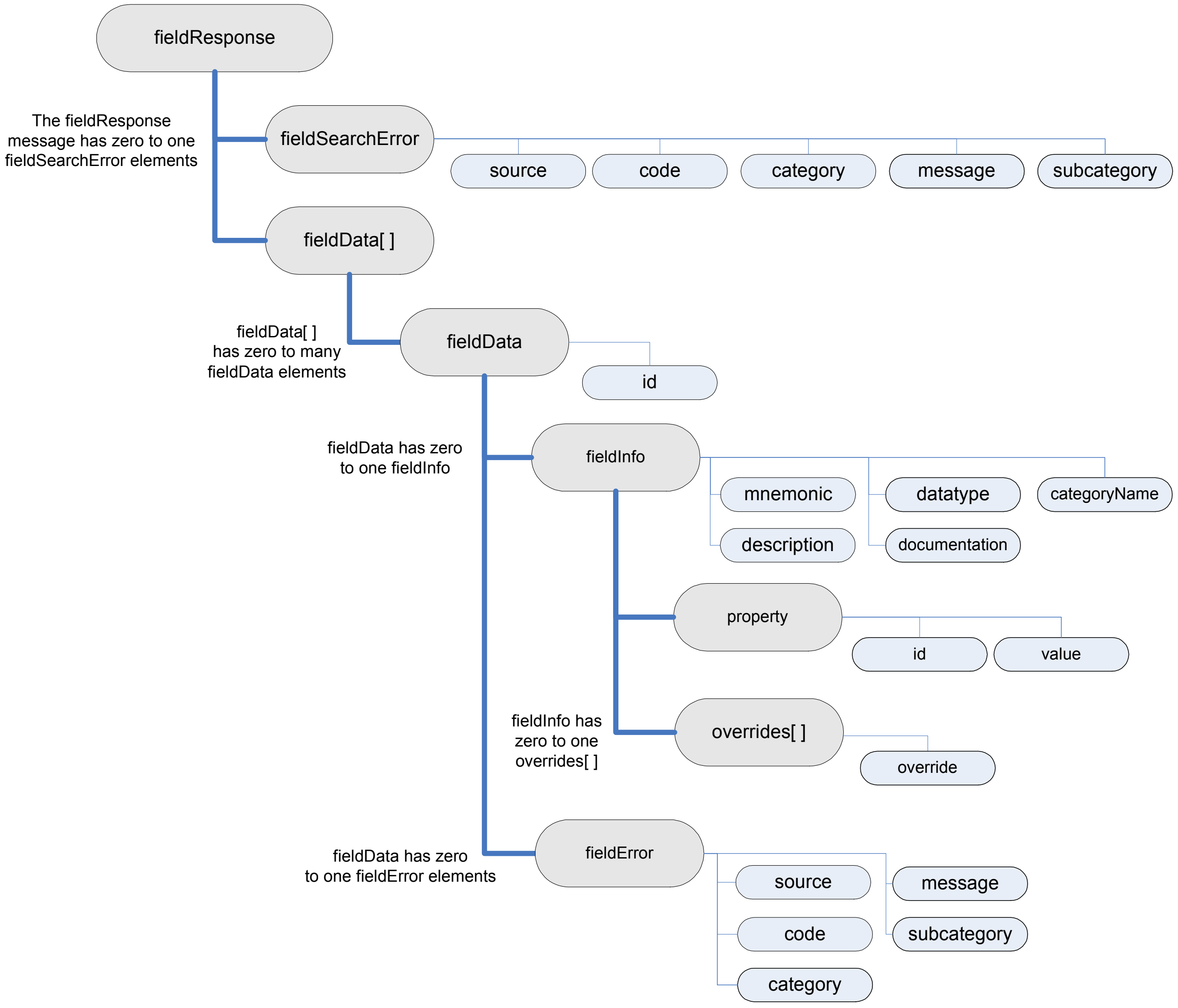

fieldResponse
The fieldResponse message has zero to one fieldSearchError elements
fieldSearchError
source
code
category
message
subcategory
fieldData[ ]
fieldData[ ] has zero to many fieldData elements
fieldData
id
fieldData has zero to one fieldInfo
fieldInfo
mnemonic
datatype
categoryName
description
documentation
property
id
value
fieldInfo has zero to one overrides[ ]
overrides[ ]
override
fieldData has zero to one fieldError elements
fieldError
source
message
code
subcategory
category

Figure A-7: Field Search Request Response

A.3.5 Categorized Field Search Request

Identifier: the reference or streaming fields desired.			
Element	**Element Value**	**Type**	**Description**
searchSpec		String	The string argument to search through mnemonics, descriptions and definitions. It is also able to 'intelligently' expand works, i.e. mkt ==> market.

```
Example Syntax:  request.Set("searchSpec", "mutual fund");
```

Exclude options:			
Element	**Element Value**	**Type**	**Description**
category	New Fields Analysis Corporate Actions Custom Fields Descriptive Earnings Estimates Fundamentals Market Activity Metadata Ratings Trading Systems	String	Categories for fields
productType	All	String	The results will be filtered by fields that are avaliable for this yellow key (security type).
	Govt	String	
	Corp	String	
	Mtge	String	
	M-Mkt	String	
	Muni	String	
	Pfd	String	
	Equity	String	
	Cmdty	String	
	Index	String	
	Curncy	String	

fieldType	All	String	Results include fields that are both streaming (real-time and delayed) and reference (static)
	Realtime	String	Results include fields that provide streaming data (real-time and delayed)
	Static	String	Results include fields that provide reference data (static).

```
Example Syntax:  Element element = request.getElement ("exclude");
                 element.setElement("productType", "Equity");
                 element.setElement("fieldType", "Static");
                 Element element1 = element.GetElement("category");
                 element1.AppendValue("Ratings");
                 element1.AppendValue("Analysis");
```

Return field documenation:

Element	**Element Value**	**Type**	**Description**
returnFieldDocumentatio n	TRUE or FALSE	Boolean	Returns a description about the field as seen on FLDS<GO>. Default value is false.

Example Syntax: `request.Set("returnFieldDocumentation", true);`

A.3.5.1 Categorized Field Search Request Response

See “Field Service Response Elements” on page 143 and “Field Service Response Values” on page 144 for more information.

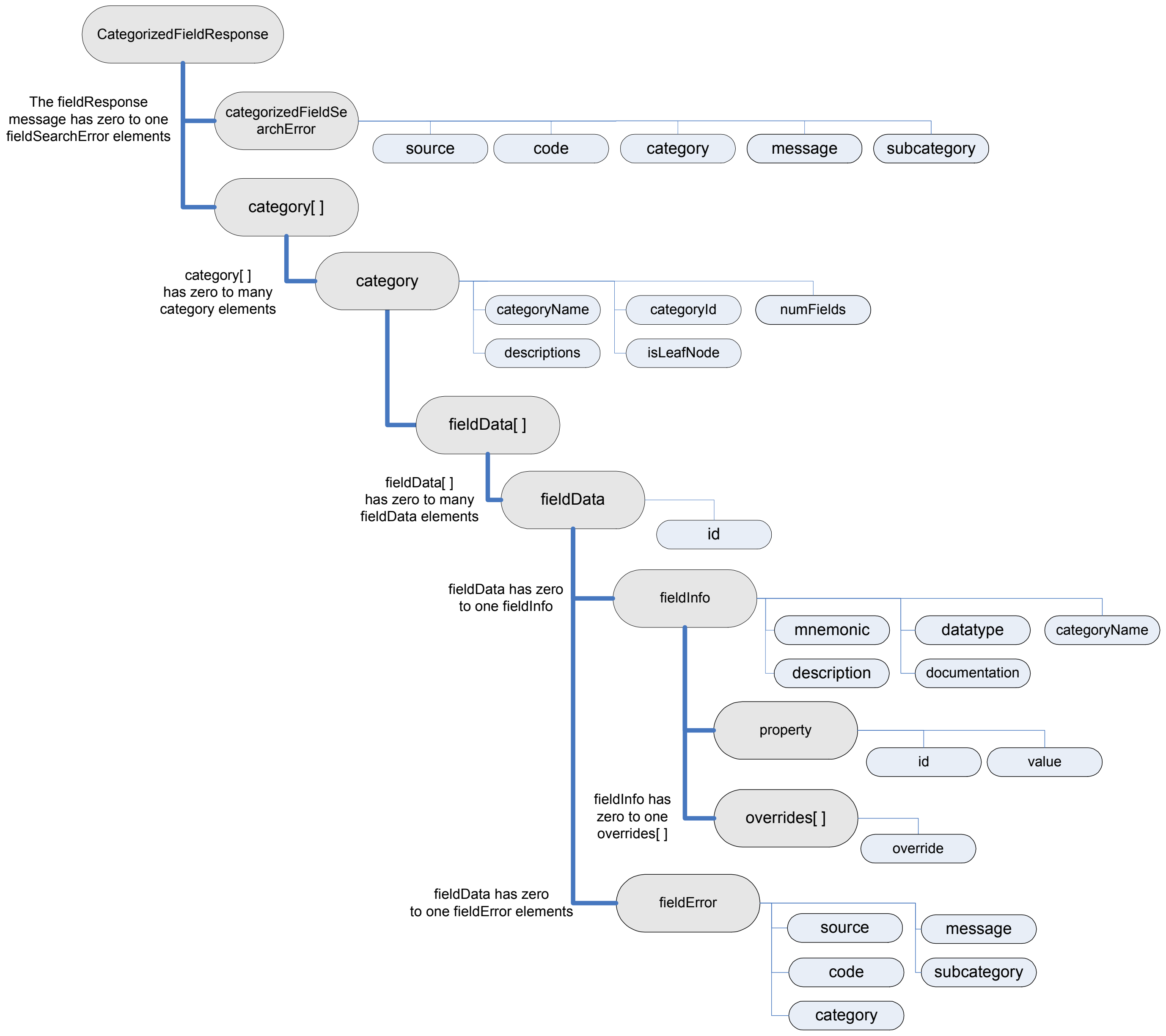

CategorizedFieldResponse
The fieldResponse message has zero to one fieldSearchError elements
categorizedFieldSearchError
source
code
category
message
subcategory
category[ ]
category[ ] has zero to many category elements
category
categoryName
categoryId
numFields
descriptions
isLeafNode
fieldData[ ]
fieldData[ ] has zero to many fieldData elements
fieldData
id
fieldData has zero to one fieldInfo
fieldInfo
mnemonic
datatype
categoryName
description
documentation
property
id
value
fieldInfo has zero to one overrides[ ]
overrides[ ]
override
fieldData has zero to one fieldError elements
fieldError
source
message
code
subcategory
category

Figure A-8: Categorized Field Search Request Response

A.3.6 Field List Request

Identifier: the reference or streaming fields desired.			
Element	**Element Value**	**Type**	**Description**
fieldType	All	String	Results include fields that are both streaming (real-time and delayed) and reference (static)
	Realtime	String	Results include fields that provide streaming data (real-time and delayed)
	Static	String	Results include fields that provide reference data (static).
`Example Syntax:  element.setElement("fieldType", "Static");`			

Return field documenation:			
Element	**Element Value**	**Type**	**Description**
returnFieldDocumentation	TRUE or FALSE	Boolean	Returns a description about the field as seen on FLDS<GO>. Default value is false.
`request.Set("returnFieldDocumentation", true);`			

A.3.6.1 Field List Request Response

See "Field Service Response Elements" on page 143 and "Field Service Response Values" on page 144 for more information.

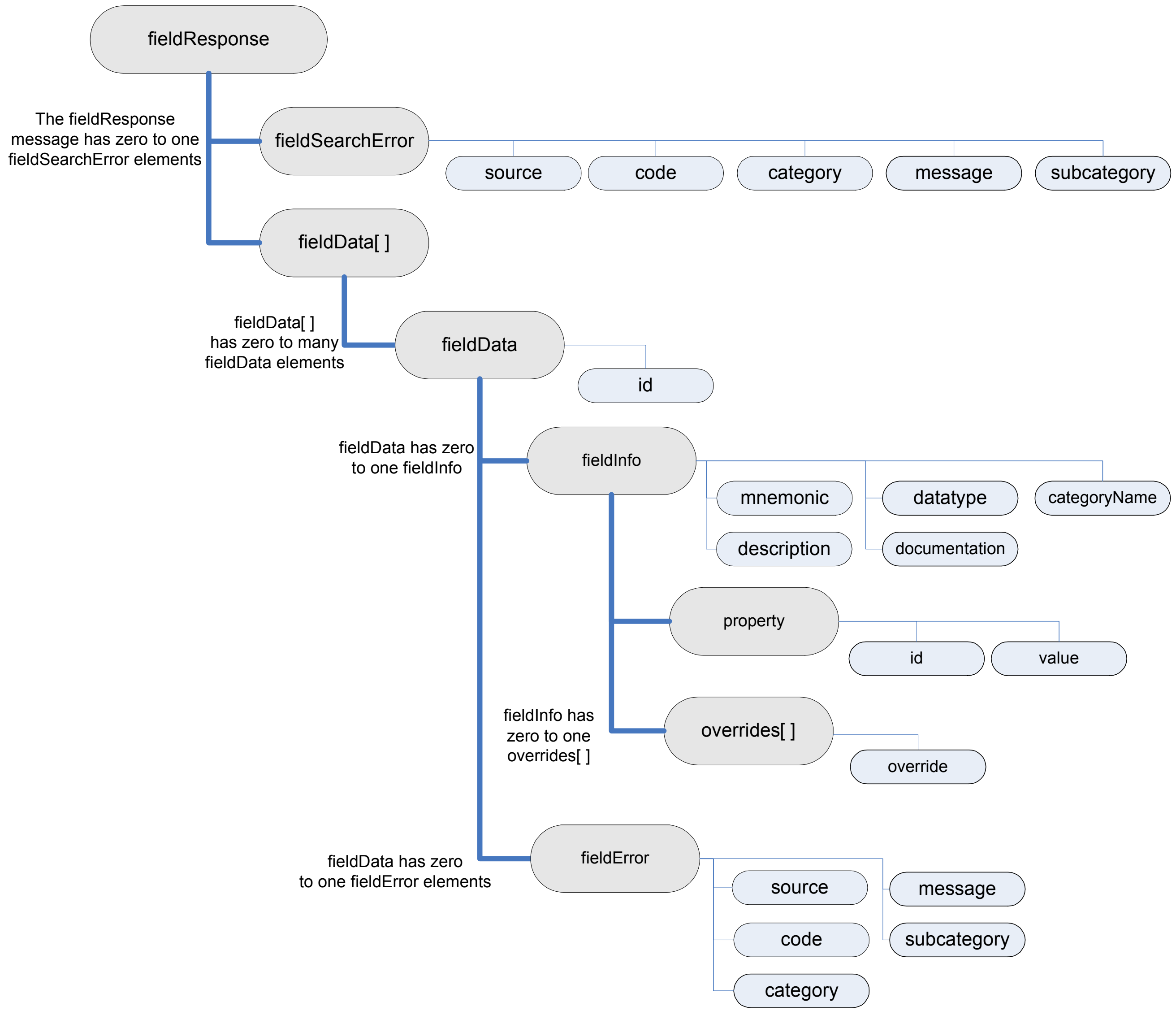

fieldResponse
The fieldResponse message has zero to one fieldSearchError elements
fieldSearchError
source
code
category
message
subcategory
fieldData[ ]
fieldData[ ] has zero to many fieldData elements
fieldData
id
fieldData has zero to one fieldInfo
fieldInfo
mnemonic
datatype
categoryName
description
documentation
property
id
value
fieldInfo has zero to one overrides[ ]
overrides[ ]
override
fieldData has zero to one fieldError elements
fieldError
source
message
code
subcategory
category

Figure A-9: Field List Request Response

A.3.7 Field Service Response Elements

The following table provides descriptions of the individual elements received in the field service responses. Please view graphs A.3.3, A.3.5, A.3.7 and A.3.9 for information on the structure of the response.

Element	Description
fieldSearchError	Returned when a request cannot be completed for any reason. It is an errorInfo element.
fieldData[ ]	Contains an array of fieldData values
fieldData	Contains a id corresponding to the requested field identifier, along with either a fieldInfo or fieldError element
fieldInfo	Contains values on the mnemonic, datatype, categoryName, description, and documentation.
fieldError	Returned when a request cannot be completed for any reason or in the case of a fieldInfoRequest when an invalid field mnemonic or alpha-numeric is entered.
categorizedFieldSearchError	Returned when a request cannot be completed for any reason. It is an errorInfo element.
category[ ]	Contains an array of category elements.
category	Contains categoryName, categoryId, numFields, descriptions, isLeafNode and a fieldData[ ] element.
errorInfo	Contains values about the error which has occurred, including the source, code, category, message, and subcategory.

A.3.8 Field Service Response Values

Element	Type	Description
id	String	Resulting field represented as an alphanumeric or a Mnemonic, i.e., PR005 or PX_LAST.
mnemonic	Integer	Resulting field represented as a mnemonic, i.e., PX_LAST.
datatype	Enumeration	Enumeration values representing Bloomberg data types. Please see specific SDK documentation for the enum values.
ftype	Enumeration	Enumeration value representing data types shown in **XDM<GO>**.
categoryName	String	Response value for the name of the category. Could be one of the following: New Fields, Analysis, Corporate Actions, Custom Fields, Descriptive, Earnings Estimates, Fundamentals, Market Activity, Metadata, Ratings, and Trading Systems.
description	String	Is the short description describing the field, for example for the mnemonic LAST_PRICE the description is "Last Trade/Last Price".
documentation	String	Corresponds to the definition in **FLDS<GO>**
Time	DateTime	Tick time for an intraday tick request
Type	String	The event type for an intraday tick
Source	String	Bloomberg internal error source information.
Code	Integer	Bloomberg internal error code.
Category	String	Bloomberg error classification. Used to determine the general classification of the failure.
message	String	Human readable description of the failure.
subcategory	String	Bloomberg sub-error classification. Used to determine the specific classification of the failure.

A.4 Market Bar Subscription

A.4.1 Market Bar Subscription Settings

Argument Value	Type	Description
security	string	As with any Subscription, a Market Bar Subscription must contain at least one security, field and Correlation ID. The topic is defined as: `"//blp/mktbar/symbology/identifier"`
field	string	The following fields are returned for Market Bars: TIME, OPEN, HIGH, LOW, CLOSE, NUMBER_OF_TICKS, VOLUME. These values are only updated on a trade. For this reason, LAST_PRICE should be submitted in the subscription string. See "Fields" on page 53 for additional details. Fields can be specified as a alpha numeric or mnemonic.
Example Syntax: `Subscription mySubscription = new Subscription("//blp/mktbar/ticker/VOD LN Equity", "LAST_PRICE", new CorrelationID(id));`		
interval	string	*Optional*. Interval time defined thelength in minutes of a bar. If undefined it is set to 1 minute. This is the minimum duration. The maximum duration is 1440 minutes, (=24 hours).
start_time	string	*Optional*. This should be in the format hh:mm. If these values are not specified then they default is time of subscription.
end_time	string	*Optional*. This should be in the format hh:mm. If these values are not specified then they default is session end time.
Example Syntax: `Subscription mySubscription = new Subscription(security, field, "interval=5" "start_time=15:00", "end_time=15:30",CorrelationID(id));`		

A.4.2 Market Bar Subscription: Data Events Response

Argument Value	Type	Description
TIME	datetime	Returns the time of the last TRADE on every update.
Example Syntax: `Datetime time = msg.getElementAsDatetime(TIME);`		
OPEN	Float64	Returns open price for each bar. Will be returned in the first tick for the bar.
Example Syntax: `int open = msg.getElementAsFloat64(OPEN);`		
HIGH	Float64	Returns high price at the beginning of the bar and subsequently every higher price that occurs until the end of the bar.
Example Syntax: `int high = msg.getElementAsFloat64(HIGH);`		
LOW	Float64	Returns low price at the beginning of the bar and subsequently every higher price that occurs until the end of the bar.
Example Syntax: `int low = msg.getElementAsFloat64(LOW);`		

Argument Value	Type	Description
CLOSE	Float64	Returns updated close price on every update.
`Example Syntax: int close = msg.getElementAsFloat64(CLOSE);`		
NUMBER_OF_TICKS	Int32	Counts tick number on every update until a new bar starts.
Example Syntax: `int number_of_ticks = msg.getElementAsInt32(NUMBER_OF_TICKS);`		
VOLUME	Int64	Volume increments for number of trades in each market bar and is reset at the start of each market bar.
Example Syntax: `float volume = msg.getElementAsInt64(VOLUME);`		

A.5 Schema for Market Data and Custom VWAP

A.5.1 MarketDataEvents: Choice

Events related to Market Data:

Event Name	Type	Description
MarketDataUpdatee	MarketDataUpdate	Market Data Update

A.5.2 Market Data Service Subscription Options

Argument Value	Type	Description
interval	string	Sets a defined period in seconds for which updates will be received for the subscription. The range for this argument is 0.10 to 86400.00, which is equal to 100ms to 24hours. For example setting this argument to 30 will result in the requesting application to receive updates every 30 seconds for the requested securities.
Example Syntax: `Subscription mySubscription = new Subscription(security, fields, "interval=30.0", new CorrelationID(security));`		
delayed	string	Forces the subscription to be delayed even if the requestor has real-time exchange entitlements.
Example Syntax: `Subscription mySubscription = new Subscription(security, fields, "delayed", new CorrelationID(security));`		

A.5.3 MarketDataUpdate: Sequence

Fields in subscription

Element	Type	Description
TORONTO_MOC_ELIGIBLE_REALTIME	Optional Boolean	Toronto MOC Eligible
NASDAQ_CLOSING_CROSS_ELIGIBLE_RT	Optional Boolean	Nasdaq Closing Cross Eligible
MGF_SETTING_RT	Optional Boolean	MGF Setting (Real-time)
RT_EXCH_TRADE_STATUS	Optional Boolean	Exchange Trading Status
RT_QUOTE_STATUS	Optional Boolean	Quotation Status

Element	Type	Description
IND_BID_FLAG	Optional Boolean	Indicative Bid Flag
IND_ASK_FLAG	Optional Boolean	Indicative Ask Flag
TRADING_DT_REALTIME	Optional Date	Trading Date
RT_TIME_OF_TRADE	Optional Datetime	Time Trade Occurred
CR_OBSERVATION_DATE	Optional Datetime	Current Observation Date
PRIOR_OBSERVATION_DATE	Optional Datetime	Prior Observation Date
TIME	Optional Datetime	Time of Last Update
VOLUME	Optional Int32	Volume
BID_YIELD	Optional Float32	Bid Yield
ASK_YIELD	Optional Float32	Ask Yield
RT_OPEN_INTEREST	Optional Float32	Open Interest (Real-time)
OFF_ON_EXCH_VOLUME_RT	Optional Int32	Off And On Exchange Volume (Real-time)
OFF_EXCH_VOLUME_RT	Optional Int32	Off Exchange Volume (Real-time)
PX_VOLUME_BAL_RT	Optional Int32	Volume Balance (Real-time)
OPT_DELTA_BID_RT	Optional Float32	Delta Bid (Real-time)
OPT_DELTA_ASK_RT	Optional Float32	Delta Ask (Real-time)
OPT_DELTA_MID_RT	Optional Float32	Delta Mid (Real-time)
OPT_DELTA_LAST_RT	Optional Float32	Delta Last Trade (Real-time)
OPT_GAMMA_BID_RT	Optional Float32	Gamma Bid (Real-time)
OPT_GAMMA_ASK_RT	Optional Float32	Gamma Ask (Real-time)
OPT_GAMMA_MID_RT	Optional Float32	Gamma Mid (Real-time)
OPT_GAMMA_LAST_RT	Optional Float32	Gamma Last Trade (Real-time)
OPT_VEGA_BID_RT	Optional Float32	Vega Bid (Real-time)
OPT_VEGA_ASK_RT	Optional Float32	Vega Ask (Real-time)
OPT_VEGA_MID_RT	Optional Float32	Vega Mid (Real-time)
OPT_VEGA_LAST_RT	Optional Float32	Vega Last Trade (Real-time)
OPT_IMPLIED_VOLATILITY_BID_RT	Optional Float32	Implied Volatility Bid (Real-time)
OPT_IMPLIED_VOLATILITY_ASK_RT	Optional Float32	Implied Volatility ASK (Real-time)
OPT_IMPLIED_VOLATILITY_MID_RT	Optional Float32	Implied Volatility Mid (Real-time)
OPT_IMPLIED_VOLATILITY_LAST_RT	Optional Float32	Implied Volatility Last Trade (Real-time)
EQY_SH_FOREIGN_RT	Optional Float32	Shares Available To Foreign Investors (Real-time)
LISTED_SH_RT	Optional Float32	Number Of Listed Shares (Real-time)

Element	Type	Description
BLP_SPRD_TO_BENCH_BID_RT	Optional Float32	Bloomberg Bid Spread To Benchmark (Real-time)
BLP_SPRD_TO_BENCH_ASK_RT	Optional Float32	Bloomberg Ask Spread To Benchmark (Real-time)
BLP_SPRD_TO_BENCH_MID_RT	Optional Float32	Bloomberg Mid Spread To Benchmark (Real-time)
BLP_Z_SPRD_MID_RT	Optional Float32	Bloomberg Mid Z Spread (Real-time)
BLP_ASW_SPREAD_MID_RT	Optional Float32	Bloomberg Mid ASW Spread (Real-time)
BLP_I_SPRD_MID_RT	Optional Float32	Bloomberg Mid I Spread (Real-time)
BLP_CDS_BASIS_MID_RT	Optional Float32	Bloomberg Mid CDS Basis (Real-time)
BLP_SPRD_TO_BENCH_CHG_RT	Optional Float32	Bloomberg Sprd To Bench Chg On Day (Real-time)
BLP_Z_SPRD_CHG_RT	Optional Float32	Bloomberg Z Spread Change On Day (Real-time)
BLP_ASW_SPRD_CHG_RT	Optional Float32	Bloomberg ASW Spread Change On Day (Real-time)
BLP_I_SPRD_CHG_RT	Optional Float32	Bloomberg I Spread Change On Day (Real-time)
BLP_CDS_BASIS_CHG_RT	Optional Float32	Bloomberg CDS Basis Change On Day (Real-time)
BLP_SPRD_TO_BENCH_PCT_CHG_RT	Optional Float32	Bloomberg Spd To Bench % Chg On Day (Real-time)
BLP_Z_SPRD_PCT_CHG_RT	Optional Float32	Bloomberg Z Spread % Change On Day (Real-time)
BLP_ASW_SPRD_PCT_CHG_RT	Optional Float32	Bloomberg ASW Spread % Chg On Day (Real-time)
BLP_I_SPRD_PCT_CHG_RT	Optional Float32	Bloomberg I Spread % Change On Day (Real-time)
BLP_CDS_BASIS_PCT_CHG_RT	Optional Float32	Bloomberg CDS Basis % Change On Day (Real-time)
PX_SETTLE_ACTUAL_RT	Optional Float32	Settlement Price Actual (Real-time)
ARBITRAGE_ASK_ORD_NOT_MATCHED_RT	Optional Float32	Arbitrage Ask Orders Not Matched (Real-time)
ARBITRAGE_BID_ORD_NOT_MATCHED_RT	Optional Float32	Arbitrage Bid Orders Not Matched (Real-time)
NON_ARBITRAGE_ASK_NOT_MATCHED_RT	Optional Float32	Non Arbitrage Ask Orders Not Matched (Real-time)
NON_ARBITRAGE_BID_NOT_MATCHED_RT	Optional Float32	Non Arbitrage Bid Orders Not Matched (Real-time)
ARBITRAGE_ASK_ORD_VOLUME_RT	Optional Int32	Arbitrage Ask Orders Volume (Real-time)
ARBITRAGE_BID_ORD_VOLUME_RT	Optional Int32	Arbitrage Bid Orders Volume (Real-time)

