



Mobile SDK Development Guide

Salesforce Mobile SDK 6.0 (Android Native, iOS Native, React Native, and Hybrid)



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CHAPTER 1 Introduction to Mobile Development

In this chapter ...

- [About Salesforce Mobile Apps](#)
- [Customize the Salesforce App, or Create a Custom App?](#)
- [About This Guide](#)
- [Sending Feedback](#)

In the twenty-first century, mobile devices have profoundly changed our personal and professional lives. From impromptu videos to mobile geolocation to online shopping, people everywhere use personal mobile devices to create and consume content. Corporate employees, too, use smart devices to connect with customers, stay in touch with coworkers, and engage the public on social networks.

For enterprise IT departments, the explosion of mobile interaction requires a quick response in software services. Salesforce provides the Salesforce Platform to address this need. This cloud supports new-generation mobile operating systems on various form factors—phone, tablet, wearable—with reliability, availability, and security. Its technologies let you build custom apps, connect to data from any system, and manage your enterprise from anywhere.

About Salesforce Mobile Apps

The Salesforce Platform offers two ways to build and deploy enterprise-ready mobile applications.

- The Salesforce app, available on Apple AppStore and Google Play Store, delivers the fastest way for Salesforce platform administrators and developers to build and deliver apps for employees. It offers simple point-and-click tools for administrators and the Lightning web development platform for advanced developers. *This trail doesn't address Salesforce application development.*
- Salesforce Mobile SDK gives developers the tools to build mobile applications with customized user experiences. Mobile SDK lets you produce stand-alone custom apps that you distribute through the Apple App Store or Google Play Store. These apps can target employees, customers, or partners. You can choose native or web technologies to build these apps while enjoying the same grade of reliability and security found in the Salesforce app.

Enterprise Identity & Security

Mobile SDK includes a complete implementation of Salesforce Connected App Policy, so that all users can access their data securely and easily. It supports SAML and advanced authentication flows so that administrators always have full control over data access.

SmartStore Encrypted Database

Mobile databases are useful for building highly responsive apps that also work in any network condition. SmartStore provides an easy way to store and retrieve data locally while supporting a flexible data model. It also uses AES-256 encryption to ensure that your data is always protected.

SmartSync Data Framework

SmartSync Data Framework provides a simple API for synchronizing data between your offline database and the Salesforce cloud. With SmartSync Data Framework, developers can focus on the UI and business logic of their application while leaving the complex synchronization logic to Mobile SDK.

Mobile Services


Mobile SDK supports a wide range of platform mobile services, including push notifications, geolocation, analytics, collaboration tools, and business logic in the cloud. These services can supercharge your mobile application and also reduce development time.

Salesforce Communities

With Salesforce Communities and Mobile SDK, developers can build mobile applications that target their customers and partners. These applications benefit from the same enterprise features and reliability as employee apps.

Native and Hybrid, iOS and Android

Mobile SDK lets you choose any technology (native, React Native, or Cordova-based hybrid apps) on iOS and Android.

 **Note:** Currently, Lightning components do not support running in Salesforce Mobile SDK apps.

Customize the Salesforce App, or Create a Custom App?

When you're developing mobile apps for Salesforce org users, you have options. The Salesforce app is the customizable mobile app developed, built, and distributed by Salesforce. Custom apps are standalone iOS or Android apps built from scratch on Salesforce Mobile SDK. Although this book deals only with Mobile SDK development, here are some differences between the Salesforce app and custom apps.

Customizing the Salesforce App

- Has a pre-defined user interface.
- Has full access to Salesforce org data.
- You can create an integrated experience with functionality developed in the Salesforce Platform.

- The Action Bar gives you a way to include your own apps/functionality.
- You can customize the Salesforce app with either point-and-click or programmatic customizations.
- Functionality can be added programmatically through Visualforce pages or Canvas apps.
- Salesforce mobile customizations or apps adhere to the Salesforce mobile navigation. So, for example, a Visualforce page can be called from the navigation menu or from the Action Bar.
- You can leverage existing Salesforce development experience, both point-and-click and programmatic.
- Included in all Salesforce editions and supported by Salesforce.

Developing Custom Mobile Apps

Custom apps can be free-standing apps built on Salesforce Mobile SDK, or browser apps using plain HTML5 and JavaScript with Ajax. With custom apps, you can:

- Define a custom user experience.
- Access data from Salesforce orgs using REST APIs in native and hybrid local apps, or with Visualforce in hybrid apps using JavaScript Remoting. In HTML5 apps, do the same using JQueryMobile and Ajax.
- Brand your user interface for customer-facing exposure.
- Create standalone mobile apps, either with native APIs using Java for Android or Objective-C for iOS, or through a hybrid container using JavaScript and HTML5 (Mobile SDK only).
- Distribute apps through mobile industry channels, such as the Apple App Store or Google Play (Mobile SDK only).
- Configure and control complex offline behavior (Mobile SDK only).
- Use push notifications.
- Design a custom security container using your own OAuth module (Mobile SDK only).
- Other important Mobile SDK considerations:
 - Open-source SDK, downloadable for free through npm installers as well as from GitHub.
 - Requires you to develop and compile your apps in an external development environment (Xcode for iOS, Android Studio for Android).
 - Development costs depend on your app and your platform.

Mobile SDK integrates Lightning Platform cloud architecture into Android and iOS apps by providing:

- Implementation of Salesforce Connected App policy.
- Salesforce org login and OAuth credentials management, including persistence and refresh capabilities.
- Secure offline storage with SmartStore.
- Syncing between the Salesforce cloud and SmartStore through SmartSync Data Framework.
- Support for Salesforce Communities.
- Wrappers for Salesforce REST APIs with implicit networking.
- Fast switching between multiple users.
- Cordova-based containers for hybrid apps.

About This Guide

This guide introduces you to Salesforce Mobile SDK and teaches you how to design, develop, and manage mobile applications for the cloud. The topics cover a wide range of development techniques for various skill sets, beginning with HTML5 and JavaScript, continuing through hybrid apps, and culminating in native development.

We've included tutorials for major features. Most of these tutorials take you through the steps of creating a simple master-detail application that accesses Salesforce through REST APIs. Tutorials include:

- [Running the ContactExplorer Hybrid Sample](#)
- [Tutorial: Creating a Native Android Warehouse Application](#)
- [Tutorial: Creating a Native iOS Warehouse App](#)
- [Tutorial: Creating a Hybrid SmartSync Data Framework Application](#)


Shorter, less formal tutorials are scattered throughout the book.

Intended Audience

This guide is primarily for developers who are already familiar with mobile technology, OAuth2, and REST APIs, and who probably have some Lightning Platform experience. But if that doesn't exactly describe you, don't worry. We've tried to make this guide usable for a wider audience. For example, you might be a Salesforce admin who's developing a new mobile app to support your organization, or you might be a mobile developer who's entirely new to Lightning Platform. If either of those descriptions fit you, then you should be able to follow along just fine.

Mobile SDK and Trailhead

You can learn most of the content of this guide interactively in Trailhead. In the Mobile SDK Beginner's Trail, you study each development topic online and then earn points and badges through interactive exercises and quizzes. See trailhead.salesforce.com/trail/mobile_sdk_intro.

 **Note:** An online version of this book is available at developer.salesforce.com/docs.

Version

This book is current with Salesforce Mobile SDK 6.0.

Sending Feedback

Questions or comments about this book? Suggestions for topics you'd like to see covered in future versions? You can:

- Join the SalesforceMobileSDK community at plus.google.com/communities
- Post your thoughts on the Salesforce developer discussion forums at developer.salesforce.com/forums
- Email us directly at developerforce@salesforce.com
- Use the Feedback button at the bottom of each page in the online documentation (developer.salesforce.com/docs/atlas.en-us.mobile_sdk.meta/mobile_sdk/)

CHAPTER 2 Introduction to Salesforce Mobile SDK Development

In this chapter ...

- [About Native, HTML5, and Hybrid Development](#)
- [Enough Talk; I'm Ready](#)

Salesforce Mobile SDK lets you harness the power of Lightning Platform within stand-alone mobile apps.

Lightning Platform provides a straightforward and productive platform for Salesforce cloud computing. Developers can use Lightning Platform to define Salesforce application components—custom objects and fields, workflow rules, Visualforce pages, Apex classes, and triggers. They can then assemble those components into awesome, browser-based desktop apps.

Unlike a desktop app, a Mobile SDK app accesses Salesforce data through a mobile device's native operating system rather than through a browser. To ensure a satisfying and productive mobile user experience, you can configure Mobile SDK apps to move seamlessly between online and offline states. Before you dive into Mobile SDK, take a look at how mobile development works, and learn about essential Salesforce developer resources.

About Native, HTML5, and Hybrid Development

Salesforce Mobile SDK gives you options for developing your app. You can choose the options that fit your development skills, device and technology requirements, goals, and schedule.

Salesforce Mobile SDK supports several platforms for creating mobile apps:

- **Native** apps are specific to a given mobile platform (iOS or Android). These apps use the development tools and languages that the respective platform supports. For example, you develop iOS apps in Xcode using Objective-C or Swift. Native apps look and perform best but require the most development effort.
- **HTML5** apps use standard web technologies—typically HTML5, JavaScript, and CSS—to deliver apps through a mobile web browser. This “write once, run anywhere” approach to mobile development creates cross-platform mobile applications that work on multiple devices. While developers can create sophisticated apps with HTML5 and JavaScript alone, some challenges remain. For example, session management, secure offline storage, and access to native device features can pose problems.
- **Hybrid** apps combine the ease of HTML5 web app development with the power of the native platform by wrapping a web app inside the Salesforce container. This combined approach produces an application that accesses the device’s native capabilities and is delivered through the app store. You can also create hybrid apps using Visualforce pages delivered through the Salesforce hybrid container.
- **React Native** apps use the React Native framework from Facebook, Inc., to run JavaScript apps as native code. Rather than following the hybrid paradigm, React Native lets you assemble the native UI building blocks with JavaScript code. This framework provides direct access to native resources and lets you test without recompiling. In performance terms, React Native runs a close second to pure native execution.

Native Apps

Native apps provide the best usability, the best features, and the best overall mobile experience. There are some things you get only with native apps:

- **Fast graphics API**—The native platform gives you the fastest graphics. This advantage comes into play, for example, if you’re using large quantities of data and require a fast refresh.
- **Fluid animation**—Related to the fast graphics API is the ability to have fluid animation. This ability is especially important in gaming, highly interactive reporting, or intensely computational algorithms for transforming photos and sounds.
- **Built-in components**—The camera, address book, geolocation, and other features native to the device can be seamlessly integrated into mobile apps. Another important built-in component is encrypted storage, but more about that later.
- **Ease of use**—The native platform is what people are accustomed to. When you add that familiarity to the native features they expect, your app becomes that much easier to use.

Native app development requires an integrated development environment (IDE). IDEs provide tools for building, debugging, project management, version control, and other tools professional developers need. You need these tools because native apps are more difficult to develop. Likewise, the required level of experience is higher than in other development scenarios. If you’re a professional developer, however, you don’t have to be sold on the benefits of

- Proven APIs and frameworks
- Painless special effects through established components
- Maintaining all your code in one place

HTML5 Apps

An HTML5 mobile app is essentially one or more web pages that are designed to work on a small mobile device screen. As such, HTML5 apps are device agnostic and can be opened with any modern mobile browser. Because your content is on the web, it's searchable, which can be a huge benefit for certain types of apps (shopping, for example).

Getting started with HTML5 is easier than with native or hybrid development. Unfortunately, every mobile device seems to have its own idea of what constitutes usable screen size and resolution. This diversity imposes an extra burden of testing on different devices and different operating systems.

An important part of the "write once, run anywhere" HTML5 methodology is that distribution and support are much easier than for native apps. Need to make a bug fix or add features? Done and deployed for all users. Native app, on the other hand, require longer development and testing cycles. Furthermore, customers typically have to log in to an app store to get new versions.

If HTML5 apps are easier to develop, easier to support, and can reach the widest range of devices, what are the drawbacks?

- **No secure offline storage**—HTML5 browsers support offline databases and caching, but with no out-of-the-box encryption support. You get all three features in Mobile SDK native applications.
- **Unfriendly security features**—Trivial security measures can pose complex implementation challenges in mobile web apps. They can also be painful for users. For example, a web app with authentication requires users to enter their credentials every time the app restarts or returns from a background state.
- **Limited native features**—The camera, address book, and other native features are accessible on few, if any, browser platforms.
- **Lack of native look and feel**—HTML5 can only emulate the native look, and customers can't use familiar compound gestures.

Hybrid Apps

Hybrid apps are built using HTML5 and JavaScript wrapped inside a thin container that provides access to native platform features. Generally, hybrid apps provide the best of both HTML5 and native worlds. They're almost as easy to develop as HTML5 apps and can access all the functionality of native. In addition, hybrid apps can use the Mobile SDK SmartSync Data Framework feature to

- Model, query, search, and edit Salesforce data.
- Securely cache Salesforce data for offline use.
- Synchronize locally cached data with the Salesforce server.

You know that native apps are installed on the device, while HTML5 apps reside on a web server. Perhaps you're wondering whether hybrid apps store their files on the device or on a server. Great question! The storage location depends on whether your hybrid app is *local* or *remote*.

Local

You can package HTML and JavaScript code inside the mobile application binary, in a structure similar to a native application. You use REST APIs and Ajax to move data back and forth between the device and the cloud.

Remote

Alternatively, you can implement the full web application from the server (with optional caching for better performance). Your container app retrieves the full application from the server and displays it in a native web view.

Both types of hybrid development are covered here.

React Native Apps

React Native apps use specialized scripting languages.

- JavaScript is ES2015.
- CSS is JavaScript code that closely resembles CSS syntax and is typically written inline in your JavaScript app.

- Markup is actually a special flavor of XML named JSX. Unlike HTML, which embeds JavaScript in markup, you embed JSX markup in JavaScript.

In addition, React Native bridges provide access to standard Mobile SDK features, such as:

- SmartStore
- SmartSync Data Framework
- Salesforce login and authentication
- Salesforce REST API access.

You can even access your own native objects—in Objective-C, Swift, or Java—directly in React Native code.

Mobile Architecture Comparison

The following table shows how the various development scenarios stack up.

	Native, React Native	HTML5	Hybrid
Graphics	Native APIs	HTML, Canvas, SVG	HTML, Canvas, SVG
Performance	Fastest	Fast	Moderately fast
Look and feel	Native	Emulated	Emulated
Distribution	App store	Web	App store
Camera	Yes	Browser dependent	Yes
Notifications	Yes	No	Yes
Contacts, calendar	Yes	No	Yes
Offline storage	Secure file system	Not secure; shared SQL, Key-Value stores	Secure file system; shared SQL (through Cordova plug-ins)
Geolocation	Yes	Yes	Yes
Swipe	Yes	Yes	Yes
Pinch, spread	Yes	Yes	Yes
Connectivity	Online, offline	Mostly online	Online, offline
Development skills	Objective-C, Swift, Java, Kotlin; JavaScript (React Native only)	HTML5, CSS, JavaScript	HTML5, CSS, JavaScript

Enough Talk; I'm Ready

If you'd rather read about the details later, there are Quick Start topics in this guide for each native development scenario.

- [Hybrid Apps Quick Start](#)
- [iOS Native Quick Start](#)
- [Android Native Quick Start](#)

CHAPTER 3 What's New in Mobile SDK 6.0

In this chapter ...

- [What Was New in Recent Releases](#)

The 6.0 release brings a trove of new features that improve everything from cross-platform efficiency to login enhancements to debugging.

How to Upgrade Your Apps

For information on any necessary code upgrades to existing Mobile SDK apps, follow the instructions at [Migrating from Previous Releases](#).

General Updates (Android and iOS Native Platforms)

- A new SDK framework lets you easily turn ordinary Mobile SDK apps into identity providers and their clients. Identity providers help known users avoid reentering their Salesforce credentials every time they log in to a Mobile SDK app. See [Using Mobile SDK Apps as Identity Providers](#).
- Mobile SDK provides new native app templates for forcedroid and forceios that create identity provider apps. You can use these templates with the `forcedroid createWithTemplate` and `forceios createWithTemplate` commands. Look for these templates at <https://github.com/forcedotcom/SalesforceMobileSDK-AuthTemplates>.
- Mobile SDK 6.0 adds support for a developer settings screen in debug builds. This screen displays configuration information that is useful during the development cycle.

What's New in Mobile SDK 6.0 for Android

Version Updates:

- **Target Android SDK:** Android Oreo (API 27)
- **Minimum Android SDK:** Lollipop (API 21)
- **Android Studio:** 3.0
- **Gradle:** 4.1
- **Cordova:** 7.0.0
- **React Native:** 0.50.4

Login Enhancements:

You can now use Chrome custom tabs for authentication instead of the system web view. See [Enabling Browser-Based Authentication in Android Apps](#).

Forcedroid Changes:

- The forcedroid utility no longer creates hybrid or React Native apps. Instead, install forcehybrid and forcereact npm packages for those use cases.
- We've provided a new template that creates an identity provider app. Use this template with the `forcedroid createWithTemplate` command. You can find these templates at

<https://github.com/forcedotcom/SalesforceMobileSDK-AuthTemplates>. See [Using a Custom Template to Create Apps](#).

What's New in Mobile SDK 6.0 for iOS

Deprecation:

The `SFAuthenticationManager` class and its delegates are now deprecated for permanent removal in Mobile SDK 7.0. In its place, use the `SFUserAccountManager` class for authentication-related functionality.

Version Updates:

- **iOS SDK:** 11
- **Minimum iOS SDK supported:** 10
- **Xcode:** 9
- **Cordova:** 4.5.4
- **React Native:** 0.50.4

Forceios Changes:

- The forceios utility no longer creates hybrid or React Native apps. Instead, install forcehybrid and forcereact npm packages for those use cases.
- We've provided a new template that creates an identity provider app. Use this template with the `forceios createWithTemplate` command. You can find these templates at <https://github.com/forcedotcom/SalesforceMobileSDK-AuthTemplates>. See [Using a Custom Template to Create Apps](#).

Miscellaneous Changes:

- The `SalesforceSDKManager` class welcomes several SDK manager cousins that handle specific types of apps. This architecture now matches the analogous architecture in Mobile SDK for Android. See [SDK Manager Classes](#).
- If you're using the `SFLoginViewController` class to manage the Settings icon on the login screen, update your code to use the `SFSDKLoginViewControllerConfig` class instead. Import `SalesforceSDKCore/SFSDKLoginViewControllerConfig.h` and change this line:

```
SFLoginViewController *loginViewController =  
[SFLoginViewController sharedInstance];
```

to this one:

```
SFSDKLoginViewControllerConfig *loginViewConfig =  
[[SFSDKLoginViewControllerConfig  
alloc] init];
```

See [Hiding the Settings Icon in iOS Apps](#).

What's New in Hybrid Apps for Mobile SDK 6.0

Version Updates:

- **Android:** 7.0.0
- **iOS:** 4.5.4

Forcehybrid Tool:

Mobile SDK 6.0 introduces a new npm package, forcehybrid, for creating hybrid apps. See [Using Forcehybrid](#).

iOS Bug Fix:

In iOS hybrid apps on previous releases, `oauth.getAuthCredentials()` automatically called `authenticate()` if the user wasn't already authenticated. In Mobile SDK 6.0, we've changed this behavior to signal that the user isn't authenticated rather than directly triggering authentication. This iOS change matches the existing Android behavior.

What's New in React Native for Mobile SDK 6.0

Forcereact Tool:

Mobile SDK 6.0 introduces a new npm package, forcereact, for creating React Native apps. See [Creating a React Native Project with Forcereact](#).

Version Updates:

- **React Native:** 0.50.4.

What's New in SmartStore for Mobile SDK 6.0

Mobile SDK 6.0 introduces the ability to define your SmartStore schemas through configuration files rather than code.