Element	Type	Description
NON_ARBIT_ASK_ORD_VOLUME_RT	Optional Int32	Non Arbitrage Ask Orders Volume (Real-time)
NON_ARBIT_BID_ORD_VOLUME_RT	Optional Int32	Non Arbitrage Bid Orders Volume (Real-time)
PRE_ANNOUNCE_NUM_PROG_ASK_RT	Optional Float32	Pre Announce Num of Program Ask Orders (Real-time)
PRE_ANNOUNCE_NUM_PROG_BID_RT	Optional Float32	Pre Announce Num of Program Bid Orders (Real-time)
TRUST_ASK_ORD_VOLUME_RT	Optional Int32	Trust Ask Orders Volume (Real-time)
PROPRIETARY_ASK_ORD_VOLUME_RT	Optional Int32	Proprietary Ask Orders Volume (Real-time)
TRUST_BID_ORD_VOLUME_RT	Optional Int32	Trust Bid Orders Volume (Real-time)
PROPRIETARY_BID_ORD_VOLUME_RT	Optional Int32	Proprietary Bid Orders Volume (Real-time)
TOTAL_VOLUME_PROGRAM_TRADE_RT	Optional Int32	Total Volume of Program Trading (Real-time)
PX_INDICATIVE_BID_SIZE_RT	Optional Int32	Indicative Bid Price Size (Real-time)
PX_INDICATIVE_ASK_SIZE_RT	Optional Int32	Indicative Ask Price Size (Real-time)
NUM_TRADES_RT	Optional Int32	Number Of Trades
MGF_VOLUME_RT	Optional Int32	MGF Volume (Real-time)
NUM_TRADES_OPENING_AUCTION_RT	Optional Int32	Number Of Trades In Opening Auction (Real-time)
NUM_TRADES_CLOSING_AUCTION_RT	Optional Int32	Number Of Trades In Closing Auction (Real-time)
ALL_PRICE_SIZE	Optional Int32	All Price Size
RT_NYSE_LIQUIDITY_BID_SIZE	Optional Int32	NYSE Liquidity Quote Bid Size
RT_NYSE_LIQUIDITY_ASK_SIZE	Optional Int32	NYSE Liquidity Quote Ask Size
VOLUME_THEO	Optional Int32	Theoretical Volume
SIZE_LAST_AT_TRADE	Optional Int32	Size of Last AT Trade
SIZE_LAST_AT_TRADE_TDY	Optional Int32	Size of Today's Last AT Trade
OPEN_YLD	Optional Float32	Open Yield
OPEN_YLD_TDY	Optional Float32	Today's Open Yield
HIGH_YLD	Optional Float32	High Yield
HIGH_YLD_TDY	Optional Float32	Today's High Yield
LOW_YLD	Optional Float32	Low Yield
LOW_YLD_TDY	Optional Float32	Today's Low Yield
LAST_YLD	Optional Float32	Last Yield
LAST_YLD_TDY	Optional Float32	Today's Last Yield
SIZE_LAST_TRADE_TDY	Optional Int32	Size of Today's Last Trade

Element	Type	Description
LAST2_YLD	Optional Float32	Last 2 Yield
LAST_DIR_YLD	Optional Int32	Last Yield Direction
LAST2_DIR_YLD	Optional Int32	Second Last Yield Direction
PREV_SES_LAST_YLD	Optional Float32	Previous Session Last Yield
BID2_YLD	Optional Float32	Bid 2 Yield
ASK2_YLD	Optional Float32	Ask 2 Yield
BID_DIR_YLD	Optional Int32	Bid Yield Direction
ASK_DIR_YLD	Optional Int32	Ask Yield Direction
MID_DIR	Optional Int32	Mid Direction
MID2_DIR	Optional Int32	Second Mid Direction
RT_PX_CHG_PCT_1D	Optional Float32	Real-Time Price Change 1 Day Percent
RT_YLD_CHG_NET_1D	Optional Float32	Real-Time Yield Change 1 Day Net
RT_YLD_CHG_PCT_1D	Optional Float32	Real-Time Yield Change 1 Day Percent
ASK_SIZE_TDY	Optional Int32	Today's Ask Size
BID_SIZE_TDY	Optional Int32	Today's Bid Size
VOLUME_TDY	Optional Int32	Today's Volume
BID_YLD_TDY	Optional Float32	Today's Bid Yield
ASK_YLD_TDY	Optional Float32	Today's Ask Yield
UP_LIMIT	Optional Float32	Up Limit
DOWN_LIMIT	Optional Float32	Down Limit
LAST_DIR	Optional Int32	Last Direction
LAST2_DIR	Optional Int32	Second Last Direction
BID_DIR	Optional Int32	Bid Direction
ASK_DIR	Optional Int32	Ask Direction
SIZE_LAST_TRADE	Optional Int32	Size of Last Trade
ASK_SIZE	Optional Int32	Ask Size
BID_SIZE	Optional Int32	Bid Size
LAST_PRICE	Optional Float64	Last Price
BID	Optional Float64	Bid Price
ASK	Optional Float64	Ask Price
HIGH	Optional Float64	High Price
LOW	Optional Float64	Low Price
BEST_BID	Optional Float64	Best Bid
BEST_ASK	Optional Float64	Best Ask
MID	Optional Float64	Mid Price
LAST_TRADE	Optional Float64	Last Trade
OPEN	Optional Float64	Open Price

Element	Type	Description
PREV_SES_LAST_PRICE	Optional Float64	Previous Session Last Price
EXCH_VWAP	Optional Float64	Exchange VWAP
NASDAQ_OPEN	Optional Float64	NASDAQ Official Open Price
NASDAQ_FIRST_TRADE	Optional Float64	NASDAQ First Actual Trade
NASDAQ_PREV_BID	Optional Float64	NASDAQ Prevailing Bid Price
NASDAQ_PREV_ASK	Optional Float64	NASDAQ Prevailing Ask Price
INDICATIVE_FAR	Optional Float64	Far Indicative Price
INDICATIVE_NEAR	Optional Float64	Near Indicative Price
IMBALANCE_BID	Optional Float64	Net Order Imbalance Bid Price
IMBALANCE_ASK	Optional Float64	Net Order Imbalance Ask Price
ORDER_IMB_BUY_VOLUME	Optional Int32	Net Order Imbalance Bid Volume
ORDER_IMB_SELL_VOLUME	Optional Int32	Net Order Imbalance Ask Volume
VWAP	Optional Float64	Eqty intraday VWAP
FIXING_RATE_REALTIME	Optional Float64	Fixing Rate
HIGH_TEMP_REALTIME	Optional Float64	High Temperature
LOW_TEMP_REALTIME	Optional Float64	Low Temperature
MEAN_TEMP_REALTIME	Optional Float64	Mean Temperature
HEATING_DAYS_REALTIME	Optional Float64	Heating Degree Days
COOLING_DAYS_REALTIME	Optional Float64	Cooling Degree Days
REL_HUMIDITY_REALTIME	Optional Float64	Relative Humidity
WIND_SPEED_REALTIME	Optional Float64	Wind Speed
WEATHER_CODE_REALTIME	Optional Float64	Weather Condition Code
PRECIPITATION_REALTIME	Optional Float64	Precipitation
MARKET_DEFINED_VWAP_REALTIME	Optional Float64	Market Defined VWAP (Real-time)
MIN_LIMIT	Optional Float64	Minimum Limit Price
MAX_LIMIT	Optional Float64	Maximum Limit Price
THEO_PRICE	Optional Float64	Theoretical Price
MIN_LIMIT_OUT_OF_SESSION	Optional Float64	Minimum Limit Price Out Of Session
MAX_LIMIT_OUT_OF_SESSION	Optional Float64	Maximum Limit Price Out Of Session
BID_WEIGHTED_AVG_SPREAD	Optional Float64	Bid Weighted Average Spread
ASK_WEIGHTED_AVG_SPREAD	Optional Float64	Ask Weighted Average Spread
RT_NYSE_LIQUIDITY_PX_BID	Optional Float64	NYSE Liquidity Quote Bid Price
RT_NYSE_LIQUIDITY_PX_ASK	Optional Float64	NYSE Liquidity Quote Ask Price
INDICATIVE_BID	Optional Float64	Indicative Bid Price
INDICATIVE_ASK	Optional Float64	Indicative Ask Price
PX_EVAL_JAPANESE_REALTIME	Optional Float64	Japanese Evaluation Price
LAST_ALL_SESSIONS	Optional Float64	Last Price All Sessions

Bloomberg

Element	Type	Description
PX_NASDAQ_VWOP_REALTIME	Optional Float64	NASDAQ VWOP Price
BLP_I_SPRD_LAST_RT	Optional Float64	Bloomberg Last I Spread (Real-time)
PREV_CLOSE_VALUE_REALTIME	Optional Float64	Previous Closing Value
BID_ALL_SESSION	Optional Float64	Bid Price All Session
ASK_ALL_SESSION	Optional Float64	Ask Price All Session
EBS_TOUCH_HIGH_REALTIME	Optional Float64	EBS Touch High
EBS_TOUCH_LOW_REALTIME	Optional Float64	EBS Touch Low
PX_PREV_TO_LAST_REALTIME	Optional Float64	Previous-To-Last Price
PX_TARGIN_SERVICE_REALTIME	Optional Float64	TARGIN Service Price (Real-time)
PX_TARGIN_OFFCIAL_REALTIME	Optional Float64	TARGIN Official Price (Real-time)
FOREIGN_HOLDING_PCT_RT	Optional Float64	Percentage Of Foreign Holding (Real-time)
OWNERSHIP_LIMIT_RATIO_RT	Optional Float64	Ownership Limit Ratio (Real-time)
RT_EVAL_JAPANESE_CHG_ON_DAY	Optional Float64	Japanese Evaluation Price Change On Day (Real-time)
RT_EVAL_JAPANESE_PCT_CHG_ON_DAY	Optional Float64	Japanese Eval Price Pct Change On Day (Real-time)
BLP_Z_SPRD_LAST_RT	Optional Float64	Bloomberg Last Z Spread (Real-time)
BLP_ASW_SPREAD_LAST_RT	Optional Float64	Bloomberg Last ASW Spread (Real-time)
BLP_RT_SPRD_TO_BENCH_LAST_RT	Optional Float64	Bloomberg Last Spread to Benchmark (Real-time)
TRUST_ASK_ORD_VALUE_RT	Optional Float64	Trust Ask Orders Value (Real-time)
PROPRIETARY_ASK_ORD_VALUE_RT	Optional Float64	Proprietary Ask Orders Value (Real-time)
TRUST_BID_ORD_VALUE_RT	Optional Float64	Trust Bid Orders Value (Real-time)
PROPRIETARY_BID_ORD_VALUE_RT	Optional Float64	Proprietary Bid Orders Value (Real-time)
TOTAL_VALUE_PROGRAM_TRADE_RT	Optional Float64	Total Value of Program Trading (Real-time)
PX_OFFICIAL_AUCTION_RT	Optional Float64	Official Auction Price (Real-time)
NYSE_LRP_HIGH_PRICE_RT	Optional Float64	NYSE LRP High Price (Real-time)
NYSE_LRP_LOW_PRICE_RT	Optional Float64	NYSE LRP Low Price (Real-time)
ALL_PRICE	Optional Float64	All Price
BEST_BID1	Optional Float64	Best Bid 1
BEST_BID2	Optional Float64	Best Bid 2
BEST_BID3	Optional Float64	Best Bid 3
BEST_BID4	Optional Float64	Best Bid 4
BEST_BID5	Optional Float64	Best Bid 5
BEST_ASK1	Optional Float64	Best Ask 1
BEST_ASK2	Optional Float64	Best Ask 2

Element	Type	Description
BEST_ASK3	Optional Float64	Best Ask 3
BEST_ASK4	Optional Float64	Best Ask 4
BEST_ASK5	Optional Float64	Best Ask 5
BEST_BID1_SZ	Optional Int32	Best Bid 1 Size
BEST_BID2_SZ	Optional Int32	Best Bid 2 Size
BEST_BID3_SZ	Optional Int32	Best Bid 3 Size
BEST_BID4_SZ	Optional Int32	Best Bid 4 Size
BEST_BID5_SZ	Optional Int32	Best Bid 5 Size
BEST_ASK1_SZ	Optional Int32	Best Ask 1 Size
BEST_ASK2_SZ	Optional Int32	Best Ask 2 Size
BEST_ASK3_SZ	Optional Int32	Best Ask 3 Size
BEST_ASK4_SZ	Optional Int32	Best Ask 4 Size
BEST_ASK5_SZ	Optional Int32	Best Ask 5 Size
LAST_AT_TRADE	Optional Float64	Last AT Trade
LAST2_AT_TRADE	Optional Float64	Last 2 AT Trade
LAST_AT_TRADE_TDY	Optional Float64	Today's Last AT Trade
MID_TDY	Optional Float64	Today's Mid Price
MID2	Optional Float64	Mid 2 Price
RT_PX_CHG_NET_1D	Optional Float64	Real-Time Price Change 1 Day Net
OPEN_TDY	Optional Float64	Today's Open Price
LAST_PRICE_TDY	Optional Float64	Today's Last Price
BID_TDY	Optional Float64	Today's Bid Price
ASK_TDY	Optional Float64	Today's Ask Price
HIGH_TDY	Optional Float64	Today's High Price
LOW_TDY	Optional Float64	Today's Low Price
LAST2_PRICE	Optional Float64	Last 2 Price
BID2	Optional Float64	Bid 2 Price
ASK2	Optional Float64	Ask 2 Price
RT_EXCH_MARKET_STATUS	Optional String	Exchange Market Status
RT_TRADING_PERIOD	Optional String	Trading Period
BID_BROKER_CODE	Optional String	Bid Broker Code
ASK_BROKER_CODE	Optional String	Ask Broker Code
IMBALANCE_INDIC_RT	Optional String	Imbalance Indicator
BLP_SPREAD_BENCHMARK_NAME_RT	Optional String	Bloomberg Spread Benchmark Name (Real-time)
BLP_SWAP_CURVE_NAME_RT	Optional String	Bloomberg Swap Curve Name (Real-time)

Element	Type	Description
FINANCIAL_STATUS_INDICATOR_RT	Optional String	Financial Status Indicator (Real-time)
BID_YLD_COND_CODE	Optional String	Bid Yield Condition Code
YLD_COND_CODE	Optional String	Yield Condition Code
ASK_YLD_COND_CODE	Optional String	Ask Yield Condition Code
ALL_PRICE_COND_CODE	Optional String	
BID_COND_CODE	Optional String	Bid Condition Codes
ASK_COND_CODE	Optional String	Ask Condition Codes
RT_SIMP_SEC_STATUS	Optional String	Simplified Security Status
RT_PRICING_SOURCE	Optional String	Real-Time Pricing Source
NYSE_LRP_SEND_TIME_RT	Optional Time	NYSE LRP Send Time (Real-time)
BID_ASK_TIME	Optional Time	Time of Last Bid/Ask Update
SES_START	Optional Time	Session Start
SES_END	Optional Time	Session End
TRADE_SPREAD_TIME	Optional Time	Time of TRADE_SPREAD tick
NEWS_STORY_TIME	Optional Time	Time of NEWS_STORY tick
BID_TIME	Optional Time	Time of BID tick
BID_BEST_TIME	Optional Time	Time of BID_BEST tick
VOLUME_UPDATE_TIME	Optional Time	Time of VOLUME_UPDATE tick
MARKET_DEPTH_TIME	Optional Time	Time of MARKET_DEPTH tick
CANCEL_CORRECT_TIME	Optional Time	Time of CANCEL_CORRECT tick
MIN_LIMIT_OUT_OF_SESSION_TIME	Optional Time	Time of MIN_LIMIT_OUT_OF_SESSION tick
BID_SPREAD_TIME	Optional Time	Time of BID_SPREAD tick
BT_MKT_TURN_TIME	Optional Time	Time of BT_MKT_TURN tick
HIGH_TIME	Optional Time	Time of HIGH tick
BT_LSE_LAST_TIME	Optional Time	Time of BT_LSE_LAST tick
AT_TRADE_TIME	Optional Time	Time of AT_TRADE tick
ASK_YEILD_TIME	Optional Time	Time of ASK_YEILD tick
PRICE_UPDATE_TIME	Optional Time	Time of PRICE_UPDATE tick
OPEN_INTEREST_TIME	Optional Time	Time of OPEN_INTEREST tick
VOLUME_TIME	Optional Time	Time of VOLUME tick
EVAL_JAPANESE_TIME	Optional Time	Time of EVAL_JAPANESE tick
ASK_WEIGHTED_AVG_SPREAD_TIME	Optional Time	Time of ASK_WEIGHTED_AVG_SPREAD tick
THEO_PRICE_TIME	Optional Time	Time of THEO_PRICE tick
BUY_SELL_INFO_TIME	Optional Time	Time of BUY_SELL_INFO tick
SETS_MID_PRICE_TIME	Optional Time	Time of SETS_MID_PRICE tick

Element	Type	Description
TAKE_TIME	Optional Time	Time of TAKE tick
TICK_NUM_TIME	Optional Time	Time of TICK_NUM tick
SMART_TIME	Optional Time	Time of SMART tick
INDICATIVE_ASK_TIME	Optional Time	Time of INDICATIVE_ASK tick
BT_SEC_ASK_TIME	Optional Time	Time of BT_SEC_ASK tick
LOW_TIME	Optional Time	Time of LOW tick
BT_SEC_BID_TIME	Optional Time	Time of BT_SEC_BID tick
LOW_YIELD_TIME	Optional Time	Time of LOW_YIELD tick
MAX_LIMIT_TIME	Optional Time	Time of MAX_LIMIT tick
TRADING_PERIOD_TIME	Optional Time	Time of TRADING_PERIOD tick
INDICATIVE_BID_TIME	Optional Time	Time of INDICATIVE_BID tick
API_INTERNAL_TIME	Optional Time	Time of API_INTERNAL tick
ASK_LIFT_TIME	Optional Time	Time of ASK_LIFT tick
NYSE_LIQUIDITY_ASK_TIME	Optional Time	Time of NYSE_LIQUIDITY_ASK tick
BID_YEILD_TIME	Optional Time	Time of BID_YEILD tick
ASK_BEST_TIME	Optional Time	Time of ASK_BEST tick
MKT_INDICATOR_TIME	Optional Time	Time of MKT_INDICATOR tick
NYSE_LIQUIDITY_BID_TIME	Optional Time	Time of NYSE_LIQUIDITY_BID tick
SMART_QUOTE_TIME	Optional Time	Time of SMART_QUOTE tick
NEW_MKT_DAY_TIME	Optional Time	Time of NEW_MKT_DAY tick
MAN_TRADE_WITH_SIZE_TIME	Optional Time	Time of MAN_TRADE_WITH_SIZE tick
BT_ASK_RECAP_TIME	Optional Time	Time of BT_ASK_RECAP tick
BT_MID_PRICE_TIME	Optional Time	Time of BT_MID_PRICE tick
BID_MKT_MAKER_TIME	Optional Time	Time of BID_MKT_MAKER tick
SETTLE_TIME	Optional Time	Time of SETTLE tick
HIT_TIME	Optional Time	Time of HIT tick
BT_LAST_RECAP_TIME	Optional Time	Time of BT_LAST_RECAP tick
LAST_TRADE_TIME	Optional Time	Time of LAST_TRADE
PRE_POST_MARKET_TIME	Optional Time	Time of PRE_POST_MARKET tick
ALL_PRICE_TIME	Optional Time	Time of ALL_PRICE tick
OPEN_TIME	Optional Time	Time of OPEN tick
HIGH_YIELD_TIME	Optional Time	Time of HIGH_YIELD tick
ASK_MKT_MAKER_TIME	Optional Time	Time of ASK_MKT_MAKER tick
MAX_LIMIT_OUT_OF_SESSION_TIME	Optional Time	Time of MAX_LIMIT_OUT_OF_SESSION tick
SMARTMAX_TIME	Optional Time	Time of SMARTMAX tick
YIELD_TIME	Optional Time	Time of YIELD tick

Element	Type	Description
VWAP_TIME	Optional Time	Time of VWAP tick
BID_WEIGHTED_AVG_SPREAD_TIME	Optional Time	Time of BID_WEIGHTED_AVG_SPREAD tick
ASK_TIME	Optional Time	Time of ASK tick
MIN_LIMIT_TIME	Optional Time	Time of MIN_LIMIT tick
ASK_SPREAD_TIME	Optional Time	Time of ASK_SPREAD tick
SETTLE_YIELD_TIME	Optional Time	Time of SETTLE_YIELD tick
BID_LIFT_TIME	Optional Time	Time of BID_LIFT tick
BT_BID_RECAP_TIME	Optional Time	Time of BT_BID_RECAP tick

A.5.4 Market VWAP Service Subscription Options

Argument Value	Type	Description
VWAP_START_TIME	string	Start trade time in the format, HH:MM. HH is in 24-hr format. Only trades at this or past this time are considered for VWAP computation. Specified in **TZDF<GO>** timing for Desktop API and UTC for Server API.

Example Syntax:
`Subscription mySubscription = new Subscription( topic + security,`
`fields, "&VWAP_START_TIME=11:00",`
`new CorrelationID(security) );`		

VWAP_END_TIME	string	End trade time in the format, HH:MM. HH is in 24-hr format. Only trades at this or before this time are considered for VWAP computation. Specified in **TZDF<GO>** timing for Desktop API and UTC for Server API.

Example Syntax:
`Subscription mySubscription = new Subscription( topic + security,`
`fields, "&VWAP_END_TIME=12:00",`
`new CorrelationID(security) );`		

VWAP_MIN_SIZE	string	Minimum trade volume for a trade to be included in VWAP computation. Values are taken as signed integers.

Example Syntax:
`Subscription mySubscription = new Subscription( topic + security,`
`fields, "&VWAP_MIN_SIZE=1000",`
`new CorrelationID(security) );`		

VWAP_MAX_SIZE	string	Maximum trade volume for a trade to be included in VWAP computation. Values are taken as signed integers.

Example Syntax:
`Subscription mySubscription = new Subscription( topic + security,`
`fields, "&VWAP_MAX_SIZE=2000",`
`new CorrelationID(security) );`		

VWAP_MIN_PX	string	Minimum trade price for a trade to be included in VWAP computation. Values are taken as floats.

Example Syntax:
`Subscription mySubscription = new Subscription( topic + security,`
`fields, "&VWAP_MIN_PX=23.5",`
`new CorrelationID(security) );`		

VWAP_MAX_PX	string	Maximum trade price for a trade to be included in VWAP computation. Values are taken as floats.

Example Syntax:
`Subscription mySubscription = new Subscription( topic + security,`
`fields, "&VWAP_MAX_PX=25.5",`
`new CorrelationID(security) );`		

Bloomberg

A.6 Schema for API Authorization

Element	Description
AuthorizationRequest	Requests Bloomberg to check if a given Bloomberg Anywhere user is logged into the BLOOMBERG PROFESSIONAL service at a specified location.
UserAsidEquivalenceRequest	*Deprecated.* Compares the exchanges entitlements of a given user to the exchange entitlements of the ServerAPI.
LogonStatusRequest	Requests a user's logon status for their Bloomberg Anywhere.
UserEntitlementsRequest	Requests a list of the user's exchange entitlements
SecurityEntitlementsRequest	Requests a list of a specific security's exchange entitlements
SecurityEntitlementsByUserRequest	*Deprecated.* Requests a list of exchange entitlements for a security by user.
TokenRequest	*Deprecated.* Requests a token.

A.6.1 Authorization Request

Bloomberg UUID: the Bloomberg unique user identifier

Element	Element Value	Type	Description
uuid		integer	The Bloomberg unique user identifier

Example Syntax:
```
Request request = authSvc.CreateAuthorizationRequest();
request.Set("uuid", 11223344);
```

IP Address: Location of where the user is viewing the ServerAPI data

Element	Element Value	Type	Description
ipAddress		string	

Example Syntax:
```
Request authRequest = d_apiAuthSvc.CreateAuthorizationRequest();
authRequest.Set("ipAddress", "111.22.33.44");
```

Require ASID equivalence: *Deprecated.* Sets a flag to check the user has a superset of entitlements compared to the ServerAPI. Used for the All-or-None model of permissioning.

Element	Element Value	Type	Description
requireAsidEquivalence	TRUE or FALSE	Boolean	When set to 'true', the AuthorizationRequest will succeed only if the users permission are equal to or greater than that of the Server API.

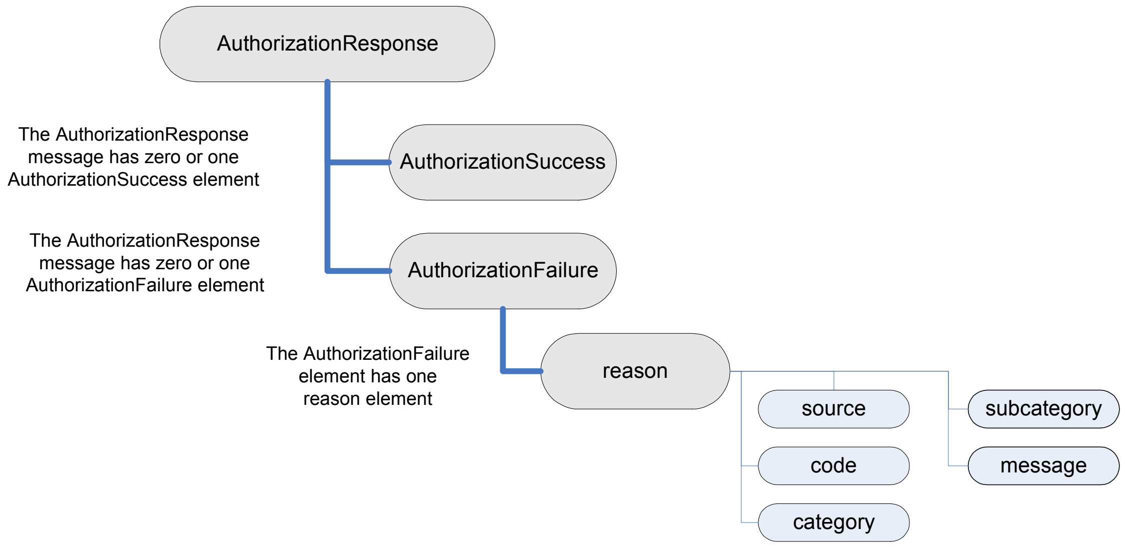
Example Syntax: request.Set("requireAsidEquivalence", true);

Token: *Deprecated.* Authorizes the user with the token based approach.

Element	Element Value	Type	Description
token			Token returned by TokenRequest for a user. (Optional. Either ipAddress or token must be supplied.)

A.6.2 Authorization Request Response

See “Field Service Response Elements” on page 165 and “Field Service Response Elements” on page 165.


AuthorizationResponse
The AuthorizationResponse message has zero or one AuthorizationSuccess element
AuthorizationSuccess
The AuthorizationResponse message has zero or one AuthorizationFailure element
AuthorizationFailure
The AuthorizationFailure element has one reason element
reason
source
code
category
subcategory
message

A.6.3 Logon Status Request

Bloomberg UUID: the Bloomberg unique user identifier			
Element	**Element Value**	**Type**	**Description**
uuid		integer	The Bloomberg Unique User Identifier (UUID)
sid			Deprecated. do not use
sidInstance			Deprecated. do not use
terminalSid			Deprecated. do not use
terminalSidInstance			Deprecated. do not use.

Example Syntax:

```
  Request request = authSvc.CreateRequest("LogonStatusRequest");
  Element userinfo = request.GetElement("userInfo");
  userinfo.SetElement("uuid", 11223344);
```

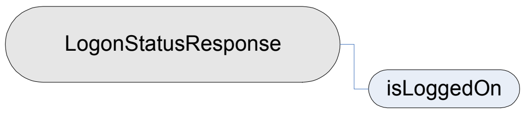
IP Address: The location where the user is viewing API data			
Element	**Element Value**	**Type**	**Description**
ipAddress		string	The location where the user is viewing API data

Example Syntax:

```
 Request logonStatusRequest = authSvc.CreateRequest("LogonStatusRequest");
 logonStatusRequest.Set("ipAddress", "111.22.33.44");
```

A.6.4 Logon Status Request Response

See “Field Service Response Elements” on page 165 and “Field Service Response Elements” on page 165.



A.6.5 User Entitlements Request

Bloomberg UUID: the Bloomberg unique user identifier

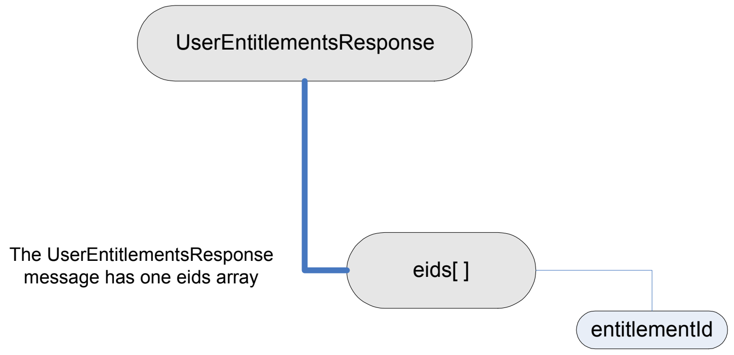
Element	Element Value	Type	Description
uuid		integer	The Bloomberg Unique User Identifier (UUID)
sid			*Deprecated*. do not use
sidInstance			*Deprecated*. do not use
terminalSid			*Deprecated*. do not use
terminalSidInstance			*Deprecated*. do not use.

Example Syntax:

```
Request request = authSvc.CreateRequest("UserEntitlementsRequest");
Element userinfo = request.GetElement("userInfo");
userinfo.SetElement("uuid", 11223344);
```

A.6.6 User Entitlements Request Response

See “Field Service Response Elements” on page 165 and “Field Service Response Elements” on page 165.



A.6.7 Security Entitlements Request

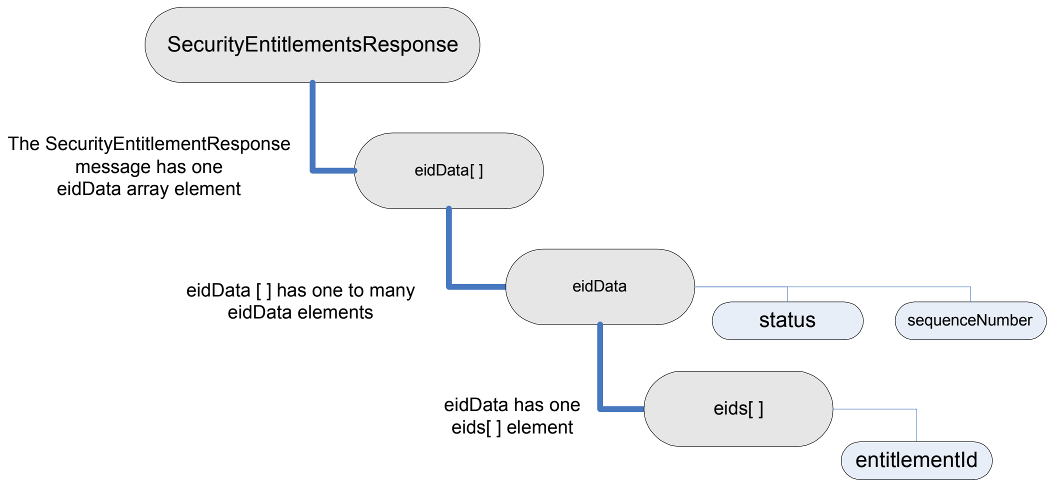
Securities: the reference or streaming fields desired.			
Element	**Element Value**	**Type**	**Description**
securities		string	Element holding the list of securities to retrieve exchange entitlements.

Example Syntax:

```
Request request = authSvc.CreateRequest("SecurityEntitlementsRequest");
Element securities = request.GetElement("securities");
securities.AppendValue("IBM US Equity");
```

A.6.8 Security Entitlements Request Response

See “Field Service Response Elements” on page 165 and “Field Service Response Elements” on page 165.


SecurityEntitlementsResponse
The SecurityEntitlementResponse message has one eidData array element
eidData[ ]
eidData [ ] has one to many eidData elements
eidData
status
sequenceNumber
eidData has one eids[ ] element
eids[ ]
entitlementId

A.6.9 Authorization Token Request

Identifier: The Bloomberg Unique User Identifier.			
Element	**Element Value**	**Type**	**Description**
uuid		integer	The Bloomberg Unique User Identifier (UUID)

Example Syntax:

```
Request request = authSvc.CreateRequest("AuthorizationTokenRequest");
request.Set("uuid", 11223344);
```

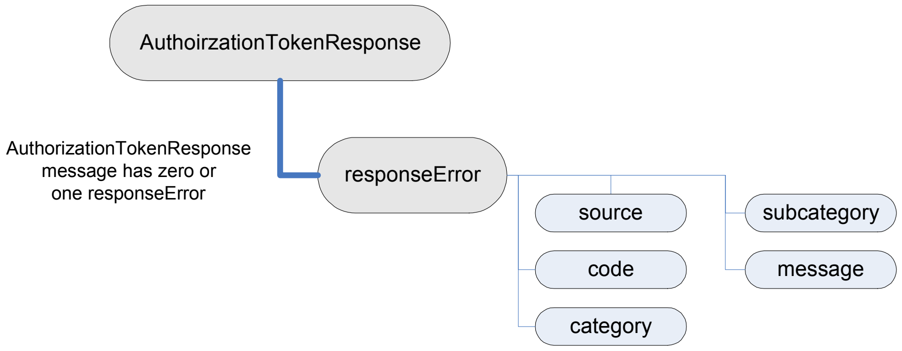
Label: A label that identifies which Server API application is requesting the token.			
Element	**Element Value**	**Type**	**Description**
label		string	String identifier for the requesting ServerAPI application

Example Syntax:

```
Request request = authSvc.CreateRequest("AuthorizationTokenRequest");
request.Set("label", "myApp");
```

A.6.10 Authorization Token Request Response

See “Field Service Response Elements” on page 165 and “Field Service Response Elements” on page 165.


AuthoirzationTokenResponse
AuthorizationTokenResponse message has zero or one responseError
responseError
source
code
category
subcategory
message

A.6.11 Field Service Response Elements

Element	Description
AuthorizationSuccess	Returned for an authorization request when the UUID provided is logged into the Bloomberg Anywhere at the specified IP address.
AuthorizationFailure	Returned for an authorization request on failure. It is an errorInfo element.
reason	An AuthorizationFailure message will contain one "reason" element
responseError	Returned when a request cannot be completed for any reason. It is an errorInfo element.
errorInfo	Contains values about the error which has occurred, including the source, code, category, message, and subcategory.
eidData[ ]	Contains a list of eidData elements, each associated to a security requested.
eidData[ ]::eidData	Contains status, sequence number and list of entitlement identifiers.
eids[ ]	Contains a list of entitlementId values associated to the user.

A.6.12 Field Service Request Values

Element	Type	Description
Source	String	Bloomberg internal error source information.
Code	Integer	Bloomberg internal error code.
Category	String	Bloomberg error classification. Used to determine the general classification of the failure.
message	String	Human readable description of the failure.
subcategory	String	Bloomberg sub-error classification. Used to determine the specific classification of the failure.
entitlementId	Integer	Entitlement identifier (EID)
status	Integer	Status where success = 0. Any other code indicates failure.
sequenceNumber	Integer	Security sequence number, specifying the position of the security in the request.
isLoggedOn	Boolean	Returns true when the UUID specified in logged into the BLOOMBERG PROFESSIONAL service at the specified IP address.

B Java Examples

This section contains the following code examples and sample output from each example:

Bloomberg

B.1 Request Response Paradigm

```
/ RequestResponseParadigm.java

package BloombergLP;

import com.bloomberglp.blpapi.CorrelationID;
import com.bloomberglp.blpapi.Event;
import com.bloomberglp.blpapi.Message;
import com.bloomberglp.blpapi.MessageIterator;
import com.bloomberglp.blpapi.Request;
import com.bloomberglp.blpapi.Service;
import com.bloomberglp.blpapi.Session;
import com.bloomberglp.blpapi.SessionOptions;

public class RequestResponseParadigm {

   public static void main(String[] args) throws Exception {
      SessionOptions sessionOptions = new SessionOptions();
      sessionOptions.setServerHost("localhost");
      sessionOptions.setServerPort(8194);
      Session session = new Session(sessionOptions);
      if (!session.start()) {
         System.out.println("Could not start session.");
         System.exit(1);
      }
      if (!session.openService("//blp/refdata")) {
         System.out.println("Could not open service " +
                            "//blp/refdata");
         System.exit(1);
      }
      CorrelationID requestID  = new CorrelationID(1);
      Service       refDataSvc = session.getService("//blp/refdata");
      Request       request    =
                    refDataSvc.createRequest("ReferenceDataRequest");
      request.append("securities", "IBM US Equity");
      request.append("fields", "PX_LAST");
      session.sendRequest(request, requestID);
```

```
        boolean continueToLoop = true;
        while (continueToLoop) {
            Event event = session.nextEvent();
            switch (event.eventType().intValue()) {
            case Event.EventType.Constants.RESPONSE: // final event
               continueToLoop = false;                // fall through
            case Event.EventType.Constants.PARTIAL_RESPONSE:
               handleResponseEvent(event);
               break;
            default:
                  handleOtherEvent(event);
               break;
            }
         }
      }

      private static void handleResponseEvent(Event event) throws Exception {
         System.out.println("EventType =" + event.eventType());
         MessageIterator iter = event.messageIterator();
         while (iter.hasNext()) {
            Message message = iter.next();
            System.out.println("correlationID=" +
                               message.correlationID());
            System.out.println("messageType  =" +
                               message.messageType());
            message.print(System.out);
            }
      }

      private static void handleOtherEvent(Event event) throws Exception
      {
         System.out.println("EventType=" + event.eventType());
         MessageIterator iter = event.messageIterator();
         while (iter.hasNext()) {
            Message message = iter.next();
            System.out.println("correlationID=" +
                               message.correlationID());
            System.out.println("messageType=" + message.messageType());
            message.print(System.out);
            if (Event.EventType.Constants.SESSION_STATUS ==
                event.eventType().intValue()
            &&  "SessionTerminated" ==
                message.messageType().toString()){
               System.out.println("Terminating: " +
                                  message.messageType());
               System.exit(1);
            }
         }
      }
   }
```

B.1.1 Request Response Paradigm Output

```
EventType=SESSION_STATUS
correlationID=null
messageType=SessionStarted
SessionStarted = {
}
EventType=SERVICE_STATUS
correlationID=Internal: 1
messageType=ServiceOpened
ServiceOpened = {
}
EventType =RESPONSE
correlationID=User: 1
messageType  =ReferenceDataResponse
ReferenceDataResponse (choice) = {
    securityData[] = {
        securityData = {
            security = IBM US Equity
            sequenceNumber = 0
            fieldData = {
                PX_LAST = 92.51
            }
        }
    }
}
```

B.2 Subscription Paradigm

```
// SubscriptionParadigm.java

package BloombergLP;

import com.bloomberglp.blpapi.CorrelationID;
import com.bloomberglp.blpapi.Event;
import com.bloomberglp.blpapi.Message;
import com.bloomberglp.blpapi.MessageIterator;
import com.bloomberglp.blpapi.Session;
import com.bloomberglp.blpapi.SessionOptions;
import com.bloomberglp.blpapi.Subscription;
import com.bloomberglp.blpapi.SubscriptionList;

public class SubscriptionParadigm {

   public static void main(String[] args) throws Exception {
      SessionOptions sessionOptions = new SessionOptions();
      sessionOptions.setServerHost("localhost");
      sessionOptions.setServerPort(8194);
      Session session = new Session(sessionOptions);
      if (!session.start()) {
         System.out.println("Could not start session.");
         System.exit(1);
      }
      if (!session.openService("//blp/mktdata")) {
         System.err.println("Could not start session.");
         System.exit(1);
      }

      CorrelationID    subscriptionID = new CorrelationID(2);
      SubscriptionList subscriptions  = new SubscriptionList();
      subscriptions.add(new Subscription("AAPL US Equity",
                                         "LAST_PRICE",
                                         subscriptionID));
      session.subscribe(subscriptions);
```

```
         int updateCount = 0;
         while (true) {
            Event event = session.nextEvent();
            switch (event.eventType().intValue()) {
            case Event.EventType.Constants.SUBSCRIPTION_DATA:
               handleDataEvent(event, updateCount++);
               break;
            default:
               handleOtherEvent(event);
                break;
            }
         }
      }

      private static void handleDataEvent(Event event, int updateCount)
                                                     throws Exception {
         System.out.println("EventType=" + event.eventType());
         System.out.println("updateCount = " + updateCount);
         MessageIterator iter = event.messageIterator();
         while (iter.hasNext()) {
            Message message = iter.next();
            System.out.println("correlationID = " +
                                  message.correlationID());
            System.out.println("messageType   = " +
                                  message.messageType());
            message.print(System.out);
         }
      }

      private static void handleOtherEvent(Event event) throws Exception
      {
         System.out.println("EventType=" + event.eventType());
         MessageIterator iter = event.messageIterator();
         while (iter.hasNext()) {
            Message message = iter.next();
            System.out.println("correlationID=" +
                                  message.correlationID());
            System.out.println("messageType=" + message.messageType());
            message.print(System.out);
            if (Event.EventType.Constants.SESSION_STATUS ==
                event.eventType().intValue()
            &&  "SessionTerminated" ==
                message.messageType().toString()){
               System.out.println("Terminating: " +
                                     message.messageType());
               System.exit(1);
            }
         }
      }
   }
```

Subscription Paradigm Output

```
EventType=SESSION_STATUS
correlationID=null
messageType=SessionStarted
SessionStarted = {
}
EventType=SERVICE_STATUS
correlationID=Internal: 1
messageType=ServiceOpened
ServiceOpened = {
}
EventType=SUBSCRIPTION_STATUS
correlationID=User: 2
messageType=SubscriptionStarted
SubscriptionStarted = {
}
EventType=SUBSCRIPTION_DATA
updateCount = 0
correlationID = User: 2
messageType   = MarketDataEvents
MarketDataEvents = {
    LAST_PRICE = 93.0
    BID = 92.92
    ASK = 92.95
    VOLUME = 21168694
    HIGH = 94.34
    LOW = 92.6
    RT_OPEN_INTEREST = 31212534
    BEST_BID = 92.92
    BEST_ASK = 92.95
    LAST_TRADE = 93.0
    OPEN = 93.09
    PREV_SES_LAST_PRICE = 94.2
    VWAP = 93.3075
    TRADING_DT_REALTIME = 2009-01-29+00:00
    EQY_TURNOVER_REALTIME = 1.98702464E9
    RT_API_MACHINE = n119
    SES_START = 14:30:00.000+00:00
    SES_END = 21:30:00.000+00:00
    RT_PX_CHG_NET_1D = -1.2
    RT_PX_CHG_PCT_1D = -1.27389
    IND_BID_FLAG = false
    IND_ASK_FLAG = false
    OPEN_TDY = 93.09
    ASK_SIZE_TDY = 1
    BID_SIZE_TDY = 1
    VOLUME_TDY = 21168694
```

```
        LAST_PRICE_TDY = 93.0
        BID_TDY = 92.92
        ASK_TDY = 92.95
        HIGH_TDY = 94.34
        LOW_TDY = 92.6
        RT_PRICING_SOURCE = US
        ASK_SIZE = 1
        BID_SIZE = 1
        TIME = 22:20:00.000+00:00
        API_MACHINE = n119
        EXCH_CODE_LAST = D
        EXCH_CODE_BID = Q
        EXCH_CODE_ASK = O
        EID = 14005
        IS_DELAYED_STREAM = false
    }
    EventType=SUBSCRIPTION_DATA
    updateCount = 1
    correlationID = User: 2
    messageType   = MarketDataEvents
    MarketDataEvents = {
        LAST_ALL_SESSIONS = 93.0
        BID_ALL_SESSION = 92.92
        ASK_ALL_SESSION = 92.95
        TRADE_SIZE_ALL_SESSIONS_RT = 0
        IS_DELAYED_STREAM = false
    }
```

B.3 Asynchronous Event Handling

```
// AsynchronousEventHandling.java

package BloombergLP;

import java.io.IOException;

import com.bloomberglp.blpapi.CorrelationID;
import com.bloomberglp.blpapi.Event;
import com.bloomberglp.blpapi.EventHandler;
import com.bloomberglp.blpapi.Message;
import com.bloomberglp.blpapi.MessageIterator;
import com.bloomberglp.blpapi.Request;
import com.bloomberglp.blpapi.Service;
import com.bloomberglp.blpapi.Session;
import com.bloomberglp.blpapi.SessionOptions;

public class AsynchronousEventHandling {

   public static void main(String[] args) throws Exception {
      SessionOptions sessionOptions = new SessionOptions();
      sessionOptions.setServerHost("localhost");
      sessionOptions.setServerPort(8194);
      Session session = new Session(sessionOptions, new MyEventHandler());
      session.startAsync();
      // Wait for events
      Object object = new Object();
         synchronized (object) {
            object.wait();
         }
   }
}
```

```
class MyEventHandler implements EventHandler {

   void dumpEvent(Event event){
      System.out.println("eventType=" + event.eventType());
      MessageIterator messageIterator = event.messageIterator();
      while (messageIterator.hasNext()){
         Message message = messageIterator.next();
         System.out.println("messageType=" + message.messageType());
         System.out.println("CorrelationID=" + message.correlationID());
         try {
            message.print(System.out);
         } catch (IOException e) {
            e.printStackTrace();
         }
      }
   }

   public void processEvent(Event event, Session session) {
      switch (event.eventType().intValue()) {
         case Event.EventType.Constants.SESSION_STATUS: {
            MessageIterator iter = event.messageIterator();
            while (iter.hasNext()) {
               Message message = iter.next();
               if (message.messageType().equals("SessionStarted")) {
                  try {
                     session.openServiceAsync("//blp/refdata",
                                              new CorrelationID(99));
                  } catch (Exception e) {
                     System.err.println(
                               "Could not open //blp/refdata for async");
                     System.exit(1);
                  }
               } else {
                  System.err.println("Could not start session.");
                  System.exit(1);
               }
            }
            break;
         }
```

```
            case Event.EventType.Constants.SERVICE_STATUS: {
               MessageIterator iter = event.messageIterator();
               while (iter.hasNext()) {
                  Message message = iter.next();
                  if (message.correlationID().value() == 99
                  &&  message.messageType().equals("ServiceOpened")) {
                     //Construct and issue a Request
                     Service service = session.getService("//blp/refdata");
                     Request request =
                               service.createRequest("ReferenceDataRequest");
                     request.append("securities", "IBM US Equity");
                     request.append("fields", "LAST_PRICE");
                     try {
                        session.sendRequest(request, new CorrelationID(86));
                     } catch (Exception e) {
                        System.err.println("Could not send request");
                        System.exit(1);
                     }
                  } else {
                    System.out.println("Unexpected SERVICE_STATUS message:");
                     try {
                        message.print(System.err);
                     } catch (Exception e){
                        e.printStackTrace();
                     }
                  }
               }
               break;
            }
            case Event.EventType.Constants.PARTIAL_RESPONSE: {//
               dumpEvent(event); // Handle Partial Response
               break;
            }
            case Event.EventType.Constants.RESPONSE:{
               dumpEvent(event); // Handle final response

               // Now, the example is complete. Shut it down.
               try {
                  session.stop(Session.StopOption.ASYNC);
               } catch (InterruptedException e) {
                  e.printStackTrace();
               }
               System.out.println("terminate process from handler");
               System.exit(0);
               break;
            }
            default: {
               System.err.println("unexpected Event");
               dumpEvent(event);
               System.exit(1);
               break;
            }
         }
      }
   }
```

B.3.1 Asynchronous Event Handling: Output

```
eventType=RESPONSE
messageType=ReferenceDataResponse
CorrelationID=User: 86
ReferenceDataResponse (choice) = {
    securityData[] = {
        securityData = {
            security = IBM US Equity
            sequenceNumber = 0
            fieldData = {
                LAST_PRICE = 92.51
            }
        }
    }
}
terminate process from handler
```

B.4 Request Response Multiple

```
// RequestResponseMultiple.java

package BloombergLP;

import com.bloomberglp.blpapi.CorrelationID;
import com.bloomberglp.blpapi.Element;
import com.bloomberglp.blpapi.Event;
import com.bloomberglp.blpapi.Message;
import com.bloomberglp.blpapi.MessageIterator;
import com.bloomberglp.blpapi.Request;
import com.bloomberglp.blpapi.Service;
import com.bloomberglp.blpapi.Session;
import com.bloomberglp.blpapi.SessionOptions;

public class RequestResponseMultiple {

   public static void main(String[] args) throws Exception {
      SessionOptions sessionOptions = new SessionOptions();
      sessionOptions.setServerHost("localhost");
      sessionOptions.setServerPort(8194);
      Session session = new Session(sessionOptions);
      if (!session.start()) {
         System.out.println("Could not start session.");
         System.exit(1);
      }
      if (!session.openService("//blp/refdata")) {
         System.out.println("Could not open service " +
                             "//blp/refdata");
         System.exit(1);
      }
      Service refDataSvc = session.getService("//blp/refdata");
      Request request = refDataSvc.createRequest("ReferenceDataRequest");
      request.getElement("securities").appendValue("AAPL US Equity");
      request.getElement("securities").appendValue("IBM US Equity");
      request.getElement("securities").appendValue(
                                          "BLAHBLAHBLAH US Equity");
      request.getElement("fields").appendValue("PX_LAST"); // Last Price
      request.getElement("fields").appendValue("DS002");   // Description
      request.getElement("fields").appendValue("VWAP_VOLUME");
        // Volume used to calculate the Volume Weighted Average Price
(VWAP)
      session.sendRequest(request, new CorrelationID(1));
```

```
        boolean continueToLoop = true;
        while (continueToLoop) {
              Event event = session.nextEvent();
              switch (event.eventType().intValue()) {
              case Event.EventType.Constants.RESPONSE:   // final response
                  continueToLoop = false;   // fall through
              case Event.EventType.Constants.PARTIAL_RESPONSE:
                  handleResponseEvent(event);
               break;
              default:
                  handleOtherEvent(event);
               break;
              }
          }
      }

      private static void handleResponseEvent(Event event) throws Exception {
         MessageIterator iter = event.messageIterator();
         while (iter.hasNext()) {
            Message message = iter.next();
             Element ReferenceDataResponse  = message.asElement();
             if (ReferenceDataResponse.hasElement("responseError")) {
                System.exit(1);
             }
             Element securityDataArray =

   ReferenceDataResponse.getElement("securityData");
             int numItems = securityDataArray.numValues();
             for (int i = 0; i < numItems; ++i) {
               Element securityData = securityDataArray.getValueAsElement(i);
                String  security     = securityData.getElementAsString(
                                                                "security");
                int     sequenceNumber =

   securityData.getElementAsInt32("sequenceNumber");
                if (securityData.hasElement("securityError")) {
                    Element securityError =
                                    securityData.getElement("securityError");
                    System.out.println("* security      =" + security);
                    //Element securityError = securityData.getElement(
                                                           "securityError");
                    securityError.print(System.out);
                    return;
                 } else {
                    Element fieldData   =
   securityData.getElement("fieldData");
                    double  px_last     = fieldData.getElementAsFloat64(
                                                                 "PX_LAST");
                    String  ds002       = fieldData.getElementAsString(
                                                                   "DS002");
                    double  vwap_volume =

   fieldData.getElementAsFloat64("VWAP_VOLUME");
```

```
                    // Individually output each value
                    System.out.println("* security      =" + security);
                    System.out.println("* sequenceNumber=" + sequenceNumber);
                    System.out.println("* px_last       =" + px_last);
                    System.out.println("* ds002         =" + ds002);
                    System.out.println("* vwap_volume   =" + vwap_volume);
                    System.out.println("");
                }
            }
        }
    }

    private static void handleOtherEvent(Event event) throws Exception
    {
        System.out.println("EventType=" + event.eventType());
        MessageIterator iter = event.messageIterator();
        while (iter.hasNext()) {
            Message message = iter.next();
            System.out.println("correlationID=" +
                               message.correlationID());
            System.out.println("messageType=" + message.messageType());
            message.print(System.out);
            if (Event.EventType.Constants.SESSION_STATUS ==
                event.eventType().intValue()
            &&  "SessionTerminated" ==
                message.messageType().toString()){
                System.out.println("Terminating: " +
                                   message.messageType());
                System.exit(1);
            }
        }
    }
}
```

B.4.1 Request Response Multiple: Output

```
EventType=SESSION_STATUS
correlationID=null
messageType=SessionStarted
SessionStarted = {
}
EventType=SERVICE_STATUS
correlationID=Internal: 1
messageType=ServiceOpened
ServiceOpened = {
}
* security      =AAPL US Equity
* sequenceNumber=0
* px_last       =93.0
* ds002         =APPLE INC
* vwap_volume   =2.0799279E7

* security      =IBM US Equity
* sequenceNumber=1
* px_last       =92.51
* ds002         =INTL BUSINESS MACHINES CORP
* vwap_volume   =8916238.0

* security      =BLAHBLAHBLAH US Equity
securityError = {
    source = 193::bbdbs1
    code = 15
    category = BAD_SEC
    message = Unknown/Invalid security [nid:193]
    subcategory = INVALID_SECURITY
}
```

B.5 Subscription Multiple

```
// SubscriptionMultiple.java

package BloombergLP;

import java.io.IOException;
import java.io.PrintStream;

import com.bloomberglp.blpapi.CorrelationID;
import com.bloomberglp.blpapi.Event;
import com.bloomberglp.blpapi.EventHandler;
import com.bloomberglp.blpapi.Message;
import com.bloomberglp.blpapi.MessageIterator;
import com.bloomberglp.blpapi.Session;
import com.bloomberglp.blpapi.SessionOptions;
import com.bloomberglp.blpapi.Subscription;
import com.bloomberglp.blpapi.SubscriptionList;

class SubscriptionEventHandler implements EventHandler {

   private String      d_label;
   private PrintStream d_printStream;

   // CREATORS
   SubscriptionEventHandler(String label, PrintStream printStream) {
      d_label       = label;
      d_printStream = printStream;
   }

   // MANIPULATORS
    public void processEvent(Event event, Session session) {
        switch (event.eventType().intValue()) {
           case Event.EventType.Constants.SUBSCRIPTION_DATA:
              handleDataEvent(event, session);
              break;
           case Event.EventType.Constants.SESSION_STATUS:
           case Event.EventType.Constants.SERVICE_STATUS:
           case Event.EventType.Constants.SUBSCRIPTION_STATUS:
              handleStatusEvent(event, session);
              break;
           default: {
               handleOtherEvent(event, session);
               break;
           }
        }
    }
```

```
      private void dumpEvent(Event event){
        d_printStream.println("handler label=" + d_label);
        d_printStream.println("eventType=" + event.eventType());
        MessageIterator messageIterator = event.messageIterator();
        while (messageIterator.hasNext()){
           Message message = messageIterator.next();
           d_printStream.println("messageType=" + message.messageType());
          d_printStream.println("CorrelationID=" + message.correlationID());
           try {
              message.print(d_printStream);
           } catch (IOException e) {
              e.printStackTrace();
           }
        }
      }

      private void handleDataEvent(Event event, Session session){
         d_printStream.println("handleDataEvent: enter");
         dumpEvent(event);
           d_printStream.println("handleDataEvent: leave");
      }

      private void handleStatusEvent(Event event, Session session){
         d_printStream.println("handleStatusEvent: enter");
         dumpEvent(event);
         d_printStream.println("handleStatusEvent: leave");
      }
      private void handleOtherEvent(Event event, Session session){
         d_printStream.println("handleOtherEvent: enter");
         dumpEvent(event);
         d_printStream.println("handleOtherEvent: leave");
      }
  }

  public class SubscriptionMultiple {

     public static void main(String[] args) throws Exception{
        SessionOptions sessionOptions = new SessionOptions();
        sessionOptions.setServerHost("localhost");
        sessionOptions.setServerPort(8194);
        Session session = new Session(sessionOptions,
                                      new SubscriptionEventHandler(
                                                                  "myLabel",
                                                                System.out));
        if (!session.start()) {
           System.out.println("Could not start session.");
           System.exit(1);
        }
        if (!session.openService("//blp/mktdata")) {
           System.out.println("Could not open service " +
                              "//blp/mktdata");
           System.exit(1);
        }
        SubscriptionList subscriptions  = new SubscriptionList();
        subscriptions.add(new Subscription("IBM US Equity",
                                           "LAST_TRADE",
                                           new CorrelationID(10)));
        subscriptions.add(new Subscription("/ticker/GOOG US Equity",
                                           "BID,ASK,LAST_PRICE",
                                           new CorrelationID(20)));
        subscriptions.add(new Subscription("MSFTT US Equity",
                                           "LAST_PRICE",
                                           "interval=.5",
                                           new CorrelationID(30)));
        subscriptions.add(new Subscription(
           "/cusip/097023105?fields=LAST_PRICE&interval=5.0", //BA US Equity
           new CorrelationID(40)));

        session.subscribe(subscriptions);

        // Wait for events
        Object object = new Object();
           synchronized (object) {
              object.wait();
           }
     }
  }
```