- To define soups for the default global store, provide a file named `globalstore.json`.
- To define soups for the default user store, provide a file named `userstore.json`.

See [Registering Soups with Configuration Files](#).

What's New in SmartSync Data Framework for Mobile SDK 6.0

Beginning in Mobile SDK 6.0, you can define sync configuration files and assign names to sync configurations. You can use sync names to run, edit, or delete a saved sync operation.

You can also define "sync down" and "sync up" operations through configuration files rather than code.

- To define sync operations for the default global store, provide a file named `globalsyncs.json`.
- To define sync operations for the default user store, provide a file named `usersyncs.json`.

See [Defining Sync Names and Sync Configuration Files](#).

What Was New in Recent Releases

Here's an archive of What's New bulletins from recent Mobile SDK releases.

Mobile SDK 5.3

What Was New in Mobile SDK 5.3 for Android

- **OS Version Support:** Android Oreo (API 26) is now fully supported.
- **Library Upgrades:** For Android we've updated SQLCipher to version 3.5.7.
- **Kotlin Support:** We now support Kotlin in native Android apps. Accordingly, forcedroid provides a new app type: `native_kotlin`.

What Was New in Mobile SDK 5.3 for iOS

- **Deprecations:**
 - `CSFNetwork`, `CSFAction` and all related network classes are deprecated for permanent removal in Mobile SDK 6.0. Instead, use `SFRestAPI` and `SFNetwork`.
 - `SFLogger` is deprecated for permanent removal in Mobile SDK 6.0. Instead, use `SFSDKLogger`.
- **OS Version Support:** iOS 11.0 is fully supported in Mobile SDK 5.3.
- **Library Upgrades:** For iOS we've updated SQLCipher to version 3.4.1.

Mobile SDK 5.2

The 5.2 release brings Mobile SDK support for recent REST API enhancements. It also includes updates for SmartSync Data Framework in native apps. For details on updating your code, see [Migrating from Previous Releases](#).

General Updates (Android and iOS Native Platforms)

Login Enhancements

We've added support for branded community login pages by adding methods for configuring the brand parameter. See [Use Your Branded Login Page](#).

New Logging Framework

We've added a logging framework. See [Salesforce Mobile SDK Logging Framework](#)

What Was New in Mobile SDK 5.2 for iOS

- Mobile SDK now uses `SFSafariViewController` instead of the Safari browser for advanced authentication. This update provides a better user experience with no app swizzling.
- **IMPORTANT! Deprecations:**
 - `CSFNetwork`, `CSFAction`, and all related network classes are now deprecated and will be removed in Mobile SDK 6.0. Instead, use `SFRestAPI` and `SFNetwork`.
 - `SFLogger` is now deprecated and will be removed in Mobile SDK 6.0. Instead, use `SFSDKLogger`.

What Was New in Hybrid Apps for Mobile SDK 5.2

We've updated our Cordova library versions as follows:

- **Android:** Cordova 6.2.3
- **iOS:** Cordova 4.4.0

What Was New in SmartSync Data Framework for Mobile SDK 5.2

We've added sync targets for native Android and iOS that let you sync related records up or down in a single call. See [Syncing Related Records](#).

Mobile SDK 5.1

General Updates (All Platforms)

In the REST API, SOSL search response bodies recently changed. Instead of returning an array of matching records, SOSL search now returns a dictionary. The array of matching records is in this dictionary under the key "searchRecords". Mobile SDK 5.1 has amended all SOSL code in its libraries to handle the new response format.

 **Important:** If your application uses SOSL, **be sure to update your code accordingly!**

What Was New in Mobile SDK 5.1 for Android

To keep up with recent innovations in the REST API, Mobile SDK adds support for the following features:

- `If-Unmodified-Since` conditional requests.
- Use of "Id" as the external ID field for upserts, coupled with null for the external ID. This pattern is useful if you're upserting multiple records with different external ID fields.
- `SObjectTree` requests.
- Batch requests.
- Composite requests.

All API changes occur in the `RestRequest` class. See [RestRequest Class](#).

What Was New in Mobile SDK 5.1 for iOS

- To keep up with recent innovations in the REST API, Mobile SDK adds support for the following features:
 - `ifUnmodifiedSinceDate` conditional requests.
 - Use of "Id" as the external ID field for upserts, coupled with null for the external ID. This pattern is useful if you're upserting multiple records with different external ID fields.
 - `SObjectTree` requests.
 - Batch requests.
 - Composite requests.

See [Supported Operations](#) for more information.
- Our native network stack now uses `NSURLSession` directly via the new `SFNetwork` class. These classes replace the `CSFNetwork` and `CSFAction` classes.

What Was New in Hybrid Apps for Mobile SDK 5.1

We've replaced our custom `WKWebViewEngine` plug-in with Cordova's `WKWebViewEngine` plug-in.

What Was New in SmartSync Data Framework for Mobile SDK 5.1

- Thanks to API refactoring, custom targets can now control SmartSync Data Framework interaction with SmartStore databases.
- You can now initialize "sync up" targets with separate field lists for create and update operations. This configuration can sometimes save you from implementing a custom "sync up" target.

What Was New in React Native for Mobile SDK 5.1

- **Version Update**—Mobile SDK is now built with React Native version 0.50.4.
- **SmartSync Data Framework Update**—Handling of field lists for "sync up" operations has changed in Mobile SDK 5.1. .

Mobile SDK 5.0

What Was New in Mobile SDK 5.0 for Android

- We've added a library named `salesforceAnalytics`. This library collects non-sensitive data that tells us which Mobile SDK features are being used. The analytics feature is on by default, but you can turn it off if necessary. See [Instrumentation and Event Collection](#).
- The `forcedroid` utility now supports rich app templates. See [Using a Custom Template to Create Apps](#).
- Mobile SDK for Android now requires the following versions of third-party tools.
 - Java JDK 8
 - Gradle 2.14.1
 - Target API version: Android Nougat (API 25)
 - Android Studio 2.2
 - Cordova Android 6.1.0 (hybrid apps)
 - Cordova CLI 6.4.0 (hybrid apps)
- We've removed dependencies on the `guava` library.

What Was New in Mobile SDK 5.0 for iOS


- The `forceios` utility now supports rich app templates. See [Using a Custom Template to Create Apps](#).
- As a result of refactoring libraries, our CocoaPods pod specs have changed. See [Migrate iOS Apps from 4.3 to 5.0](#) for details.
- iOS app extensions are now fully supported. See the `SmartSyncExplorer` sample app for an example.
- Salesforce servers are now fully ATS-compliant. As a result, we have removed ATS exceptions from Mobile SDK apps.

Mobile SDK for iOS now requires the following versions of third-party tools.

- iOS 9 (minimum), iOS 10 (fully supported)
- Xcode 8
- CocoaPods 1.10 (minimum)
- Cordova iOS 4.3.0 (hybrid apps)
- Cordova CLI 6.4.0 (hybrid apps)

What Was New in Hybrid Apps for Mobile SDK 5.0

- Mobile SDK upgrades its Cordova requirements as follows:
 - **iOS:** Cordova 4.3.0
 - **Android:** Cordova 6.1.0
 - Cordova CLI 6.4.0 or later
- The `forceios` and `forceios` utilities now support rich app templates. See [Using a Custom Template to Create Apps](#).
- The `forcetk.mobilesdk.js` library has been replaced with `force.js`. This new library handles networking natively through the `com.salesforce.plugin.network` plug-in. As a result, you no longer have to refresh session tokens in your own code.
 - 📌 **Note:** This update results in breaking changes for hybrid apps. See [Migrate Hybrid Apps from 4.3 to 5.0](#) for details.
- A new JavaScript library, `force+promise.js`, serves as an alternative to `force.js` and reimplements `force.js` using promises instead of callbacks.
- We've changed the way you run hybrid tests and sample apps in a browser.

 **Note:** This update results in breaking changes for hybrid apps. See [Migrate Hybrid Apps from 4.3 to 5.0](#) for details.

See the following SmartStore and SmartSync Data Framework sections for more JavaScript updates.

What Was New in SmartStore for Mobile SDK 5.0

- We've made it easier for hybrid and React Native apps to use multiple named stores, either global or user-based. Hybrid SmartStore APIs that previously accepted an optional `isGlobalStore` first argument now give you an extra option. Instead of a Boolean value, you can provide a `storeConfig` object that specifies an optional store name and indicates whether the store you're using is global. See [Creating and Accessing User-based Stores](#).
- A new Cordova plug-in, `com.salesforce.plugin.smartstore.client`, reimplements SmartStore APIs using promises instead of callbacks.
- The parameter list for `moveCursorToNextPage()` and `moveCursorToPreviousPage()` JavaScript functions has changed. See [Migrate Hybrid Apps from 4.3 to 5.0](#).

What Was New in SmartSync Data Framework for Mobile SDK 5.0

- SmartSync Data Framework provides a new "refresh" target that is streamlined for easily importing cloud data into cached SmartStore records.
- SmartSync Data Framework now lets you specify which fields to include in sync down and refresh operations.
- The `smartsync.js` library has dropped jQuery and implemented native promises. If you use this library on Android 19, see [Migrate Hybrid Apps from 4.3 to 5.0](#) for an important instruction.

What Was New in React Native for Mobile SDK 5.0

- **Version Update**—Mobile SDK is now built with React Native version 0.35.
- Many SmartStore and SmartSync Data Framework APIs receive non-breaking changes to their prototypes. See [What Was New in Hybrid Apps for Mobile SDK 5.0](#) for more information.

CHAPTER 4 Getting Started With Mobile SDK 6.0 for Android and iOS

In this chapter ...

- [Developer Edition or Sandbox Environment?](#)
- [Development Prerequisites for Android and iOS](#)
- [Sign Up for Lightning Platform](#)
- [Creating a Connected App](#)
- [Installing Mobile SDK](#)
- [Mobile SDK Sample Apps](#)

Let's get started creating custom mobile apps! If you haven't done so already, begin by signing up for Salesforce and installing Mobile SDK development tools.

In addition to signing up, you need a connected app definition, regardless of which development options you choose. To install Mobile SDK for Android or iOS (hybrid and native), you use the Mobile SDK npm packages.

Developer Edition or Sandbox Environment?

Salesforce offers a range of environments for developers. The environment that's best for you depends on many factors, including:

- The type of application you're building
- Your audience
- Your company's resources

Development environments are used strictly for developing and testing apps. These environments contain test data that isn't business-critical. Development can be done inside your browser or with the Force.com IDE, which is based on the Eclipse development tool.

Types of Developer Environments

A *Developer Edition* environment is a free, fully featured copy of the Enterprise Edition environment, with less storage and users. Developer Edition is a logically separate environment, ideal as your initial development environment. You can sign up for as many Developer Edition orgs as you need. This allows you to build an application designed for any of the Salesforce production environments.

A *Partner Developer Edition* is a licensed version of the free Developer Edition that includes more storage, features, and licenses. Partner Developer Editions are free to enrolled Salesforce partners.

Sandbox is a nearly identical copy of your production environment available to Professional, Enterprise, Performance, and Unlimited Edition customers. The sandbox copy can include data, configurations, or both. You can create multiple sandboxes in your production environments for a variety of purposes without compromising the data and applications in your production environment.

Choosing an Environment


In this book, all exercises assume you're using a Developer Edition org. However, in reality a sandbox environment can also host your development efforts. Here's some information that can help you decide which environment is best for you.

- Developer Edition is ideal if you're a:
 - Partner who intends to build a commercially available Salesforce app by creating a managed package for distribution through AppExchange or Trialforce. Only Developer Edition or Partner Developer Edition environments can create managed packages.
 - Salesforce customer with a Group or Personal Edition, and you don't have access to Sandbox.
 - Developer looking to explore the Lightning Platform for FREE!
- Partner Developer Edition is ideal if you:
 - Are developing in a team and you require a master environment to manage all the source code. In this case, each developer has a Developer Edition environment and checks code in and out of this master repository environment.
 - Expect more than two developers to log in to develop and test.
 - Require a larger environment that allows more users to run robust tests against larger data sets.
- Sandbox is ideal if you:
 - Are a Salesforce customer with Professional, Enterprise, Performance, Unlimited, or Lightning Platform Edition, which includes Sandbox.
 - Are developing a Salesforce application specifically for your production environment.
 - Aren't planning to build a Salesforce application to be distributed commercially.
 - Have no intention to list on the AppExchange or distribute through Trialforce.

Development Prerequisites for Android and iOS

We recommend some background knowledge and system setup before you begin building Mobile SDK apps.

It's helpful to have some experience with Lightning Platform. Familiarity with OAuth, login and passcode flows, and Salesforce connected apps is essential to designing and debugging Mobile SDK apps. See [Authentication, Security, and Identity in Mobile Apps](#).

 **Note:** Have you completed the Mobile SDK Trailhead project, “[Set Up Your Mobile SDK Developer Tools](#)”? It's the easiest route to a complete Mobile SDK installation.

General Requirements (for All Platforms and Environments)

The following software is required for all Mobile SDK development.

- [Node.js](#)
- Npm version 3.10 or later (installed with Node.js).
- A Salesforce [Developer Edition organization](#) with a [connected app](#).

iOS Native Requirements

- iOS 10 or later.
- Xcode version 9 or later. (We recommend the latest version.)
- CocoaPods version 1.2 or later ([cocoapods.org](#)).
- forceios version 6.0.

Android Native Requirements

- Java JDK 1.8.x or later—[www.oracle.com/downloads](#).
- forcedroid npm package, version 6.0.
- Android Studio 3.0 or later—[developer.android.com/sdk](#).
- Android SDK and Android SDK Tools—Install from within Android Studio.
 1. In the Android Studio menu, click **Tools > Android > SDK Manager**.
 2. Click the **SDK Platforms** tab.
 3. Install at least the following required SDK levels and all intervening levels:
 - Minimum API: Android KitKat (API 21)
 - Target API: Android Oreo (API 27)
 4. Click the **SDK Tools** tab.
 5. Install the latest Android SDK Tools version.
- Android Virtual Device (AVD)—Install from within Android Studio.
 1. In the Android Studio menu, click **Tools > Android > AVD Manager**.
 2. Click **Create Virtual Device...**
 3. Install at least one AVD that targets Android KitKat (API 21) and above. To learn how to set up an AVD in Android Studio, follow the instructions at [developer.android.com/guide/developing/devices/managing-avds.html](#).

Hybrid Requirements

- For each mobile platform you support, all native requirements except for `forceios` and `forcedroid` npm packages.
- Cordova CLI 7.0.0.
- Forcehybrid npm package, version 6.0.
- Proficiency in HTML5 and JavaScript languages.
- For hybrid remote applications:
 - A Salesforce organization that has Visualforce.
 - A Visualforce start page.

React Native Requirements

- For each mobile platform you support, all native requirements except for `forceios` and `forcedroid` npm packages.
- Forcereact npm package, version 6.0.
- Proficiency in JavaScript ([ES2015](#)).

Sign Up for Lightning Platform

To access a wealth of tutorials, blogs, and support forums for all Salesforce developer programs, join the Lightning Platform.

1. In your browser go to <https://developer.salesforce.com/signup>.
2. Fill in the fields about you and your company.
3. In the `Email Address` field, make sure to use a public address you can easily check from a Web browser.
4. Enter a unique `Username`. Note that this field is also in the *form* of an email address, but it does not have to be the same as your email address, and in fact, it's usually better if they aren't the same. Your username is your login and your identity on `developer.salesforce.com`, and so you're often better served by choosing a username that describes the work you're doing, such as `develop@workbook.org`, or that describes you, such as `firstname@lastname.com`.
5. Read and then select the checkbox for the `Master Subscription Agreement`.
6. Enter the Captcha words shown and click **Submit Registration**.
7. In a moment you'll receive an email with a login link. Click the link and change your password.

Creating a Connected App

To enable your mobile app to connect to the Salesforce service, you need to create a connected app. The connected app includes a consumer key, a prerequisite to all development scenarios in this guide.

Create a Connected App

A Salesforce administrator creates connected apps on the Salesforce server. Salesforce connected apps include many settings that are used only by other mobile offerings such as the Salesforce app. The following steps cover the settings that apply to Mobile SDK apps.

To create a connected app:

1. Log into your Lightning Platform instance.

2. In Setup, enter *Apps* in the *Quick Find* box, then select **Apps**.
3. Under Connected Apps, click **New**.
4. Perform steps for [Basic Information](#).
5. Perform steps for [API \(Enable OAuth Settings\)](#).
6. If applicable, perform the optional steps for [Mobile App Settings](#).
7. Click **Save**.

If you plan to support push notifications, see [Push Notifications and Mobile SDK](#) for additional connected app settings. You can add these settings later if you don't currently have the necessary information.

After you create your connected app, be sure to copy the consumer key and callback URL for safekeeping. You use these values in Mobile SDK apps for OAuth configuration. To look them up later in Lightning Experience:

1. In Lightning Experience go to Setup.
2. Navigate to **Apps > App Manager**.
3. Select an unmanaged connected app (where App Type equals **Connected**).
4. Click the dropdown button at the right end of the row and select **View**.

 **Note:**

- For basic Mobile SDK apps, the callback URL doesn't have to be a valid URL; it only has to match what the app expects in this field. You can use any custom prefix, such as `sfdc://`.
- To support advanced authentication, the callback URL must be a valid endpoint using your custom URI scheme.
- For IdP use cases, the callback URL must be a valid endpoint using the HTTPS protocol.
- The detail page for your connected app displays a consumer key. It's a good idea to copy this key, as you'll need it later.
- After you create a new connected app, wait a few minutes for the token to propagate before running your app.

Basic Information

Specify basic information about your Mobile SDK app in this section.

1. Enter a connected app name and press Return. The name you enter must be unique among connected apps in your org and may contain spaces.

 **Note:** Salesforce automatically fills in the API Name field with a version of the name without spaces.

2. Enter a contact email.

Other basic information fields are optional and are not used by Mobile SDK.

API (Enable OAuth Settings)

1. Select **Enable OAuth Settings**.
2. Enter the callback URL (endpoint). Mobile SDK uses this URL to call back to your application during authentication. This value must match the OAuth redirect URI specified in your app's project configuration.
3. For Selected OAuth Scopes, select **Access and manage your data (api)**, **Perform requests on your behalf at any time (refresh_token, offline_access)**, and **Provide access to your data via the Web (web)**.
4. To support Mobile SDK apps that perform authentication through the device's native browser, deselect **Require Secret for Web Server Flow**.

Mobile App Settings

Most settings in this section are not used by Mobile SDK. Here are the exceptions.

1. To support PIN protection, select **PIN Protect**.
2. To support push notifications, select **Push Messaging Enabled**. You can find instructions for this section at [Step 2: Creating a Connected App](#) in the *Salesforce Mobile Push Notifications Implementation Guide*.

See Also

[Create a Connected App](#) in *Salesforce Help*.

SEE ALSO:

[Scope Parameter Values](#)

Installing Mobile SDK

Salesforce Mobile SDK provides two installation paths.

- (Recommended) Use a Node Packaged Module (npm) script to create and configure ready-to-run Mobile SDK projects.
- Download the Mobile SDK open source code from GitHub and set up your own development environment.

Do This First: Install Node.js, npm, and git

To use the Mobile SDK npm installers, you first install Node.js. The Node.js installer automatically installs npm. You also install the latest version of the Git command line.

Mobile SDK 6.0 requires the following minimum versions:

- npm 3.10
 - Git command line (latest version)
1. Download the Node.js installer from www.nodejs.org.
 2. Run the installer, accepting all prompts that ask for permission to install. This module installs both node.js and npm.
 3. Test your installation at a command prompt by running the `npm` command. If you don't see a page of command usage information, revisit Step 2 to find out what's missing.
 4. Go to <https://git-scm.com/> to download and install the latest Git package for your system.

Now you're ready to download the Salesforce Mobile SDK npm scripts that create Android and iOS apps.