B.5.1 Multiple Subscription: Output

```
SuhandleStatusEvent: enter
handler label=myLabel
eventType=SESSION_STATUS
messageType=SessionStarted
CorrelationID=null
SessionStarted = {
}
handleStatusEvent: leave
handleStatusEvent: enter
handler label=myLabel
eventType=SERVICE_STATUS
messageType=ServiceOpened
CorrelationID=Internal: 1
ServiceOpened = {
}
handleStatusEvent: leave
handleStatusEvent: enter
handler label=myLabel
eventType=SUBSCRIPTION_STATUS
messageType=SubscriptionFailure
CorrelationID=User: 30
SubscriptionFailure = {
    reason = {
        source = BBDB@n558
        errorCode = 2
        category = BAD_SEC
        description = Invalid security
    }
}
handleStatusEvent: leave
handleStatusEvent: enter
handler label=myLabel
eventType=SUBSCRIPTION_STATUS
messageType=SubscriptionStarted
CorrelationID=User: 10
SubscriptionStarted = {
}
messageType=SubscriptionStarted
CorrelationID=User: 20
SubscriptionStarted = {
}
messageType=SubscriptionStarted
CorrelationID=User: 40
SubscriptionStarted = {
}
handleStatusEvent: leave
handleDataEvent: enter
handler label=myLabel
eventType=SUBSCRIPTION_DATA
messageType=MarketDataEvents
CorrelationID=User: 20
```

```
    MarketDataEvents = {
        LAST_PRICE = 343.32
        BID = 343.43
        ASK = 343.44
        VOLUME = 7283742
        HIGH = 345.05
        LOW = 340.11
        BEST_BID = 343.43
        BEST_ASK = 343.44
        LAST_TRADE = 343.32
        OPEN = 344.54
        PREV_SES_LAST_PRICE = 348.67
        INDICATIVE_FAR = 343.16
        INDICATIVE_NEAR = 343.16
        VWAP = 342.842
        THEO_PRICE = 343.16
        LAST_ALL_SESSIONS = 344.2
        IMBALANCE_INDIC_RT = NOIM
        BID_ALL_SESSION = 343.4
        ASK_ALL_SESSION = 344.2
        TRADING_DT_REALTIME = 2009-01-29+00:00
        EQY_TURNOVER_REALTIME = 2.4559597933911133E9
        LAST_UPDATE_BID_RT = 21:00:00.000+00:00
        LAST_UPDATE_ASK_RT = 21:00:00.000+00:00
        TOT_CALL_VOLUME_CUR_DAY_RT = 3644
        TOT_PUT_VOLUME_CUR_DAY_RT = 3623
        TOT_OPT_VOLUME_CUR_DAY_RT = 7267
        PUT_CALL_VOLUME_RATIO_CUR_DAY_RT = 0
        IN_AUCTION_RT = false
        RT_API_MACHINE = n242
        ALL_PRICE_SIZE = 250
        ALL_PRICE = 344.2
        VOLUME_THEO = 732968
        BID_ASK_TIME = 21:00:00.000+00:00
        LAST_AT_TRADE_TDY = 0.0
        SIZE_LAST_AT_TRADE_TDY = 0
        OPEN_YLD_TDY = 0.0
        HIGH_YLD_TDY = 0.0
        LOW_YLD_TDY = 0.0
        LAST_YLD_TDY = 0.0
        MID_TDY = 0.0
        SES_START = 14:30:00.000+00:00
        SES_END = 21:30:00.000+00:00
        RT_PX_CHG_NET_1D = -5.35
        RT_PX_CHG_PCT_1D = -1.5344
        IND_BID_FLAG = false
        IND_ASK_FLAG = false
        OPEN_TDY = 344.54
        ASK_SIZE_TDY = 1
        BID_SIZE_TDY = 7
        VOLUME_TDY = 7283742
        LAST_PRICE_TDY = 343.32
        BID_TDY = 343.43
        ASK_TDY = 343.44
        HIGH_TDY = 345.05
        LOW_TDY = 340.11
        BID_YLD_TDY = 0.0
        ASK_YLD_TDY = 0.0
        LAST2_PRICE = 340.54
        LAST_DIR = 1
        LAST2_DIR = -1
        BID_DIR = 1
        ASK_DIR = -1
        BID2 = 343.4
        ASK2 = 343.45
        ASK_SIZE = 1
        BID_SIZE = 7
        TIME = 22:20:00.000+00:00
        API_MACHINE = n242
        TRADE_SIZE_ALL_SESSIONS_RT = 250
        EID = 14005
        IS_DELAYED_STREAM = false
    }
    handleDataEvent: leave
    handleDataEvent: enter
    handler label=myLabel
    eventType=SUBSCRIPTION_DATA
    messageType=MarketDataEvents
    CorrelationID=User: 20
    MarketDataEvents = {
        VOLUME = 7283742
        LAST_AT_TRADE_TDY = 0.0
        SIZE_LAST_AT_TRADE_TDY = 0
        OPEN_YLD_TDY = 0.0
        HIGH_YLD_TDY = 0.0
        LOW_YLD_TDY = 0.0
        LAST_YLD_TDY = 0.0
        MID_TDY = 0.0
        RT_PX_CHG_NET_1D = -5.35
        RT_PX_CHG_PCT_1D = -1.5344
        IND_BID_FLAG = false
        IND_ASK_FLAG = false
        OPEN_TDY = 344.54
        ASK_SIZE_TDY = 1
        BID_SIZE_TDY = 7
        VOLUME_TDY = 7283742
        LAST_PRICE_TDY = 343.32
        BID_TDY = 343.43
        ASK_TDY = 343.44
        HIGH_TDY = 345.05
        LOW_TDY = 340.11
        BID_YLD_TDY = 0.0
        ASK_YLD_TDY = 0.0
        EID = 14005
        IS_DELAYED_STREAM = false
    }
    handleDataEvent: leave
    handleDataEvent: enter
    handler label=myLabel
    eventType=SUBSCRIPTION_DATA
    messageType=MarketDataEvents
    CorrelationID=User: 10
    MarketDataEvents = {
        LAST_PRICE = 92.51
        BID = 92.56
        ASK = 92.62
        VOLUME = 9233664
        HIGH = 94.58
        LOW = 92.02
        BEST_BID = 92.56
        BEST_ASK = 92.62
        LAST_TRADE = 92.51
        OPEN = 93.58
        PREV_SES_LAST_PRICE = 94.82
        IMBALANCE_ASK = 92.52
        ORDER_IMB_SELL_VOLUME = 34800.0
        VWAP = 93.2768
        THEO_PRICE = 92.52
        LAST_ALL_SESSIONS = 92.49
        IMBALANCE_INDIC_RT = SELL
        BID_ALL_SESSION = 92.31
        ASK_ALL_SESSION = 92.5
        TRADING_DT_REALTIME = 2009-01-29+00:00
        EQY_TURNOVER_REALTIME = 8.743154979367981E8
        LAST_UPDATE_BID_RT = 21:00:00.000+00:00
        LAST_UPDATE_ASK_RT = 21:00:00.000+00:00
        NYSE_LRP_HIGH_PRICE_RT = 93.63
        NYSE_LRP_LOW_PRICE_RT = 91.63
        NYSE_LRP_SEND_TIME_RT = 20:59:52.000+00:00
        TOT_CALL_VOLUME_CUR_DAY_RT = 4950
        TOT_PUT_VOLUME_CUR_DAY_RT = 7369
        TOT_OPT_VOLUME_CUR_DAY_RT = 12319
        PUT_CALL_VOLUME_RATIO_CUR_DAY_RT = 1
        IN_AUCTION_RT = false
        RT_API_MACHINE = p065
        ALL_PRICE_SIZE = 200
        ALL_PRICE = 92.5
        VOLUME_THEO = 467100
        BID_ASK_TIME = 21:00:00.000+00:00
        LAST_AT_TRADE_TDY = 0.0
        SIZE_LAST_AT_TRADE_TDY = 0
        OPEN_YLD_TDY = 0.0
        HIGH_YLD_TDY = 0.0
        LOW_YLD_TDY = 0.0
        LAST_YLD_TDY = 0.0
        MID_TDY = 0.0
        SES_START = 14:30:00.000+00:00
        SES_END = 21:30:00.000+00:00
        RT_PX_CHG_NET_1D = -2.31
        RT_PX_CHG_PCT_1D = -2.43619
        IND_BID_FLAG = false
        IND_ASK_FLAG = false
        OPEN_TDY = 93.58
        ASK_SIZE_TDY = 5
        BID_SIZE_TDY = 1
        VOLUME_TDY = 9233664
        LAST_PRICE_TDY = 92.51
        BID_TDY = 92.56
        ASK_TDY = 92.62
        HIGH_TDY = 94.58
        LOW_TDY = 92.02
        BID_YLD_TDY = 0.0
        ASK_YLD_TDY = 0.0
        LAST2_PRICE = 92.51
        LAST_DIR = -1
        LAST2_DIR = 1
        BID_DIR = -1
        ASK_DIR = 1
        BID2 = 92.56
        ASK2 = 92.61
        ASK_SIZE = 5
        BID_SIZE = 1
        TIME = 21:15:12.000+00:00
        API_MACHINE = p065
        TRADE_SIZE_ALL_SESSIONS_RT = 500
        EID = 14003
        IS_DELAYED_STREAM = false
    }
    handleDataEvent: leave
    handleDataEvent: enter
    handler label=myLabel
    eventType=SUBSCRIPTION_DATA
    messageType=MarketDataEvents
    CorrelationID=User: 10
    MarketDataEvents = {
        VOLUME = 9233664
        VWAP = 93.2764
        LAST_ALL_SESSIONS = 92.5
        BID_ALL_SESSION = 92.31
        ASK_ALL_SESSION = 92.5
        EQY_TURNOVER_REALTIME = 8.743154979367981E8
        ALL_PRICE_SIZE = 200
        ALL_PRICE = 92.5
        LAST_AT_TRADE_TDY = 0.0
        SIZE_LAST_AT_TRADE_TDY = 0
        OPEN_YLD_TDY = 0.0
        HIGH_YLD_TDY = 0.0
        LOW_YLD_TDY = 0.0
        LAST_YLD_TDY = 0.0
        MID_TDY = 0.0
        RT_PX_CHG_NET_1D = -2.31
        RT_PX_CHG_PCT_1D = -2.43619
        IND_BID_FLAG = false
        IND_ASK_FLAG = false
        OPEN_TDY = 93.58
        ASK_SIZE_TDY = 5
        BID_SIZE_TDY = 1
        VOLUME_TDY = 9233664
        LAST_PRICE_TDY = 92.51
        BID_TDY = 92.56
        ASK_TDY = 92.62
        HIGH_TDY = 94.58
        LOW_TDY = 92.02
        BID_YLD_TDY = 0.0
        ASK_YLD_TDY = 0.0
        TRADE_SIZE_ALL_SESSIONS_RT = 200
        EID = 14003
        IS_DELAYED_STREAM = false
    }
    handleDataEvent: leave
    handleDataEvent: enter
    handler label=myLabel
    eventType=SUBSCRIPTION_DATA
    messageType=MarketDataEvents
    CorrelationID=User: 40
    MarketDataEvents = {
        LAST_PRICE = 40.71
        BID = 40.71
        ASK = 40.77
        VOLUME = 8446464
        HIGH = 42.76
        LOW = 40.37
        RT_OPEN_INTEREST = 7953467
        BEST_BID = 40.71
        BEST_ASK = 40.77
        LAST_TRADE = 40.71
        OPEN = 42.76
        PREV_SES_LAST_PRICE = 43.24
        VWAP = 40.9212
        TRADING_DT_REALTIME = 2009-01-29+00:00
        EQY_TURNOVER_REALTIME = 3.45612128E8
        PREV_TRADING_DT_REALTIME = 2009-01-29+00:00
        RT_API_MACHINE = p164
        SES_START = 14:30:00.000+00:00
        SES_END = 21:30:00.000+00:00
        RT_PX_CHG_NET_1D = -2.53
        RT_PX_CHG_PCT_1D = -5.85106
        IND_BID_FLAG = false
        IND_ASK_FLAG = false
        OPEN_TDY = 42.76
        ASK_SIZE_TDY = 124
        BID_SIZE_TDY = 228
        VOLUME_TDY = 8446464
        LAST_PRICE_TDY = 40.71
        BID_TDY = 40.71
        ASK_TDY = 40.77
        HIGH_TDY = 42.76
        LOW_TDY = 40.37
        RT_PRICING_SOURCE = US
        ASK_SIZE = 124
        BID_SIZE = 228
        TIME = 21:15:02.000+00:00
        API_MACHINE = p164
        EXCH_CODE_LAST = N
        EXCH_CODE_BID = N
        EXCH_CODE_ASK = N
        EID = 14003
        IS_DELAYED_STREAM = false
    }
    handleDataEvent: leave
    handleDataEvent: enter
    handler label=myLabel
    eventType=SUBSCRIPTION_DATA
    messageType=MarketDataEvents
    CorrelationID=User: 40
    MarketDataEvents = {
        LAST_ALL_SESSIONS = 40.71
        BID_ALL_SESSION = 40.71
        ASK_ALL_SESSION = 40.77
        SES_START = 14:30:00.000+00:00
        SES_END = 21:30:00.000+00:00
        RT_PX_CHG_NET_1D = -2.53
        RT_PX_CHG_PCT_1D = -5.85106
        TIME = 21:15:02.000+00:00
        TRADE_SIZE_ALL_SESSIONS_RT = 0
        IS_DELAYED_STREAM = false
    }
    handleDataEvent: leave
```

B.6 Authorization by IP Address

```
// AuthorizationByIpAddress.java

package BloombergLP;

import java.io.IOException;
import java.util.ArrayList;

import com.bloomberglp.blpapi.CorrelationID;
import com.bloomberglp.blpapi.Element;
import com.bloomberglp.blpapi.Event;
import com.bloomberglp.blpapi.Message;
import com.bloomberglp.blpapi.MessageIterator;
import com.bloomberglp.blpapi.Request;
import com.bloomberglp.blpapi.Service;
import com.bloomberglp.blpapi.Session;
import com.bloomberglp.blpapi.SessionOptions;
import com.bloomberglp.blpapi.Identity;

public class AuthorizationByIpAddress {

    private static void dumpEvent(Event event) throws IOException{
        System.out.println("eventType=" + event.eventType());
        MessageIterator messageIterator = event.messageIterator();
        while (messageIterator.hasNext()){
            Message message = messageIterator.next();
            System.out.println("messageType=" + message.messageType());
            System.out.println("CorrelationID=" +
message.correlationID());
            message.print(System.out);
        }
    }

    private static boolean hasMessageType(Event  event,
                                          String messageType) {
        MessageIterator messageIterator = event.messageIterator();
        while (messageIterator.hasNext()){
            Message message = messageIterator.next();
            if (message.messageType().equals(messageType)) {
                return true;
            }
        }
        return false;
    }
    private static void printSecurityData(String  security,
                                          int     sequenceNumber,
                                          Element securityData)
    {
        Element fieldData   = securityData.getElement("fieldData");
        double  px_last     = fieldData.getElementAsFloat64("PX_LAST");
        String  ds002       = fieldData.getElementAsString("DS002");
        double  vwap_volume = fieldData.getElementAsFloat64("VWAP_VOLUME");

        // Individually output each value
        System.out.println("* security      =" + security);
        System.out.println("* sequenceNumber=" + sequenceNumber);
        System.out.println("* px_last       =" + px_last);
        System.out.println("* ds002         =" + ds002);
        System.out.println("* vwap_volume   =" + vwap_volume);
        System.out.println("");
    }

    private static void handleResponseEvent(Event event, Identity identity)
                                                          throws IOException {
        MessageIterator iter = event.messageIterator();
        while (iter.hasNext()) {
            Message message                = iter.next();
            Element ReferenceDataResponse  = message.asElement();
            if (ReferenceDataResponse.hasElement("responseError")) {
                message.print(System.out);
                System.exit(1);
            }
            Element securityDataArray =

ReferenceDataResponse.getElement("securityData");
            int     numItems          = securityDataArray.numValues();
            for (int i = 0; i < numItems; ++i) {
                Element securityData   =
securityDataArray.getValueAsElement(i);
                String  security       =
                                securityData.getElementAsString("security");
                int     sequenceNumber =

securityData.getElementAsInt32("sequenceNumber");

                if (securityData.hasElement("securityError")) {
                    Element securityError =
                                   securityData.getElement("securityError");
                    System.out.println("* security      =" + security);
                    securityError.print(System.out);
                    return;
                }
```

```
                   ArrayList missingEntitlements = new ArrayList();
                    Element   neededEntitlements  =
   securityData.hasElement("eidData")
                                              ? securityData.getElement("eidData")
                                                 : null;
                    if (null == neededEntitlements) {
                        System.out.println("no entitlements needed");
                        System.out.println();
                        printSecurityData(security, sequenceNumber, securityData);
                    } else if (identity.hasEntitlements(neededEntitlements,
                                                        message.service(),
                                                        missingEntitlements)) {
                       System.out.println("user has the needed Entitlements for: "
                                                                    + security);
                        System.out.println("provide data to the requesting user");
                        System.out.println();
                        printSecurityData(security, sequenceNumber, securityData);
                    } else {
                        System.out.println("user lacks entitlements for: "
                                                                    + security);
                        System.out.println("neededEntitlements  = "
                                                        + neededEntitlements);
                        System.out.println("missingEntitlements = " +
                                                           missingEntitlements);
                        System.out.println();
                        System.out.println(
                                    "do not provide data to the requesting user");
                    }
                }
            }
        }

        private static void handleOtherEvent(Event event) throws Exception
        {
            System.out.println("EventType=" + event.eventType());
            MessageIterator iter = event.messageIterator();
            while (iter.hasNext()) {
                Message message = iter.next();
                System.out.println("correlationID="
                             + message.correlationID());
                System.out.println("messageType=" + message.messageType());
                message.print(System.out);
                if (Event.EventType.Constants.SESSION_STATUS ==
                       event.eventType().intValue()
                && "SessionTerminated" ==
                       message.messageType().toString()){
                    System.out.println("Terminating: " +
                            message.messageType());
                    System.exit(1);
                }
            }
        }
        static private boolean handleAuthenticationResponseEvent(Event event)
                                                                throws IOException{
            if (hasMessageType(event, "AuthorizationSuccess")){
                System.out.println("Authorization OK");
                return true;
            } else if (hasMessageType(event, "AuthorizationFailure")) {
                System.out.println("Authorization Problem");
                dumpEvent(event);
            } else {
                System.out.println("Authorization: Other Problem");
                dumpEvent(event);
            }
            return false;
        }

        public static void main(String[] args) throws Exception{

            int    uuid      = uuid;
            String ipAddress = ipAddress;

            SessionOptions sessionOptions = new SessionOptions();
            sessionOptions.setServerHost("localhost"); //default
            sessionOptions.setServerPort(8194);        //default
            Session session = new Session(sessionOptions);
            if (!session.start()) {
                System.out.println("Could not start session.");
                System.exit(1);
            }

            if (!session.openService("//blp/apiauth")) {
                System.out.println("Could not open service " +
                                   "//blp/apiauth");
                System.exit(1);
            }
            Service apiAuthSvc = session.getService("//blp/apiauth");

             Request authorizationRequest =
                                     apiAuthSvc.createAuthorizationRequest();
            authorizationRequest.set("uuid", uuid);
            authorizationRequest.set("ipAddress", ipAddress);

            Identity    identity             = session.createIdentity();
            CorrelationID authorizationRequestID = new CorrelationID(10);

            session.sendAuthorizationRequest(authorizationRequest,
                                             identity,
                                             authorizationRequestID);
            System.out.println("sent Authorization Request using ipAddress");

            // Wait for 'AuthorizationSuccess' message which indicates
            // that 'identity' can be used.
            for (boolean continueToLoop = true; continueToLoop; ) {
                Event event = session.nextEvent();
                //dumpEvent(event);
                switch (event.eventType().intValue()) {
                case Event.EventType.Constants.RESPONSE:
                    if (!handleAuthenticationResponseEvent(event)) {
                        System.out.println("Authorization Failed");
                        System.exit(1);
                    }
                    continueToLoop = false;
                    break;
                default:
                     handleOtherEvent(event);
                    break;
                }
            }

            if (!session.openService("//blp/refdata")) {
                System.out.println("Could not open service " + "//blp/refdata");
                System.exit(1);
            }
            Service refDataSvc = session.getService("//blp/refdata");

            Request request = refDataSvc.createRequest("ReferenceDataRequest");
            request.append("securities", "VOD LN Equity");
            request.append("fields", "PX_LAST");
            request.append("fields", "DS002");
            request.append("fields", "VWAP_VOLUME");
            request.set("returnEids", true);    // new

            CorrelationID requestID = new CorrelationID(20);
            session.sendRequest(request, requestID);
```

```
            for (boolean continueToLoop = true; continueToLoop; ) {
                Event event = session.nextEvent();
                dumpEvent(event);
                switch (event.eventType().intValue()) {
                case Event.EventType.Constants.RESPONSE: // final event
                    continueToLoop = false;              // fall through
                case Event.EventType.Constants.PARTIAL_RESPONSE:
                    handleResponseEvent(event, identity);   // new argument
                    break;
                default:
                     handleOtherEvent(event);
                    break;
                }
            }
        }
    }
```

Bloomberg

C .Net Examples

This section contains the following code examples:

C.1 RequestResponseParadigm

```
// RequestResponseParadigm.cs

using System;
using System.Collections.Generic;
using System.Text;

using CorrelationID  = Bloomberglp.Blpapi.CorrelationID;
using Element        = Bloomberglp.Blpapi.Element;
using Event          = Bloomberglp.Blpapi.Event;
using Message        = Bloomberglp.Blpapi.Message;
using Request        = Bloomberglp.Blpapi.Request;
using Service        = Bloomberglp.Blpapi.Service;
using Session        = Bloomberglp.Blpapi.Session;
using SessionOptions = Bloomberglp.Blpapi.SessionOptions;

namespace RequestResponseParadigm
{
    class RequestResponseParadigm
    {
        static void Main(string[] args)
        {
            SessionOptions sessionOptions = new SessionOptions();
                sessionOptions.ServerHost = "localhost";
            sessionOptions.ServerPort = 8194;
            Session session = new Session(sessionOptions);
            if (!session.Start())
            {
                System.Console.WriteLine("Could not start session.");
                System.Environment.Exit(1);
            }
            if (!session.OpenService("//blp/refdata"))
            {
                System.Console.WriteLine("Could not open service " +
                                         "//blp/refdata");
                System.Environment.Exit(1);
            }
            CorrelationID requestID = new CorrelationID(1);
            Service refDataSvc = session.GetService("//blp/refdata");
            Request request    =
                    refDataSvc.CreateRequest("ReferenceDataRequest");
            request.Append("securities", "IBM US Equity");
            request.Append("fields", "PX_LAST");
            session.SendRequest(request, requestID);
```

```
                bool continueToLoop = true;
                while (continueToLoop)
                {
                    Event eventObj = session.NextEvent();
                    switch (eventObj.Type)
                    {
                        case Event.EventType.RESPONSE: // final event
                            continueToLoop = false;
                            handleResponseEvent(eventObj);
                            break;
                        case Event.EventType.PARTIAL_RESPONSE:
                            handleResponseEvent(eventObj);
                            break;
                        default:
                            handleOtherEvent(eventObj);
                            break;
                    }
                }
            }


            private static void handleResponseEvent(Event eventObj)
            {
                System.Console.WriteLine("EventType =" + eventObj.Type);
                foreach (Message message in eventObj.GetMessages())
                {
                    System.Console.WriteLine("correlationID=" +
                                             message.CorrelationID);
                    System.Console.WriteLine("messageType  =" +
                                             message.MessageType);
                    message.Print(System.Console.Out);
                }
            }

            private static void handleOtherEvent(Event eventObj)
            {
                System.Console.WriteLine("EventType=" + eventObj.Type);
                foreach (Message message in eventObj.GetMessages())
                {
                    System.Console.WriteLine("correlationID=" +
                                             message.CorrelationID);
                    System.Console.WriteLine("messageType=" +
                                             message.MessageType);
                    message.Print(System.Console.Out);
                    if (Event.EventType.SESSION_STATUS == eventObj.Type
                    && message.MessageType.Equals("SessionTerminated"))
                    {
                        System.Console.WriteLine("Terminating: " +
                                                 message.MessageType);
                        System.Environment.Exit(1);
                    }
                }
            }
        }
    }
```

C.1.1 Request Response Paradigm Output

```
EventType=SESSION_STATUS
correlationID=
messageType=SessionStarted
SessionStarted = {
}
EventType=SERVICE_STATUS
correlationID=Internal: 1
messageType=ServiceOpened
ServiceOpened = {
}
EventType =RESPONSE
correlationID=User: 1
messageType  =ReferenceDataResponse
ReferenceDataResponse (choice) = {
    securityData[] = {
        securityData = {
            security = IBM US Equity
            sequenceNumber = 0
            fieldData = {
                PX_LAST = 91.84
            }
        }
    }
}
```

C.2 Subscription Paradigm

```
// SubscriptionParadigm.cs

using System;
using System.Collections.Generic;
using System.Text;

using CorrelationID  = Bloomberglp.Blpapi.CorrelationID;
using Event          = Bloomberglp.Blpapi.Event;
using EventHandler   = Bloomberglp.Blpapi.EventHandler;
using Message        = Bloomberglp.Blpapi.Message;
using Session        = Bloomberglp.Blpapi.Session;
using SessionOptions = Bloomberglp.Blpapi.SessionOptions;
using Subscription   = Bloomberglp.Blpapi.Subscription;

namespace SubscriptionParadigm
{
    class SubscriptionParadigm
    {
        static void Main(string[] args)
        {

            SessionOptions sessionOptions = new SessionOptions();
            sessionOptions.ServerHost = "localhost";
            sessionOptions.ServerPort = 8194;
            Session session = new Session(sessionOptions);
            if (!session.Start())
            {
                System.Console.WriteLine("Could not start session.");
                System.Environment.Exit(1);
            }
            if (!session.OpenService("//blp/mktdata"))
            {
                System.Console.WriteLine("Could not open service " +
                                         "//blp/mktdata");
                System.Environment.Exit(1);
            }
            CorrelationID subscriptionID = new CorrelationID(2);
            List<Subscription> subscriptions = new List<Subscription>();
            subscriptions.Add(new Subscription("AAPL US Equity",
                                               "LAST_PRICE",
                                               subscriptionID));
            session.Subscribe(subscriptions);
```

```
                int updateCount = 0;
                while (true)
                {
                    Event eventObj = session.NextEvent();
                    switch (eventObj.Type)
                    {
                        case Event.EventType.SUBSCRIPTION_DATA:
                            handleDataEvent(eventObj, updateCount++);
                            break;
                        default:
                            handleOtherEvent(eventObj);
                            break;
                    }
                }
            }

            private static void handleDataEvent(Event eventObj, int
    updateCount)
            {
                System.Console.WriteLine("EventType=" + eventObj.Type);
                System.Console.WriteLine("updateCount = " + updateCount);
                foreach (Message message in eventObj.GetMessages())
                {
                    System.Console.WriteLine("correlationID = " +
                                             message.CorrelationID);
                    System.Console.WriteLine("messageType   = " +
                                             message.MessageType);
                    message.Print(System.Console.Out);
                }
            }

            private static void handleOtherEvent(Event eventObj)
            {
                System.Console.WriteLine("EventType=" + eventObj.Type);
                foreach (Message message in eventObj.GetMessages())
                {
                    System.Console.WriteLine("correlationID=" +
                                             message.CorrelationID);
                    System.Console.WriteLine("messageType=" +
                                             message.MessageType);
                    message.Print(System.Console.Out);
                    if (Event.EventType.SESSION_STATUS == eventObj.Type
                    &&  message.MessageType.Equals("SessionTerminated"))
                    {
                        System.Console.WriteLine("Terminating: " +
                                                 message.MessageType);
                        System.Environment.Exit(1);
                    }
                }
            }
        }
    }
```

Subscription Paradigm Output

```
EventType=SESSION_STATUS
correlationID=
messageType=SessionStarted
SessionStarted = {
}
EventType=SERVICE_STATUS
correlationID=Internal: 1
messageType=ServiceOpened
ServiceOpened = {
}
EventType=SUBSCRIPTION_STATUS
correlationID=User: 2
messageType=SubscriptionStarted
SubscriptionStarted = {
}
EventType=SUBSCRIPTION_DATA
updateCount = 0
correlationID = User: 2
messageType   = MarketDataEvents
MarketDataEvents = {
    LAST_PRICE = 90.89
    BID = 90.88
    ASK = 90.9
    VOLUME = 14304168
    HIGH = 93.62
    LOW = 90.6
    BEST_BID = 90.88
    BEST_ASK = 90.9
    LAST_TRADE = 90.89
    OPEN = 92.6
    PREV_SES_LAST_PRICE = 93
    INDICATIVE_FAR = 92.62
    INDICATIVE_NEAR = 92.62
    IMBALANCE_BID = 92.6
    VWAP = 91.9119
    LAST_ALL_SESSIONS = 90.89
    IMBALANCE_INDIC_RT = BUY
    BID_ALL_SESSION = 90.88
    ASK_ALL_SESSION = 90.9
    TRADING_DT_REALTIME = 2009-01-30+00:00
    EQY_TURNOVER_REALTIME = 1294308731.96565
    LAST_UPDATE_BID_RT = 18:45:46.000+00:00
    LAST_UPDATE_ASK_RT = 18:45:46.000+00:00
    TOT_CALL_VOLUME_CUR_DAY_RT = 12783
    TOT_PUT_VOLUME_CUR_DAY_RT = 17211
    TOT_OPT_VOLUME_CUR_DAY_RT = 29994
    PUT_CALL_VOLUME_RATIO_CUR_DAY_RT = 1
    IN_AUCTION_RT = false
    RT_API_MACHINE = p060
    ALL_PRICE_SIZE = 100
    ALL_PRICE = 90.89
```

```
        BID_ASK_TIME = 18:45:46.000+00:00
        LAST_AT_TRADE_TDY = 0
        SIZE_LAST_AT_TRADE_TDY = 0
        OPEN_YLD_TDY = 0
        HIGH_YLD_TDY = 0
        LOW_YLD_TDY = 0
        LAST_YLD_TDY = 0
        MID_TDY = 0
        SIZE_LAST_TRADE_TDY = 100
        SES_START = 14:30:00.000+00:00
        SES_END = 21:30:00.000+00:00
        RT_PX_CHG_NET_1D = -2.11
        RT_PX_CHG_PCT_1D = -2.26882
        IND_BID_FLAG = false
        IND_ASK_FLAG = false
        OPEN_TDY = 92.6
        ASK_SIZE_TDY = 19
        BID_SIZE_TDY = 5
        VOLUME_TDY = 14304168
        LAST_PRICE_TDY = 90.89
        BID_TDY = 90.88
        ASK_TDY = 90.9
        HIGH_TDY = 93.62
        LOW_TDY = 90.6
        BID_YLD_TDY = 0
        ASK_YLD_TDY = 0
        LAST2_PRICE = 90.89
        LAST_DIR = 1
        LAST2_DIR = 1
        BID_DIR = -1
        ASK_DIR = 1
        BID2 = 90.88
        ASK2 = 90.9
        SIZE_LAST_TRADE = 100
        ASK_SIZE = 19
        BID_SIZE = 5
        TIME = 18:45:45.000+00:00
        API_MACHINE = p060
        TRADE_SIZE_ALL_SESSIONS_RT = 100
        EID = 14005
        IS_DELAYED_STREAM = false
    }
    EventType=SUBSCRIPTION_DATA
    updateCount = 1
    correlationID = User: 2
    messageType   = MarketDataEvents
    MarketDataEvents = {
        LAST_PRICE = 90.89
        BID = 90.88
        ASK = 90.9
        VOLUME = 14304168
        HIGH = 93.62
        LOW = 90.6
        BEST_BID = 90.88
        BEST_ASK = 90.9
        LAST_TRADE = 90.89
        VWAP = 91.6348
        LAST_ALL_SESSIONS = 90.89
        BID_ALL_SESSION = 90.88
        ASK_ALL_SESSION = 90.9
        EQY_TURNOVER_REALTIME = 1294308731.96565
        LAST_UPDATE_BID_RT = 18:45:46.000+00:00
        LAST_UPDATE_ASK_RT = 18:45:46.000+00:00
        TOT_CALL_VOLUME_CUR_DAY_RT = 12783
        TOT_PUT_VOLUME_CUR_DAY_RT = 17211
        TOT_OPT_VOLUME_CUR_DAY_RT = 29994
        PUT_CALL_VOLUME_RATIO_CUR_DAY_RT = 1
        IN_AUCTION_RT = false
        ALL_PRICE_SIZE = 100
        ALL_PRICE = 90.89
        BID_ASK_TIME = 18:45:46.000+00:00
        LAST_AT_TRADE_TDY = 0
        SIZE_LAST_AT_TRADE_TDY = 0
        OPEN_YLD_TDY = 0
        HIGH_YLD_TDY = 0
        LOW_YLD_TDY = 0
        LAST_YLD_TDY = 0
        MID_TDY = 0
        SIZE_LAST_TRADE_TDY = 100
        RT_PX_CHG_NET_1D = -2.11
        RT_PX_CHG_PCT_1D = -2.26882
        IND_BID_FLAG = false
        IND_ASK_FLAG = false
        OPEN_TDY = 92.6
        ASK_SIZE_TDY = 19
        BID_SIZE_TDY = 5
        VOLUME_TDY = 14304168
        LAST_PRICE_TDY = 90.89
        BID_TDY = 90.88
        ASK_TDY = 90.9
        HIGH_TDY = 93.62
        LOW_TDY = 90.6
        BID_YLD_TDY = 0
        ASK_YLD_TDY = 0
        LAST2_PRICE = 90.89
        LAST_DIR = 1
        LAST2_DIR = 1
        BID_DIR = -1
        ASK_DIR = 1
        BID2 = 90.88
        ASK2 = 90.9
        SIZE_LAST_TRADE = 100
        ASK_SIZE = 19
        BID_SIZE = 5
        TIME = 18:45:45.000+00:00
        TRADE_SIZE_ALL_SESSIONS_RT = 100
        EID = 14005
        IS_DELAYED_STREAM = false
    }
```