Mobile SDK npm Packages

Most mobile developers want to use Mobile SDK as a "black box" and begin creating apps as quickly as possible. For this use case Salesforce provides a set of npm packages. Each package installs a command line tool that you can use at a Terminal window or in a Windows command prompt.

Mobile SDK command line tools provide a static snapshot of an SDK release. For iOS, the npm package installs binary modules rather than uncompiled source code. For Android, the npm package installs a snapshot of the SDK source code rather than binaries. You use the npm scripts not only to install Mobile SDK, but also to create projects.

Mobile SDK provides the following command line tools:

forcedroid

Creates native Android projects in Java or Kotlin.

forceios

Creates native iOS projects in Objective-C or Swift.

forcehybrid

Creates a hybrid project based on Cordova with build targets for iOS, Android, or both.

forcereact

Creates a React Native project with build targets for iOS, Android, or both.

Npm packages reside at <https://www.npmjs.org>. We recommend installing Mobile SDK packages globally using the following command:

- **On Windows:**

```
npm install -g <npm-package-name>
```

- To install a package locally, omit `-g`.

- **On Mac OS X:**

```
sudo npm install -g <npm-package-name>
```

- If you have read-write permissions to `/usr/local/bin/`, you can omit `sudo`.

- To install a package locally in a user-owned directory, omit `sudo` and `-g`.

- If npm doesn't exist on your system, install the latest release of Node.js from nodejs.org.
- Npm packages do not support source control, so you can't update your installation dynamically for new releases. Instead, you install each release separately. To upgrade to new versions of the SDK, go to the [npmjs.org](https://www.npmjs.org) website and download the new package.

iOS Preparation

Before you try to create Mobile SDK apps for iOS—native, hybrid, or React Native—install CocoaPods and the iOS native development environment.

In Mobile SDK 4.0 and later, `forceios` requires CocoaPods. Apps created with `forceios` run in a CocoaPod-driven workspace. The CocoaPods utility enhances debugging by making Mobile SDK source code available in your workspace. Also, with CocoaPods, updating to a new Mobile SDK version is painless. You merely update the podfile and then run `pod update` in a terminal window.

Follow these instructions to make sure you're fully prepared for Mobile SDK development on iOS.

- Regardless of the type of iOS app you're developing, make sure that you're up to speed with the iOS native requirements listed at [Native iOS Requirements](#).
- To install CocoaPods, use the Getting Started instructions at guides.cocoapods.org.
- To install `forceios`, `forcehybrid`, or `forcereact`, see [Mobile SDK npm Packages](#).

SEE ALSO:

[Use CocoaPods with Mobile SDK](#)

[Refreshing Mobile SDK Pods](#)

Android Preparation

Before you try to create Mobile SDK apps for Android—native, hybrid, or React Native—install the Android native development environment.

Follow these instructions to make sure you're fully prepared for Mobile SDK development on Android.

- Make sure that you're up to speed with the requirements listed at [Native Android Requirements](#).
- To install forcedroid, forcehybrid, or forcereact, see [Mobile SDK npm Packages](#).

Uninstalling Mobile SDK npm Packages

If you need to uninstall an npm package, use the npm script.

Uninstall Global Installations

For global installations, run the following command from any folder:

- **On Mac OS X:**

```
sudo npm uninstall <package-name> -g
```

Use `sudo` if you lack read-write permissions on the `/usr/local/bin/` directory.

- **On Windows:**

```
npm uninstall <package-name> -g
```

where `<package-name>` is replaced by one of the following values:

- forcedroid
- forceios
- forcehybrid
- forcereact

Uninstall Local Installations

For local installations, run the following command from the folder where you installed the package:

- **On Mac OS X or Windows:**

```
npm uninstall <package-name>
```

where `<package-name>` is replaced by one of the following values:

- forcedroid
- forceios
- forcehybrid
- forcereact

Mobile SDK GitHub Repositories

More adventurous developers can delve into the SDK, keep up with the latest changes, and possibly contribute to SDK development through GitHub. Using GitHub allows you to monitor source code in public pre-release development branches. In this scenario, your app includes the SDK source code, which is built along with your app.

You don't have to sign up for GitHub to access the Mobile SDK, but it's a good idea to join this social coding community.

<https://github.com/forcedotcom>

You can always find the latest Mobile SDK releases in our public repositories:

- <https://github.com/forcedotcom/SalesforceMobileSDK-iOS>
- <https://github.com/forcedotcom/SalesforceMobileSDK-Android>

 **Important:** To submit pull requests for any Mobile SDK platform, check out the **dev** branch as the basis for your changes.

If you're using GitHub only to build source code for the current release, check out the **master** branch.

Cloning the Mobile SDK for iOS GitHub Repository (Optional)

1. Clone the Mobile SDK for iOS repository to your local file system by issuing the following command at the OS X Terminal app: `git clone git://github.com/forcedotcom/SalesforceMobileSDK-iOS.git`

 **Note:** If you have the GitHub app for Mac OS X, click **Clone in Mac**. In your browser, navigate to the Mobile SDK iOS GitHub repository: <https://github.com/forcedotcom/SalesforceMobileSDK-iOS>.

2. In the OS X Terminal app, change to the directory where you installed the cloned repository (`SalesforceMobileSDK-iOS` by default).
3. Run the install script from the command line: `./install.sh`

Cloning the Mobile SDK for Android GitHub Repository (Optional)

1. In your browser, navigate to the Mobile SDK for Android GitHub repository: <https://github.com/forcedotcom/SalesforceMobileSDK-Android>.
2. Clone the repository to your local file system by issuing the following command: `git clone git://github.com/forcedotcom/SalesforceMobileSDK-Android.git`
3. Open a terminal prompt or command window in the directory where you installed the cloned repository.
4. Run `./install.sh` on Mac, or `cscript install.vbs` on Windows


 **Note:** After you've run `cscript install.vbs` on Windows, `git status` returns a list of modified and deleted files. This output is an unfortunate side effect of resolving symbolic links in the repo. Do not clean or otherwise revert these files.

Creating Android Projects with the Cloned GitHub Repository

To create native and hybrid projects with the cloned `SalesforceMobileSDK-Android` repository, follow the instructions in `native/README.md` and `hybrid/README.md` files.

Creating iOS Projects with the Cloned GitHub Repository

To create projects with the cloned `SalesforceMobileSDK-iOS` repository, follow the instructions in `build.md` in the repository's root directory.

 **Important:** Before building Mobile SDK for Android or iOS, be sure to install npm (nodejs.org).

SEE ALSO:

[Do This First: Install Node.js, npm, and git](#)

Mobile SDK Sample Apps

Salesforce Mobile SDK includes a wealth of sample applications that demonstrate its major features. You can use the hybrid and native samples as the basis for your own applications, or just study them for reference.

Installing the Sample Apps

In GitHub, sample apps live in the Mobile SDK repository for the target platform. For hybrid samples, you have the option of using the Cordova command line with source code from the `SalesforceMobileSDK-Shared` repository.

Accessing Sample Apps From the GitHub Repositories

For Android:

- Clone or refresh the SalesforceMobileSDK-Android GitHub repo (<https://github.com/forcedotcom/SalesforceMobileSDK-Android>).
- In the repo root folder, run the install script:
 - **Windows:** `cscript install.vbs`
 - **Mac OS X:** `./install.sh`
- In Android Studio, import the folder that contains your local `SalesforceMobileSDK-Android` clone.
- Look for sample apps in the `hybrid/HybridNativeSamples` and `native/NativeHybridSamples` project folders.

 **Important:** On Windows, be sure to run Android Studio as administrator.

For iOS:

- Clone or refresh the SalesforceMobileSDK-iOS GitHub repo (<https://github.com/forcedotcom/SalesforceMobileSDK-iOS>).
- Run `./install.sh` in the repository root folder.
- In Xcode, open the `SalesforceMobileSDK-iOS/SalesforceMobileSDK.xcworkspace` file.
- Look for the sample apps in the `NativeSamples` and `HybridSamples` workspace folders.

Building Hybrid Sample Apps With Cordova

To build hybrid sample apps using the Cordova command line, see [Build Hybrid Sample Apps](#).

Android Sample Apps

Native

- **RestExplorer** demonstrates the OAuth and REST API functions of Mobile SDK. It's also useful for investigating REST API actions from a tablet.

- **SmartSyncExplorer** demonstrates the power of the native SmartSync Data Framework library on Android. It resides in Mobile SDK for Android under `native/NativeSampleApps/SmartSyncExplorer`.

Hybrid

- **AccountEditor**: Demonstrates how to synchronize offline data using the `smartsync.js` library.
- **NoteSync**: Demonstrates how to use non-REST APIs to retrieve Salesforce Notes.
- **SmartSyncExplorerHybrid**: Demonstrates how to synchronize offline data using the SmartSync Data Framework plugin.

iOS Sample Apps

Native

- **RestAPIExplorer** exercises all native REST API wrappers. It resides in Mobile SDK for iOS under `native/SampleApps/RestAPIExplorer`.
- **SmartSyncExplorer** demonstrates the power of the native SmartSync Data Framework library on iOS. It resides in Mobile SDK for iOS under `native/SampleApps/SmartSyncExplorer`.

Hybrid

- **AccountEditor**: Demonstrates how to synchronize offline data using the `smartsync.js` library.
- **NoteSync**: Demonstrates how to use non-REST APIs to retrieve Salesforce Notes.
- **SmartSyncExplorerHybrid**: Demonstrates how to synchronize offline data using the SmartSync Data Framework plugin.

Hybrid Sample Apps (Source Only)

Mobile SDK provides only the web app source code for most hybrid sample apps. You can build platform-specific versions of these apps using the Cordova command line. To get the source code, clone the [SalesforceMobileSDK-Shared](#) GitHub repository and look in the `samples` folder. To build these hybrid apps for specific mobile platforms, follow the instructions at [Build Hybrid Sample Apps](#).

- **accounteditor**: Uses the SmartSync Data Framework to access Salesforce data.
- **contactexplorer**: Uses Cordova to retrieve local device contacts. It also uses the `force.js` toolkit to implement REST transactions with the Salesforce REST API. The app uses the OAuth2 support in Salesforce SDK to obtain OAuth credentials and then propagates those credentials to `force.js` by sending a javascript event.
- **fileexplorer**: Demonstrates the Files API.
- **notesync**: Uses non-REST APIs to retrieve Salesforce Notes.
- **simplesyncreact**: Demonstrates a React Native app that uses the SmartSync Data Framework plug-in.
- **smartstoreexplorer**: Lets you explore SmartStore APIs.
- **smartsynceexplorer**: Demonstrates using `smartsync.js`, rather than the SmartSync Data Framework plug-in, for offline synchronization.
- **userandgroupsearch**: Lets you search for users in groups.
- **userlist**: Lists users in an organization. This is the simplest hybrid sample app.
- **usersearch**: Lets you search for users in an organization.
- **vfconnector**: Wraps a Visualforce page in a native container. This example assumes that your org has a Visualforce page called `BasicVFTest`. The app first obtains OAuth login credentials using the Salesforce SDK OAuth2 support and then uses those credentials to set appropriate webview cookies for accessing Visualforce pages.

CHAPTER 5 Updating Mobile SDK Apps (5.0 and Later)

In this chapter ...

- [Using Maven to Update Mobile SDK Libraries in Android Apps](#)

In Mobile SDK 5.0, native and React native apps get an easier path to future Mobile SDK upgrades. Instead of creating an app and porting your app's resources to it, you now update a simple configuration file and then run a script that regenerates your app with the new SDK libraries.

Updating Native and React Native Apps

Each native and React native app directory contains a `package.json` file at its root level. This JSON file contains a "dependencies" object that includes a list of name-value pairs describing Mobile SDK source paths. You can set these values to any local or network path that points to a valid copy of the platform's Mobile SDK. After you've updated this file, perform the update by running:

- `install.js` for Android native, iOS native, and native Swift apps
- `installandroid.js` for React native apps on Android
- `installios.js` for React native apps on iOS

You can find the appropriate file in your app's root folder.

For example, here's the dependencies section of a native Android `package.json` file:

```
"dependencies": {
  "salesforcemobilesdk-android":
  "https://github.com/forcedotcom/SalesforceMobileSDK-Android.git"
}
```

This path points to the current release branch of the SalesforceMobileSDK-Android repo.

For iOS, it's the same idea:

```
"dependencies": {
  "salesforcemobilesdk-ios":
  "https://github.com/forcedotcom/SalesforceMobileSDK-iOS.git"
}
```

For React native, you can set targets for both Android and iOS, as well as React native versions:

```
"dependencies": {
  "react": "15.3.2",
  "react-native": "0.35.0",
  "salesforcemobilesdk-ios":
  "https://github.com/forcedotcom/SalesforceMobileSDK-iOS.git",
  "react-native-force":
  "https://github.com/forcedotcom/SalesforceMobileSDK-ReactNative.git",
  "salesforcemobilesdk-android":
  "https://github.com/forcedotcom/SalesforceMobileSDK-Android.git"
}
```

 **Important:** Remember that your React native version must be paired with compatible Mobile SDK versions.

To point to the development branch of any Mobile SDK repo—that is, the branch where the upcoming release is being developed—append “#dev” to the URL. For example:

```
"dependencies": {  
  "salesforcemobilesdk-android":  
  "https://github.com/forcedotcom/SalesforceMobileSDK-Android.git#dev"  
}
```



Example: The following steps update an Android native app.

1. From your app directory, open `package.json` for editing.
2. In the “dependencies” section, change the value for “salesforcemobilesdk-android” to point a different version of the SalesforceMobileSDK-Android repo. You can point to the development branch or a different tag of the master branch (5.x or later).
3. Run `install.js` for native apps, or `installandroid.js` for React native apps.

The steps for iOS are identical. Just replace the Android references with iOS labels.

Updating Hybrid Apps

For hybrid apps, the Mobile SDK libraries are delivered through the Mobile SDK Cordova plug-in. However, with a major release such as 5.0, we recommend that you start with a new template app.

1. Run: `forcehybrid create`
2. Create the same type of hybrid project with the same name as your existing project, but in a different folder.
3. When the script finishes, `cd` to your new project folder.
4. Add any third-party Cordova plug-ins that your original app used. For example, if your app uses the Cordova status bar plug-in, type:

```
cordova plugin add cordova-plugin-statusbar
```

5. After you’ve added all your third-party plugins, remove and then re-add the Mobile SDK Cordova plugin as follows:

```
cordova plugin remove com.salesforce  
cordova plugin add  
https://github.com/forcedotcom/SalesforceMobileSDK-CordovaPlugin  
--force
```

6. Copy your web app resources—JavaScript, HTML5, and CSS files, and so on—from the original project into your new project’s `www/` folder. For example, on Mac OS X:

```
cp -RL ~/MyProjects/MyMobileSDK50Project/www/* www/
```

7. Run: `cordova prepare`



Note: For details on required changes for specific releases, see [Migrating from Previous Releases](#).

Using Maven to Update Mobile SDK Libraries in Android Apps

Beginning with version 5.0, Mobile SDK provides native Android libraries on Bintray's jCenter Maven repository. As a result, you can now consume any Mobile SDK library by adding a single line to the dependencies section of your app's `build.gradle` file.

To import a library with Gradle, you add a `compile` statement to the `dependencies` section of your project's `build.gradle` file. To update a library with Gradle, you simply change its version number in the `compile` statement to the updated version, and then resync your libraries.

The Details

Here's what a typical Gradle `dependencies` section looks like:

```
dependencies {
    classpath 'com.android.tools.build:gradle:2.2.3'
}
```

A `compile` statement takes the form

```
compile '<groupId>:<artifactID>:<version>'
```

For Mobile SDK libraries:

- `groupId` is "com.salesforce.mobilesdk"
- `artifactID` is "SalesforceSDK", "SalesforceHybrid", "SmartStore", or "SmartSync"
- `version` is "x.x.x" (for example, "5.0.1")

The `compile` statement imports not only the specified library, but also all its dependencies. As a result, you never have to explicitly compile SalesforceAnalytics, for example, because every other library depends on it. It also means that you can get everything you need with just one statement.

To import Mobile SDK 5.0.1 libraries, add one of the following lines:

- For the SalesforceSDK library:

```
compile 'com.salesforce.mobilesdk:SalesforceSDK:5.0.1'
```

- For the SmartStore library (also imports the SalesforceSDK library):

```
compile 'com.salesforce.mobilesdk:SmartStore:5.0.1'
```

- For the SmartSync Data Framework library (also imports the SalesforceSDK and SmartStore libraries):

```
compile 'com.salesforce.mobilesdk:SmartSync:5.0.1'
```

- For the SalesforceHybrid library (also imports the SalesforceSDK, SmartStore, SmartSync Data Framework, and Apache Cordova libraries):

```
compile 'com.salesforce.mobilesdk:SalesforceHybrid:5.0.1'
```

Note:

- The Salesforce React library is not currently available through Maven.
- Mobile SDK enforces a few coding requirements for proper initialization and configuration. To get started, see [Android Application Structure](#).

CHAPTER 6 Welcome to Mobile SDK Labs!

In this chapter ...

- [Mobile UI Elements with Polymer](#)

Mobile SDK Labs is where we share information on newer technologies that we're currently testing, or that could become unstable because they're rapidly evolving. Check here with each release if you're eager to experiment with the cutting edge in your Mobile SDK apps.

Introducing Salesforce Mobile SDK Labs

Salesforce is committed to empowering developers to create mobile apps on their own terms. We hope to provide you with complete freedom to use the technologies that best serve your needs.

In the mobile development world, innovation moves at breakneck speeds. New tools, frameworks, libraries, and design patterns emerge almost on a weekly basis. Some of these technologies become mainstream—stable and secure enough for production apps—while others fade away. The Mobile SDK team is always testing emerging technologies for use with SDK libraries, samples, and resources. Salesforce Mobile SDK Labs gives you the opportunity to try out the third-party tools and frameworks as we're investigating them.

Because Mobile SDK is a community-assisted effort, we value your feedback and typically incorporate it into our decision-making process. You can contact us at our Google+ community: [SalesforceMobileSDK](#).



Warning: Salesforce does not officially support the apps and code in Salesforce Mobile SDK Labs. Use these projects with caution in production apps.

Mobile UI Elements with Polymer

Happy mobile app developers spend their time creating innovative functionality—not writing yet another detail page bound to a set of APIs. The Salesforce Mobile UI Elements library wraps Lightning Platform APIs in Google’s Polymer framework for rapid HTML5 development.

Mobile UI Elements empower HTML and JavaScript developers to build powerful Salesforce mobile apps with technologies they already know. The open source Mobile UI Elements project provides a pre-built component library that is flexible and surprisingly easy to learn.

You can deploy a Mobile UI Elements app several ways.

- In a Visualforce page
- In a remotely hosted page on www.heroku.com or another third-party service
- As a stand-alone app, using the hybrid container provided by Salesforce Mobile SDK

Mobile UI Elements is an open-source, unsupported library based on Google’s Polymer framework. It provides fundamental building blocks that you can combine to create fairly complex mobile apps. The component library enables any HTML developer to quickly and easily build mobile applications without having to dig into complex mobile frameworks and design patterns.

You can find the source code for Mobile UI Elements at github.com/ForceDotComLabs/mobile-ui-elements.

Third-Party Code

The Mobile UI Elements library uses these third-party components:

- [Polymer](#), a JavaScript library for adding new extensions and features to modern HTML5 browsers. It's built on Web Components and is designed to use the evolving Web platform on modern browsers.
- [jQuery](#), the JavaScript library that makes it easy to write JavaScript.
- [Backbone.js](#), a JavaScript library providing the model–view–presenter (MVP) application design paradigm.
- [Underscore.js](#), a “utility belt” library for JavaScript.
- [Ratchet](#), prototype iPhone apps with simple HTML, CSS, and JavaScript components.

See github.com/ForceDotComLabs/mobile-ui-elements for a catalog of currently available elements.

force_selector_list

The `force-selector-list` element is an extension of `core-selector` element and provides a wrapper around the `force-object-collection` element. `force-selector-list` acts as a base for any list UI element that needs selector functionality. It automatically updates the selected attribute when the user taps a row.

Example

```
<force-selector-list subject="Account" querytype="mru"></force-selector-list>
```

force-selector-relatedlist

The `force-selector-relatedlist` element is an extension of the `core-selector` element and fetches the records of related sObjects using a `force-object-collection` element. `force-selector-relatedlist` is a base element for UI elements that render a record’s related list and also require selector functionality.

Example

```
<force-selector-relatedlist related="{{related}}"></force-selector-relatedlist>
```

force-object

The `force-object` element wraps the SmartSync `Force.SObject` in a Polymer element. The `force-object` element:

- Provides automatic management of the offline store for caching
- Provides a simpler DOM-based interface to interact with the SmartSync Data Framework SObject Model
- Allows other Polymer elements to consume SmartSync Data Framework easily

Example

```
<force-object object="Account" recordid="00100000000AAA"></force-object>
```

force-object-collection

The `force-object-collection` element is a low-level Polymer wrapper for the SmartSync `Force.SObjectCollection` object. This element:

- Automatically manages the offline data store for caching (when running inside a container)
- Provides a simple DOM-based interface for SmartSync Data Framework interactions
- Allows other Polymer elements to easily consume data from SmartSync Data Framework

Example

```
<force-object-collection object="Account" querytype="mru"></force-object-collection>
```

force-object-layout

The `force-object-layout` element provides the layout information for a particular `sObject` record. It wraps the `describeLayout` API call. The layout information is cached in memory for the existing session and is stored in SmartStore for offline consumption. The `force-object-layout` element also provides a base definition for elements that depend on page layouts, such as `force-ui-detail` and `force-object-related`.

Example

```
<force-object-layout object="Account"></force-object-layout>
```

force-object-relatedlists

The `force-object-relatedlists` element enables the rendering of related lists of a `sObject` record. It embeds the `force-object-layout` element to fetch the related lists configuration from the page layout settings. It parses the related lists configuration for a particular `sObject` type. If the `recordid` attribute is provided, it also generates a SOQL/cache query to fetch the related record items.

Example

```
<force-object-relatedlists object="Account"
recordid="001000000000AAA"></force-object-relatedlists>
```

force-object-store

The `force-object-store` element wraps the SmartSync `Force.StoreCache` in a Polymer element. This element:

- Automatically manages the lifecycle of the SmartStore soup for each sObject type
- Automatically creates index specs based on the lookup relationships on the sObject
- Provides a simpler DOM-based interface to interact with the SmartSync Data Framework SObject model
- Allows other Polymer elements to easily consume SmartStore data

Example

```
<force-object-store object="Account"></force-object-store>
```

force-ui-app

The `force-ui-app` element is a top-level UI element that provides the basic styling and structure for the application. This element uses Polymer layout features to enable flexible sections on the page. This is useful in a single-page view with split view panels. All children of the main section must specify the "content" class to apply the correct styles.

Example

When used in a Visualforce context:

```
<force-ui-app multipage="true"></force-ui-app>
```

force-ui-detail

The `force-ui-detail` element enables the rendering of a full view of a Salesforce record. This element uses the `force-object-layout` element to fetch the page layout for the record. This element also embeds a `force-object` element to allow all the CRUD operations on an sObject. To inherit the default styles, this element should always be a child of `force-ui-app`.

Example

```
<force-ui-detail object="Account" recordid="001000000000AAA"></force-ui-detail>
```

force-ui-list

The `force-ui-list` element enables the rendering of the list of records for any sObject. Using attributes, you can configure this element to show specific set of records. To inherit the appropriate styles, this element should always be a child of `force-ui-app`.

Example

```
<force-ui-list subject="Account" querytype="mru"></force-ui-list>
```

force-ui-relatedlist

The `force-ui-relatedlist` element extends `force-selector-relatedlistelement` and renders a list of related records to an `subject` record. To inherit the default styles, this element should always be a child of `force-ui-app`.

Example

```
<force-ui-relatedlist related="{related}"></force-ui-relatedlist>
```

CHAPTER 7 React Native Development

In this chapter ...

- [Creating a React Native Project with Forcereact](#)
- [Using Mobile SDK Components in React Native Apps](#)
- [Mobile SDK Native Modules for React Native Apps](#)
- [Mobile SDK Sample App Using React Native](#)
- [Defer Login](#)
- [Upload Binary Content](#)

React Native is a third-party framework that lets you access native UI elements directly with JavaScript, style sheets, and markup. You can combine this technology with special Mobile SDK native modules for rapid development using native resources.

Since its inception, Mobile SDK has supported two types of mobile apps:

- **Native apps** provide the best user experience and performance. However, you have to use a different development technology for each mobile platform you support.
- **Hybrid apps** let you share your JavaScript and style sheets code across platforms, but the generic underlying web view can compromise the user experience.

In Mobile SDK 4.0 and later, you have a third option: React Native. React Native couples the cross-platform advantages of JavaScript development with the platform-specific "look and feel" of a native app. At the same time, the developer experience matches the style and simplicity of hybrid development.

- You use flexible, widely known web technologies (JavaScript, style sheets, and markup) for layout and styling.
- No need to recompile to check your code updates. You simply refresh the browser to see your changes.
- To debug, you use your favorite browser's developer tools.
- All views are rendered natively, so your customers get the user experience of a native app.

Mobile SDK 6.0 uses React Native 0.50.4. You can find React Native 0.50.4 source code and documentation at github.com/facebook/react-native/releases/ under the 0.50.4 tag.

What's New in React Native for Mobile SDK 6.0

Forcereact Tool:

Mobile SDK 6.0 introduces a new npm package, forcereact, for creating React Native apps. See [Creating a React Native Project with Forcereact](#).

Version Updates:

- **React Native:** 0.50.4.

Getting Started

React Native requires some common Mobile SDK components and at least one native development environment—iOS or Android. Your best bet for getting started is the React Native [Trailhead module](#). See you back here afterwards.

Creating a React Native Project with Forcereact

After you've successfully installed a native Mobile SDK environment, you can begin creating React Native apps.

To create an app, use `forcereact` in a terminal window or at a Windows command prompt. The `forcereact` utility gives you two ways to create your app.

- Specify the type of application you want, along with basic configuration data.

OR

- Use an existing Mobile SDK app as a template. You still provide the basic configuration data.

You can use `forcereact` in interactive mode with command-line prompts, or in scripted mode with the parameterized command-line version.

Using Forcereact Interactively

To enter application options interactively at a command prompt, type `forcereact create`. The `forcereact` utility then prompts you for each configuration option.

Using Forcereact with Command-Line Options

If you prefer, you can specify `forcereact` parameters directly at the command line. To see usage information, type `forcereact` without arguments. The list of available options displays:

```
$ forcereact

forcereact: tool for building react native mobile applications using Salesforce Mobile SDK

Usage:

# create ios/android react_native mobile application
forcereact create
  --platform=Comma separated platforms (ios, android)
  --appname=Application Name
  --packagename=App Package Identifier (e.g. com.mycompany.myapp)
  --organization=Organization Name (Your company's/organization's name)
  [--outputdir=Output Directory (Leave empty for current directory)]
```

Using this information, type `forcereact create`, followed by your options and values. For example:

```
$ forcereact create
--platform=ios,android
--appname=CoolReact
--packagename=com.test.my_new_app
--organization="Acme Widgets, Inc."
--outputdir=CoolReact
```

Specifying a Template

`forcereact createWithTemplate` is identical to `forcereact create` except that it also asks for a template repo URI. You set this path to point to any repo directory that contains a Mobile SDK app that can be used as a template. Your template app can

be any supported Mobile SDK app type. The force script changes the template's identifiers and configuration to match the values you provide for the other parameters.

Here's command-line usage information for `forcercact createWithTemplate`:

```
forcercact createWithTemplate
  --platform=Comma separated platforms (ios, android)
  --templaterepouri=Template repo URI
  --appname=Application Name
  --packagename=App Package Identifier (e.g. com.mycompany.myapp)
  --organization=Organization Name (Your company's/organization's name)
  [--outputdir=Output Directory (Leave empty for current directory)]
```

For example, consider the following command-line call:

```
forcercact createWithTemplate
--platform=ios,android
--templaterepouri=https://github.com/forcedotcom/SmartSyncExplorerReactNative
--appname=MyReact
--packagename=com.mycompany.react
--organization="Acme Software, Inc."
--outputdir=""
```

This call creates a React Native app in the current directory that supports both iOS and Android. It uses the same source code and resources as the SmartSyncExplorerReactNative sample app. However, this call changes the app name from "SmartSyncExplorerReactNative" to "MyReact".

Build and Run Your App in Android Studio

1. In a Terminal window or at Windows command prompt, change to your project's root directory.

```
cd <my_project_root>
```

2. Run the following command:

- On Mac OS: `npm start`
- On Windows: `npm run-script start-windows`

3. Open your project in Android Studio.

- From the Welcome screen, click **Import Project (Eclipse ADT, Gradle, etc.)**.

OR

- From the File menu, click **File > New > Import Project...**

4. Browse to your `<project_root>/android/` directory and click **OK**.

Android Studio automatically builds your workspace. This process can take several minutes. When the status bar reports "Gradle build successful", you're ready to run the project.

5. Click **Run 'app'**, or press `SHIFT+F10`.

Android Studio launches your app in the emulator or on your connected Android device.

Build and Run Your App in Xcode

1. In a Terminal window, change to your project's root directory.

```
cd <my_project_root>
```

2. Type `npm start`, then press Return.
3. In Xcode, open `<project_root>/ios/<project_name>.xcworkspace`.
4. Click **Run**.

Xcode launches your app in the simulator or on your connected iOS device.

How the Forcereact Script Generates New Apps

- The script downloads templates at runtime from a GitHub repo. For the `forcereact create` command, the script uses the default templates in the [SalesforceMobileSDK-Templates](#) GitHub repo.
- The script uses npm to download React Native dependencies.
- The script uses git (Android) or CocoaPods (iOS) to download Mobile SDK libraries.

Using Mobile SDK Components in React Native Apps

React Native apps access the same Mobile SDK libraries as Mobile SDK native apps. For React Native, Mobile SDK provides JavaScript components, or *bridges*, that execute your JavaScript code as native Mobile SDK instructions.

In React Native, you access Mobile SDK functionality through the following native bridges:


- `react.force.oauth.js`
- `react.force.network.js`
- `react.force.smartstore.js`
- `react.force.smartsync.js`

To use these bridges, add an import statement in your JavaScript code. The following example imports all four bridges.

```
import {oauth, net, smartstore, smartsync} from 'react-native-force';
```

React native apps built with forcereact specify the `react-native-force` source path in the `package.json` file:

```
"react-native-force": "https://github.com/forcedotcom/SalesforceMobileSDK-ReactNative.git"
```

 **Note:** You can't use the `force.js` library with React Native.

Mobile SDK Native Modules for React Native Apps

Mobile SDK provides native modules for React Native that serve as JavaScript bridges to native Mobile SDK functionality.

OAuth

The OAuth bridge is similar to the OAuth plugin for Cordova.

Usage

```
import {oauth} from 'react-native-force';
```

Methods

```
oauth.getAuthCredentials(success, fail);  
oauth.logout();
```

Network

The Network bridge is similar to the force.js library for hybrid apps.

Usage

```
import {net} from 'react-native-force';
```

Methods

```
net.setApiVersion(version);  
net.getApiVersion();  
net.versions(callback, error);  
net.resources(callback, error);  
net.describeGlobal(callback, error);  
net.metadata(objtype, callback, error);  
net.describe(objtype, callback, error);  
net.describeLayout(objtype, recordTypeId, callback, error);  
net.create(objtype, fields, callback, error);  
net.retrieve(objtype, id, fieldlist, callback, error);  
net.upsert(objtype, externalIdField, externalId, fields, callback, error);  
net.update(objtype, id, fields, callback, error);  
net.del(objtype, id, callback, error);  
net.query(soql, callback, error);  
net.queryMore(url, callback, error);  
net.search(sosl, callback, error);  
net.getAttachment(id, callback, error);
```

SmartStore

The SmartStore bridge is similar to the SmartStore plugin for Cordova. Unlike the plugin, however, first arguments are not optional in React Native.

Usage

```
import {smartstore} from 'react-native-force';
```

Methods

```
smartstore.buildAllQuerySpec(indexPath, order, pageSize,  
                             selectPaths);  
smartstore.navigator.smartstore.buildExactQuerySpec(  
  path, matchKey, pageSize, order, orderPath, selectPaths);  
smartstore.navigator.smartstore.buildRangeQuerySpec(  
  path, beginKey, endKey, order, pageSize, orderPath, selectPaths);  
smartstore.navigator.smartstore.buildLikeQuerySpec(  
  path, matchKey, pageSize, order, orderPath, selectPaths);
```

```
    path, likeKey, order, pageSize, orderPath, selectPaths);
smartstore.navigator.smartstore.buildMatchQuerySpec(
    path, matchKey, order, pageSize, orderPath, selectPaths);
smartstore.buildSmartQuerySpec(smartSql, pageSize);

smartstore.getDatabaseSize(isGlobalStore, successCB, errorCallback);
smartstore.getDatabaseSize(storeConfig, successCB, errorCallback);

smartstore.registerSoup(isGlobalStore, soupName, indexSpecs,
    successCB, errorCallback);
smartstore.registerSoup(storeConfig, soupName, indexSpecs,
    successCB, errorCallback);
smartstore.registerSoupWithSpec(storeConfig, soupSpec, indexSpecs, successCB, errorCallback);

smartstore.removeSoup(isGlobalStore, soupName, successCB, errorCallback);
smartstore.removeSoup(storeConfig, soupName, successCB, errorCallback);

smartstore.getSoupIndexSpecs(isGlobalStore, soupName, successCB,
    errorCallback);
smartstore.getSoupIndexSpecs(storeConfig, soupName, successCB,
    errorCallback);

smartstore.getSoupSpec(storeConfig, soupName, successCB, errorCallback);

smartstore.alterSoup(isGlobalStore, soupName, indexSpecs, reIndexData,
    successCB, errorCallback);
smartstore.alterSoup(storeConfig, soupName, indexSpecs, reIndexData,
    successCB, errorCallback);smartstore.reIndexSoup(storeConfig, soupName, paths, successCB,
    errorCallback);
smartstore.alterSoupWithSpec(storeConfig, soupName, soupSpec, indexSpecs, reIndexData,
    successCB, errorCallback);

smartstore.reIndexSoup(storeConfig, soupName, paths, successCB, errorCallback);

smartstore.clearSoup(isGlobalStore, soupName, successCB, errorCallback);
smartstore.clearSoup(storeConfig, soupName, successCB, errorCallback);

smartstore.showInspector(isGlobalStore);
smartstore.showInspector(storeConfig);

smartstore.soupExists(isGlobalStore, soupName, successCB, errorCallback);
smartstore.soupExists(storeConfig, soupName, successCB, errorCallback);

smartstore.querySoup(isGlobalStore, soupName, querySpec,
    successCB, errorCallback);
smartstore.querySoup(storeConfig, soupName, querySpec,
    successCB, errorCallback);

smartstore.runSmartQuery(isGlobalStore, querySpec, successCB, errorCallback);
smartstore.runSmartQuery(storeConfig, querySpec, successCB, errorCallback);

smartstore.retrieveSoupEntries(isGlobalStore, soupName, entryIds,
    successCB, errorCallback);
```

```

smartstore.retrieveSoupEntries(storeConfig, soupName, entryIds,
    successCB, errorCallback);

smartstore.upsertSoupEntries(isGlobalStore, soupName, entries,
    successCB, errorCallback);
smartstore.upsertSoupEntries(storeConfig, soupName, entries,
    successCB, errorCallback);

smartstore.upsertSoupEntriesWithExternalId(isGlobalStore, soupName,
    entries, externalIdPath, successCB, errorCallback);
smartstore.upsertSoupEntriesWithExternalId(storeConfig, soupName,
    entries, externalIdPath, successCB, errorCallback);

smartstore.removeFromSoup(isGlobalStore, soupName, entryIds,
    successCB, errorCallback);
smartstore.removeFromSoup(storeConfig, soupName, entryIds,
    successCB, errorCallback);

smartstore.moveCursorToPageIndex(isGlobalStore, cursor, newPageIndex,
    successCB, errorCallback);
smartstore.moveCursorToPageIndex(storeConfig, cursor, newPageIndex,
    successCB, errorCallback);

smartstore.moveCursorToNextPage(isGlobalStore, cursor, successCB,
    errorCallback);
smartstore.moveCursorToNextPage(storeConfig, cursor, successCB,
    errorCallback);

smartstore.moveCursorToPreviousPage(isGlobalStore, cursor, successCB,
    errorCallback);
smartstore.moveCursorToPreviousPage(storeConfig, cursor, successCB,
    errorCallback);

smartstore.closeCursor(isGlobalStore, cursor, successCB, errorCallback);
smartstore.closeCursor(storeConfig, cursor, successCB, errorCallback);

smartstore.getAllStores(storeConfig, successCB, errorCallback);
smartstore.getAllGlobalStores(successCB, errorCallback);

smartstore.removeStore(storeConfig, successCB, errorCallback);
smartstore.removeAllGlobalStores(successCB, errorCallback);
smartstore.removeAllStores(successCB, errorCallback);

```

SmartSync Data Framework

The SmartSync Data Framework bridge is similar to the SmartSync Data Framework plugin for Cordova. Unlike the plugin, however, first arguments are not optional in React Native.

Usage

```
import {smartsync} from 'react-native-force';
```

Methods

```

smartsync.syncDown(isGlobalStore, target, soupName, options, syncName, successCB,
errorCB);
smartsync.syncDown(storeConfig, target, soupName, options, syncName, successCB, errorCB);

smartsync.reSync(isGlobalStore, syncIdOrName, successCB, errorCB);
smartsync.reSync(storeConfig, syncIdOrName, successCB, errorCB);

smartsync.cleanResyncGhosts(isGlobalStore, syncId, successCB, errorCB);
smartsync.cleanResyncGhosts(storeConfig, syncId, successCB, errorCB);

smartsync.syncUp(isGlobalStore, target, soupName, options, syncName, successCB,
errorCB);
smartsync.syncUp(storeConfig, target, soupName, options, syncName, successCB,
errorCB);

smartsync.getSyncStatus(isGlobalStore, syncIdOrName, successCB, errorCB);
smartsync.getSyncStatus(storeConfig, syncIdOrName, successCB, errorCB);

smartstore.deleteSync(isGlobalStore, syncIdOrName, successCB, errorCB);
smartstore.deleteSync(storeConfig, syncIdOrName, successCB, errorCB);

```



Note: Handling of field lists for “sync up” operations has changed in Mobile SDK 5.1. See [SmartSync Data Framework Plugin Methods](#) for a description of the JavaScript `syncUp ()` method.

Mobile SDK Sample App Using React Native

The best way to get up-to-speed on React Native in Mobile SDK is to study the sample code.

Mobile SDK provides four implementations of the SmartSyncExplorer application:

- Objective-C (for iOS native)
- Java (for Android native)
- HTML/JavaScript (for hybrid on iOS and Android)
- JavaScript with React (for React Native on iOS and Android)

Implementation	iOS	Android
Native (Objective-C/Java)	<ol style="list-style-type: none"> 1. Clone the SalesforceMobileSDK-iOS GitHub repo. 2. Open the SalesforceMobileSDK workspace in Xcode. 3. Run the SmartSyncExplorer application (in the NativeSamples workspace folder). 	<ol style="list-style-type: none"> 1. Clone the SalesforceMobileSDK-Android GitHub repo. 2. Import the SalesforceMobileSDK-Android project in Android Studio. 3. Run the SmartSyncExplorer application (in the <code>native/NativeSampleApps</code> project folder).