C.3 Asynchronous Event Handling

```
// AsynchronousEventHandling.cs

using System;
using System.Collections.Generic;
using System.Text;

using CorrelationID  = Bloomberglp.Blpapi.CorrelationID;
using Event          = Bloomberglp.Blpapi.Event;
using EventHandler   = Bloomberglp.Blpapi.EventHandler;
using Message        = Bloomberglp.Blpapi.Message;
using Request        = Bloomberglp.Blpapi.Request;
using Service        = Bloomberglp.Blpapi.Service;
using Session        = Bloomberglp.Blpapi.Session;
using SessionOptions = Bloomberglp.Blpapi.SessionOptions;


namespace BloombergLP
{
    class AsynchronousEventHandling
    {
        static void Main(string[] args)
        {
            SessionOptions sessionOptions = new SessionOptions();
            sessionOptions.ServerHost = "localhost";
            sessionOptions.ServerPort = 8194;
            Session session = new Session(sessionOptions,
                                 new EventHandler(ProcessEvent));
            session.StartAsync();
            // Wait for events
            Object obj = new Object();
            lock (obj)
            {
                System.Threading.Monitor.Wait(obj);
            }
        }


        static void dumpEvent(Event eventObj)
        {
            System.Console.WriteLine("eventType=" + eventObj.Type);
            foreach (Message message in eventObj.GetMessages())
            {
                System.Console.WriteLine("messageType=" +
                                         message.MessageType);
                System.Console.WriteLine("CorrelationID=" +
                                         message.CorrelationID);
                try
                {
                    message.Print(System.Console.Out);
                }
                catch (System.IO.IOException e)
                {
                    System.Console.WriteLine(e);
                }
            }
        }
        static public void ProcessEvent(Event eventObj, Session session)
        {
            switch (eventObj.Type)
            {
                case Event.EventType.SESSION_STATUS:
                    {
                       foreach (Message message in eventObj.GetMessages())
                        {
                            if
  (message.MessageType.Equals("SessionStarted"))
                            {
                                try
                                {
                                    session.OpenServiceAsync(
                                                "//blp/refdata",
                                                new CorrelationID(99));
                                }
                                catch (Exception)
                                {
                                    System.Console.Error.WriteLine(
                                     "Could not open //blp/refdata for
  async");
                                    System.Environment.Exit(1);
                                }
                            }
                            else
                            {
                                System.Console.Error.WriteLine(
                                              "Could not start session.");
                                System.Environment.Exit(1);
                            }
                        }
                        break;
                    }
                case Event.EventType.SERVICE_STATUS:
                    {
                       foreach (Message message in eventObj.GetMessages())
                        {
                            if (message.CorrelationID.Value == 99
                           && message.MessageType.Equals("ServiceOpened"))
                            {
                                //Construct and issue a Request
                                Service service = session.GetService(
                                                         "//blp/refdata");
                                Request request = service.CreateRequest(
                                                  "ReferenceDataRequest");
                                request.Append("securities",
                                               "IBM US Equity");
                                request.Append("fields", "PX_LAST");
                                try
                                {
                                    session.SendRequest(
                                                     request,
                                                   new CorrelationID(86));
                                }
                                catch (Exception)
                                {
                                    System.Console.Error.WriteLine(
                                                "Could not send request");
                                    System.Environment.Exit(1);
                                }
                            }
                            else
                            {
                                System.Console.WriteLine(
                                    "Unexpected SERVICE_STATUS message:");
                                try
                                {
                                    message.Print(System.Console.Error);
                                }
                                catch (Exception e)
                                {
                                    System.Console.WriteLine(e);
                                }
                            }
                        }
                        break;
                    }
```

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```
                    case Event.EventType.PARTIAL_RESPONSE:
                        {//
                            dumpEvent(eventObj); // Handle Partial Response
                            break;
                        }
                    case Event.EventType.RESPONSE:
                        {
                            dumpEvent(eventObj); // Handle final response

                            // Now, the example is complete. Shut it down.
                            try
                            {
                                session.Stop(Session.StopOption.ASYNC);
                            }
                           catch (System.Threading.ThreadInterruptedException
e)
                            {
                                System.Console.WriteLine(e);

                            }
                            System.Console.Error.WriteLine(
                                            "terminate process from handler");
                            System.Environment.Exit(0);
                            break;
                        }
                    default:
                        {
                            break;
                        }
                    case Event.EventType.RESPONSE:
                        {
                            dumpEvent(eventObj); // Handle final response
                            System.Console.WriteLine("unexpected Event");
                            dumpEvent(eventObj);
                            System.Environment.Exit(1);
                            break;
                        }
                }
            }
        }
    }
```

C.3.1 Asynchronous Event Handling: Output

```
eventType=RESPONSE
messageType=ReferenceDataResponse
CorrelationID=User: 86
ReferenceDataResponse (choice) = {
    securityData[] = {
        securityData = {
            security = IBM US Equity
            sequenceNumber = 0
            fieldData = {
                PX_LAST = 91.85
            }
        }
    }
}
```

C.4 Request Response Multiple

```
// RequestResponseMultiple.cs

using System;
using System.Collections.Generic;
using System.Text;

using CorrelationID  = Bloomberglp.Blpapi.CorrelationID;
using Element        = Bloomberglp.Blpapi.Element;
using Event          = Bloomberglp.Blpapi.Event;
using Message        = Bloomberglp.Blpapi.Message;
using Request        = Bloomberglp.Blpapi.Request;
using Service        = Bloomberglp.Blpapi.Service;
using Session        = Bloomberglp.Blpapi.Session;
using SessionOptions = Bloomberglp.Blpapi.SessionOptions;

namespace RequestResponseMultiple
{
    class RequestResponseMultiple
    {
        static void Main(string[] args)
        {
            SessionOptions sessionOptions = new SessionOptions();
            sessionOptions.ServerHost = "localhost";
            sessionOptions.ServerPort = 8194;
            Session session = new Session(sessionOptions);
            if (!session.Start())
            {
                System.Console.WriteLine("Could not start session.");
                System.Environment.Exit(1);
            }
            if (!session.OpenService("//blp/refdata"))
            {
                System.Console.WriteLine("Could not open service " +
                                         "//blp/refdata");
                System.Environment.Exit(1);
            }
            Service refDataSvc = session.GetService("//blp/refdata");
            Request request    = refDataSvc.CreateRequest(
                                           "ReferenceDataRequest");
           request.GetElement("securities").AppendValue("AAPL US Equity");
            request.GetElement("securities").AppendValue("IBM US Equity");
            request.GetElement("securities").AppendValue(
                                         "BLAHBLAHBLAH US Equity");
            request.GetElement("fields").AppendValue("PX_LAST");
                                                      // Last Price
            request.GetElement("fields").AppendValue("DS002");
                                                     // Description
            request.GetElement("fields").AppendValue("VWAP_VOLUME");
             // Volume used to calculate the Volume Weighted Average Price
            session.SendRequest(request, new CorrelationID(1));
```

```
                bool continueToLoop = true;
                while (continueToLoop)
                {
                    Event eventObj = session.NextEvent();
                    switch (eventObj.Type)
                    {
                        case Event.EventType.RESPONSE:   // final response
                            continueToLoop = false;
                            handleResponseEvent(eventObj);
                            break;
                        case Event.EventType.PARTIAL_RESPONSE:
                            handleResponseEvent(eventObj);
                            break;
                        default:
                            handleOtherEvent(eventObj);
                            break;
                    }
                }
            }

            private static void handleResponseEvent(Event eventObj)
            {
                foreach (Message message in eventObj.GetMessages())
                {
                    Element ReferenceDataResponse = message.AsElement;
                    if (ReferenceDataResponse.HasElement("responseError"))
                    {
                        System.Environment.Exit(1);
                    }
                    Element securityDataArray =
                             ReferenceDataResponse.GetElement("securityData");
                    int numItems = securityDataArray.NumValues;
                    for (int i = 0; i < numItems; ++i)
                    {
                        Element securityData   =
                                       securityDataArray.GetValueAsElement(i);
                        String  security       =
                                    securityData.GetElementAsString("security");
                        int     sequenceNumber =
                             securityData.GetElementAsInt32("sequenceNumber");
                        if (securityData.HasElement("securityError"))
                        {
                            Element securityError =
                                     securityData.GetElement("securityError");
                            System.Console.WriteLine("* security      =" +
                                                         security);
                            Element securityError =
                                     securityData.GetElement("securityError");
                            securityError.Print(System.Console.Out);
                            return;
                        }
                        else
                        {
                            Element fieldData   =
                                         securityData.GetElement("fieldData");
                            double  px_last     =
                                     fieldData.GetElementAsFloat64("PX_LAST");
                            String  ds002       =
                                        fieldData.GetElementAsString("DS002");
                            double  vwap_volume =
                                 fieldData.GetElementAsFloat64("VWAP_VOLUME");

                            // Individually output each value
                            System.Console.WriteLine("* security      =" +
                                                     security);
                            System.Console.WriteLine("* sequenceNumber=" +
                                                     sequenceNumber);
                            System.Console.WriteLine("* px_last       =" +
                                                     px_last);
                            System.Console.WriteLine("* ds002         =" +
                                                     ds002);
                            System.Console.WriteLine("* vwap_volume   =" +
                                                     vwap_volume);
                            System.Console.WriteLine("");
                        }
                    }
                }
            }

            private static void handleOtherEvent(Event eventObj)
            {
                System.Console.WriteLine("EventType=" + eventObj.Type);
                foreach (Message message in eventObj.GetMessages())
                {
                    System.Console.WriteLine("correlationID=" +
                                             message.CorrelationID);
                    System.Console.WriteLine("messageType=" +
                                             message.MessageType);
                    message.Print(System.Console.Out);
                    if (Event.EventType.SESSION_STATUS == eventObj.Type
                    &&  message.MessageType.Equals("SessionTerminated"))
                    {
                        System.Console.WriteLine("Terminating: " +
                                                 message.MessageType);
                        System.Environment.Exit(1);
                    }
                }
            }
        }
    }
```

C.4.1 Request Response Multiple: Output

```
EventType=SESSION_STATUS
correlationID=
messageType=SessionStarted
SessionStarted = {
}
EventType=SERVICE_STATUS
correlationID=Internal: 1
messageType=ServiceOpened
ServiceOpened = {
}
* security      =AAPL US Equity
* sequenceNumber=0
* px_last       =90.95
* ds002         =APPLE INC
* vwap_volume   =14300635

* security      =IBM US Equity
* sequenceNumber=1
* px_last       =92.04
* ds002         =INTL BUSINESS MACHINES CORP
* vwap_volume   =4661754

* security      =BLAHBLAHBLAH US Equity
securityError = {
    source = 236::bbdbs2
    code = 15
    category = BAD_SEC
    message = Unknown/Invalid security [nid:236]
    subcategory = INVALID_SECURITY
}
```

C.5 Subscription Multiple

```
// SubscriptionMultiple.cs

using System;
using System.Collections.Generic;
using System.Text;
using System.IO;

using CorrelationID  = Bloomberglp.Blpapi.CorrelationID;
using Event          = Bloomberglp.Blpapi.Event;
using EventHandler   = Bloomberglp.Blpapi.EventHandler;
using Message        = Bloomberglp.Blpapi.Message;
using Session        = Bloomberglp.Blpapi.Session;
using SessionOptions = Bloomberglp.Blpapi.SessionOptions;
using Subscription   = Bloomberglp.Blpapi.Subscription;

namespace SubscriptionMultiple
{
    class SubscriptionEventHandler {
        private String      d_label;
        private TextWriter  d_printStream;

        // CREATORS
        public SubscriptionEventHandler(String label, TextWriter 
printStream)
        {
            d_label = label;
            d_printStream = printStream;
        }

        // MANIPULATORS
        public void ProcessEvent(Event eventObj, Session session)
        {
            switch (eventObj.Type)
            {
                case Event.EventType.SUBSCRIPTION_DATA:
                    handleDataEvent(eventObj, session);
                    break;
                case Event.EventType.SESSION_STATUS:
                case Event.EventType.SERVICE_STATUS:
                case Event.EventType.SUBSCRIPTION_STATUS:
                    handleStatusEvent(eventObj, session);
                    break;
                default:
                    {
                        handleOtherEvent(eventObj, session);
                        break;
                    }
            }
        }
        private void dumpEvent(Event eventObj)
        {
            d_printStream.WriteLine("handler label=" + d_label);
            d_printStream.WriteLine("eventType=" + eventObj.Type);
            foreach (Message message in eventObj.GetMessages())
            {
                d_printStream.WriteLine("messageType=" +
                                         message.MessageType);
                d_printStream.WriteLine("CorrelationID=" +
                                        message.CorrelationID);
                try
                {
                    message.Print(d_printStream);
                }
                catch (IOException e)
                {
                    System.Console.WriteLine(e);
                }
            }
        }

        private void handleDataEvent(Event eventObj, Session session)
        {
            d_printStream.WriteLine("handleDataEvent: enter");
            dumpEvent(eventObj);
            d_printStream.WriteLine("handleDataEvent: leave");
        }

        private void handleStatusEvent(Event eventObj, Session session)
        {
            d_printStream.WriteLine("handleStatusEvent: enter");
            dumpEvent(eventObj);
            d_printStream.WriteLine("handleStatusEvent: leave");
        }

        private void handleOtherEvent(Event eventObj, Session session)
        {
            d_printStream.WriteLine("handleOtherEvent: enter");
            dumpEvent(eventObj);
            d_printStream.WriteLine("handleOtherEvent: leave");
        }
    }

    class SubscriptionMultiple
    {
        static void Main(string[] args)
        {
            SessionOptions sessionOptions = new SessionOptions();
            sessionOptions.ServerHost = "localhost";
            sessionOptions.ServerPort = 8194;
            Session session = new Session(sessionOptions,
                                          new EventHandler(
                                             new SubscriptionEventHandler(
                                                  "myLabel",
                                       System.Console.Out).ProcessEvent));
            if (!session.Start())
            {
                System.Console.WriteLine("Could not start session.");
                System.Environment.Exit(1);
            }
            if (!session.OpenService("//blp/mktdata"))
            {
                System.Console.WriteLine("Could not open service " +
                                         "//blp/mktdata");
                System.Environment.Exit(1);
            }

            List<Subscription> subscriptions = new List<Subscription>();
            subscriptions.Add(new Subscription("IBM US Equity",
                                               "LAST_TRADE",
                                               new CorrelationID(10)));
            subscriptions.Add(new Subscription("/ticker/GOOG US Equity",
                                               "BID,ASK,LAST_PRICE",
                                               new CorrelationID(20)));
            subscriptions.Add(new Subscription("MSFTT US Equity",
                                               "LAST_PRICE",
                                               "interval=.5",
                                               new CorrelationID(30)));
            subscriptions.Add(new Subscription( //BA US Equity
                "/cusip/097023105?fields=LAST_PRICE&interval=5.0",
                new CorrelationID(40)));

            session.Subscribe(subscriptions);

            // Wait for events
            Object obj = new Object();
            lock (obj)
            {
                System.Threading.Monitor.Wait(obj);
            }
        }
    }
}
```

C.5.1 Multiple Subscription: Output

```
handleStatusEvent: enter
handler label=myLabel
eventType=SESSION_STATUS
messageType=SessionStarted
CorrelationID=
SessionStarted = {
}
handleStatusEvent: leave
handleStatusEvent: enter
handler label=myLabel
eventType=SERVICE_STATUS
messageType=ServiceOpened
CorrelationID=Internal: 1
ServiceOpened = {
}
handleStatusEvent: leave
handleStatusEvent: enter
handler label=myLabel
eventType=SUBSCRIPTION_STATUS
messageType=SubscriptionFailure
CorrelationID=User: 30
SubscriptionFailure = {
    reason = {
        source = BBDB@n558
        errorCode = 2
        category = BAD_SEC
        description = Invalid security
    }
}
handleStatusEvent: leave
handleStatusEvent: enter
handler label=myLabel
eventType=SUBSCRIPTION_STATUS
messageType=SubscriptionStarted
CorrelationID=User: 10
SubscriptionStarted = {
}
messageType=SubscriptionStarted
CorrelationID=User: 20
SubscriptionStarted = {
}
messageType=SubscriptionStarted
CorrelationID=User: 40
SubscriptionStarted = {
}
```

```
handleStatusEvent: leave
handleDataEvent: enter
handler label=myLabel
eventType=SUBSCRIPTION_DATA
messageType=MarketDataEvents
CorrelationID=User: 20
MarketDataEvents = {
    LAST_PRICE = 340.7
    BID = 340.74
    ASK = 340.92
    VOLUME = 2630520
    HIGH = 348.8
    LOW = 337.62
    BEST_BID = 340.74
    BEST_ASK = 340.92
    LAST_TRADE = 340.7
    OPEN = 344.69
    PREV_SES_LAST_PRICE = 343.32
    INDICATIVE_FAR = 344.69
    INDICATIVE_NEAR = 344.69
    IMBALANCE_ASK = 344.76
    VWAP = 341.6714
    LAST_ALL_SESSIONS = 340.7
    IMBALANCE_INDIC_RT = SELL
    BID_ALL_SESSION = 340.74
    ASK_ALL_SESSION = 340.92
    TRADING_DT_REALTIME = 2009-01-30+00:00
    EQY_TURNOVER_REALTIME = 891123786.45166
    LAST_UPDATE_BID_RT = 18:46:07.000+00:00
    LAST_UPDATE_ASK_RT = 18:46:09.000+00:00
    TOT_CALL_VOLUME_CUR_DAY_RT = 2146
    TOT_PUT_VOLUME_CUR_DAY_RT = 2887
    TOT_OPT_VOLUME_CUR_DAY_RT = 5033
    PUT_CALL_VOLUME_RATIO_CUR_DAY_RT = 1
    IN_AUCTION_RT = false
    RT_API_MACHINE = p060
    ALL_PRICE_SIZE = 300
    ALL_PRICE = 340.7
    BID_ASK_TIME = 18:46:09.000+00:00
    LAST_AT_TRADE_TDY = 0
    SIZE_LAST_AT_TRADE_TDY = 0
    OPEN_YLD_TDY = 0
    HIGH_YLD_TDY = 0
    LOW_YLD_TDY = 0
    LAST_YLD_TDY = 0
    MID_TDY = 0
    SIZE_LAST_TRADE_TDY = 300
    SES_START = 14:30:00.000+00:00
    SES_END = 21:30:00.000+00:00
    RT_PX_CHG_NET_1D = -2.62
    RT_PX_CHG_PCT_1D = -0.763135
    IND_BID_FLAG = false
    IND_ASK_FLAG = false
```

```
        OPEN_TDY = 344.69
        ASK_SIZE_TDY = 3
        BID_SIZE_TDY = 3
        VOLUME_TDY = 2630520
        LAST_PRICE_TDY = 340.7
        BID_TDY = 340.74
        ASK_TDY = 340.92
        HIGH_TDY = 348.8
        LOW_TDY = 337.62
        BID_YLD_TDY = 0
        ASK_YLD_TDY = 0
        LAST2_PRICE = 340.77
        LAST_DIR = -1
        LAST2_DIR = -1
        BID_DIR = 1
        ASK_DIR = -1
        BID2 = 340.74
        ASK2 = 340.92
        SIZE_LAST_TRADE = 300
        ASK_SIZE = 3
        BID_SIZE = 3
        TIME = 18:46:02.000+00:00
         API_MACHINE = p060
        TRADE_SIZE_ALL_SESSIONS_RT = 300
        EID = 14005
        IS_DELAYED_STREAM = false
    }
    handleDataEvent: leave
    handleDataEvent: enter
    handler label=myLabel
    eventType=SUBSCRIPTION_DATA
    messageType=MarketDataEvents
    CorrelationID=User: 10
    MarketDataEvents = {
        LAST_PRICE = 91.88
        BID = 91.85
        ASK = 91.88
        VOLUME = 4625564
        HIGH = 93.48
        LOW = 91.56
        BEST_BID = 91.85
        BEST_ASK = 91.88
        LAST_TRADE = 91.88
        OPEN = 92.23
        PREV_SES_LAST_PRICE = 92.51
        VWAP = 92.5054
        THEO_PRICE = 0
        LAST_ALL_SESSIONS = 91.88
        IMBALANCE_INDIC_RT = NOIM
        BID_ALL_SESSION = 91.85
        ASK_ALL_SESSION = 91.88
        TRADING_DT_REALTIME = 2009-01-30+00:00
        EQY_TURNOVER_REALTIME = 426434047.387161
        FINANCIAL_STATUS_INDICATOR_RT = 0
        LAST_UPDATE_BID_RT = 18:46:09.000+00:00
        LAST_UPDATE_ASK_RT = 18:46:09.000+00:00
        NYSE_LRP_HIGH_PRICE_RT = 92.85
        NYSE_LRP_LOW_PRICE_RT = 90.85
        NYSE_LRP_SEND_TIME_RT = 18:46:08.000+00:00
        TOT_CALL_VOLUME_CUR_DAY_RT = 1507
        TOT_PUT_VOLUME_CUR_DAY_RT = 2122
        TOT_OPT_VOLUME_CUR_DAY_RT = 3629
        PUT_CALL_VOLUME_RATIO_CUR_DAY_RT = 1
        IN_AUCTION_RT = false
        RT_API_MACHINE = n160
        ALL_PRICE_SIZE = 100
        ALL_PRICE = 91.88
        VOLUME_THEO = 0
        BID_ASK_TIME = 18:46:09.000+00:00
        LAST_AT_TRADE_TDY = 0
        SIZE_LAST_AT_TRADE_TDY = 0
        OPEN_YLD_TDY = 0
        HIGH_YLD_TDY = 0
        LOW_YLD_TDY = 0
        LAST_YLD_TDY = 0
        MID_TDY = 0
        SIZE_LAST_TRADE_TDY = 100
        SES_START = 14:30:00.000+00:00
        SES_END = 21:30:00.000+00:00
        RT_PX_CHG_NET_1D = -0.6299
        RT_PX_CHG_PCT_1D = -0.680898
        IND_BID_FLAG = false
        IND_ASK_FLAG = false
        OPEN_TDY = 92.23
        ASK_SIZE_TDY = 1
        BID_SIZE_TDY = 3
        VOLUME_TDY = 4625564
        LAST_PRICE_TDY = 91.88
        BID_TDY = 91.85
        ASK_TDY = 91.88
        HIGH_TDY = 93.48
        LOW_TDY = 91.56
        BID_YLD_TDY = 0
        ASK_YLD_TDY = 0
        LAST2_PRICE = 91.87
        LAST_DIR = 1
        LAST2_DIR = 1
        BID_DIR = 1
        ASK_DIR = 1
        BID2 = 91.85
        ASK2 = 91.88
        SIZE_LAST_TRADE = 100
        ASK_SIZE = 1
        BID_SIZE = 3
        TIME = 18:46:09.000+00:00
        API_MACHINE = n160
        TRADE_SIZE_ALL_SESSIONS_RT = 100
        EID = 14003
        IS_DELAYED_STREAM = false
    }
```

D C++ Examples

This section contains the following code examples:

Note: These examples use `assert` statements to make manifest the program state at various key points. Follow your organization's guidelines for best practices on the use of `assert` statements in production code.

D.1 RequestResponseParadigm

```
// RequestResponseParadigm.cpp

#include <blpapi_correlationid.h>
#include <blpapi_event.h>
#include <blpapi_message.h>
#include <blpapi_request.h>
#include <blpapi_session.h>

#include <iostream>
#include <string.h>  // for strcmp(3C)

using namespace BloombergLP;
using namespace blpapi;

static void handleResponseEvent(const Event& event)
{
    std::cout << "EventType ="
              << event.eventType()
              << std::endl;

    MessageIterator iter(event);
    while (iter.next()) {
        Message message = iter.message();
        std::cout << "correlationId="
                  << message.correlationId()
                  << std::endl;
        std::cout << "messageType  ="
                  << message.messageType()
                  << std::endl;
        message.print(std::cout);
    }
}

static void handleOtherEvent(const Event& event)
{
    std::cout << "EventType="
              << event.eventType()
              << std::endl;
    MessageIterator iter(event);
    while (iter.next()) {
        Message message = iter.message();
        std::cout << "correlationId="
                  << message.correlationId()
                  << std::endl;
        std::cout << "messageType="
                  << message.messageType()
                  << std::endl;
        message.print(std::cout);
        if (Event::SESSION_STATUS == event.eventType()
        &&  0 == ::strcmp("SessionTerminated",
message.messageType().string())) {
              std::cout << "Terminating: "
                        << message.messageType()
                        << std::endl;
              ::exit(1);
        }
    }
}

int main()
{
    SessionOptions sessionOptions;
    sessionOptions.setServerHost("localhost");
    sessionOptions.setServerPort(8194);

    Session session(sessionOptions);   // Establish session
    // Start Session
    if (!session.start()) {
        std::cerr << "Failed to start session." << std::endl;
            return 1;
    }

    if (!session.openService("//blp/refdata")){
        std::cerr << "Failed to open service //blp/refdata." << std::endl;
        return 1;
    }
    CorrelationId requestId(1);
    Service refDataSvc = session.getService("//blp/refdata");

    Request request = refDataSvc.createRequest("ReferenceDataRequest");

    request.append("securities", "IBM US Equity");
    request.append("fields", "PX_LAST");

    session.sendRequest(request, requestId);
    bool continueToLoop = true;
    while (continueToLoop) {
        Event event = session.nextEvent();
        switch (event.eventType()) {
          case Event::RESPONSE:             // final event
            continueToLoop = false;         // fall through
          case Event::PARTIAL_RESPONSE:
            handleResponseEvent(event);
            break;
          default:
            handleOtherEvent(event);
            break;
        }
    }

    session.stop();

    return 0;
}
```

Request Response Paradigm Output

```
EventType=2
correlationId=[ valueType=UNSET classId=0 value=0 ]
messageType=SessionStarted
SessionStarted =  {
 }
EventType=9
correlationId=[ valueType=UNSET classId=0 value=0 ]
messageType=ServiceOpened
ServiceOpened =  {
 }
EventType =5
correlationId=[ valueType=INT classId=0 value=1 ]
messageType  =ReferenceDataResponse
ReferenceDataResponse =  {
    securityData[] =
        securityData =  {
            security = IBM US Equity
            eidData[] =

            fieldExceptions[] =

            sequenceNumber = 0
            fieldData =  {
                PX_LAST = 92.510000
             }
         }
 }
```

D.2 Subscription Paradigm