Implementation	iOS	Android
Hybrid (HTML/JavaScript)	<ol style="list-style-type: none"> 1. Clone the SalesforceMobileSDK-iOS GitHub repo. 2. Open the SalesforceMobileSDK workspace in Xcode. 3. Run the SmartSyncExplorerHybrid application (in the HybridSamples workspace folder). 	<ol style="list-style-type: none"> 1. Clone the SalesforceMobileSDK-Android GitHub repo. 2. Import the SalesforceMobileSDK-Android project in Android Studio. 3. Run the "SmartSyncExplorer" application (in the hybrid/HybridSampleApps project folder).
React Native (JavaScript with React)	<ol style="list-style-type: none"> 1. Clone SmartSyncExplorerReactNative GitHub repo. 2. In a terminal window or command prompt, run <code>./install.sh</code> (on Mac) or <code>cscript install.vbs</code> (on Windows) 3. <code>cd</code> to the <code>app</code> folder and run <code>npm start</code> 4. Open the <code>app/ios</code> folder in Xcode. 5. Run the SmartSyncExplorerReactNative application 	<ol style="list-style-type: none"> 1. Clone SmartSyncExplorerReactNative GitHub repo. 2. In a terminal window or command prompt, run <code>./install.sh</code> (on Mac) or <code>cscript install.vbs</code> (on Windows) 3. <code>cd</code> to the <code>app</code> folder and run <code>npm start</code> 4. Open the <code>app/android</code> folder in Android Studio 5. Run the SmartSyncExplorerReactNative application

A few notes about the SmartSyncExplorer for React Native

Table 1: Key Folder and Files

Path	Description
README.md	Instructions to get started
external	Dependencies (iOS/Android SDKs) They are downloaded when you run <code>./install.sh</code> (Mac) or <code>cscript install.vbs</code> (Windows)
app/ios	The iOS application
app/android	The Android application
app/js	The JavaScript source files for the application

Table 2: React Components

File	Component	Description
app/js/index.android.js		Android starting script
app/js/index.ios.js		iOS starting script
app/js/App.js	SmartSyncExplorerReactNative	Root component (the entire application) (iOS and Android)
app/js/SearchScreen.js	SearchScreen	Search screen (iOS and Android)
app/js/ContactScreen.js	ContactScreen	Used for viewing and editing a single contact (iOS and Android)
app/js/SearchBar.ios.js	SearchBar	Search bar in the search screen (iOS)
app/js/SearchBar.android.js	SearchBar	Search bar in the search screen (Android)
app/js/ContactCell.js	ContactCell	A single row in the list of results in the search screen (iOS and Android)
app/js/ContactBadge.js	ContactBadge	Colored circle with initials used in the search results screen (iOS and Android)
app/js/Field.js	Field	A field name and value used in the contact screen (iOS and Android)
app/js/StoreMgr.js	StoreMgr	Interacts with SmartStore and the server (via SmartSync Data Framework).

 **Note:** Most components are shared between iOS and Android. However, some components are platform specific.

Defer Login

Apps built with early versions of React Native for Mobile SDK always present a Salesforce login screen at startup. Sometimes, however, these apps can benefit from deferring authentication until some later point. Beginning with React Native for Mobile SDK 4.2, you can defer login to any logical place in your app.

Deferred login implementation is a two-step process:

1. In your iOS or Android native container app, you call Mobile SDK native methods to disable authentication at startup.
2. In your React code, you call a Mobile SDK JavaScript function at the point where you plan to initiate authentication.

Read on for the implementation details.

Step1: Disable Login at Startup

iOS (Objective-C):

By default, the Salesforce login screen appears at startup. To disable this behavior, set the `authenticateAtLaunch` property of `SalesForceSDKManager` to `NO`.

1. Edit the `AppDelegate.m` file.

2. Change this line:

```
[SalesforceSDKManager sharedManager].authenticateAtLaunch = YES;
```

to:

```
[SalesforceSDKManager sharedManager].authenticateAtLaunch = NO;
```

Android (Java):

By default, the Salesforce login screen appears at startup. To disable this behavior, override the `shouldAuthenticate()` method in your `MainActivity` class (or whichever class subclasses `SalesforceReactActivity`), as follows:

```
@Override
public boolean shouldAuthenticate() {
    return false;
}
```

Step 2: Initiate Authentication in React (JavaScript)

To initiate the authentication process, call the following `react.force.oauth.js` function:

```
function authenticate(success, fail)
```

This function takes two arguments: a success callback function and a failure callback function. If authentication fails, your failure callback is invoked. If authentication succeeds, your success callback is invoked with a dictionary containing the following keys:

- `accessToken`
- `refreshToken`
- `clientId`
- `userId`
- `orgId`
- `loginUrl`
- `instanceUrl`
- `userAgent`
- `communityId`
- `communityUrl`

Upload Binary Content

Beginning with Mobile SDK 4.2, you can upload binary content to any `force.com` endpoint that supports the binary upload feature.

The `sendRequest()` method in `react.force.net.js` has a new optional parameter named `fileParams`.

```
function sendRequest(endPoint, path, successCB, errorCB, method, payload, headerParams,
fileParams)
```

This parameter expects the following form:

```
{
  <fileParamNameInPost>: // value depends on the endpoint
  {
```

```

    fileMimeType:<someMimeType>,
    fileUrl:<fileUrl>, // url to file to upload
    fileName:<fileNameForPost>
  }
}


```

For example:

```

{
  fileUpload:
  {
    fileMimeType:'image/jpeg',
    fileUrl:localPhotoUrl,
    fileName:'pic.jpg'
  }
}

```

 **Example:** The github.com/wmathurin/MyUserPicReactNative sample app demonstrates binary upload. This sample allows you to change your profile picture. Binary upload of the new pic happens in the `uploadPhoto()` function of the `UserPic.js` file.

Here's the sample's `sendRequest()` call in the `getUserInfo()` function:

```

getUserInfo(callback) {
  forceClient.sendRequest('/services/data',
    '/v36.0/connect/user-profiles/' + this.state.userId + '/photo',
    (response) => {
      callback(response);
    },
    (error) => {
      console.log('Failed to upload user photo:' + error);
    },
    'POST',
    {},
    {'X-Connect-Bearer-Urls': 'true'},
    {fileUpload:
      {
        fileUrl:localPhotoUrl,
        fileMimeType:'image/jpeg',
        fileName:'pic.jpg'
      }
    }
  );
},

```


CHAPTER 8 Native iOS Development

In this chapter ...

- [iOS Native Quick Start](#)
- [Native iOS Requirements](#)
- [Creating an iOS Project with Forceios](#)
- [Use CocoaPods with Mobile SDK](#)
- [Developing a Native iOS App](#)
- [Using iOS App Extensions with Mobile SDK](#)
- [Tutorial: Creating a Native iOS Warehouse App](#)
- [iOS Sample Applications](#)

Salesforce Mobile SDK delivers libraries and sample Xcode projects for developing mobile apps on iOS.

Two important features that the iOS native SDK provides are:

- Automation of the OAuth2 login process, making it easy to integrate OAuth with your app.
- Access to the REST API with infrastructure classes that make that access as easy as possible.

When you create a native app using the forceios application, your project starts as a fully functioning app. This app allows you to connect to a Salesforce organization and run a simple query. It doesn't do much, but it lets you know things are working as designed.

iOS Native Quick Start

Use the following procedure to get started quickly.

1. Make sure you meet the [native iOS requirements](#).
2. Install nodejs (includes npm)—<https://nodejs.org>
3. Install the current version of CocoaPods—<https://www.cocoapods.org>.
4. Using npm, install forceios. (npm is automatically installed with nodejs).

```
sudo npm install -g forceios
```

5. In a Terminal window, [use forceios](#) on page 48 to create an app.

```
forceios create
```

Native iOS Requirements

The following software is required for all Mobile SDK development.

- [Node.js](#)
- Npm version 3.10 or later (installed with Node.js).
- A Salesforce [Developer Edition organization](#) with a [connected app](#).

iOS development with Mobile SDK 6.0 also requires the following software.

- iOS 10 or later.
- Xcode version 9 or later. (We recommend the latest version.)
- CocoaPods version 1.2 or later (cocoapods.org).
- forceios version 6.0.

 **Note:** Mobile SDK for iOS supports Cocoa Touch dynamic frameworks.

SEE ALSO:

[iOS Preparation](#)

[Use CocoaPods with Mobile SDK](#)

[Refreshing Mobile SDK Pods](#)

Creating an iOS Project with Forceios

To create an app, use forceios in a terminal window. The forceios utility gives you two ways to create your app.

- Specify the type of application you want, along with basic configuration data.
or
- Use an existing Mobile SDK app as a template. You still provide the basic configuration data.

You can use forceios in interactive mode with command-line prompts, or in script mode with command-line arguments. To see command usage information, type `forceios` without arguments.

 **Note:** Be sure to install CocoaPods before using forceios. See [iOS Preparation](#).

Forceios Project Types

The `forceios create` command requires you to specify one of the following project types:

App Type	Architecture	Language
<code>native</code>	Native	Objective-C
<code>native_swift</code>	Native	Swift

To develop a native iOS app in Objective-C, specify `native`.

Using `forceios create` Interactively

To use interactive prompts to create an app, open a Terminal window and type `forceios create`. For example:

```
$ forceios create
Enter your application type (native, native_swift): native
Enter your application name: testNative
Enter the package name for your app (com.mycompany.myapp): com.bestapps.ios
Enter your organization name (Acme, Inc.): BestApps.com
Enter output directory for your app (leave empty for the current directory): testNative
```

This command creates a native Objective-C iOS app named “testNative” in the `testNative/` subdirectory of your current directory.

Using `forceios create` in Script Mode

In script mode, you can use forceios without interactive prompts. For example, to create a native app written in Objective-C:

```
$ forceios create --apptype="native" --appname="package-test"
--packagename="com.acme.mobile_apps"
--organization="Acme Widgets, Inc." --outputdir="PackageTest"
```

Or, to create a native app written in Swift:

```
$ forceios create --apptype="native_swift" --appname="package-test"
--packagename="com.acme.mobile_apps"
--organization="Acme Widgets, Inc." --outputdir="PackageTest"
```

Each of these calls creates a native app named “package-test” and places it in the `PackageTest/` subdirectory of your current directory.

Creating an App from a Template

The `forceios createWithTemplate` command is identical to `forceios create` except that it asks for a GitHub repo URI instead of an app type. You set this URI to point to any repo directory that contains a Mobile SDK app that can be used as a template. Your template app can be any supported Mobile SDK app type. The script changes the template’s identifiers and configuration to match the values you provide for the other parameters.

Here's command-line usage information for `forceios createWithTemplate`:

```
Usage:
forceios createWithTemplate
  --templaterepouri=<Template repo URI> (e.g.
https://github.com/forcedotcom/SmartSyncExplorerReactNative)]
  --appname=<Application Name>
  --packagename=<App Package Identifier> (e.g. com.mycompany.myapp)
  --organization=<Organization Name> (Your company's/organization's name)
  --outputdir=<Output directory> (Leave empty for current directory)]
```

You can use `forceios createWithTemplate` interactively or in script mode. For example, here's a script mode call:

```
forceios createWithTemplate
--templaterepouri=https://github.com/forcedotcom/SmartSyncExplorerReactNative
--appname=MyReact
--packagename=com.mycompany.react
--organization="Acme Software, Inc."
--outputdir=testWithTemplate
```

This call creates a React Native app with the same source code and resources as the `SmartSyncExplorerReactNative` sample app. Forceios places the new app in the `testWithTemplate/` subdirectory of your current directory. It also changes the name "SmartSyncExplorerReactNative" to "MyReact" throughout the app.

Checking the Forceios Version

To find out which version of forceios you've installed, run the following command:

```
forceios version
```

Open the New Project in Xcode

Apps created with forceios are ready to run, right out of the box. After the app creation script finishes, you can open and run the project in Xcode.

1. In Xcode, select **File > Open**.
2. Navigate to the output folder you specified.
3. Open the workspace file (`<project_name>.xcworkspace`).
4. When Xcode finishes building, click the **Run** button.

How the Forceios Script Generates New Apps

- Apps are based on CocoaPods.
- The script downloads templates at runtime from a GitHub repo.
- For the `forceios create` command, the script uses the default templates in the [SalesforceMobileSDK-Templates](#) GitHub repo.
- The script uses npm at runtime to download Mobile SDK libraries. The podfile refers to these libraries with `:path => node_modules/...` directives.

- For native Swift apps only, the podfile includes `!use_frameworks`.

SEE ALSO:

[Updating Mobile SDK Apps \(5.0 and Later\)](#)

Run the Xcode Project Template App

The Xcode project template includes a sample application you can run right away.

1. Press **Command-R** and the default template app runs in the iOS simulator.
2. On startup, the application starts the OAuth authentication flow, which results in an authentication page. Enter your credentials, and click **Login**.
3. Tap **Allow** when asked for permission.

You should now be able to compile and run the sample project. It's a simple app that logs you into an org via OAuth2, issues a `select Name from Account` SOQL query, and displays the result in a `UITableView` instance.

Using a Custom Template to Create Apps

Wishing you could use your own—or someone else's—custom app as a template? Good idea! Custom templates promote reuse of code, rapid development, and internal consistency. Beginning in Mobile SDK 5.0, you can use either `forceios` or `forcedroid` to create apps with custom templates. To turn a Mobile SDK app into a template, you perform a few steps to prepare the app's repo for Mobile SDK consumption.

About Mobile SDK Templates

Mobile SDK defines a template for each architecture it supports on iOS and Android. These templates are maintained in the github.com/forcedotcom/SalesforceMobileSDK-Templates repo. When a customer runs the `forcedroid` or `forceios create` command, the script copies the appropriate built-in template from the repo and transforms this copy into the new app. Apps created this way are basic Mobile SDK apps with little functionality.

Perhaps you'd like to create your own template, with additional functionality, resources, or branding. You can harness the same Mobile SDK mechanism to turn your own app into a template. You can then tell `forcedroid` or `forceios` to use that template instead of its own.

How to Use a Custom Template

In addition to `forcedroid` and `forceios create`, Mobile SDK defines a `createWithTemplate` command. When you run `forcedroid` or `forceios createWithTemplate`, you specify a template app repo instead of an app type, followed by the remaining app creation parameters. The template app repo contains a Mobile SDK app that the script recognizes as a template. To create a new Mobile SDK app from this template, the script copies the template app to a new folder and applies your parameter values to the copied code.

The `template.js` File

To accept your unknown app as a template, `forceios` and `forcedroid` require you to define a `template.js` configuration file. You save this file in the root of your template app repo. This file tells the script how to perform its standard app refactoring tasks—moving files, replacing text, removing and renaming resources. However, you might have even more extensive changes that you want to apply. In such cases, you can also adapt `template.js` to perform customizations beyond the standard scope. For example, if you insert your app name in classes other than the main entry point class, you can use `template.js` to perform those changes.

A `template.js` file contains two parts: a JavaScript “prepare” function for preparing new apps from the template, and a declaration of exports.

The `template.js` Prepare Function

Most of a `template.js` file consists of the “prepare” function. By default, prepare functions use the following signature:

```
function prepare(config, replaceInFiles, moveFile, removeFile)
```

You can rename this function, as long as you remember to specify the updated name in the list of exports. The Mobile SDK script calls the function you export with the following arguments:

- `config`: A dictionary identifying the platform (iOS or Android), app name, package name, organization, and Mobile SDK version.
- `replaceInFiles`: Helper function to replace a string in files.
- `moveFile`: Helper function to move files and directories.
- `removeFile`: Helper function to remove files and directories.

The default prepare function found in Mobile SDK templates replaces strings and moves and removes the files necessary to personalize a standard template app. If you intend to add functionality, place your code within the prepare function. Note, however, that the helper functions passed to your prepare function can only perform the tasks of a standard template app. For custom tasks, you’ll have to implement and call your own methods.

Exports Defined in `template.js`

Each `template.js` file defines the following two exports.

appType

Assign one of the following values:

- `'native'`
- `'native_kotlin'` (forcedroid only)
- `'native_swift'` (forceios only)
- `'react_native'`
- `'hybrid_local'`
- `'hybrid_remote'`

prepare

The handle of your prepare function (listed without quotation marks).

Here’s an example of the export section of a `template.js` file. This template is for a native app that defines a prepare function named `prepare`:

```
//
// Exports
//
module.exports = {
  appType: 'native',
  prepare: prepare
};
```

In this case, the prepare function’s handle is, in fact, “prepare”:

```
function prepare(config, replaceInFiles, moveFile, removeFile)
```

Template App Identification in `template.js` (Native and React Native Apps)

For native and React native apps, a template app's `prepare` function defines an app name, a package name, and an organization or company name. These values identify the template app itself—not a new custom app created from the template. At runtime, the Mobile SDK script uses these values to find the strings to be replaced with the script's input values. Here's an example of the settings for these `iOSNativeTemplate` template app:


```
// Values in template
var templateAppName = 'iOSNativeTemplate';
var templatePackageName = 'com.salesforce.iosnativetemplate';
var templateOrganization = 'iOSNativeTemplateOrganizationName';
```

Examples of `template.js` Files

Mobile SDK defines the following `template.js` files in the github.com/forcedotcom/SalesforceMobileSDK-Templates repo:

- `iOSNativeTemplate/template.js` (forceios only)
- `iOSNativeSwiftTemplate/template.js` (forceios only)
- `ReactNativeTemplate/template.js`
- `HybridLocalTemplate/template.js`
- `HybridRemoteTemplate/template.js`
- `AndroidNativeTemplate/template.js` (forcedroid only)

These templates are the bare bones apps used by `forceios create` and `forcedroid create`. Their level of complexity is intentionally low. For an example of a more complex template repo created from a full-fledged app, check out github.com/forcedotcom/SmartSyncExplorerReactNative.

 **Note:** Always match the script command to the template. Use iOS-specific templates with `forceios createWithTemplate` only, and Android-specific templates with `forcedroid createWithTemplate` only. This restriction doesn't apply to hybrid and React native templates.

Define a Basic `template.js` File

The following steps describe the quickest way to create a basic `template.js` file.

1. Copy a `template.js` file from the github.com/forcedotcom/SalesforceMobileSDK-Templates repo to the root of your custom template app repo. Be sure to choose the template that matches the type of app your template should build.
2. For native or React native apps only, update the app name, package name, and organization to reflect your template app.
3. If necessary, update the `appType` and `prepare` settings in the `module.exports` object, as described earlier. Although this step isn't required for this basic example, you might need it later if you create your own `template.js` files.

Restrictions and Guidelines

A few restrictions apply to custom templates.

- The template app can be any valid Mobile SDK app that targets any supported platform and architecture.
- A primary requirement is that the template repo and your local Mobile SDK repo must be on the same Mobile SDK version. You can use git version tags to sync both repos to a specific earlier version, but doing so isn't recommended.

- Always match the script command to the template. Use iOS-specific templates with `forceios createWithTemplate` only, and Android-specific templates with `forcedroid createWithTemplate` only. This restriction doesn't apply to hybrid and React native templates.

Use CocoaPods with Mobile SDK

CocoaPods provides a convenient mechanism for merging Mobile SDK modules into existing Xcode projects. The steps in this article guide you through manually setting up CocoaPods in a Mobile SDK iOS app. If you created your app with `forceios` 4.0 or later, you get the CocoaPods setup automatically. In that case, you don't have to perform the steps in this article—you only have to install CocoaPods software, and `forceios` does the rest. If you're creating apps some other way, use this article to import Mobile SDK modules through CocoaPods.

Beginning in Mobile SDK 4.0, `forceios` uses CocoaPods to create projects. Developers can also use CocoaPods manually to add Mobile SDK to existing iOS apps.

You're required to install CocoaPods to import Mobile SDK 4.0 and later into iOS apps. If you're unfamiliar with CocoaPods, start by reading the documentation at www.cocoapods.org.