```cpp
// SubscriptionParadigm.cpp

#include <blpapi_correlationid.h>
#include <blpapi_event.h>
#include <blpapi_message.h>
#include <blpapi_request.h>
#include <blpapi_session.h>
#include <blpapi_subscriptionlist.h>

#include <iostream>

using namespace BloombergLP;
using namespace blpapi;

static void handleDataEvent(const Event& event, int updateCount) {
    std::cout << "EventType="
              << event.eventType()
              << std::endl;
    std::cout << "updateCount = "
              << updateCount
              << std::endl;
    MessageIterator iter(event);
    while (iter.next()) {
        Message message = iter.message();
        std::cout << "correlationId = "
                  << message.correlationId()
                  << std::endl;
        std::cout << "messageType   = "
                  << message.messageType()
                  << std::endl;
        message.print(std::cout);
    }
}

static void handleOtherEvent(const Event& event)
{
    std::cout << "EventType="
              << event.eventType()
              << std::endl;
    MessageIterator iter(event);
    while (iter.next()) {
        Message message = iter.message();
        std::cout << "correlationId="
                  << message.correlationId()
                  << std::endl;
        std::cout << "messageType="
                  << message.messageType()
                  << std::endl;
        message.print(std::cout);
        if (Event::SESSION_STATUS == event.eventType()
         &&  0 == ::strcmp("SessionTerminated",
message.messageType().string())) {
            std::cout << "Terminating: "
                      << message.messageType()
                      << std::endl;
            ::exit(1);
        }
    }
}

int main(int argc, char **argv)
{
    SessionOptions sessionOptions;
    sessionOptions.setServerHost("localhost");
    sessionOptions.setServerPort(8194);

    Session session(sessionOptions);

    if (!session.start()) {
        std::cerr <<"Failed to start session." << std::endl;
        return 1;
    }

    if (!session.openService("//blp/mktdata")) {
        std::cerr <<"Failed to open //blp/mktdata" << std::endl;
        return 1;
    }
```

```
        CorrelationId subscriptionId((long long)2);
        SubscriptionList subscriptions;
        subscriptions.add("AAPL US Equity",
                          "LAST_PRICE",
                          "",
                          subscriptionId);
        session.subscribe(subscriptions);

        int updateCount = 0;
        while (true) {
            Event event = session.nextEvent();
            switch (event.eventType()) {
              case Event::SUBSCRIPTION_DATA:
              handleDataEvent(event, updateCount++);
              break;
            default:
              handleOtherEvent(event);
              break;
           }
        }
        return 0;
    }
```

Subscription Paradigm Output

```
EventType=2
correlationId=[ valueType=UNSET classId=0 value=0 ]
messageType=SessionStarted
SessionStarted =  {
 }
EventType=9
correlationId=[ valueType=UNSET classId=0 value=0 ]
messageType=ServiceOpened
ServiceOpened =  {
 }
EventType=3
correlationId=[ valueType=INT classId=0 value=2 ]
messageType=SubscriptionStarted
SubscriptionStarted =  {
    exceptions[] =

 }
EventType=8
updateCount = 0
correlationId = [ valueType=INT classId=0 value=2 ]
messageType   = MarketDataEvents
MarketDataEvents =  {
    LAST_PRICE = 93.000000
    BID = 92.920000
    ASK = 92.950000
    VOLUME = 21170839
    HIGH = 94.340000
    LOW = 92.600000
    RT_OPEN_INTEREST = 31212534
    BEST_BID = 92.920000
    BEST_ASK = 92.950000
    LAST_TRADE = 93.000000
    OPEN = 93.090000
    VWAP = 93.307500
    LAST_ALL_SESSIONS = 93.020000
    BID_ALL_SESSION = 93.000000
    ASK_ALL_SESSION = 93.020000
    TRADING_DT_REALTIME = 2009-01-29
    EQY_TURNOVER_REALTIME = 1987223541.981339
    TOT_CALL_VOLUME_CUR_DAY_RT = 12824
    TOT_PUT_VOLUME_CUR_DAY_RT = 18332
    TOT_OPT_VOLUME_CUR_DAY_RT = 31156
    PUT_CALL_VOLUME_RATIO_CUR_DAY_RT = 1
    IN_AUCTION_RT = false
    RT_API_MACHINE = n208
    ALL_PRICE_SIZE = 400
    ALL_PRICE = 93.020000
    ALL_PRICE_COND_CODE =
    LAST_AT_TRADE_TDY = 0.000000
    SIZE_LAST_AT_TRADE_TDY = 0
    OPEN_YLD_TDY = 0.000000
    HIGH_YLD_TDY = 0.000000
    LOW_YLD_TDY = 0.000000
    LAST_YLD_TDY = 0.000000
    MID_TDY = 0.000000
    SIZE_LAST_TRADE_TDY =
    IND_BID_FLAG = false
    IND_ASK_FLAG = false
    OPEN_TDY = 93.090000
    ASK_SIZE_TDY = 1
    BID_SIZE_TDY = 1
    VOLUME_TDY = 21170839
    LAST_PRICE_TDY = 93.000000
    BID_TDY = 92.920000
    ASK_TDY = 92.950000
    HIGH_TDY = 94.340000
    LOW_TDY = 92.600000
    BID_YLD_TDY = 0.000000
    ASK_YLD_TDY = 0.000000
    LAST2_PRICE = 93.070000
    LAST_DIR = -1
    LAST2_DIR = 1
    RT_PRICING_SOURCE = US
    SIZE_LAST_TRADE =
    ASK_SIZE = 1
    BID_SIZE = 1
    API_MACHINE = n208
    EXCH_CODE_LAST =
    EXCH_CODE_BID = Q
    EXCH_CODE_ASK = O
    TRADE_SIZE_ALL_SESSIONS_RT = 400
    IS_DELAYED_STREAM = false
    EID = 14005
    PREV_SES_LAST_PRICE = 94.200000
    RT_PX_CHG_NET_1D = -1.200000
    RT_PX_CHG_PCT_1D = -1.273890
    TIME = 22:20:00.000+00:00
    SES_START = 14:30:00.000+00:00
    SES_END = 21:30:00.000+00:00
 }
```

D.3 Asynchronous Event Handling

```
// AsynchronousEventHandling.cpp

#include <blpapi_correlationid.h>
#include <blpapi_event.h>
#include <blpapi_message.h>
#include <blpapi_request.h>
#include <blpapi_session.h>

#include <iostream>
#include <string.h>  // for strcmp(3C)
#include <unistd.h>  // for pause(2)

using namespace BloombergLP;
using namespace blpapi;

namespace {
                        // =========================
                        // class RefDataEventHandler
                        // =========================

class RefDataEventHandler: public EventHandler
{
  private:
      static void dumpEvent(const Event& event);
  public:
    // CREATORS
    RefDataEventHandler();
    ~RefDataEventHandler();

    // MANIPULATORS
    bool processEvent(const Event& event, Session *session);
};
// CREATORS
RefDataEventHandler::RefDataEventHandler()
{
}

RefDataEventHandler::~RefDataEventHandler()
{
}
```

```
// MANIPULATORS
bool RefDataEventHandler::processEvent(const Event&  event,
                                       Session      *session)
{
    switch (event.eventType()) {
      case Event::SESSION_STATUS: {
        MessageIterator iter(event);
        while (iter.next()) {
            Message message = iter.message();
            if (0 == ::strcmp("SessionStarted",
                              message.messageType().string())) {
                session->openServiceAsync("//blp/refdata",
                                          CorrelationId((long long)99));
            } else {
                std::cerr << "Session Start Failure" << std::endl;
                message.print(std::cerr);
                ::exit(1);
            }
        }
        break;
      }
      case Event::SERVICE_STATUS: {
        MessageIterator iter(event);
        iter.next();
        Message message = iter.message();
        if (message.correlationId() == 99
        &&  0 == ::strcmp("ServiceOpened",
                          message.messageType().string())) {
            // Construct and issue a Request
            Service service = session->getService("//blp/refdata");
            Request request =
service.createRequest("ReferenceDataRequest");
            request.append("securities", "IBM US Equity");
            request.append("fields", "LAST_PRICE");
            session->sendRequest(request, CorrelationId((long long)86));
        } else {
            std::cerr << "Unexpected message" << std::endl;
            message.print(std::cerr);
            ::exit(1);
        }
        break;
      }
      case Event::PARTIAL_RESPONSE: {
        dumpEvent(event);
        break;
      }
      case Event::RESPONSE: {
        dumpEvent(event);
        session->stop();
        std::cout << "terminate process from handler" << std::endl;
        ::exit(0);
        break;
      }
```

```
        default: {
          std::cerr << "Unxepected Event Type"
                    << event.eventType()
                    << std::endl;
          ::exit(1);
          break;
        }
      }
      return true;
  }
  void RefDataEventHandler::dumpEvent(const Event& event)
  {
      std::cout << "eventType="
                << event.eventType()
                << std::endl;
      MessageIterator messageIterator(event);
      while (messageIterator.next()) {
          Message message = messageIterator.message();
          std::cout << "messageType="
                    << message.messageType()
                    << std::endl;
          std::cout << "CorrelationId="
                    << message.correlationId()
                    << std::endl;
          message.print(std::cout);
      }
  }

  }  // close unnamed namespace


  int main()
  {
      SessionOptions sessionOptions;
      sessionOptions.setServerHost("localhost");
      sessionOptions.setServerPort(8194);
      RefDataEventHandler refDataEventHandler;

      Session session(sessionOptions, &refDataEventHandler);
      // Start Session
      if (!session.startAsync()) {
          std::cerr << "Failed to start async session." << std::endl;
          return 1;
      }

      ::pause();

      return 0;
  }
```

Asynchronous Event Handling: Output

```
eventType=5
messageType=ReferenceDataResponse
CorrelationId=[ valueType=INT classId=0 value=86 ]
ReferenceDataResponse =  {
    securityData[] =
        securityData =  {
            security = IBM US Equity
            eidData[] =

            fieldExceptions[] =

            sequenceNumber = 0
            fieldData =  {
                LAST_PRICE = 92.510000
             }
         }
 }
terminate process from handler
```

D.4 Request Response Multiple

```
// RequestResponseParadigm.cpp

#include <blpapi_correlationid.h>
#include <blpapi_element.h>
#include <blpapi_event.h>
#include <blpapi_message.h>
#include <blpapi_request.h>
#include <blpapi_session.h>

#include <iostream>
#include <string.h>  // for strcmp(3C)

using namespace BloombergLP;
using namespace blpapi;

static void handleResponseEvent(const Event& event)
{
    MessageIterator iter(event);
    while (iter.next()) {
        Message message = iter.message();
        Element referenceDataResponse = message.asElement();
        if (referenceDataResponse.hasElement("responseError")) {
            message.print(std::cout);
            ::exit(1);
        }

        Element securityDataArray =
                           referenceDataResponse.getElement("securityData");
        int     numItems           = securityDataArray.numValues();

        for (int i = 0; i < numItems; ++i) {
          Element     securityData =  securityDataArray.getValueAsElement(i);
           std::string security     =
                                securityData.getElementAsString("security");
           int         sequenceNumber =
                           securityData.getElementAsInt32("sequenceNumber");
              if (securityData.hasElement("securityError")) {
                Element securityError =
                                   securityData.getElement("securityError");
                std::cout << "* security      ="
                          << security
                          << std::endl;
                securityError.print(std::cout);
                return;
            } else {
                Element      fieldData   =
                                   securityData.getElement("fieldData");
                double       px_last     =
                                     fieldData.getElementAsFloat64("PX_LAST");
                std::string  ds002       =
                                   fieldData.getElementAsString("DS002");
                double       vwap_volume =
                                 fieldData.getElementAsFloat64("VWAP_VOLUME");

                // Individually ouput each value.
                std::cout << "* security      =" << security       << "\n"
                          << "* sequenceNumber=" << sequenceNumber << "\n"
                          << "* px_last       =" << px_last        << "\n"
                          << "* ds002         =" << ds002          << "\n"
                          << "* vwap_volume   =" << vwap_volume    << "\n"
                                                                << std::endl;
            }
        }
    }
}

static void handleOtherEvent(const Event& event)
{
    std::cout << "EventType="
              << event.eventType()
              << std::endl;
    MessageIterator iter(event);
    while (iter.next()) {
        Message message = iter.message();
        std::cout << "correlationId="
                  << message.correlationId()
                  << std::endl;
        std::cout << "messageType="
                  << message.messageType()
                  << std::endl;
        message.print(std::cout);
        if (Event::SESSION_STATUS == event.eventType()
       &&  0 == ::strcmp("SessionTerminated", message.messageType().string())){
            std::cout << "Terminating: "
                      << message.messageType()
                      << std::endl;
            ::exit(1);
        }
    }
}
```

```
int main()
{
    SessionOptions sessionOptions;
    sessionOptions.setServerHost("localhost");
    sessionOptions.setServerPort(8194);

    Session session(sessionOptions);   // Establish session
    // Start Session
    if (!session.start()) {
        std::cerr << "Failed to start session." << std::endl;
            return 1;
    }

    if (!session.openService("//blp/refdata")){
        std::cerr << "Failed to open service //blp/refdata." << std::endl;
        return 1;
    }

    CorrelationId requestId(1);
    Service refDataSvc = session.getService("//blp/refdata");

    Request request = refDataSvc.createRequest("ReferenceDataRequest");

    // append fields to request
    std::cout << "Initialize Request" << std::endl;
    request.getElement("securities").appendValue("AAPL US Equity");
    request.getElement("securities").appendValue("IBM US Equity");
    request.getElement("securities").appendValue("BLAHBLAHBLAH US
Equity");
    request.getElement("fields").appendValue("PX_LAST");
    request.getElement("fields").appendValue("DS002");
    request.getElement("fields").appendValue("VWAP_VOLUME");
      // Volume used to calcuate the Volume Weighted Average Price (VWAP)

    session.sendRequest(request, CorrelationId(1));

    bool continueToLoop = true;
    while (continueToLoop) {
        Event event = session.nextEvent();
        switch (event.eventType()) {
          case Event::RESPONSE:            // final event
            continueToLoop = false;        // fall through
          case Event::PARTIAL_RESPONSE:
            handleResponseEvent(event);
            break;
          default:
            handleOtherEvent(event);
            break;
        }
    }
```

```
        session.stop();

        return 0;
    }
```

Request Response Multiple: Output

```
    Initialize Request
    EventType=2
    correlationId=[ valueType=UNSET classId=0 value=0 ]
    messageType=SessionStarted
    SessionStarted =  {
     }
    EventType=9
    correlationId=[ valueType=UNSET classId=0 value=0 ]
    messageType=ServiceOpened
    ServiceOpened =  {
     }
    * security      =AAPL US Equity
    * sequenceNumber=0
    * px_last       =91.3
    * ds002         =APPLE INC
    * vwap_volume   =1.31384e+07

    * security      =IBM US Equity
    * sequenceNumber=1
    * px_last       =92.37
    * ds002         =INTL BUSINESS MACHINES CORP
    * vwap_volume   =4.22627e+06

    * security      =BLAHBLAHBLAH US Equity
    securityError =  {
        source = 119::bbdbs1
        code = 15
        category = BAD_SEC
        message = Unknown/Invalid security [nid:119]
        subcategory = INVALID_SECURITY
     }
```

D.5 Subscription Multiple

```
// SubscriptionMultiple.cpp

#include <blpapi_correlationid.h>
#include <blpapi_event.h>
#include <blpapi_message.h>
#include <blpapi_request.h>
#include <blpapi_session.h>
#include <blpapi_subscriptionlist.h>

#include <iostream>
#include <cassert>
#include <string>

#include <unistd.h>  // for pause(2)

using namespace BloombergLP;
using namespace blpapi;

namespace {
                        // ==============================
                        // class SubscriptionEventHandler
                        // ==============================

class SubscriptionEventHandler: public EventHandler
{
      std::string     d_label;
      std::ostream   *d_stream; // held

      void            handleDataEvent  (const Event&   event,
                                         const Session& session);
      void            handleStatusEvent(const Event&   event,
                                         const Session& session);
      void            handleOtherEvent (const Event&   event,
                                         const Session& session);

      void            dumpEvent(const Event& event);
  public:
    // CREATORS
    SubscriptionEventHandler(const std::string&  label,
                             std::ostream       *stream);
    ~SubscriptionEventHandler();

    // MANIPULATORS
    bool processEvent(const Event& event, Session *session);
};
```

```
// CREATORS
SubscriptionEventHandler::SubscriptionEventHandler(const std::string&
label,
                                               std::ostream       *stream)
: d_label(label)
, d_stream(stream)
{
    assert(d_stream);
}

SubscriptionEventHandler::~SubscriptionEventHandler()
{
}

// MANIPULATORS
bool SubscriptionEventHandler::processEvent(const Event&  event,
                                            Session      *session)
{
    assert(session);
    switch (event.eventType()) {
      case Event::SUBSCRIPTION_DATA:
          handleDataEvent(event, *session);
        break;
      case Event::SESSION_STATUS:
      case Event::SERVICE_STATUS:
      case Event::SUBSCRIPTION_STATUS:
          handleStatusEvent(event, *session);
        break;
      default:
          handleOtherEvent(event, *session);
        break;
    }
    return true;
}

void SubscriptionEventHandler::dumpEvent(const Event& event)
{
    *d_stream << "handler  label="
              << d_label
              << std::endl
              << "eventType="
              << event.eventType()
              << std::endl;
    MessageIterator messageIterator(event);
    while (messageIterator.next()) {
        Message message = messageIterator.message();
        *d_stream << "messageType="
                  << message.messageType()
                  << std::endl
                  << "CorrelationId="
                  << message.correlationId()
                  << std::endl;
        message.print(*d_stream);
    }
}

void SubscriptionEventHandler::handleDataEvent(const Event&   event,
                                               const Session& session)
{
    *d_stream << "handleDataEventHandler: enter" << std::endl;
    dumpEvent(event);
    *d_stream << "handleDataEventHandler: leave" << std::endl;
}

void SubscriptionEventHandler::handleStatusEvent(const Event&   event,
                                                 const Session& session)
{
    *d_stream << "handleStatusEventHandler: enter" << std::endl;
    dumpEvent(event);
    *d_stream << "handleStatusEventHandler: leave" << std::endl;
}

void SubscriptionEventHandler::handleOtherEvent(const Event&   event,
                                                const Session& session)
{
    *d_stream << "handleOtherEvent: enter" << std::endl;
    dumpEvent(event);
    *d_stream << "handleOtherEvent: leave" << std::endl;
}

}  // close unnamed namespace
```

```
int main(int argc, char **argv)
{
    SessionOptions sessionOptions;
    sessionOptions.setServerHost("localhost");
    sessionOptions.setServerPort(8194);

    SubscriptionEventHandler
    subscriptionEventHandler(std::string("myLabel"), &std::cout);

    Session session(sessionOptions, &subscriptionEventHandler);

    if (!session.start()) {
        std::cerr <<"Failed to start session." << std::endl;
        return 1;
    }

    if (!session.openService("//blp/mktdata")) {
        std::cerr <<"Failed to open //blp/mktdata" << std::endl;
        return 1;
    }

    SubscriptionList subscriptions;
    subscriptions.add("IBM US Equity",
                      "LAST_TRADE",
                      "",
                      CorrelationId((long long)10));
    subscriptions.add("/ticket/GOOG US Equity",
                      "BID,ASK,LAST_PRICE",
                      "",
                      CorrelationId((long long)20));
    subscriptions.add("MSFTT US Equity",
                      "LAST_PRICE",
                      "interval=.5",
                      CorrelationId((long long)30));
    subscriptions.add("/cusip/097023105?fields=LAST_PRICE&interval=5.0",
                      "",
                      "",
                      CorrelationId((long long)40));
    session.subscribe(subscriptions);

    ::pause();

    return 0;
}
```

Subscription Multiple: Output

```
handleStatusEventHandler: enter
handler  label=myLabel
eventType=2
messageType=SessionStarted
CorrelationId=[ valueType=UNSET classId=0 value=0 ]
SessionStarted =  {
 }
handleStatusEventHandler: leave
handleStatusEventHandler: enter
handler  label=myLabel
eventType=9
messageType=ServiceOpened
CorrelationId=[ valueType=UNSET classId=0 value=0 ]
ServiceOpened =  {
 }
handleStatusEventHandler: leave
handleStatusEventHandler: enter
handler  label=myLabel
eventType=3
messageType=SubscriptionFailure
CorrelationId=[ valueType=INT classId=0 value=30 ]
SubscriptionFailure =  {
    reason =  {
        errorCode = 2
        description = Invalid security
        category = BAD_SEC
        source = BBDB@n558
     }
 }
handleStatusEventHandler: leave
handleStatusEventHandler: enter
handler  label=myLabel
eventType=3
messageType=SubscriptionStarted
CorrelationId=[ valueType=INT classId=0 value=40 ]
SubscriptionStarted =  {
    exceptions[] =

 }
messageType=SubscriptionStarted
CorrelationId=[ valueType=INT classId=0 value=10 ]
SubscriptionStarted =  {
    exceptions[] =

 }
messageType=SubscriptionStarted
CorrelationId=[ valueType=INT classId=0 value=20 ]
SubscriptionStarted =  {
    exceptions[] =

 }
```

```
handleStatusEventHandler: leave
handleDataEventHandler: enter
handler  label=myLabel
eventType=8
messageType=MarketDataEvents
CorrelationId=[ valueType=INT classId=0 value=20 ]
MarketDataEvents =  {
    LAST_PRICE = 338.460000
    BID = 338.360000
    ASK = 338.500000
    VOLUME = 4068281
    HIGH = 348.800000
    LOW = 336.001000
    BEST_BID = 338.360000
    BEST_ASK = 338.500000
    LAST_TRADE = 338.460000
    OPEN = 344.690000
    INDICATIVE_FAR = 344.690000
    INDICATIVE_NEAR = 344.690000
    IMBALANCE_BID =
    IMBALANCE_ASK = 344.760000
    VWAP = 341.666700
    LAST_ALL_SESSIONS = 338.460000
    IMBALANCE_INDIC_RT = SELL
    PREV_CLOSE_VALUE_REALTIME = 343.320000
    BID_ALL_SESSION = 338.360000
    ASK_ALL_SESSION = 338.500000
    TRADING_DT_REALTIME = 2009-01-30
    EQY_TURNOVER_REALTIME = 1379007507.741211
    TOT_CALL_VOLUME_CUR_DAY_RT = 3266
    TOT_PUT_VOLUME_CUR_DAY_RT = 4650
    TOT_OPT_VOLUME_CUR_DAY_RT = 7916
    PUT_CALL_VOLUME_RATIO_CUR_DAY_RT = 1
    IN_AUCTION_RT = false
    RT_API_MACHINE = p060
    ALL_PRICE_SIZE = 100
    ALL_PRICE = 338.460000
    ALL_PRICE_COND_CODE =
    BID_COND_CODE =
    ASK_COND_CODE =
    LAST_AT_TRADE_TDY = 0.000000
    SIZE_LAST_AT_TRADE_TDY = 0
    OPEN_YLD_TDY = 0.000000
    HIGH_YLD_TDY = 0.000000
    LOW_YLD_TDY = 0.000000
    LAST_YLD_TDY = 0.000000
    MID_TDY = 0.000000
    SIZE_LAST_TRADE_TDY = 100
    IND_BID_FLAG = false
    IND_ASK_FLAG = false
    OPEN_TDY = 344.690000
```

```
        ASK_SIZE_TDY = 2
        BID_SIZE_TDY = 3
        VOLUME_TDY = 4068281
        LAST_PRICE_TDY = 338.460000
        BID_TDY = 338.360000
        ASK_TDY = 338.500000
        HIGH_TDY = 348.800000
        LOW_TDY = 336.001000
        BID_YLD_TDY = 0.000000
        ASK_YLD_TDY = 0.000000
        LAST2_PRICE = 338.450000
        LAST_DIR = 1
        LAST2_DIR = 1
        BID_DIR = 1
        ASK_DIR = 1
        BID2 = 338.360000
        ASK2 = 338.500000
        SIZE_LAST_TRADE = 100
        ASK_SIZE = 2
        BID_SIZE = 3
        API_MACHINE = p060
        EXCH_CODE_LAST =
        EXCH_CODE_BID =
        EXCH_CODE_ASK =
        TRADE_SIZE_ALL_SESSIONS_RT = 100
        IS_DELAYED_STREAM = false
        EID = 14005
        PREV_SES_LAST_PRICE = 343.320000
        RT_PX_CHG_NET_1D = -4.860000
        RT_PX_CHG_PCT_1D = -1.415590
        TIME = 20:48:30.000+00:00
        LAST_UPDATE_BID_RT = 20:48:33.000+00:00
        LAST_UPDATE_ASK_RT = 20:48:32.000+00:00
        BID_ASK_TIME = 20:48:33.000+00:00
        SES_START = 14:30:00.000+00:00
        SES_END = 21:30:00.000+00:00
     }
    handleDataEventHandler: leave
    handleDataEventHandler: enter
    handler  label=myLabel
    eventType=8
    messageType=MarketDataEvents
    CorrelationId=[ valueType=INT classId=0 value=10 ]
    MarketDataEvents =  {
        LAST_PRICE = 91.830000
        BID = 91.820000
        ASK = 91.830000
        VOLUME = 7233307
        HIGH = 93.480000
        LOW = 91.250000
        BEST_BID = 91.820000
        BEST_ASK = 91.830000
        LAST_TRADE = 91.830000
        OPEN = 92.230000
        IMBALANCE_BID =
        IMBALANCE_ASK = 91.780000
        ORDER_IMB_BUY_VOLUME =
        ORDER_IMB_SELL_VOLUME = 54500.000000
        VWAP = 92.495700
        THEO_PRICE = 0.000000
        LAST_ALL_SESSIONS = 91.830000
        IMBALANCE_INDIC_RT = SELL
        PREV_CLOSE_VALUE_REALTIME = 92.510000
        BID_ALL_SESSION = 91.820000
        ASK_ALL_SESSION = 91.830000
       TRADING_DT_REALTIME = 2009-01-30
        EQY_TURNOVER_REALTIME = 666435537.542725
        FINANCIAL_STATUS_INDICATOR_RT = 0
        NYSE_LRP_HIGH_PRICE_RT = 92.850000
        NYSE_LRP_LOW_PRICE_RT = 90.850000
        TOT_CALL_VOLUME_CUR_DAY_RT = 2345
        TOT_PUT_VOLUME_CUR_DAY_RT = 2282
        TOT_OPT_VOLUME_CUR_DAY_RT = 4627
        PUT_CALL_VOLUME_RATIO_CUR_DAY_RT = 0
        IN_AUCTION_RT = false
        RT_API_MACHINE = n160
        ALL_PRICE_SIZE = 100
        ALL_PRICE = 91.830000
        ALL_PRICE_COND_CODE =
        BID_COND_CODE =
        ASK_COND_CODE =
        VOLUME_THEO = 0
        LAST_AT_TRADE_TDY = 0.000000
        SIZE_LAST_AT_TRADE_TDY = 0
        OPEN_YLD_TDY = 0.000000
        HIGH_YLD_TDY = 0.000000
        LOW_YLD_TDY = 0.000000
        LAST_YLD_TDY = 0.000000
        MID_TDY = 0.000000
        SIZE_LAST_TRADE_TDY = 100
        IND_BID_FLAG = false
        IND_ASK_FLAG = false
        OPEN_TDY = 92.230000
        ASK_SIZE_TDY = 1
        BID_SIZE_TDY = 2
        VOLUME_TDY = 7233307
        LAST_PRICE_TDY = 91.830000
        BID_TDY = 91.820000
        ASK_TDY = 91.830000
        HIGH_TDY = 93.480000
        LOW_TDY = 91.250000
        BID_YLD_TDY = 0.000000
        ASK_YLD_TDY = 0.000000
        LAST2_PRICE = 91.839000
        LAST_DIR = -1
        LAST2_DIR = 1
        BID_DIR = -1
        ASK_DIR = -1
        BID2 = 91.820000
        ASK2 = 91.830000
        SIZE_LAST_TRADE = 100
        ASK_SIZE = 1
        BID_SIZE = 2
        API_MACHINE = n160
        EXCH_CODE_LAST =
        EXCH_CODE_BID =
        EXCH_CODE_ASK =
        TRADE_SIZE_ALL_SESSIONS_RT = 100
        IS_DELAYED_STREAM = false
        EID = 14003
        PREV_SES_LAST_PRICE = 92.510000
        RT_PX_CHG_NET_1D = -0.679900
        RT_PX_CHG_PCT_1D = -0.734947
        TIME = 20:48:34.000+00:00
        LAST_UPDATE_BID_RT = 20:48:34.000+00:00
        LAST_UPDATE_ASK_RT = 20:48:34.000+00:00
        NYSE_LRP_SEND_TIME_RT = 20:48:34.000+00:00
        BID_ASK_TIME = 20:48:34.000+00:00
        SES_START = 14:30:00.000+00:00
        SES_END = 21:30:00.000+00:00
    }
```

Bloomberg

E C Examples

This section contains the following code examples:

Note: These examples use `assert` statements to make manifest the program state at various key points. Follow your organization's guidelines for best practices on the use of `assert` statements in production code.

Note: When using the C language interface the programmer must explicitly recover allocated resources such as sessions, session options, requests, and message iterators. In general, a pointer to a resource obtained from a function containing the word "create" must be recovered by invoking a similarly named function containing the word "destroy". For example, the `blpapi_Service_createRequest` function delivers a pointer to a `blpapi_Request_t` type and that pointer, when no longer needed, must be passed to the `blpapi_Request_destroy` function.

E.1 RequestResponseParadigm

```c
/* RequestResponseParadigm.c */

#include <blpapi_correlationid.h>
#include <blpapi_element.h>
#include <blpapi_event.h>
#include <blpapi_message.h>
#include <blpapi_request.h>
#include <blpapi_session.h>

#include <assert.h>
#include <stdio.h>
#include <stdlib.h>
#include <string.h>  /* for strcmp(3C) and memset(3C) */

static int streamWriter(const char* data, int length, void *stream)
{
    assert(data);
    assert(stream);
    return fwrite(data, length, 1, (FILE *)stream);
}

static void handleResponseEvent(const blpapi_Event_t *event)
{
    blpapi_MessageIterator_t *iter    = 0;
    blpapi_Message_t         *message = 0;

    assert(event);

    printf("Event Type = %d\n", blpapi_Event_eventType(event));

    iter = blpapi_MessageIterator_create(event);
    assert(iter);

    while (0 == blpapi_MessageIterator_next(iter, &message)) {
        blpapi_CorrelationId_t  correlationId;
        blpapi_Element_t       *messageElements = 0;

        assert(message);
        correlationId = blpapi_Message_correlationId(message, 0);
        printf("correlationId=%d %d %lld\n",
               correlationId.valueType,
               correlationId.classId,
               correlationId.value.intValue);
```

```
            printf("messageType  =%s\n", blpapi_Message_typeString(message));
            messageElements = blpapi_Message_elements(message);
            assert(messageElements);
           blpapi_Element_print(messageElements, &streamWriter, stdout, 0, 4);
        }
        blpapi_MessageIterator_destroy(iter);
    }

    static void handleOtherEvent(const blpapi_Event_t *event)
    {
        blpapi_MessageIterator_t *iter    = 0;
        blpapi_Message_t         *message = 0;

        assert(event);

        printf("EventType=%d\n", blpapi_Event_eventType(event));

        iter = blpapi_MessageIterator_create(event);
        assert(iter);

        while (0 == blpapi_MessageIterator_next(iter, &message)) {
            blpapi_CorrelationId_t  correlationId;
            blpapi_Element_t       *messageElements = 0;

            assert(message);

            correlationId = blpapi_Message_correlationId(message, 0);
            printf("correlationId=%d %d %lld\n",
                   correlationId.valueType,
                   correlationId.classId,
                   correlationId.value.intValue);

            printf("messageType=%s\n", blpapi_Message_typeString(message));

            messageElements = blpapi_Message_elements(message);
            assert(messageElements);
           blpapi_Element_print(messageElements, &streamWriter, stdout, 0, 4);

            if (BLPAPI_EVENTTYPE_SESSION_STATUS ==
    blpapi_Event_eventType(event)
            &&  0 == strcmp("SessionTerminated",
                            blpapi_Message_typeString(message))){
                fprintf(stdout,
                       "Terminating: %s\n",
                        blpapi_Message_typeString(message));
                exit(1);
            }
        }
        blpapi_MessageIterator_destroy(iter);
    }
```

```
int main()
{
    blpapi_SessionOptions_t *sessionOptions     = 0;
    blpapi_Session_t        *session            = 0;
    blpapi_CorrelationId_t   requestId;
    blpapi_Service_t        *refDataSvc         = 0;
    blpapi_Request_t        *request            = 0;
    blpapi_Element_t        *elements           = 0;
    blpapi_Element_t        *securitiesElements = 0;
    blpapi_Element_t        *fieldsElements     = 0;
    int                      continueToLoop     = 1;
    blpapi_CorrelationId_t   correlationId;

    sessionOptions = blpapi_SessionOptions_create();
    assert(sessionOptions);

    blpapi_SessionOptions_setServerHost(sessionOptions, "localhost");
    blpapi_SessionOptions_setServerPort(sessionOptions, "8194")

    session = blpapi_Session_create(sessionOptions, 0, 0, 0);
    assert(session);

    blpapi_SessionOptions_destroy(sessionOptions);

    if (0 != blpapi_Session_start(session)) {
        fprintf(stderr, "Failed to start session.\n");
        blpapi_Session_destroy(session);
        return 1;
    }

    if (0 != blpapi_Session_openService(session, "//blp/refdata")){
        fprintf(stderr, "Failed to open service  //blp/refdata.\n");
        blpapi_Session_destroy(session);
        return 1;
    }
    memset(&requestId, '\0', sizeof(requestId));
    requestId.size           = sizeof(requestId);
    requestId.valueType      = BLPAPI_CORRELATION_TYPE_INT;
    requestId.value.intValue = (blpapi_UInt64_t)1;

    blpapi_Session_getService(session, &refDataSvc, "//blp/refdata");

    blpapi_Service_createRequest(refDataSvc,
                                 &request,
                                 "ReferenceDataRequest");
    assert(request);
    elements = blpapi_Request_elements(request);
    assert(elements);

    blpapi_Element_getElement(elements,
                              &securitiesElements,
                              "securities",
                              0);
    assert(securitiesElements);
    blpapi_Element_setValueString(securitiesElements,
                                  "IBM US Equity",
                                  BLPAPI_ELEMENT_INDEX_END);

    blpapi_Element_getElement(elements, &fieldsElements, "fields", 0);
    blpapi_Element_setValueString(fieldsElements,
                                  "PX_LAST",
                                  BLPAPI_ELEMENT_INDEX_END);

    memset(&correlationId, '\0', sizeof(correlationId));
    correlationId.size           = sizeof(correlationId);
    correlationId.valueType      = BLPAPI_CORRELATION_TYPE_INT;
    correlationId.value.intValue = (blpapi_UInt64_t)1;

    blpapi_Session_sendRequest(session, request, &correlationId, 0, 0, 0,
0);

    while (continueToLoop) {
        blpapi_Event_t *event = 0;

        blpapi_Session_nextEvent(session, &event, 0);
        assert(event);
        switch (blpapi_Event_eventType(event)) {
          case BLPAPI_EVENTTYPE_RESPONSE:  // final event
            continueToLoop = 0;            // fall through
          case BLPAPI_EVENTTYPE_PARTIAL_RESPONSE:
            handleResponseEvent(event);
            break;
          default:
            handleOtherEvent(event);
            break;
        }
        blpapi_Event_release(event);
    }

    blpapi_Session_stop(session);

    blpapi_Request_destroy(request);
    blpapi_Session_destroy(session);

    return 0;
}
```

Request Response Paradigm Output

```
EventType=2
correlationId=0 0 0
messageType=SessionStarted
SessionStarted =  {
 }
EventType=9
correlationId=0 0 0
messageType=ServiceOpened
ServiceOpened =  {
 }
Event Type = 5
correlationId=1 0 1
messageType  =ReferenceDataResponse
ReferenceDataResponse =  {
    securityData[] =
        securityData =  {
            security = IBM US Equity
            eidData[] =

            fieldExceptions[] =

            sequenceNumber = 0
            fieldData =  {
                PX_LAST = 91.170000
             }
         }
 }
```

E.2 Subscription Paradigm

```
/* SubscriptionParadigm.c */

#include <blpapi_correlationid.h>
#include <blpapi_element.h>
#include <blpapi_event.h>
#include <blpapi_message.h>
#include <blpapi_request.h>
#include <blpapi_session.h>
#include <blpapi_subscriptionlist.h>

#include <assert.h>
#include <stdio.h>
#include <stdlib.h>  /* for exit(2) */
#include <string.h>  /* for strcmp(3C) and memset(3C) */

static int streamWriter(const char* data, int length, void *stream)
{
    assert(data);
    assert(stream);
    return fwrite(data, length, 1, (FILE *)stream);
}

static void handleDataEvent(const blpapi_Event_t *event, int updateCount)
{
    blpapi_MessageIterator_t *iter    = 0;
    blpapi_Message_t         *message = 0;

    assert(event);

    printf("EventType=%d\n", blpapi_Event_eventType(event));
    printf("updateCount = %d\n", updateCount);

    iter = blpapi_MessageIterator_create(event);
    assert(iter);

    while (0 == blpapi_MessageIterator_next(iter, &message)) {
        blpapi_CorrelationId_t  correlationId;
        blpapi_Element_t       *messageElements = 0;

        assert(message);

        correlationId = blpapi_Message_correlationId(message, 0);
        printf("correlationId=%d %d %lld\n",
               correlationId.valueType,
               correlationId.classId,
               correlationId.value.intValue);
        printf("messageType   = %s\n", blpapi_Message_typeString(message));
         messageElements = blpapi_Message_elements(message);
        blpapi_Element_print(messageElements, &streamWriter, stdout, 0, 4);
    }
    blpapi_MessageIterator_destroy(iter);
}

static void handleOtherEvent(const blpapi_Event_t *event)
{
    blpapi_MessageIterator_t *iter    = 0;
    blpapi_Message_t         *message = 0;

    assert(event);

    printf("EventType=%d\n", blpapi_Event_eventType(event));
    iter = blpapi_MessageIterator_create(event);
    assert(iter);

    while (0 == blpapi_MessageIterator_next(iter, &message)) {
        blpapi_CorrelationId_t  correlationId;
        blpapi_Element_t       *messageElements = 0;

        assert(message);

        correlationId = blpapi_Message_correlationId(message, 0);
        printf("correlationId=%d %d %lld\n",
               correlationId.valueType,
               correlationId.classId,
               correlationId.value.intValue);

        printf("messageType=%s\n", blpapi_Message_typeString(message));
        messageElements = blpapi_Message_elements(message);
        blpapi_Element_print(messageElements, &streamWriter, stdout, 0, 4);

        if (BLPAPI_EVENTTYPE_SESSION_STATUS ==
blpapi_Event_eventType(event)
        &&  0 == strcmp("SessionTerminated",
                        blpapi_Message_typeString(message))){
            fprintf(stdout,
                   "Terminating: %s\n",
                    blpapi_Message_typeString(message));
            exit(1);
        }
    }
    blpapi_MessageIterator_destroy(iter);
}
```

```
int main()
{
    blpapi_SessionOptions_t  *sessionOptions  = 0;
    blpapi_Session_t         *session         = 0;
    blpapi_CorrelationId_t    subscriptionId;
    blpapi_SubscriptionList  *subscriptions   = 0;
    const char               *fields[1]       = {"LAST_PRICE"};
    const char              **options         = 0;
    int                       updateCount     = 0;

    setbuf(stdout, 0); /* NO SHOW */

    sessionOptions = blpapi_SessionOptions_create();
    assert(sessionOptions);
    blpapi_SessionOptions_setServerHost(sessionOptions, "localhost");
    blpapi_SessionOptions_setServerPort(sessionOptions, "8194");

    session = blpapi_Session_create(sessionOptions, 0, 0, 0);
    assert(session);

    blpapi_SessionOptions_destroy(sessionOptions);

    if (0 != blpapi_Session_start(session)) {
        fprintf(stderr, "Failed to start session.\n");
                         blpapi_Session_destroy(session);
        return 1;
    }

    if (0 != blpapi_Session_openService(session, "//blp/mktdata")){
        fprintf(stderr, "Failed to open service //blp/mktdata.\n");
        blpapi_Session_destroy(session);
        return 1;
    }

    memset(&subscriptionId, '\0', sizeof(subscriptionId));
    subscriptionId.size            = sizeof(subscriptionId);
    subscriptionId.valueType       = BLPAPI_CORRELATION_TYPE_INT;
    subscriptionId.value.intValue = (blpapi_UInt64_t)2;

    subscriptions = blpapi_SubscriptionList_create();
    assert(subscriptions);
    blpapi_SubscriptionList_add(subscriptions,
                                "AAPL US Equity",
                                &subscriptionId,
                                fields,
                                options,
                                1,
                                0);

    blpapi_Session_subscribe(session,
                             subscriptions,
                             0,
                             0,
                             0);

    while (1) {
        blpapi_Event_t *event = 0;
        blpapi_Session_nextEvent(session, &event, 0);
        assert(event);

        switch (blpapi_Event_eventType(event)) {
          case BLPAPI_EVENTTYPE_SUBSCRIPTION_DATA:
            handleDataEvent(event, updateCount++);
            break;
          default:
            handleOtherEvent(event);
            break;
       }
       blpapi_Event_release(event);
    }

    return 0;
}
```

Subscription Paradigm Output

```
EventType=2
correlationId=0 0 0
messageType=SessionStarted
SessionStarted =  {
 }
EventType=9
correlationId=0 0 0
messageType=ServiceOpened
ServiceOpened =  {
 }
EventType=3
correlationId=1 0 2
messageType=SubscriptionStarted
SubscriptionStarted =  {
    exceptions[] =

 }
EventType=8
updateCount = 0
correlationId=1 0 2
messageType   = MarketDataEvents
MarketDataEvents =  {
    LAST_PRICE = 90.886000
    BID = 90.880000
    ASK = 90.910000
    VOLUME = 7596090
    HIGH = 91.640000
    LOW = 88.900000
    BEST_BID = 90.880000
    BEST_ASK = 90.910000
    LAST_TRADE = 90.886000
    OPEN = 89.100000
    INDICATIVE_FAR = 89.130000
    INDICATIVE_NEAR = 89.130000
    IMBALANCE_BID =
    IMBALANCE_ASK =
    VWAP = 90.159300
    LAST_ALL_SESSIONS = 90.886000
    IMBALANCE_INDIC_RT = NOIM
    BID_ALL_SESSION = 90.880000
    ASK_ALL_SESSION = 90.910000
    TRADING_DT_REALTIME = 2009-02-02
    EQY_TURNOVER_REALTIME = 682873786.088959
    TOT_CALL_VOLUME_CUR_DAY_RT = 4886
    TOT_PUT_VOLUME_CUR_DAY_RT = 3457
    TOT_OPT_VOLUME_CUR_DAY_RT = 8343
    PUT_CALL_VOLUME_RATIO_CUR_DAY_RT = 0
    IN_AUCTION_RT = false
    RT_API_MACHINE = n125
    ALL_PRICE_SIZE = 1000
```

```
        ALL_PRICE = 90.886000
        ALL_PRICE_COND_CODE =
        BID_COND_CODE =
        ASK_COND_CODE =
        LAST_AT_TRADE_TDY = 0.000000
        SIZE_LAST_AT_TRADE_TDY = 0
        OPEN_YLD_TDY = 0.000000
        HIGH_YLD_TDY = 0.000000
        LOW_YLD_TDY = 0.000000
        LAST_YLD_TDY = 0.000000
        MID_TDY = 0.000000
        SIZE_LAST_TRADE_TDY = 1000
        IND_BID_FLAG = false
        IND_ASK_FLAG = false
        OPEN_TDY = 89.100000
        ASK_SIZE_TDY = 5
        BID_SIZE_TDY = 7
        VOLUME_TDY = 7596090
        LAST_PRICE_TDY = 90.886000
        BID_TDY = 90.880000
        ASK_TDY = 90.910000
        HIGH_TDY = 91.640000
        LOW_TDY = 88.900000
        BID_YLD_TDY = 0.000000
        ASK_YLD_TDY = 0.000000
        LAST2_PRICE = 90.900000
        LAST_DIR = -1
        LAST2_DIR = 1
        BID_DIR = 1
        ASK_DIR = 1
        BID2 = 90.880000
        ASK2 = 90.910000
        SIZE_LAST_TRADE = 1000
        ASK_SIZE = 5
        BID_SIZE = 7
        API_MACHINE = n166
        EXCH_CODE_LAST =
        EXCH_CODE_BID =
        EXCH_CODE_ASK =
        TRADE_SIZE_ALL_SESSIONS_RT = 1000
        IS_DELAYED_STREAM = false
        EID = 14005
        PREV_SES_LAST_PRICE = 90.130000
        RT_PX_CHG_NET_1D = 0.756000
        RT_PX_CHG_PCT_1D = 0.838788
        TIME = 16:36:33.000+00:00
        LAST_UPDATE_BID_RT = 16:36:35.000+00:00
        LAST_UPDATE_ASK_RT = 16:36:32.000+00:00
        BID_ASK_TIME = 16:36:35.000+00:00
        SES_START = 14:30:00.000+00:00
        SES_END = 21:30:00.000+00:00
    }
```

```
EventType=8
updateCount = 1
correlationId=1 0 2
messageType   = MarketDataEvents
MarketDataEvents =  {
    LAST_PRICE = 90.886000
    BID = 90.880000
    ASK = 90.910000
    VOLUME = 7596090
    HIGH = 91.640000
    LOW = 88.900000
    BEST_BID = 90.880000
    BEST_ASK = 90.910000
    LAST_TRADE = 90.886000
    VWAP = 90.644800
    LAST_ALL_SESSIONS = 90.886000
    BID_ALL_SESSION = 90.880000
    ASK_ALL_SESSION = 90.910000
    EQY_TURNOVER_REALTIME = 682873786.088959
    TOT_CALL_VOLUME_CUR_DAY_RT = 4886
    TOT_PUT_VOLUME_CUR_DAY_RT = 3457
    TOT_OPT_VOLUME_CUR_DAY_RT = 8343
    PUT_CALL_VOLUME_RATIO_CUR_DAY_RT = 0
    IN_AUCTION_RT = false
    ALL_PRICE_SIZE = 1000
    ALL_PRICE = 90.886000
    ALL_PRICE_COND_CODE =
    LAST_AT_TRADE_TDY = 0.000000
    SIZE_LAST_AT_TRADE_TDY = 0
    OPEN_YLD_TDY = 0.000000
    HIGH_YLD_TDY = 0.000000
    LOW_YLD_TDY = 0.000000
    LAST_YLD_TDY = 0.000000
    MID_TDY = 0.000000
    SIZE_LAST_TRADE_TDY = 1000
    IND_BID_FLAG = false
    IND_ASK_FLAG = false
    OPEN_TDY = 89.100000
    ASK_SIZE_TDY = 5
    BID_SIZE_TDY = 7
    VOLUME_TDY = 7596090
    LAST_PRICE_TDY = 90.886000
    BID_TDY = 90.880000
    ASK_TDY = 90.910000
    HIGH_TDY = 91.640000
    LOW_TDY = 88.900000
    BID_YLD_TDY = 0.000000
    ASK_YLD_TDY = 0.000000
    LAST2_PRICE = 90.900000
    LAST_DIR = -1
    LAST2_DIR = 1
    BID_DIR = 1
    ASK_DIR = 1
    BID2 = 90.880000
```

```
        ASK2 = 90.910000
        SIZE_LAST_TRADE = 1000
        ASK_SIZE = 5
        BID_SIZE = 7
        EXCH_CODE_LAST =
        EXCH_CODE_BID =
        EXCH_CODE_ASK =
        TRADE_SIZE_ALL_SESSIONS_RT = 1000
        IS_DELAYED_STREAM = false
        EID = 14005
        RT_PX_CHG_NET_1D = 0.756000
        RT_PX_CHG_PCT_1D = 0.838788
        TIME = 16:36:33.000+00:00
        LAST_UPDATE_BID_RT = 16:36:35.000+00:00
        LAST_UPDATE_ASK_RT = 16:36:32.000+00:00
        BID_ASK_TIME = 16:36:35.000+00:00
     }
    EventType=8
    updateCount = 2
    correlationId=1 0 2
    messageType   = MarketDataEvents
    MarketDataEvents =  {
        LAST2_PRICE = 90.886000
        LAST_PRICE = 90.910000
        LAST_ALL_SESSIONS = 90.910000
        LAST_PRICE_TDY = 90.910000
        LAST2_DIR = -1
        LAST_DIR = 1
        EQY_TURNOVER_REALTIME = 682882877.088959
        SIZE_LAST_TRADE = 100
        SIZE_LAST_TRADE_TDY = 100
        TRADE_SIZE_ALL_SESSIONS_RT = 100
        VOLUME = 7596190
        VOLUME_TDY = 7596190
        LAST_TRADE = 90.910000
        ALL_PRICE = 90.910000
        ALL_PRICE_SIZE = 100
        EID = 14005
        RT_PX_CHG_NET_1D = 0.780000
        RT_PX_CHG_PCT_1D = 0.865417
        IS_DELAYED_STREAM = false
        TIME = 16:36:37.000+00:00
        EVENT_TIME = 16:36:37.000+00:00
     }
```

```
EventType=8
updateCount = 3
correlationId=1 0 2
messageType   = MarketDataEvents
MarketDataEvents =  {
    LAST2_PRICE = 90.910000
    LAST_PRICE = 90.910000
    LAST_ALL_SESSIONS = 90.910000
    LAST_PRICE_TDY = 90.910000
    LAST2_DIR = 1
    EQY_TURNOVER_REALTIME = 682891968.088959
    SIZE_LAST_TRADE = 100
    SIZE_LAST_TRADE_TDY = 100
    TRADE_SIZE_ALL_SESSIONS_RT = 100
    VOLUME = 7596290
    VOLUME_TDY = 7596290
    LAST_TRADE = 90.910000
    ALL_PRICE = 90.910000
    ALL_PRICE_SIZE = 100
    EID = 14005
    RT_PX_CHG_NET_1D = 0.780000
    RT_PX_CHG_PCT_1D = 0.865417
    IS_DELAYED_STREAM = false
    TIME = 16:36:37.000+00:00
    EVENT_TIME = 16:36:37.000+00:00
 }
correlationId=1 0 2
messageType   = MarketDataEvents
MarketDataEvents =  {
    LAST2_PRICE = 90.910000
    LAST_PRICE = 90.910000
    LAST_ALL_SESSIONS = 90.910000
    LAST_PRICE_TDY = 90.910000
    LAST2_DIR = 1
    EQY_TURNOVER_REALTIME = 682901059.088959
    SIZE_LAST_TRADE = 100
    SIZE_LAST_TRADE_TDY = 100
    TRADE_SIZE_ALL_SESSIONS_RT = 100
    VOLUME = 7596390
    VOLUME_TDY = 7596390
    LAST_TRADE = 90.910000
    ALL_PRICE = 90.910000
    ALL_PRICE_SIZE = 100
    EID = 14005
    RT_PX_CHG_NET_1D = 0.780000
    RT_PX_CHG_PCT_1D = 0.865417
    IS_DELAYED_STREAM = false
    TIME = 16:36:37.000+00:00
    EVENT_TIME = 16:36:37.000+00:00
 }
```

E.3 Asynchronous Event Handling

```c
/* RequestResponseParadigm.c */

#include <blpapi_correlationid.h>
#include <blpapi_element.h>
#include <blpapi_event.h>
#include <blpapi_message.h>
#include <blpapi_request.h>
#include <blpapi_session.h>

#include <assert.h>
#include <stdio.h>
#include <stdlib.h>  /* for exit(2)  */
#include <string.h>  /* for strcmp(3C) and memset(3C) */
#include <unistd.h>  /* for pause(2) */

static int streamWriter(const char* data, int length, void *stream)
{
    assert(data);
    assert(stream);
    return fwrite(data, length, 1, (FILE *)stream);
}

static void dumpEvent(blpapi_Event_t *event) /* not const! */
{
    blpapi_MessageIterator_t *iter    = 0;
    blpapi_Message_t         *message = 0;

    assert(event);

    printf("eventType=%d\n", blpapi_Event_eventType(event));

    iter = blpapi_MessageIterator_create(event);
    assert(iter);

    while (0 == blpapi_MessageIterator_next(iter, &message)) {
        blpapi_CorrelationId_t  correlationId;
        blpapi_Element_t       *messageElements = 0;

        assert(message);
        printf("messageType=%s\n", blpapi_Message_typeString(message));

        correlationId = blpapi_Message_correlationId(message, 0);
        printf("correlationId=%d %d %lld\n",
               correlationId.valueType,
               correlationId.classId,
               correlationId.value.intValue);
```

```
            messageElements = blpapi_Message_elements(message);
            assert(messageElements);
           blpapi_Element_print(messageElements, &streamWriter, stdout, 0, 4);
        }
    }

    #ifdef __cplusplus
    extern "C"
    #endif
    static void processEvent(blpapi_Event_t   *event,
                             blpapi_Session_t *session,
                             void             *userData)
    {
        assert(event);
        assert(session);

        switch (blpapi_Event_eventType(event)) {
          case BLPAPI_EVENTTYPE_SESSION_STATUS: {
            blpapi_MessageIterator_t *iter    = 0;
            blpapi_Message_t         *message = 0;

            iter = blpapi_MessageIterator_create(event);
            assert(iter);

            while (0 == blpapi_MessageIterator_next(iter, &message)) {

                if (0 == strcmp("SessionStarted",
                                blpapi_Message_typeString(message))) {

                    blpapi_CorrelationId_t  correlationId;

                    memset(&correlationId, '\0', sizeof(correlationId));
                    correlationId.size           = sizeof(correlationId);
                   correlationId.valueType      = BLPAPI_CORRELATION_TYPE_INT;
                    correlationId.value.intValue = (blpapi_UInt64_t)99;

                    blpapi_Session_openServiceAsync(session,
                                                    "//blp/refdata",
                                                    &correlationId);
                } else {
                    blpapi_Element_t *messageElements = 0;

                    messageElements = blpapi_Message_elements(message);
                    assert(messageElements);
                    blpapi_Element_print(messageElements,
                                         &streamWriter,
                                         stdout,
                                         0,
                                         4);
                    exit(1);
                }
            }
            break;
          }
          case BLPAPI_EVENTTYPE_SERVICE_STATUS: {
            blpapi_MessageIterator_t *iter       = 0;
            blpapi_Message_t         *message    = 0;
            blpapi_Service_t         *refDataSvc = 0;
            blpapi_CorrelationId_t    correlationId;

            iter = blpapi_MessageIterator_create(event);
            assert(iter);

            while (0 == blpapi_MessageIterator_next(iter, &message)) {
                assert(message);

                correlationId = blpapi_Message_correlationId(message, 0);

                if (correlationId.value.intValue == (blpapi_UInt64_t)99
                &&  0 == strcmp("ServiceOpened",
                                blpapi_Message_typeString(message))) {
                    blpapi_Request_t *request            = 0;
                    blpapi_Element_t *elements           = 0;
                    blpapi_Element_t *securitiesElements = 0;
                    blpapi_Element_t *fieldsElements     = 0;


                    /* Construct and issue a Request */
                    blpapi_Session_getService(session,
                                              &refDataSvc,
                                              "//blp/refdata");

                    blpapi_Service_createRequest(refDataSvc,
                                                 &request,
                                                 "ReferenceDataRequest");
                    assert(request);
                    elements = blpapi_Request_elements(request);
                    assert(elements);

                    blpapi_Element_getElement(elements,
                                              &securitiesElements,
                                              "securities",
                                              0);
                    assert(securitiesElements);

                    blpapi_Element_setValueString(securitiesElements,
                                                  "IBM US Equity",
                                                  BLPAPI_ELEMENT_INDEX_END);

                    blpapi_Element_getElement(elements,
                                              &fieldsElements,
                                              "fields",
                                              0);
                    blpapi_Element_setValueString(fieldsElements,
                                                  "PX_LAST",
                                                  BLPAPI_ELEMENT_INDEX_END);
                    memset(&correlationId, '\0', sizeof(correlationId));
                    correlationId.size           = sizeof(correlationId);
                   correlationId.valueType      = BLPAPI_CORRELATION_TYPE_INT;
                    correlationId.value.intValue = (blpapi_UInt64_t)86;

                    blpapi_Session_sendRequest(session,
                                               request,
                                               &correlationId,
                                               0,
                                               0,
                                               0,
                                               0);
                } else {
                    blpapi_Element_t *messageElements = 0;

                    fprintf(stderr, "Unexpected message\n");

                    messageElements = blpapi_Message_elements(message);
                    assert(messageElements);
                    blpapi_Element_print(messageElements,
                                         &streamWriter,
                                         stdout,
                                         0,
                                         4);
                }
            }
            break;
          }
          case BLPAPI_EVENTTYPE_PARTIAL_RESPONSE: {
            dumpEvent(event);
            break;
          }
          case BLPAPI_EVENTTYPE_RESPONSE: {
            dumpEvent(event);
            assert(session);
            printf("terminate process from handler\n");
            blpapi_Session_stop(session);
            exit(0);
            break;
          }
          default: {
            fprintf(stderr, "default-case\n");
            fprintf(stderr, "Unxepected Event Type %d\n",
                             blpapi_Event_eventType(event));
            exit(1);
            break;
          }
        }
    }
```

```
int main()
{
    blpapi_SessionOptions_t *sessionOptions  = 0;
    blpapi_Session_t        *session         = 0;

    sessionOptions = blpapi_SessionOptions_create();
    assert(sessionOptions);

    blpapi_SessionOptions_setServerHost(sessionOptions, "localhost");
    blpapi_SessionOptions_setServerPort(sessionOptions, "8194");

    session = blpapi_Session_create(sessionOptions, &processEvent, 0, 0);
    assert(session);

    blpapi_SessionOptions_destroy(sessionOptions);

    if (0 != blpapi_Session_start(session)) {
        fprintf(stderr, "Failed to start async session.\n");
        blpapi_Session_destroy(session);
        return 1;
    }

    pause();

    blpapi_Session_destroy(session);
    return 0;
}
```

Asynchronous Event Handling Output