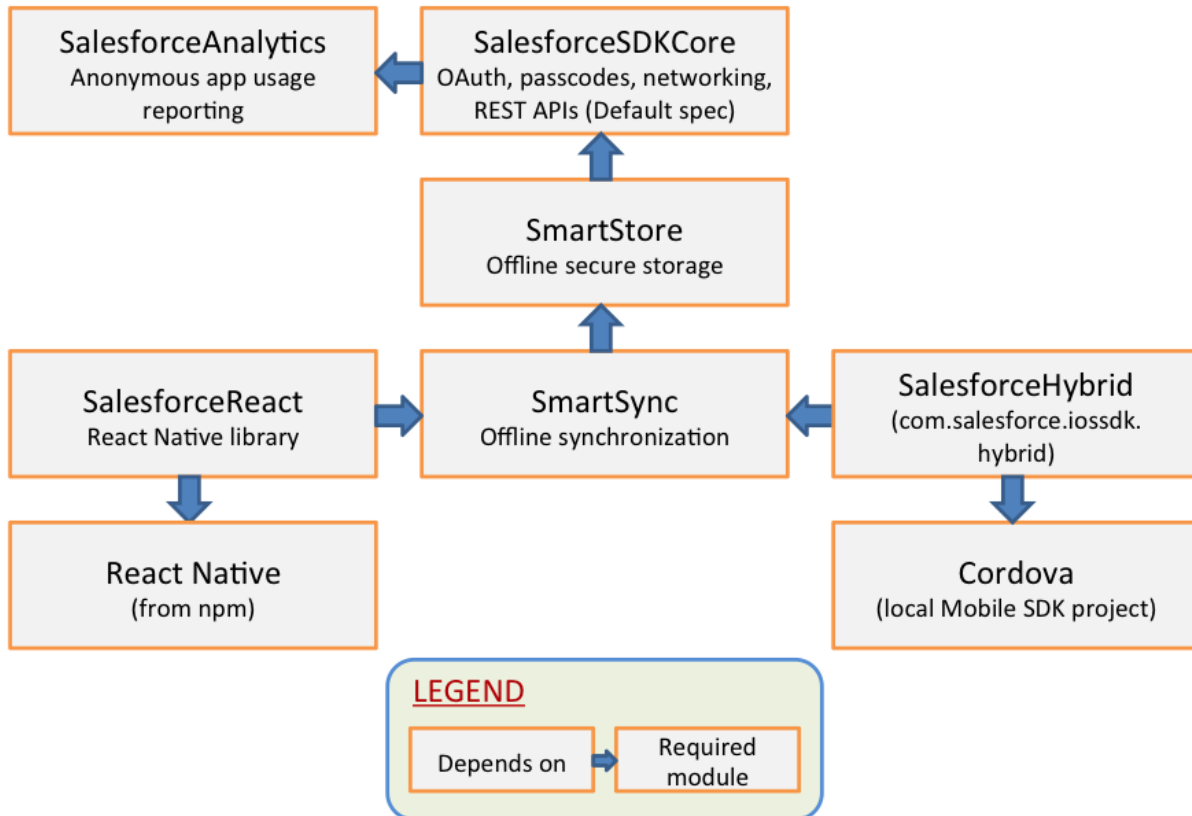
Mobile SDK provides CocoaPods pod specifications, or *podspecs*, for each Mobile SDK module.

- `SalesforceSDKCore`—Implements OAuth, passcodes, networking, and REST APIs. All other pods depend on this pod, either directly or indirectly.
- `SmartStore`—Implements secure offline storage. Depends on `FMDB`.
- `SmartSync Data Framework`—Implements offline synchronization. Depends on `SalesforceRestAPI` and `SmartStore`.
- `SalesforceReact`—Implements Salesforce Mobile SDK React Native bridges for apps written with React JavaScript and markup. Depends on `SmartSync Data Framework`.
- `SalesforceAnalytics`—Implements a reporting mechanism that sends Salesforce anonymous statistics on Mobile SDK feature usage and popularity.

Mobile SDK also consumes `FMDB`, an external module, through CocoaPods.

The following chart shows the dependencies between specs. In this chart, the arrows point from the dependent specs to their dependencies.

iOS Library Hierarchy



If you declare a pod, you automatically get everything in that pod's dependency chain. For example, by declaring a pod for `SalesforceReact`, you automatically get the entire chain of Mobile SDK.

You can access all versions of the Mobile SDK podspecs in the github.com/forcedotcom/SalesforceMobileSDK-iOS-Specs repo. You can also get the current version from the github.com/forcedotcom/SalesforceMobileSDK-iOS repo.

To use CocoaPods with the current Mobile SDK release, follow these steps.

1. Be sure you've installed the `cocoapods` Ruby gem as described at www.cocoapods.org. Mobile SDK 6.0 requires pod version 1.2 minimum.
2. In your project's Podfile, add the `SalesforceMobileSDK-iOS-Specs` repo as a source. Make sure that you put this entry first, before the CocoaPods source path.

```
target 'YourAppName' do
  source 'https://github.com/forcedotcom/SalesforceMobileSDK-iOS-Specs.git' # needs to be
  first
  source 'https://github.com/CocoaPods/Specs.git'
  ...
end
```

3. (Mobile SDK 5.3 and later only) Declare the FMDB pod so that you can specify a special build that works with Xcode 9 and iOS 11.

```
target 'YourAppName' do
  source 'https://github.com/forcedotcom/SalesforceMobileSDK-iOS-Specs.git' # needs to be
  first
  source 'https://github.com/CocoaPods/Specs.git'

  # NB: get rid of next line once FMDB works with Xcode 9
  pod 'FMDB', :git => 'https://github.com/forcedotcom/fmdb', :branch => '2.7.2_xcode9'

end
```

4. Reference the Mobile SDK podspec that you intend to merge into your app. For example, to add OAuth and passcode modules to your app, declare the `SalesforceSDKCore` pod in your Podfile. For example:

```
target 'YourAppName' do
  source 'https://github.com/forcedotcom/SalesforceMobileSDK-iOS-Specs.git' # needs to be
  first
  source 'https://github.com/CocoaPods/Specs.git'

  NB: get rid of next line once FMDB works with xcode 9
  pod 'FMDB', :git => 'https://github.com/forcedotcom/fmdb', :branch => '2.7.2_xcode9'
  pod 'SalesforceSDKCore'

end
```

This pod configuration is the minimum for a Mobile SDK app. Note that `SalesforceSDKCore` implicitly includes `SalesforceAnalytics`, as well as third-party `SqlCipher` and `CocoaLumberJack` pods.

5. To add other modules, replace `SalesforceSDKCore` with a different pod declaration. For example, to use SmartSync Data Framework:

```
target 'YourAppName' do
  source 'https://github.com/forcedotcom/SalesforceMobileSDK-iOS-Specs.git' # needs to be
  first
  source 'https://github.com/CocoaPods/Specs.git'

  NB: get rid of next line once FMDB works with xcode 9
  pod 'FMDB', :git => 'https://github.com/forcedotcom/fmdb', :branch => '2.7.2_xcode9'
  pod 'SmartSync'

end
```

Since the `SmartSync` pod depends on `SmartStore`, `SalesforceSDKCore`, and `SalesforceAnalytics`, there's no need to declare those pod dependencies explicitly.

6. (Alternate method) To work with the upcoming release of Mobile SDK, you clone the `SalesforceMobileSDK-iOS` repo, check out the `dev` branch, and then pull resources from it. In this case, you must declare each pre-release dependency explicitly so you can indicate its repo path. If you omit a dependency declaration, CocoaPods loads its production version.
 - a. Clone github.com/forcedotcom/SalesforceMobileSDK-iOS locally at the desired commit.
 - b. At the Terminal window, run `git checkout dev` to switch to the development branch.
 - c. Run `./install.sh` in the root directory of your clone.
 - d. To each pod call in your Podfile, add a `:path` parameter that points to your clone.

Here's the previous example repurposed to pull resources from a local clone:

```
target 'YourAppName' do
  source 'https://github.com/forcedotcom/SalesforceMobileSDK-iOS-Specs.git' # need to be
  first
  source 'https://github.com/CocoaPods/Specs.git'

  # NB: get rid of next line once FMDB works with xcode 9
  pod 'FMDB', :git => 'https://github.com/forcedotcom/fmdb', :branch => '2.7.2_xcode9'
  # Specify each pre-release pod
  pod 'SalesforceSDKCore', :path => '/<path-to-clone-of>/SalesforceMobileSDK-iOS/'
  pod 'SalesforceAnalytics', :path => '/<path-to-clone-of>/SalesforceMobileSDK-iOS/'
  pod 'SmartStore', :path => '/<path-to-clone-of>/SalesforceMobileSDK-iOS/'
  pod 'SmartSync', :path => '/<path-to-clone-of>/SalesforceMobileSDK-iOS/'

end
```

7. In a Terminal window, run `pod install` from your project directory. CocoaPods downloads the dependencies for your requested pods, merges them into your project, and creates a workspace containing the newly merged project.

 **Important:** After running CocoaPods, always access your project only from the workspace that `pod install` creates. For example, instead of opening `MyProject.xcodeproj`, open `MyProject.xcworkspace`.


8. To use Mobile SDK APIs in your merged app, remember these important tips.

- a. Import header files using angle brackets ("`<`" and "`>`") rather than double quotes. For example:

```
import <SalesforceSDKCore/SFRestAPI.h>
```

- b. For Swift applications, be sure to specify `use_frameworks!` in your Podfile. Also, in your Swift source files, remember to import modules instead of header files. For example:

```
import SalesforceSDKCore
```

 **Note:** If you're upgrading an app created with forceios 5.2 or earlier to Mobile SDK 5.3 or later, you're required to add the FMDB pod to your existing podfile, as shown in the preceding examples.

Refreshing Mobile SDK Pods

CocoaPods caches its pods in repos stored locally on your machine. If the pod repo gets out of sync with forceios, you can manually update it.

When forceios creates a native app, it prints a list of installed pods and their versions. For example:

```
Installing SalesforceSDKCore (5.0.0)
Installing SalesforceAnalytics (5.0.0)
Installing SmartStore (5.0.0)
Installing SmartSync (5.0.0)
```

You can compare these versions to your forceios version by typing:

```
forceios version
```

If the reported pod versions are older than your `forceios` version, run the following commands in the Terminal window:

```
pod repo remove forcedotcom
pod setup
```

After setup completes, recreate your app with `forceios create`.

Developing a Native iOS App

The Salesforce Mobile SDK for native iOS provides the tools you need to build apps for Apple mobile devices. Features of the SDK include:

- Classes and interfaces that make it easy to call the Salesforce REST API
- Fully implemented OAuth login and passcode protocols
- SmartStore library for securely managing user data offline


The native iOS SDK requires you to be proficient in Objective-C coding. You also need to be familiar with iOS application development principles and frameworks. If you're a newbie, developer.apple.com/develop/ is a good place to begin learning. See [Native iOS Requirements](#) for additional prerequisites.

In a few Mobile SDK interfaces, you're required to override some methods and properties. SDK header (.h) files include comments that indicate mandatory and optional overrides.

About Login and Passcodes

To access Salesforce objects from a Mobile SDK app, the customer logs in to an organization on a Salesforce server. When the login flow begins, your app sends its connected app configuration to Salesforce. Salesforce responds by posting a login screen to the mobile device.

Optionally, a Salesforce administrator can set the connected app to require a passcode after login. Mobile SDK handles presentation of the login and passcode screens, as well as authentication handshakes. Your app doesn't have to do anything to display these screens. However, it's important to understand the login flow and how OAuth tokens are handled. See [About PIN Security](#) and [OAuth 2.0 Authentication Flow](#).

 **Note:** Mobile SDK for iOS supports the use of Touch ID to supply the PIN. Customers must type the PIN when first launching the app. After first launch, the app prompts the customer to use either Touch ID or the keyboard to enter the PIN.

About Memory Management

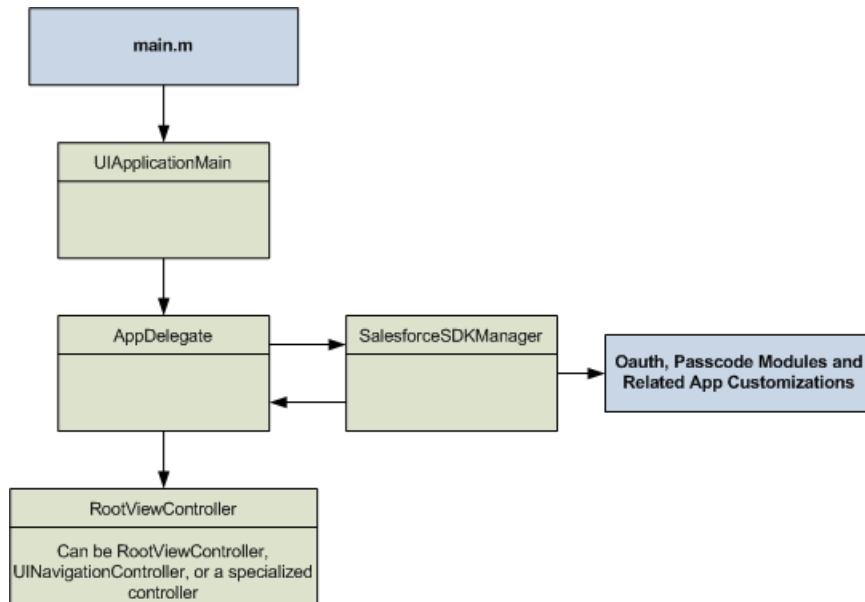
Beginning in Mobile SDK 2.0, native iOS apps use Automatic Reference Counting (ARC) to manage object memory. You don't have to allocate and then remember to deallocate your objects. See the [Mac Developer Library](#) at <https://developer.apple.com> for ARC syntax, guidelines, and best practices.

Overview of Application Flow

A project created with `forceios` defines three classes: `AppDelegate`, `InitialViewController`, and `RootViewController`. The `AppDelegate` object loads `InitialViewController` as the first view to show. After the authentication process completes, the `AppDelegate` object displays the view associated with `RootViewController` as the entry point to your app.

Native iOS apps built with Mobile SDK follow the same design as other iOS apps. The `main.m` source file creates a `UIApplicationMain` object that is the root object for the rest of the application. The `UIApplicationMain` constructor creates an `AppDelegate` object that manages the application lifecycle.

`AppDelegate` uses a Mobile SDK service object, `SalesforceSDKManager`, to coordinate Salesforce authentication and passcode activities. After the user is authenticated, `AppDelegate` passes control to the `RootViewController` object.



Note: The workflow demonstrated by the template app is just an example. You can tailor your `AppDelegate` and supporting classes to achieve your desired workflow. For example, you can postpone Salesforce authentication until a later point. You can retrieve data through REST API calls and display it, launch other views, perform services, and so on. Your app remains alive in memory until the user explicitly terminates it, or until the device is rebooted.

SEE ALSO:

[SDK Manager Classes](#)

SDK Manager Classes

The `SalesforceSDKManager` class combines app identity and bootstrap configuration in a single component. It manages complex interactions between authentication and passcodes using configuration provided by the app developer. In effect, `SalesforceSDKManager` shields developers from having to control the bootstrap process.

The Mobile SDK template application uses the `SalesforceSDKManager` class to implement most of the Salesforce-specific startup functionality for you. `SalesforceSDKManager` manages and coordinates all objects involved in app launching, including PIN code, OAuth configuration, and other bootstrap processes. Using `SalesforceSDKManager` ensures that interactions between these processes occur in the proper sequence, while still letting you customize individual parts of the launch flow. Beginning with Mobile SDK 3.0, all iOS native apps must use `SalesforceSDKManager` to manage application launch behavior.

Note: The `SalesforceSDKManager` class, which debuted in Mobile SDK 3.0, does not replace existing authentication management objects or events. Rather, it's a super-manager of the existing boot management objects. Existing code should continue to work fine, but we strongly urge developers to upgrade to the latest Mobile SDK version and `SalesforceSDKManager`.

What About SmartStoreSDKManager and Other SDK Manager Classes?

Mobile SDK 6.0 adds a complement of specialized SDK manager classes. For example, apps that use SmartStore now require an instance of the `SmartStoreSDKManager` class. This class does not replace `SalesforceSDKManager` in your code. Instead, you configure the shared `SalesforceSDKManager` instance to use `SmartStoreSDKManager` as its instance class.

Here's the list of SDK manager classes.

- `SalesforceSDKManager`
- `SmartStoreSDKManager`—subclass of `SalesforceSDKManager` (replaces the `SalesforceSDKManagerWithSmartStore` legacy class)
- `SmartSyncSDKManager`—subclass of `SmartStoreSDKManager` (new in 6.0)
- `SalesforceHybridSDKManager`—subclass of `SmartSyncSDKManager` (new in 6.0)
- `SalesforceReactSDKManager`—subclass of `SmartSyncSDKManager` (new in 6.0)
- `SalesforceSwiftSDKManager`—subclass of `SmartSyncSDKManager` (new in 6.0)

If you're updating apps from pre-6.0 Mobile SDK releases, we recommend using Mobile SDK npm scripts to create a new app from a template, and then importing your assets. This approach saves you from directly changing the SDK manager code, the pod specs, and other code changes. For the curious, however, the following example shows an updated SDK manager configuration. This code configures a native iOS app to use SmartStore but not the SmartSync Data Framework.

In your `AppDelegate.m` file:

1. Import the `SmartStoreSDKManager` header:

```
#import <SmartStore/SmartStoreSDKManager.h>
```

2. In your `init` method, before the first use of `[SalesforceSDKManager sharedInstance]`, add the following call:

```
[SalesforceSDKManager sharedInstance].setInstanceClass:[SmartStoreSDKManager class];
```

This call is the only place where you explicitly reference the `SmartStoreSDKManager` class. No other code changes are required.

Other types of apps configure the SDK manager similarly, using the following values.

- Native apps using SmartSync Data Framework and SmartStore:

```
#import <SmartSync/SmartSyncSDKManager.h>
...
[SalesforceSDKManager sharedInstance].setInstanceClass:[SmartSyncSDKManager class];
```

- Hybrid apps (configuration occurs in the `AppDelegate+SalesforceHybrid.m` file of the hybrid plug-in):

```
#import <SalesforceHybrid/SalesforceHybridSDKManager.h>
...
[SalesforceSDKManager sharedInstance].setInstanceClass:[SalesforceHybridSDKManager class];
```

- React Native apps:

```
#import <SalesforceReact/SalesforceReactSDKManager.h>
...
[SalesforceSDKManager sharedInstance].setInstanceClass:[SalesforceReactSDKManager class];
```

- Swift apps require a different setup, in the `AppDelegate.swift` file. These apps call `initSDK()` on the `SalesforceSwiftSDKManager` class and, eventually, `launch()` on the shared `SalesforceSwiftSDKManager` object:

```
import SalesforceSwiftSDK
...
    override
    init()
    {
        super.init()

        SalesforceSwiftSDKManager.initSDK()
    }
...

func application(_ application: UIApplication, didFinishLaunchingWithOptions
launchOptions: [UIApplicationLaunchOptionsKey: Any]?) -> Bool
{
    self.window = UIWindow(frame: UIScreen.main.bounds)
    self.initializeAppViewState();

    //
    // If you wish to register for push notifications, uncomment the line below.
    // Note that, if you want to receive push notifications from Salesforce,
    // you will also need to implement the
    // application:didRegisterForRemoteNotificationsWithDeviceToken: method below.
    //
    // SFPushNotificationManager.sharedInstance().registerForRemoteNotifications()

    //
    // Uncomment the code below to see how you can customize the color, textcolor,
    // font and fontsize of the navigation bar
    //
    // let loginViewController = SFLoginViewController.sharedInstance();
    // Set showNavBar to NO if you want to hide the top bar
    // loginViewController.showNavbar = true;
    // Set showSettingsIcon to NO if you want to hide the settings icon on
    // the nav bar
    // loginViewController.showSettingsIcon = true;
    // Set primary color to different color to style the navigation header
    // loginViewController.navBarColor = UIColor(red: 0.051, green: 0.765,
    //     blue: 0.733, alpha: 1.0);
    // loginViewController.navBarFont = UIFont (name: "Helvetica Neue",
    //     size: 16);
    // loginViewController.navBarTextColor = UIColor.black;
    //
    SalesforceSwiftSDKManager.shared().launch()

    return true
}
```

For a full example, see the [AppDelegate class](#) in the SmartSyncExplorer sample app.