```
eventType=5
messageType=ReferenceDataResponse
correlationId=1 0 86
ReferenceDataResponse =  {
    securityData[] =
        securityData =  {
            security = IBM US Equity
            eidData[] =

            fieldExceptions[] =

            sequenceNumber = 0
            fieldData =  {
                PX_LAST = 91.170000
             }
         }
 }
terminate process from handler
```

E.4 Request Response Multiple

```
/* RequestResponseParadigm.c */

#include <blpapi_correlationid.h>
#include <blpapi_element.h>
#include <blpapi_event.h>
#include <blpapi_message.h>
#include <blpapi_request.h>
#include <blpapi_session.h>

#include <assert.h>
#include <stdio.h>
#include <string.h>  /* for strcmp(3C) */

static int streamWriter(const char* data, int length, void *stream)
{
    assert(data);
    assert(stream);
    return fwrite(data, length, 1, (FILE *)stream);
}

static void handleResponseEvent(const blpapi_Event_t *event)
{
    blpapi_MessageIterator_t *iter    = 0;
    blpapi_Message_t         *message = 0;

    assert(event);

    iter = blpapi_MessageIterator_create(event);
    assert(iter);

    while (0 == blpapi_MessageIterator_next(iter, &message)) {
        blpapi_Element_t       *referenceDataResponse = 0;
        blpapi_Element_t       *securityDataArray     = 0;
        int                     numItems              = 0;

        assert(message);

        referenceDataResponse = blpapi_Message_elements(message);
        assert(referenceDataResponse);

        if (blpapi_Element_hasElement(referenceDataResponse,
                                      "responseError",
                                      0)) {
```

```
                fprintf(stderr, "has responseError\n");
                blpapi_Element_print(referenceDataResponse,
                                     &streamWriter,
                                     stdout,
                                     0,
                                     4);
                exit(1);
            }

            blpapi_Element_getElement(referenceDataResponse,
                                      &securityDataArray,
                                      "securityData",
                                      0);
            numItems = blpapi_Element_numValues(securityDataArray);

            for (int i = 0; i < numItems; ++i) {
                blpapi_Element_t *securityData          =  0;
                blpapi_Element_t *securityElement       =  0;
                const char       *security              =  0;
                blpapi_Element_t *sequenceNumberElement =  0;
                int               sequenceNumber        = -1;

                blpapi_Element_getValueAsElement(securityDataArray,
                                                 &securityData,
                                                 i);
                assert(securityData);

                blpapi_Element_getElement(securityData,
                                          &securityElement,
                                          "security",
                                          0);
                assert(securityElement);
                blpapi_Element_getValueAsString(securityElement,
                                                &security,
                                                0);
                assert(security);

                blpapi_Element_getElement(securityData,
                                          &sequenceNumberElement,
                                          "sequenceNumber",
                                          0);
                assert(sequenceNumberElement);
                blpapi_Element_getValueAsInt32(sequenceNumberElement,
                                               &sequenceNumber,
                                               0);
            if (blpapi_Element_hasElement(securityData, "securityError",
0)){
                blpapi_Element_t *securityErrorElement = 0;

                printf("*security      =%s\n", security);

                blpapi_Element_getElement(securityData,
                                             &securityErrorElement,
                                          "securityError",
                                          0);
                assert(securityErrorElement);

                blpapi_Element_print(securityErrorElement,
                                     &streamWriter,
                                     stdout,
                                     0,
                                     4);
                return;
            } else {
                blpapi_Element_t    *fieldDataElement = 0;
                blpapi_Element_t     *PX_LAST_Element = 0;
                blpapi_Element_t       *DS002_Element = 0;
                blpapi_Element_t *VWAP_VOLUME_Element = 0;

                double      px_last     = (double)777;
                const char *ds002       = 0;
                double      vwap_volume = (double)666;

                blpapi_Element_getElement(securityData,
                                          &fieldDataElement,
                                          "fieldData",
                                          0);
                assert(fieldDataElement);

                blpapi_Element_getElement(fieldDataElement,
                                          &PX_LAST_Element,
                                          "PX_LAST",
                                          0);
                assert(PX_LAST_Element);
                blpapi_Element_getValueAsFloat64(PX_LAST_Element,
                                                 &px_last,
                                                 0);
                blpapi_Element_getElement(fieldDataElement,
                                          &DS002_Element,
                                          "DS002",
                                          0);
                assert(DS002_Element);
                blpapi_Element_getValueAsString(DS002_Element,
                                                &ds002,
                                                0);
                blpapi_Element_getElement(fieldDataElement,
                                          &VWAP_VOLUME_Element,
                                          "VWAP_VOLUME",
                                          0);
                assert(VWAP_VOLUME_Element);
                blpapi_Element_getValueAsFloat64(VWAP_VOLUME_Element,
                                                 &vwap_volume,
                                                 0);

                printf("*security      =%s\n", security);
                printf("*sequenceNumber=%d\n", sequenceNumber);
                printf("*px_last       =%f\n", px_last);
                printf("*ds002         =%s\n", ds002);
                printf("*vwap_volume   =%f\n", vwap_volume);
                printf("\n");
            }
        }
    }
    blpapi_MessageIterator_destroy(iter);
}

static void handleOtherEvent(const blpapi_Event_t *event)
{
    blpapi_MessageIterator_t *iter    = 0;
    blpapi_Message_t         *message = 0;

    assert(event);

    printf("EventType=%d\n", blpapi_Event_eventType(event));

    iter = blpapi_MessageIterator_create(event);
    assert(iter);

    while (0 == blpapi_MessageIterator_next(iter, &message)) {
        blpapi_CorrelationId_t  correlationId;
        blpapi_Element_t       *messageElements = 0;

        assert(message);
        correlationId = blpapi_Message_correlationId(message, 0);
        printf("correlationId=%d %d %lld\n",
               correlationId.valueType,
               correlationId.classId,
               correlationId.value.intValue);

        printf("messageType=%s\n", blpapi_Message_typeString(message));

        messageElements = blpapi_Message_elements(message);
        assert(messageElements);
       blpapi_Element_print(messageElements, &streamWriter, stdout, 0, 4);
```

```
        if (BLPAPI_EVENTTYPE_SESSION_STATUS ==
blpapi_Event_eventType(event)
        &&  0 == strcmp("SessionTerminated",
                        blpapi_Message_typeString(message))){
            fprintf(stdout,
                   "Terminating: %s\n",
                    blpapi_Message_typeString(message));
            exit(1);
        }
    }
    blpapi_MessageIterator_destroy(iter);
}

int main()
{
    blpapi_SessionOptions_t *sessionOptions     = 0;
    blpapi_Session_t        *session            = 0;
    blpapi_CorrelationId_t   requestId;
    blpapi_Service_t        *refDataSvc         = 0;
    blpapi_Request_t        *request            = 0;
    blpapi_Element_t        *elements           = 0;
    blpapi_Element_t        *securitiesElements = 0;
    blpapi_Element_t        *fieldsElements     = 0;
    blpapi_CorrelationId_t   correlationId;
    int                      continueToLoop     = 1;

    sessionOptions = blpapi_SessionOptions_create();
    assert(sessionOptions);

    blpapi_SessionOptions_setServerHost(sessionOptions, "localhost");
    blpapi_SessionOptions_setServerPort(sessionOptions, "8194");

    session = blpapi_Session_create(sessionOptions, 0, 0, 0);
    assert(session);

    blpapi_SessionOptions_destroy(sessionOptions);

    if (0 != blpapi_Session_start(session)) {
        fprintf(stderr, "Failed to start session.\n");
        blpapi_Session_destroy(session);
        return 1;
    }

    if (0 != blpapi_Session_openService(session,"//blp/refdata")){
        fprintf(stderr, "Failed to open service //blp/refdata.\n");
        blpapi_Session_destroy(session);
        return 1;
    }
    memset(&requestId, '\0', sizeof(requestId));
    requestId.size           = sizeof(requestId);
    requestId.valueType      = BLPAPI_CORRELATION_TYPE_INT;
    requestId.value.intValue = (blpapi_UInt64_t)1;

    blpapi_Session_getService(session, &refDataSvc, "//blp/refdata");

    blpapi_Service_createRequest(refDataSvc,
                                 &request,
                                 "ReferenceDataRequest");
    assert(request);

    elements = blpapi_Request_elements(request);
    assert(elements);

    blpapi_Element_getElement(elements,
                              &securitiesElements,
                              "securities",
                              0);
    assert(securitiesElements);

    blpapi_Element_setValueString(securitiesElements,
                                  "AAPL US Equity",
                                  BLPAPI_ELEMENT_INDEX_END);
    blpapi_Element_setValueString(securitiesElements,
                                  "IBM US Equity",
                                  BLPAPI_ELEMENT_INDEX_END);
    blpapi_Element_setValueString(securitiesElements,
                                  "BLAHBLAHBLAH US Equity",
                                  BLPAPI_ELEMENT_INDEX_END);

    blpapi_Element_getElement(elements, &fieldsElements, "fields", 0);
    blpapi_Element_setValueString(fieldsElements,
                                  "PX_LAST",
                                  BLPAPI_ELEMENT_INDEX_END);
    blpapi_Element_setValueString(fieldsElements,
                                  "DS002",
                                  BLPAPI_ELEMENT_INDEX_END);
    blpapi_Element_setValueString(fieldsElements,
                                  "VWAP_VOLUME",
                                  BLPAPI_ELEMENT_INDEX_END);

    memset(&correlationId, '\0', sizeof(correlationId));
    correlationId.size           = sizeof(correlationId);
    correlationId.valueType      = BLPAPI_CORRELATION_TYPE_INT;
    correlationId.value.intValue = (blpapi_UInt64_t)1;

    blpapi_Session_sendRequest(session, request, &correlationId, 0, 0, 0,
0);
```

```
    while (continueToLoop) {
        blpapi_Event_t *event = 0;

        blpapi_Session_nextEvent(session, &event, 0);
        assert(event);
        switch (blpapi_Event_eventType(event)) {
          case BLPAPI_EVENTTYPE_RESPONSE:  /* final event  */
            continueToLoop = 0;            /* fall through */
          case BLPAPI_EVENTTYPE_PARTIAL_RESPONSE:
            handleResponseEvent(event);
            break;
          default:
            handleOtherEvent(event);
            break;
        }
        blpapi_Event_release(event);
    }

    blpapi_Session_stop(session);

    blpapi_Request_destroy(request);
    blpapi_Session_destroy(session);

    return 0;
}
```

Request Response Multiple Output

```
EventType=2
correlationId=0 0 0
messageType=SessionStarted
SessionStarted =  {
 }
EventType=9
correlationId=0 0 0
messageType=ServiceOpened
ServiceOpened =  {
 }
*security      =AAPL US Equity
*sequenceNumber=0
*px_last       =90.910000
*ds002         =APPLE INC
*vwap_volume   =7603357.000000

*security      =IBM US Equity
*sequenceNumber=1
*px_last       =91.180000
*ds002         =INTL BUSINESS MACHINES CORP
*vwap_volume   =3272079.000000

*security      =BLAHBLAHBLAH US Equity
securityError =  {
    source = 161::bbdbs2
    code = 15
    category = BAD_SEC
    message = Unknown/Invalid security [nid:161]
    subcategory = INVALID_SECURITY
 }
```

E.5 Subscription Multiple

```
/* SubscriptionMultiple.c */

#include <blpapi_correlationid.h>
#include <blpapi_element.h>
#include <blpapi_event.h>
#include <blpapi_message.h>
#include <blpapi_request.h>
#include <blpapi_session.h>
#include <blpapi_subscriptionlist.h>

#include <assert.h>
#include <stdio.h>
#include <string.h>  /* for memset(3C) */
#include <unistd.h>  /* for pause(2)   */

static int streamWriter(const char* data, int length, void *stream)
{
    assert(data);
    assert(stream);
    return fwrite(data, length, 1, (FILE *)stream);
}

typedef struct UserData {
    const char *d_label;
    FILE       *d_stream;
} UserData_t;

static void dumpEvent(const blpapi_Event_t *event,
                      const UserData_t     *userData)
{
    blpapi_MessageIterator_t *iter    = 0;
    blpapi_Message_t         *message = 0;

    assert(event);
    assert(userData);
    assert(userData->d_label);
    assert(userData->d_stream);

    fprintf(userData->d_stream, "handler label=%s\n", userData->d_label);
    fprintf(userData->d_stream, "eventType=%d\n",
                                blpapi_Event_eventType(event));

    iter = blpapi_MessageIterator_create(event);
    assert(iter);
    while (0 == blpapi_MessageIterator_next(iter, &message)) {
        blpapi_CorrelationId_t  correlationId;
        blpapi_Element_t       *messageElements = 0;

        assert(message);

        printf("messageType=%s\n", blpapi_Message_typeString(message));
        messageElements=blpapi_Message_elements(message);

        correlationId = blpapi_Message_correlationId(message, 0);
        printf("correlationId=%d %d %lld\n",
               correlationId.valueType,
               correlationId.classId,
               correlationId.value.intValue);

       blpapi_Element_print(messageElements, &streamWriter, stdout, 0, 4);

    }
}

static void handleDataEvent(const blpapi_Event_t   *event,
                            const blpapi_Session_t *session,
                            const UserData_t       *userData)
{
    assert(event);
    assert(userData);

    fprintf(userData->d_stream, "handleDataEventHandler: enter\n");
    dumpEvent(event, userData);
    fprintf(userData->d_stream, "handleDataEventHandler: leave\n");
}

static void handleStatusEvent(const blpapi_Event_t   *event,
                              const blpapi_Session_t *session,
                              const UserData_t       *userData)
{
    assert(event);
    assert(session);
    assert(userData);  /* this application expects userData */

    fprintf(userData->d_stream, "handleStatusEventHandler: enter\n");
    dumpEvent(event, userData);
    fprintf(userData->d_stream, "handleStatusEventHandler: leave\n");
}

static void handleOtherEvent(const blpapi_Event_t   *event,
                             const blpapi_Session_t *session,
                             const UserData_t       *userData)
{
    assert(event);
    assert(userData);
    assert(userData->d_stream);
    fprintf(userData->d_stream, "handleOtherEventHandler: enter\n");
    dumpEvent(event, userData);
    fprintf(userData->d_stream, "handleOtherEventHandler: leave\n");
}

#ifdef __cplusplus
extern "C"
#endif
static void processEvent(blpapi_Event_t   *event,
                         blpapi_Session_t *session,
                         void             *buffer)
{
    UserData_t *userData = (UserData_t *)buffer;

    assert(event);
    assert(session);
    assert(buffer);

    switch (blpapi_Event_eventType(event)) {
      case BLPAPI_EVENTTYPE_SUBSCRIPTION_DATA:
          handleDataEvent(event, session, userData);
        break;
      case BLPAPI_EVENTTYPE_SESSION_STATUS:
      case BLPAPI_EVENTTYPE_SERVICE_STATUS:
      case BLPAPI_EVENTTYPE_SUBSCRIPTION_STATUS:
          handleStatusEvent(event, session, userData);
        break;
      default:
          handleOtherEvent(event, session, userData);
        break;
    }
}

int main()
{
    blpapi_SessionOptions_t *sessionOptions = 0;
    blpapi_Session_t        *session        = 0;

    UserData_t               userData       = { "myLabel", stdout };
    /* IBM */
    const char     *topic_IBM   = "IBM US Equity";
    const char    *fields_IBM[] = { "LAST_TRADE" };
    const char  **options_IBM   = 0;
    int         numFields_IBM   = sizeof(fields_IBM)/sizeof(*fields_IBM);
    int        numOptions_IBM   = 0;

    /* GOOG */
    const char     *topic_GOOG   = "/ticket/GOOG US Equity";
    const char    *fields_GOOG[] = { "BID", "ASK", "LAST_TRADE" };
    const char  **options_GOOG   = 0;
    int         numFields_GOOG   = sizeof(fields_GOOG)/
sizeof(*fields_GOOG);
    int        numOptions_GOOG   = 0;
    /* MSFT */
    const char     *topic_MSFT   = "MSFTT US Equity"; /* Note: Typo! */
    const char    *fields_MSFT[] = { "LAST_PRICE"  };
    const char   *options_MSFT[] = { "interval=.5" };
    int         numFields_MSFT   = sizeof(fields_MSFT)/
sizeof(*fields_MSFT);
    int        numOptions_MSFT   = sizeof(options_MSFT)/
sizeof(*options_MSFT);

    /* CUSIP 097023105 */
    const char     *topic_097023105 =
                             "/cusip/
097023105?fields=LAST_PRICE&interval=5.0";
    const char   **fields_097023105 = 0;
    const char  **options_097023105 = 0;
    int         numFields_097023105 = 0;
    int        numOptions_097023105 = 0;

    setbuf(stdout, 0); /* DO NOT SHOW */

    blpapi_CorrelationId_t subscriptionId_IBM;
    blpapi_CorrelationId_t subscriptionId_GOOG;
    blpapi_CorrelationId_t subscriptionId_MSFT;
    blpapi_CorrelationId_t subscriptionId_097023105;

    memset(&subscriptionId_IBM, '\0', sizeof(subscriptionId_IBM));
    subscriptionId_IBM.size           = sizeof(subscriptionId_IBM);
    subscriptionId_IBM.valueType      = BLPAPI_CORRELATION_TYPE_INT;
    subscriptionId_IBM.value.intValue = (blpapi_UInt64_t)10;

    memset(&subscriptionId_GOOG, '\0', sizeof(subscriptionId_GOOG));
    subscriptionId_GOOG.size           = sizeof(subscriptionId_GOOG);
    subscriptionId_GOOG.valueType      = BLPAPI_CORRELATION_TYPE_INT;
    subscriptionId_GOOG.value.intValue = (blpapi_UInt64_t)20;

    memset(&subscriptionId_MSFT, '\0', sizeof(subscriptionId_MSFT));
    subscriptionId_MSFT.size           = sizeof(subscriptionId_MSFT);
    subscriptionId_MSFT.valueType      = BLPAPI_CORRELATION_TYPE_INT;
    subscriptionId_MSFT.value.intValue = (blpapi_UInt64_t)30;

    memset(&subscriptionId_097023105,
           '\0',
           sizeof(subscriptionId_097023105));
    subscriptionId_097023105.size           =
                                    sizeof(subscriptionId_097023105);
    subscriptionId_097023105.valueType      = BLPAPI_CORRELATION_TYPE_INT;
    subscriptionId_097023105.value.intValue = (blpapi_UInt64_t)40;

    sessionOptions = blpapi_SessionOptions_create();
    assert(sessionOptions);

    blpapi_SessionOptions_setServerHost(sessionOptions, "localhost");
    blpapi_SessionOptions_setServerPort(sessionOptions, "8194");
```

```
        session = blpapi_Session_create(sessionOptions,
                                        &processEvent,
                                        0,
                                        &userData);
        assert(session);

        blpapi_SessionOptions_destroy(sessionOptions);

        if (0 != blpapi_Session_start(session)) {
            fprintf(stderr, "Failed to start session.\n");
            blpapi_Session_destroy(session);
            return 1;
        }

        if (0 != blpapi_Session_openService(session,"//blp/mktdata")){
            fprintf(stderr, "Failed to open service //blp/mktdata.\n");
            blpapi_Session_destroy(session);
            return 1;
        }

        blpapi_SubscriptionList_t *subscriptions =
                                             blpapi_SubscriptionList_create();

        blpapi_SubscriptionList_add(subscriptions,
                                        topic_IBM,
                              &subscriptionId_IBM,
                                       fields_IBM,
                                      options_IBM,
                                    numFields_IBM,
                                   numOptions_IBM);

        blpapi_SubscriptionList_add(subscriptions,
                                       topic_GOOG,
                             &subscriptionId_GOOG,
                                      fields_GOOG,
                                     options_GOOG,
                                   numFields_GOOG,
                                  numOptions_GOOG);

        blpapi_SubscriptionList_add(subscriptions,
                                       topic_MSFT,
                             &subscriptionId_MSFT,
                                      fields_MSFT,
                                     options_MSFT,
                                   numFields_MSFT,
                                  numOptions_MSFT);

        blpapi_SubscriptionList_add(subscriptions,
                                  topic_097023105,
                        &subscriptionId_097023105,
                                 fields_097023105,
                                options_097023105,
                              numFields_097023105,
                             numOptions_097023105);
```

```
    blpapi_Session_subscribe(session, subscriptions, 0, 0, 0);

    pause();

    blpapi_SubscriptionList_destroy(subscriptions);
    blpapi_Session_destroy(session);

    return 0;
}
```

Subscription Multiple Output

```
handleStatusEventHandler: enter
handler label=myLabel
eventType=2
messageType=SessionStarted
correlationId=0 0 0
SessionStarted =  {
 }
handleStatusEventHandler: leave
handleStatusEventHandler: enter
handler label=myLabel
eventType=9
messageType=ServiceOpened
correlationId=0 0 0
ServiceOpened =  {
 }
handleStatusEventHandler: leave
handleStatusEventHandler: enter
handler label=myLabel
eventType=3
messageType=SubscriptionFailure
correlationId=1 0 30
SubscriptionFailure =  {
    reason =  {
        errorCode = 2
        description = Invalid security
        category = BAD_SEC
        source = BBDB@n151
     }
 }
handleStatusEventHandler: leave
handleStatusEventHandler: enter
handler label=myLabel
eventType=3
messageType=SubscriptionStarted
correlationId=1 0 40
SubscriptionStarted =  {
    exceptions[] =

 }
messageType=SubscriptionStarted
correlationId=1 0 10
SubscriptionStarted =  {
    exceptions[] =

 }
messageType=SubscriptionStarted
correlationId=1 0 20
SubscriptionStarted =  {
    exceptions[] =
 }
handleStatusEventHandler: leave
handleDataEventHandler: enter
handler label=myLabel
eventType=8
messageType=MarketDataEvents
correlationId=1 0 10
MarketDataEvents =  {
    LAST_PRICE = 92.410000
    BID = 92.360000
    ASK = 92.390000
    VOLUME = 11337256
    HIGH = 93.200000
    LOW = 91.220000
    BEST_BID = 92.360000
    BEST_ASK = 92.390000
    LAST_TRADE = 92.410000
    OPEN = 92.130000
    IMBALANCE_BID = 92.390000
    IMBALANCE_ASK =
    ORDER_IMB_BUY_VOLUME = 44300.000000
    ORDER_IMB_SELL_VOLUME =
    VWAP = 92.213100
    THEO_PRICE = 0.000000
    LAST_ALL_SESSIONS = 92.410000
    IMBALANCE_INDIC_RT = BUY
    BID_ALL_SESSION = 92.030000
    ASK_ALL_SESSION = 92.370000
    TRADING_DT_REALTIME = 2009-02-05
    EQY_TURNOVER_REALTIME = 1042895294.262009
    NYSE_LRP_HIGH_PRICE_RT = 93.360000
    NYSE_LRP_LOW_PRICE_RT = 91.360000
    TOT_CALL_VOLUME_CUR_DAY_RT = 5625
    TOT_PUT_VOLUME_CUR_DAY_RT = 2314
    TOT_OPT_VOLUME_CUR_DAY_RT = 7939
    PUT_CALL_VOLUME_RATIO_CUR_DAY_RT = 0
    IN_AUCTION_RT = false
    RT_API_MACHINE = p142
    ALL_PRICE_SIZE = 1200
    ALL_PRICE = 92.379200
    ALL_PRICE_COND_CODE =
    BID_COND_CODE =
    ASK_COND_CODE =
    VOLUME_THEO = 0
    LAST_AT_TRADE_TDY = 0.000000
    SIZE_LAST_AT_TRADE_TDY = 0
    OPEN_YLD_TDY = 0.000000
    HIGH_YLD_TDY = 0.000000
    LOW_YLD_TDY = 0.000000
    LAST_YLD_TDY = 0.000000
    MID_TDY = 0.000000
    SIZE_LAST_TRADE_TDY = 579500
    IND_BID_FLAG = false
```

```
        IND_ASK_FLAG = false
        OPEN_TDY = 92.130000
        ASK_SIZE_TDY = 79
        BID_SIZE_TDY = 5
        VOLUME_TDY = 11337256
        LAST_PRICE_TDY = 92.410000
        BID_TDY = 92.360000
        ASK_TDY = 92.390000
        HIGH_TDY = 93.200000
        LOW_TDY = 91.220000
        BID_YLD_TDY = 0.000000
        ASK_YLD_TDY = 0.000000
        LAST2_PRICE = 92.410000
        LAST_DIR = 1
        LAST2_DIR = 1
        BID_DIR = 1
        ASK_DIR = 1
        BID2 = 92.360000
        ASK2 = 92.390000
        SIZE_LAST_TRADE = 579500
        ASK_SIZE = 79
        BID_SIZE = 5
        API_MACHINE = p142
        EXCH_CODE_LAST =
        EXCH_CODE_BID =
        EXCH_CODE_ASK =
        TRADE_SIZE_ALL_SESSIONS_RT = 579500
        IS_DELAYED_STREAM = false
        EID = 14003
        PREV_SES_LAST_PRICE = 92.780000
        RT_PX_CHG_NET_1D = -0.369900
        RT_PX_CHG_PCT_1D = -0.398684
        TIME = 21:00:27.000+00:00
        LAST_UPDATE_BID_RT = 21:00:22.000+00:00
        LAST_UPDATE_ASK_RT = 21:00:22.000+00:00
        NYSE_LRP_SEND_TIME_RT = 20:59:57.000+00:00
        BID_ASK_TIME = 21:00:22.000+00:00
        SES_START = 14:30:00.000+00:00
        SES_END = 21:30:00.000+00:00
     }
    handleDataEventHandler: leave
    handleDataEventHandler: enter
    handler label=myLabel
    eventType=8
    messageType=MarketDataEvents
    correlationId=1 0 10
    MarketDataEvents =  {
        LAST_PRICE = 92.410000
        BID = 92.360000
        ASK = 92.390000
        VOLUME = 11337256
        BEST_BID = 92.360000
        BEST_ASK = 92.390000
        LAST_TRADE = 92.410000
        IMBALANCE_BID = 92.390000
        IMBALANCE_ASK =
        ORDER_IMB_BUY_VOLUME = 44300.000000
        ORDER_IMB_SELL_VOLUME =
        VWAP = 92.251200
        THEO_PRICE = 92.390000
        LAST_ALL_SESSIONS = 92.410000
        IMBALANCE_INDIC_RT = BUY
        BID_ALL_SESSION = 92.030000
        ASK_ALL_SESSION = 92.370000
        EQY_TURNOVER_REALTIME = 1042895294.262009
        NYSE_LRP_HIGH_PRICE_RT = 93.360000
        NYSE_LRP_LOW_PRICE_RT = 91.360000
        TOT_CALL_VOLUME_CUR_DAY_RT = 5625
        TOT_PUT_VOLUME_CUR_DAY_RT = 2314
        TOT_OPT_VOLUME_CUR_DAY_RT = 7939
        PUT_CALL_VOLUME_RATIO_CUR_DAY_RT = 0
        IN_AUCTION_RT = false
        ALL_PRICE_SIZE = 1200
        ALL_PRICE = 92.379200
        ALL_PRICE_COND_CODE =
        VOLUME_THEO = 545600
        LAST_AT_TRADE_TDY = 0.000000
        SIZE_LAST_AT_TRADE_TDY = 0
        OPEN_YLD_TDY = 0.000000
        HIGH_YLD_TDY = 0.000000
        LOW_YLD_TDY = 0.000000
        LAST_YLD_TDY = 0.000000
        MID_TDY = 0.000000
        SIZE_LAST_TRADE_TDY = 579500
        IND_BID_FLAG = false
        IND_ASK_FLAG = false
        OPEN_TDY = 92.130000
        ASK_SIZE_TDY = 79
        BID_SIZE_TDY = 5
        VOLUME_TDY = 11337256
        LAST_PRICE_TDY = 92.410000
        BID_TDY = 92.360000
        ASK_TDY = 92.390000
        HIGH_TDY = 93.200000
        LOW_TDY = 91.220000
        BID_YLD_TDY = 0.000000
        ASK_YLD_TDY = 0.000000
        LAST2_PRICE = 92.410000
        LAST_DIR = 1
        LAST2_DIR = 1
        BID_DIR = 1
        ASK_DIR = 1
        BID2 = 92.360000
        ASK2 = 92.390000
        SIZE_LAST_TRADE = 579500
        ASK_SIZE = 79
        BID_SIZE = 5
        EXCH_CODE_LAST =
        EXCH_CODE_BID =
        EXCH_CODE_ASK =
        TRADE_SIZE_ALL_SESSIONS_RT = 579500
        IS_DELAYED_STREAM = false
        EID = 14003
        RT_PX_CHG_NET_1D = -0.369900
        RT_PX_CHG_PCT_1D = -0.398684
        TIME = 21:00:27.000+00:00
        LAST_UPDATE_BID_RT = 21:00:22.000+00:00
        LAST_UPDATE_ASK_RT = 21:00:22.000+00:00
        NYSE_LRP_SEND_TIME_RT = 20:59:57.000+00:00
        BID_ASK_TIME = 21:00:22.000+00:00
    }
```