Life Cycle

`SalesforceSDKManager` is a singleton object that you access by sending the `sharedManager` class message:

```
[SalesforceSDKManager sharedManager]
```

This shared object is created exactly once, the first time your app calls `[SalesforceSDKManager sharedManager]`. It serves as a delegate for three other Mobile SDK manager objects:

- `SFUserAccountManager`
- `SFAuthenticationManager`
- `SFPasscodeManager`

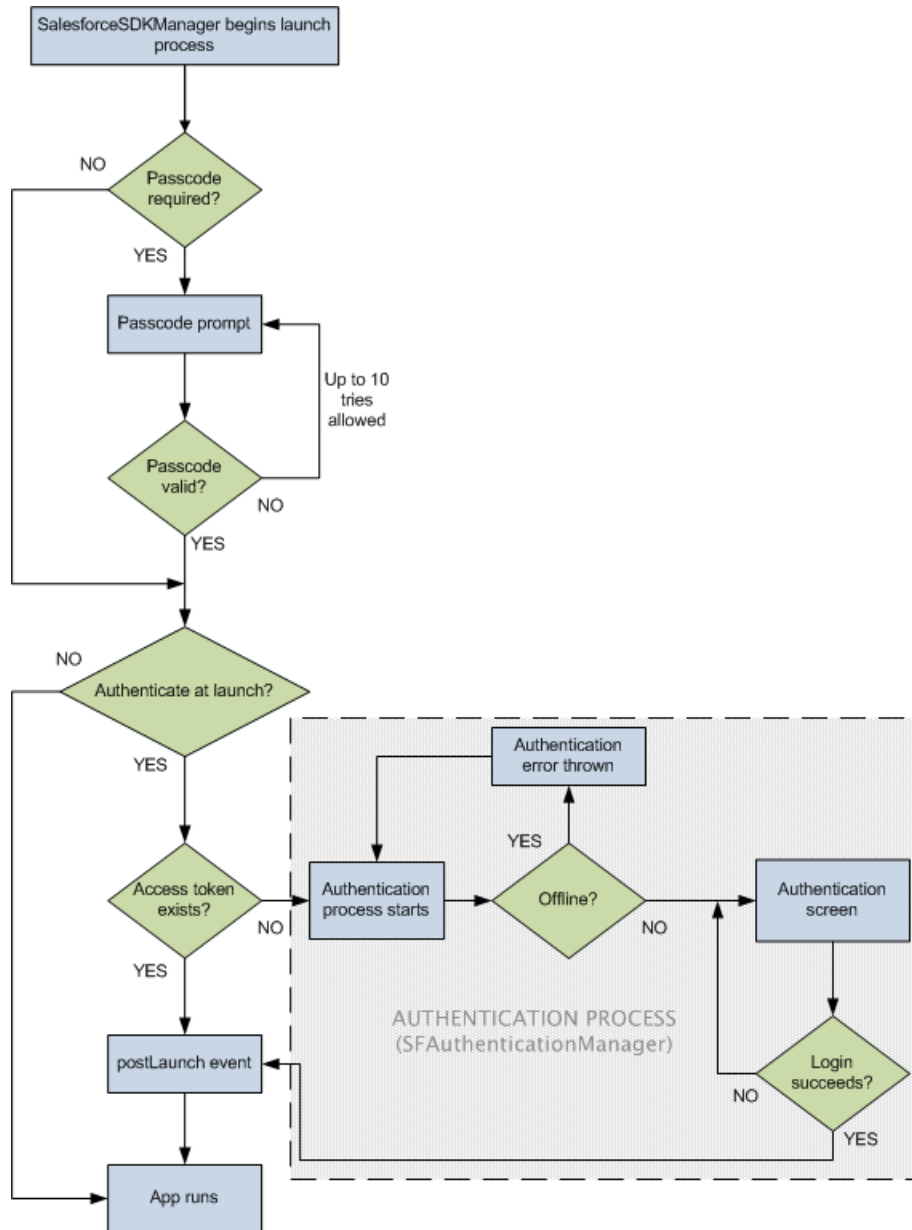
Your app uses the `SalesforceSDKManager` object in two scenarios:

1. At application startup, in the `init` and `application:didFinishLaunchingWithOptions:` methods of `AppDelegate`
2. Anytime the current user's OAuth tokens become invalid—either through logout, token expiration, or token revocation—while the app continues to run

The events in the first scenario happen only once during the app life cycle. The second scenario, though, can happen anytime. When Mobile SDK detects invalid tokens, it reruns the `SalesforceSDKManager` application launch flow, including any related event handlers that your app provides. Be sure to code these event handlers defensively so that you don't suffer unwanted losses of data or state if the app is reinitialized.

Application Launch Flow

When the `application:didFinishLaunchingWithOptions:` message arrives, you launch your app by sending the `launch` message to the shared `SalesforceSDKManager` instance. If the app's connected app requires a passcode, `SalesforceSDKManager` displays the passcode verification screen to the user before continuing with the bootstrap process. The following diagram shows this flow.



Key points:

- If the OAuth settings in the connected app definition don't require a passcode, the flow proceeds directly to Salesforce authentication.
- If a valid access token is found, the flow bypasses Salesforce authentication.
- If no access token is found and the device is offline, the authentication module throws an error and returns the user to the login screen. `SalesforceSDKManager` doesn't reflect this event to the app.
- The `postLaunch` event occurs only after all credentials and passcode challenges are verified.

Besides what's shown in the diagram, the `SalesforceSDKManager` launch process also delegates user switching and push notification setup to the app if the app supports those features. If the user fails or cancels either the passcode challenge or Salesforce login, a `postLogout` event fires, after which control returns to `AppDelegate`.

After the `postLaunch` event, the `SalesforceSDKManager` object doesn't reappear until a user logout or user switch event occurs. For either of these events, `SalesforceSDKManager` notifies your app. At that point, you can reset your app's Mobile SDK state and restart the app.

SalesforceSDKManager Launch Events

`SalesforceSDKManager` directs the app's bootstrap process according to the state of the app and the device. During the bootstrap process, several events fire at important points in the launch sequence. You can use these events to run your own logic after the `SalesforceSDKManager` flow is complete. For foregrounding, be sure to wait until your app receives the `postAppForeground` event before you resume your app's logic.

Table 3: Launch Events

Event	Description
<code>postLaunch</code>	Arrives after all launch activities have completed. The app can proceed with its business processes.
<code>launchError</code>	Sent if fatal errors occur during the launch process.
<code>postLogout</code>	Arrives after the current user has logged out, or if the user fails the passcode test or the login authentication.
<code>postAppForeground</code>	Arrives after the app returns to the foreground and the passcode (if applicable) has been verified. This event indicates that authentication is valid. After your app receives this event, you can take extra actions to handle foregrounding.
<code>switchUser</code>	Arrives after the current user has changed.

Certain events supersede others. For example, if passcode validation fails during launch, the `postLogout` event fires, but the `postLaunch` event does not. Between priority levels, the higher ranking event fires in place of the lower ranking event. Here is the list of priorities, with 1 as the highest priority level:

Table 4: Launch Event Priority Levels

Priority Level	Events	Comments
1	<code>postLogout</code> , <code>switchUser</code>	These events supersede all others.
2	<code>postLaunch</code> , <code>launchError</code>	It's important to note that these events always supersede <code>postAppForeground</code> . For instance, if you send the app to the background and then return it to the foreground during login, <code>postLaunch</code> fires if login succeeds, but <code>postAppForeground</code> does not.
3	<code>postAppForeground</code>	Any of the other events can supplant this lowest ranking event.

SalesforceSDKManager Properties

You configure your app's launch behavior by setting `SalesforceSDKManager` properties in the `init` method of `AppDelegate`. These properties contain your app's startup configuration, including:

- Connected app identifiers
- Required OAuth scopes
- Authentication behavior and associated customizations


You're required to specify at least the connected app and OAuth scopes settings.

You also use `SalesforceSDKManager` properties to define handler blocks for launch events. Event handler properties are optional. If you don't define them, the app logs a runtime warning when the event occurs. In general, it's a good idea to provide implementations for these blocks so that you have better control over the app flow.

Another especially useful property is the optional `authenticateAtLaunch`. Set this property to `NO` to defer Salesforce authentication until some point after the app has started running. You can run the authentication process at any point by sending the `authenticate` message to `SalesforceSDKManager`. However, always set the launch properties in the `init` method of `AppDelegate` and send the `launch` message to `SalesforceSDKManager` in the `application:didFinishLaunchingWithOptions:` method.

The following table describes `SalesforceSDKManager` properties.

Table 5: SalesforceSDKManager Properties

Property	Description
<code>connectedAppId</code>	(Required) The consumer ID from the associated Salesforce connected app.
<code>connectedAppCallbackUri</code>	(Required) The Callback URI from the associated Salesforce connected app.
<code>authScopes</code>	(Required) The OAuth scopes required for the app.
<code>postLaunchAction</code>	(Required) Controls how the app resumes functionality after launch completes.
<code>authenticateAtLaunch</code>	(Optional) If set to <code>YES</code> (the default), <code>SalesforceSDKManager</code> attempts authentication at launch. Set this value to <code>NO</code> to defer authentication to a different stage of your application. At the appropriate time, send the <code>authenticate</code> message to <code>SalesforceSDKManager</code> to initiate authentication.
<code>launchErrorAction</code>	(Optional) If defined, this block responds to any errors that occur during the launch process.
<code>postLogoutAction</code>	(Optional) If defined, this block is executed when the current user has logged out.
<code>switchUserAction</code>	(Optional) If defined, this block handles a switch from the current user to an existing or new user.  Note: This property is required if your app supports user switching.

Property	Description
<code>postAppForegroundAction</code>	(Optional) If defined, this block is executed after Mobile SDK finishes its post-foregrounding tasks.
<code>useSnapshotView</code>	(Optional) Set to YES to use a snapshot view when your app is in the background. This view obscures sensitive content in the app preview screen that displays when the user browses background apps from the home screen. Default is YES.
<code>snapshotView</code>	(Optional) Specifies the view that obscures sensitive app content from home screen browsing when your app is in the background. The default view is a white opaque screen.
<code>preferredPasscodeProvider</code>	(Optional) You can configure a different passcode provider to use a different passcode encryption scheme. Default is the Mobile SDK PBKDF2 provider.

AppDelegate Class

The `AppDelegate` class is the true entry point for an iOS app. In Mobile SDK apps, `AppDelegate` implements the standard iOS `UIApplicationDelegate` interface. It initializes Mobile SDK by using the shared `SalesforceSDKManager` object to oversee the app launch flow.

OAuth functionality resides in an independent module. This separation makes it possible for you to use Salesforce authentication on demand. You can start the login process from within your `AppDelegate` implementation, or you can postpone login until it's actually required—for example, you can call OAuth from a subview.

Setup

To customize the `AppDelegate` template, start by resetting the following static variables to values from your Salesforce Connected Application:

- `RemoteAccessConsumerKey`

```
static NSString * const RemoteAccessConsumerKey =
@"3MVG9Iu66FKeHhINKB117xt7kR8...YFDUpqRWcoQ2.dBv_a1Dyu5xa";
```

This variable corresponds to the Consumer Key in your connected app.

- `OAuthRedirectURI`

```
static NSString * const OAuthRedirectURI = @"testsfdc://mobilesdk/detect/oauth/done";
```

This variable corresponds to the Callback URL in your connected app.

Initialization

The following listing shows the `init` method as implemented by the template app. It is followed by a call to the `launch` method of `SalesforceSDKManager` in the `application:didFinishLaunchingWithOptions:` method.

```
- (id) init
{
```

```

self = [super init];
if (self) {
    [SalesforceSDKManager sharedManager].connectedAppId =
        RemoteAccessConsumerKey;
    [SalesforceSDKManager sharedManager].
        connectedAppCallbackUri = OAuthRedirectURI;
    [SalesforceSDKManager sharedManager].authScopes =
        @[ @"web", @"api" ];
    __weak AppDelegate *weakSelf = self;
    [SalesforceSDKManager sharedManager].postLaunchAction =
        ^(SFSDKLaunchAction launchActionList) {
            [weakSelf log:SFLLogLevelInfo
                format:@"Post-launch: launch actions taken: %@",
                    [SalesforceSDKManager
                        launchActionsStringRepresentation:
                            launchActionList]];
            [weakSelf setupRootViewController];
        };
    [SalesforceSDKManager sharedManager].launchErrorAction =
        ^(NSError *error, SFSDKLaunchAction launchActionList) {
            [weakSelf log:SFLLogLevelError
                format:@"Error during SDK launch: %@",
                    [error localizedDescription]];
            [weakSelf initializeAppViewState];
            [[SalesforceSDKManager sharedManager] launch];
        };
    [SalesforceSDKManager sharedManager].postLogoutAction = ^{
        [weakSelf handleSdkManagerLogout];
    };
    [SalesforceSDKManager sharedManager].switchUserAction =
        ^(SFUserAccount *fromUser, SFUserAccount *toUser) {
            [weakSelf handleUserSwitch:fromUser toUser:toUser];
        };
    return self;
}

- (BOOL)application:(UIApplication *)application
    didFinishLaunchingWithOptions:(NSDictionary *)launchOptions
{
    [[SalesforceSDKManager sharedManager] launch];
}

```

In the `init` method, the `SalesforceSDKManager` object:

- Initializes configuration items, such as Connected App identifiers and OAuth scopes, using the `SalesforceSDKManager` shared instance. For example:

```

[SalesforceSDKManager sharedManager].connectedAppId =
    RemoteAccessConsumerKey;
[SalesforceSDKManager sharedManager].connectedAppCallbackUri =
    OAuthRedirectURI;
[SalesforceSDKManager sharedManager].authScopes =
    @[ @"web", @"api" ];

```

- Assigns code blocks to properties that handle the `postLaunchAction`, `launchErrorAction`, `postLogoutAction`, and `switchUserAction` events. Notice the use of `weak self` in the block implementations. Besides protecting the code against cycles, this usage demonstrates an important point: `SalesforceSDKManager` is just a manager—any real work requiring a persistent self occurs within the delegate methods that actually perform the task. The following table summarizes how the `AppDelegate` template handles each event.

Event	Delegate Method	Default Behavior
<code>postLaunch</code>	<code>setupRootViewController</code>	Instantiates the controller for the app's root view and assigns it to the <code>window.rootViewController</code> property of <code>AppDelegate</code> .
<code>launchError</code>	<code>initializeAppViewState</code>	Resets the root view controller to the initial view controller.
<code>postLogout</code>	<code>handleSdkManagerLogout</code>	If there are multiple active user accounts, changes the root view controller to the multi-user view controller to allow the user to choose a previously authenticated account. If there is only one active account, automatically switches to that account. If there are no active accounts, presents the login screen.
<code>switchUser</code>	<code>handleUserSwitch:toUser:</code>	Resets the root view controller to the initial view controller, and then re-initiates the launch flow.

You can customize any part of this process. At a minimum, change `setupRootViewController` to display your own controller after authentication. You can also customize `initializeAppViewState` to display your own launch page, or the `InitialViewController` to suit your needs. You can also move the authentication details to where they make the most sense for your app. The Mobile SDK does not stipulate when—or if—actions must occur, but standard iOS conventions apply. For example, `self.window` must have a `rootViewController` by the time `application:didFinishLaunchingWithOptions:` completes.

UIApplication Event Handlers

You can also use the application delegate class to implement `UIApplication` event handlers. Important event handlers that you might consider implementing or customizing include:

`application:didFinishLaunchingWithOptions:`

First entry point when your app launches. Called only when the process first starts (not after a backgrounding/foregrounding cycle). The template app uses this method to:

- Initialize the `window` property
- Set the root view controller to the initial view controller (see `initializeAppViewState`)
- Display the initial window
- Initiate authentication by sending the launch message to the shared `SalesforceSDKManager` instance.

applicationDidBecomeActive

Called every time the application is foregrounded. The iOS SDK provides no default parent behavior; if you use it, you must implement it from the ground up.

application:didRegisterForRemoteNotificationsWithDeviceToken:**application:didFailToRegisterForRemoteNotificationsWithError:**

Used for handling incoming push notifications from Salesforce.

For a list of all `UIApplicationDelegate` event handlers, see “UIApplicationDelegate Protocol Reference” in the [iOS Developer Library](#).

About Deferred Login

You can defer user login authentication to any logical point after the `postLaunch` event occurs. To defer authentication:

1. In the `init` method of your `AppDelegate` class, set the `authenticateAtLaunch` property of `SalesforceSDKManager` to `NO`.
2. Send the `launch` method to `SalesforceSDKManager`.
3. Call the `loginWithCompletion:failure:` method of `SFAuthenticationManager` at the point of deferred login.

If you defer authentication, the logic that handles login completions and failures is left to your app’s discretion.

Upgrading Existing Apps

If you’re upgrading an app from Mobile SDK 2.3 or earlier, you can reuse any custom code that handles launch events, but you’ll have to move it to slightly different contexts. For example, code that formerly implemented the `authManagerDidLogout:` method of `SFAuthenticationManagerDelegate` now goes into the `postLogoutAction` block of `SalesforceSDKManager`. Likewise, code that implemented the `useraccountManager:didSwitchFromUser:toUser:` method of `SFUserAccountManagerDelegate` now belongs in the `switchUserAction` block of `SalesforceSDKManager`.

Finally, in your `AppDelegate` implementation, replace all calls to the `loginWithCompletion:failure:` method of `SFAuthenticationManager` with the `launch` method of `SalesforceSDKManager`. Move the code in your completion block to the `postLaunchAction` property, and move the failure block code to the `launchErrorAction` property.

SEE ALSO:

[Using Push Notifications in iOS](#)

About View Controllers

In addition to the views and view controllers discussed with the `AppDelegate` class, Mobile SDK exposes the `SFAuthorizingViewController` class. This controller displays the login screen when necessary.

To customize the login screen display:

1. Override the `SFAuthorizingViewController` class to implement your custom display logic.
2. Set the `[SFAuthenticationManager sharedManager].authViewController` property to an instance of your customized class.

The most important view controller in your app is the one that manages the first view that displays, after login or—if login is postponed—after launch. This controller is called your root view controller because it controls everything else that happens in your app. The Mobile SDK for iOS project template provides a skeletal class named `RootViewController` that demonstrates the minimal required implementation.

If your app needs additional view controllers, you're free to create them as you wish. The view controllers used in Mobile SDK projects reveal some possible options. For example, the Mobile SDK iOS template project bases its root view class on the `UITableViewController` interface, while the `RestAPIExplorer` sample project uses the `UIViewController` interface. Your only technical limits are those imposed by iOS itself and the Objective-C language.

RootViewController Class

The `RootViewController` class exists only as part of the template project and projects generated from it. It implements the `SFRestDelegate` protocol to set up a framework for your app's interactions with the Salesforce REST API. Regardless of how you define your root view controller, it must implement `SFRestDelegate` if you intend to use it to access Salesforce data through the REST APIs.

RootViewController Design

As an element of a very basic app built with the Mobile SDK, the `RootViewController` class covers only the bare essentials. Its two primary tasks are:

- Use Salesforce REST APIs to query Salesforce data
- Display the Salesforce data in a table

To do these things, the class inherits `UITableViewController` and implements the `SFRestDelegate` protocol. The action begins with an override of the `UIViewController:viewDidLoad` method:

```
- (void)viewDidLoad
{
    [super viewDidLoad];
    self.title = @"Mobile SDK Sample App";

    // Here we use a query that should work on either
    // Salesforce or Database.com
    SFRestRequest *request =
        [[SFRestAPI sharedInstance]
         requestForQuery:@"SELECT Name FROM User LIMIT 10"];
    [[SFRestAPI sharedInstance] send:request delegate:self];
}
```

The iOS runtime calls `viewDidLoad` only once in the view's life cycle, when the view is first loaded into memory. The intention in this skeletal app is to load only one set of data into the app's only defined view. If you plan to create other views, you might need to perform the query somewhere else. For example, if you add a detail view that lets the user edit data shown in the root view, you'll want to refresh the values shown in the root view when it reappears. In this case, you can perform the query in a more appropriate method, such as `viewWillAppear`.

After calling the superclass method, this code sets the title of the view and then issues a REST request in the form of an asynchronous SQL query. The query in this case is a simple `SELECT` statement that gets the `Name` property from each `User` object and limits the number of rows returned to ten. Notice that the `requestForQuery` and `send:delegate:` messages are sent to a singleton shared instance of the `SFRestAPI` class. Use this singleton object for all REST requests. This object uses authenticated credentials from the singleton `SFAccountManager` object to form and send authenticated requests.

The Salesforce REST API responds by passing status messages and, hopefully, data to the delegate listed in the `send` message. In this case, the delegate is the `RootViewController` object itself:

```
[[SFRestAPI sharedInstance] send:request delegate:self];
```


The `RootViewController` object can act as an `SFRestAPI` delegate because it implements the `SFRestDelegate` protocol. This protocol declares four possible response callbacks:

- `request:didLoadResponse:`—Request was processed. The delegate receives the response in JSON format. This callback is the only one that indicates success.
- `request:didFailLoadWithError:`—Request couldn't be processed. The delegate receives an error message.
- `requestDidCancelLoad`—Request was canceled due to some external factor, such as administrator intervention, a network glitch, or another unexpected event. The delegate receives no return value.
- `requestDidTimeout`—The Salesforce server failed to respond in time. The delegate receives no return value.

The response arrives in one of the callbacks you've implemented in `RootViewController`. Place your code for handling Salesforce data in the `request:didLoadResponse:` callback. For example:

```
- (void)request:(SFRestRequest *)request
    didLoadResponse:(id)jsonResponse {
    NSArray *records = [jsonResponse objectForKey:@"records"];
    NSLog(@"request:didLoadResponse: #records: %d", records.count);
    self.dataRows = records;
    [self.tableView reloadData];
}
```

As the use of the `id` data type suggests, this code handles JSON responses in generic Objective-C terms. It addresses the `jsonResponse` object as an instance of `NSDictionary` and treats its records as an `NSArray` object. Because `RootViewController` implements `UITableViewController`, it's simple to populate the table in the view with extracted records.

A call to `request:didFailLoadWithError:` results from one of the following conditions:

- If you use invalid request parameters, you get a `kSFRestErrorDomain` error code. For example, you get this error if you pass `nil` to `requestForQuery:`, or you try to update a nonexistent object.
- If an OAuth access token expires, the framework tries to obtain a new access token and, if successful, retries the query. If a request for a new access token or session ID fails, you get a `kSFOAuthErrorDomain` error code. For example, you get this error if the access token expires, and the OAuth refresh token is invalid. This scenario rarely occurs.
- If the low-level HTTP request fails, you get an `RKRestKitErrorDomain` error code. For example, you get this error if a Salesforce server becomes temporarily inaccessible.

The other callbacks are self-describing and don't return an error code. You can choose to handle the result however you want: display an error message, write to the log, retry the request, and so on.

About Salesforce REST APIs

Salesforce makes a wide range of object-based tasks and data available through authenticated REST endpoints. To provide easy access to these services, Mobile SDK delivers a set of REST API classes and interfaces that handle low-level network configuration for you. For REST requests, Mobile SDK implements convenience methods that conform to specific request parameters. For other Salesforce APIs, Mobile SDK provides wrapper methods that help you manually configure a custom request object. You can even use Mobile SDK REST API wrappers to make unauthenticated and external API calls.

In Mobile SDK for iOS, all REST requests are performed asynchronously. You can choose between delegate and block versions of the REST wrapper classes to adapt your requests to various scenarios. REST responses are formatted as `NSArray` or `NSDictionary` objects for a successful request, or, if the request fails, `NSError`.

Salesforce supports an ever-growing variety of REST APIs. For an overview of our offerings, see [Which API Do I Use?](#) in Salesforce Help. For information on REST request and response formats, see [REST API Developer Guide](#).

SEE ALSO:

[Native REST API Classes for iOS](#)

Supported Operations

The iOS REST APIs support the standard object operations offered by Salesforce REST and SOAP APIs. Salesforce Mobile SDK offers delegate and block versions of its REST request APIs. All versions return an `SFRestRequest` object that you can then send to Salesforce for execution. With delegate methods, the REST response goes to an implementation of the `SFRestDelegate` protocol that you specify. With block methods, the REST response goes to the success or failure block that you define in your method call.

Delegate request methods are defined in the `SFRestAPI` class, while block request methods are defined in the `SFRestAPI (Blocks)` category. File requests are defined in the `SFRestAPI (Files)` category and are documented in [SFRestAPI \(Files\) Category](#).

The following sections describe the supported operations.

Manual REST Request

Execute a request that you've built.

Delegate Method

```
- (void) send:(SFRestRequest *) request
    delegate:(nullable id<SFRestDelegate>) delegate;
```

Block Method

```
- (void) sendRESTRequest:(SFRestRequest *) request
    failBlock:(SFRestFailBlock) failBlock
    completeBlock:(SFRestResponseBlock) completeBlock;
```

SOQL Query

Execute the given SOQL string and return the resulting data set.

Delegate Method

```
- (SFRestRequest *) requestForQuery:(NSString *) soql;
```

Block Method

```
- (SFRestRequest *) performSOQLQuery:(NSString *) query
    failBlock:(SFRestFailBlock) failBlock
    completeBlock:(SFRestDictionaryResponseBlock) completeBlock;
```

SOQL Query All

Execute the given SOQL string. The result includes all current and deleted objects that satisfy the query.

Delegate Method

```
- (SFRestRequest *) requestForQueryAll:(NSString *) soql;
```

Block Method

```
- (SFRestRequest *) performSOQLQueryAll:(NSString *)query
    failBlock:(SFRestFailBlock) failBlock
    completeBlock:(SFRestDictionaryResponseBlock) completeBlock;
```

Batch Request

Execute a batch of up to 25 subrequests specified as an array of `SFRestRequest` objects. Each subrequest counts against rate limits.

Delegate Method

```
- (SFRestRequest *) batchRequest:(NSArray<SFRestRequest*>*)
    requests haltOnError:(BOOL) haltOnError;
```

Block Method

(Not supported)

Composite Request

Execute a composite request. The Boolean `allOrNone` parameter indicates whether to treat all requests as a transactional block in error conditions. Regardless of the number of subrequests, each composite request counts as one API call. See “Composite” in the [REST API Developer Guide](#).

Delegate Method

```
- (SFRestRequest *) compositeRequest:(NSArray<SFRestRequest*>*) requests
    refIds:(NSArray<NSString*>*) refIds
    allOrNone:(BOOL) allOrNone;
```

Block Method

(Not supported)

SOSL Search

Execute the given SOSL string and return the resulting data set.

Delegate Method

```
- (SFRestRequest *) requestForSearch:(NSString *)sosl;
```

Block Method

```
- (SFRestRequest *) performSOSLSearch:(NSString *)search
    failBlock:(SFRestFailBlock) failBlock
    completeBlock:(SFRestArrayResponseBlock) completeBlock;
```

Search Result Layout

Get a search result layout.

Delegate Method

```
- (SFRestRequest *) requestForSearchResultLayout:(NSString*) objectList;
```

Block Method

```
- (SFRestRequest *) performRequestForSearchResultLayout:(NSString*)objectList
                    failBlock:(SFRestFailBlock) failBlock

completeBlock:(SFRestArrayResponseBlock) completeBlock;
```

Search Scope and Order

Get the search scope and order.

Delegate Method

```
- (SFRestRequest *) requestForSearchScopeAndOrder;
```

Block Method

```
- (SFRestRequest *)
    performRequestForSearchScopeAndOrderWithFailBlock:(SFRestFailBlock) failBlock
    completeBlock:(SFRestArrayResponseBlock) completeBlock;
```

Metadata

Return the object's metadata.

Delegate Method

```
- (SFRestRequest *) requestForMetadataWithObjectType:(NSString *)objectType;
```

Block Method

```
- (SFRestRequest *) performMetadataWithObjectType:(NSString *)objectType
                    failBlock:(SFRestFailBlock) failBlock
                    completeBlock:(SFRestDictionaryResponseBlock) completeBlock;
```

Describe Global

Return a list of all available objects in your org and their metadata.

Delegate Method

```
- (SFRestRequest *) requestForDescribeGlobal;
```

Block Method

```
- (SFRestRequest *)
    performDescribeGlobalWithFailBlock:(SFRestFailBlock) failBlock
    completeBlock:(SFRestDictionaryResponseBlock) completeBlock;
```

Describe with Object Type

Return a description of a single object type.

Delegate Method

```
- (SFRestRequest *) requestForDescribeWithObjectType:(NSString *)objectType;
```

Block Method

```
- (SFRestRequest *) performDescribeWithObjectType:(NSString *)objectType
    failBlock:(SFRestFailBlock) failBlock
    completeBlock:(SFRestDictionaryResponseBlock) completeBlock;
```

Retrieve

Retrieve a single record by object ID.

Delegate Method

```
- (SFRestRequest *) requestForRetrieveWithObjectType:(NSString *)objectType
    objectId:(NSString *)objectId
    fieldList:(nullable NSString *)fieldList;
```

Block Method

```
- (SFRestRequest *) performRetrieveWithObjectType:(NSString *)objectType
    objectId:(NSString *)objectId
    fieldList:(NSArray<NSString*> *)fieldList
    failBlock:(SFRestFailBlock) failBlock
    completeBlock:(SFRestDictionaryResponseBlock) completeBlock;
```

Update

Update an object with the given map and, optionally, that satisfies a given If-Modified-Since condition.

Delegate Method

```
- (SFRestRequest *) requestForUpdateWithObjectType:(NSString *)objectType
    objectId:(NSString *)objectId
    fields:(nullable NSDictionary<NSString*, id> *)fields;
```

```
- (SFRestRequest *) requestForUpdateWithObjectType:(NSString *)objectType
    objectId:(NSString *)objectId
    fields:(nullable NSDictionary<NSString*, id> *)fields

    ifUnmodifiedSinceDate:(nullable NSDate *) ifUnmodifiedSinceDate;
```

Block Method

```
- (SFRestRequest *) performUpdateWithObjectType:(NSString *)objectType
    objectId:(NSString *)objectId
    fields:(NSDictionary<NSString*, id> *)fields
    failBlock:(SFRestFailBlock) failBlock
    completeBlock:(SFRestDictionaryResponseBlock) completeBlock;
```

Upsert

Update or insert an object from external data, based on whether the external ID currently exists in the external ID field. If you set the name of the external ID field to "Id" and the external ID to null, a new record is created.

Delegate Method

```
- (SFRestRequest *)requestForUpsertWithObjectType:(NSString *)objectType
    externalIdField:(NSString *)externalIdField
    externalId:(nullable NSString *)externalId
    fields:(NSDictionary<NSString*, id> *)fields;
```

Block Method

```
- (SFRestRequest *)performUpsertWithObjectType:(NSString *)objectType
    externalIdField:(NSString *)externalIdField
    externalId:(NSString *)externalId
    fields:(NSDictionary<NSString*, id> *)fields
    failBlock:(SFRestFailBlock)failBlock
    completeBlock:(SFRestDictionaryResponseBlock)completeBlock;
```

Create

Create a record in the specified object.

Delegate Method

```
- (SFRestRequest *)requestForCreateWithObjectType:(NSString *)objectType
    fields:(nullable NSDictionary<NSString*, id> *)fields;
```

Block Method

```
- (SFRestRequest *)performCreateWithObjectType:(NSString *)objectType
    fields:(NSDictionary<NSString*, id> *)fields
    failBlock:(SFRestFailBlock)failBlock
    completeBlock:(SFRestDictionaryResponseBlock)completeBlock;
```

Delete

Delete the object of the given type with the given ID.

Delegate Method

```
- (SFRestRequest *)requestForDeleteWithObjectType:(NSString *)objectType
    objectId:(NSString *)objectId;
```

Block Method

```
- (SFRestRequest *)performDeleteWithObjectType:(NSString *)objectType
    objectId:(NSString *)objectId
    failBlock:(SFRestFailBlock)failBlock
    completeBlock:(SFRestDictionaryResponseBlock)completeBlock;
```

Versions

Return Salesforce version metadata.

Delegate Method

```
- (SFRestRequest *)requestForVersions;
```

Block Method

```
- (SFRestRequest *) performRequestForVersionsWithFailBlock:(SFRestFailBlock) failBlock
completeBlock:(SFRestDictionaryResponseBlock) completeBlock;
```

Resources

Return available resources for the specified API version, including resource name and URL.

Delegate Method

```
- (SFRestRequest *) requestForResources;
```

Block Method

```
- (SFRestRequest *) performRequestForResourcesWithFailBlock:(SFRestFailBlock) failBlock
completeBlock:(SFRestDictionaryResponseBlock) completeBlock;
```

SObject Tree

Returns an `SFRestRequest` object that requests one or more sObject trees.

Delegate Method

```
- (SFRestRequest*) requestForObjectTree:(NSString*) objectType
objectTrees:(NSArray<SFObjectTree*>*) objectTrees;
```

Block Method

(Not supported)



Example: For sample calls, see

`/libs/SalesforceSDKCore/SalesforceSDKCoreTests/SalesforceRestAPITests.m` at
github.com/forcedotcom/SalesforceMobileSDK-iOS.

SFRestAPI Interface

`SFRestAPI` defines the native interface for creating and formatting Salesforce REST requests. It works by formatting and sending your requests to the Salesforce service, then relaying asynchronous responses to your implementation of the `SFRestDelegate` protocol.

`SFRestAPI` serves as a factory for `SFRestRequest` instances. It defines a group of methods that represent the request types supported by the Salesforce REST API. Each `SFRestAPI` method corresponds to a single request type. Each of these methods returns your request in the form of an `SFRestRequest` instance. You then use that return value to send your request to the Salesforce server. The HTTP coding layer is encapsulated, so you don't have to worry about REST API syntax.

For a list of supported query factory methods, see [Supported Operations](#)

SFRestDelegate Protocol

When a class adopts the `SFRestDelegate` protocol, it intends to be a target for REST responses sent from the Salesforce server. When you send a REST request to the server, you tell the shared `SFRestAPI` instance which object receives the response. When the server sends the response, Mobile SDK routes the response to the appropriate protocol method on the given object.

The `SFRestDelegate` protocol declares four possible responses:

- `request:didLoadResponse:`—Request was processed. The delegate receives the response in JSON format. This callback is the only one that indicates success.
- `request:didFailLoadWithError:`—Request couldn't be processed. The delegate receives an error message.
- `requestDidCancelLoad`—Request was canceled due to some external factor, such as administrator intervention, a network glitch, or another unexpected event. The delegate receives no return value.
- `requestDidTimeout`—The Salesforce server failed to respond in time. The delegate receives no return value.

The response arrives in your implementation of one of these delegate methods. Because you can't predict the type of response, you're required to implement all the methods.

`request:didLoadResponse:` Method

The `request:didLoadResponse:` method is the only protocol method that handles a success condition, so place your code for handling Salesforce data in that method. For example:

```
- (void)request:(SFRestRequest *)request
    didLoadResponse:(id)jsonResponse {
    NSArray *records = [jsonResponse objectForKey:@"records"];
    NSLog(@"request:didLoadResponse: #records: %d", records.count);
    self.dataRows = records;
    [self.tableView reloadData];
}
```

At the server, all responses originate as JSON strings. Mobile SDK receives these raw responses and reformats them as iOS SDK objects before passing them to the `request:didLoadResponse:` method. Thus, the `jsonResponse` payload arrives as either an `NSDictionary` object or an `NSArray` object. The object type depends on the type of JSON data returned. If the top level of the server response represents a JSON object, `jsonResponse` is an `NSDictionary` object. If the top level represents a JSON array of other data, `jsonResponse` is an `NSArray` object.

If your method cannot infer the data type from the request, use `[NSObject isKindOfClass:]` to determine the data type. For example:

```
if ([jsonResponse isKindOfClass:[NSArray class]]) {
    // Handle an NSArray here.
} else {
    // Handle an NSDictionary here.
}
```

You can address the response as an `NSDictionary` object and extract its records into an `NSArray` object. To do so, send the `NSDictionary:objectForKey:` message using the key "records".

`request:didFailLoadWithError:` Method

A call to the `request:didFailLoadWithError:` callback results from one of the following conditions:

- If you use invalid request parameters, you get a `kSFRestErrorDomain` error code. For example, you pass `nil` to `requestForQuery:`, or you try to update a non-existent object.
- If an OAuth access token expires, the framework tries to obtain a new access token and, if successful, retries the query. If a request for a new access token or session ID fails, you get a `kSFOAuthErrorDomain` error code. For example, the access token expires, and the OAuth refresh token is invalid. This scenario rarely occurs.
- If the low-level HTTP request fails, you get an `RKRestKitErrorDomain` error code. For example, a Salesforce server becomes temporarily inaccessible.

requestDidCancelLoad and requestDidTimeout Methods

The `requestDidCancelLoad` and `requestDidTimeout` delegate methods are self-describing and don't return an error code. You can choose to handle the result however you want: display an error message, write to the log, retry the request, and so on.

Creating REST Requests

Salesforce Mobile SDK for iOS natively supports many types of SOQL and SOSL REST requests. The `SFRestAPI` class provides factory methods that handle most of the syntactical details for you. Mobile SDK also offers considerable flexibility for how you create REST requests.

- For standard SOQL queries and SOSL searches, `SFRestAPI` methods create query strings based on minimal data input and package them in an `SFRestRequest` object that can be sent to the Salesforce server.
- If you are using a Salesforce REST API that isn't based on SOQL or SOSL, `SFRestRequest` methods let you configure the request itself to match the API format.
- The `SFRestAPI (QueryBuilder)` category provides methods that create free-form SOQL queries and SOSL search strings so you don't have to manually format the query or search string.
- Request methods in the `SFRestAPI (Blocks)` category let you pass callback code as block methods, instead of using a delegate object.

Sending a REST Request

Salesforce Mobile SDK for iOS natively supports many types of SOQL and SOSL REST requests. Luckily, the `SFRestAPI` provides factory methods that handle most of the syntactical details for you.

At runtime, Mobile SDK creates a singleton instance of `SFRestAPI`. You use this instance to obtain an `SFRestRequest` object and to send that object to the Salesforce server.

To send a REST request to the Salesforce server from an `SFRestAPI` delegate:

1. Build a SOQL, SOSL, or other REST request string.

For standard SOQL and SOSL queries, it's most convenient and reliable to use the factory methods in the `SFRestAPI` class. See [Supported Operations](#).

2. Create an `SFRestRequest` object with your request string.

Message the `SFRestAPI` singleton with the request factory method that suits your needs. For example, this code uses `theSFRestAPI:requestForQuery:` method, which prepares a SOQL query.

```
// Send a request factory message to the singleton SFRestAPI instance
SFRestRequest *request = [[SFRestAPI sharedInstance]
    requestForQuery:@"SELECT Name FROM User LIMIT 10"];
```

3. Send the `send:delegate:` message to the shared `SFRestAPI` instance. Use your new `SFRestRequest` object as the `send:` parameter. The second parameter designates an `SFRestDelegate` object to receive the server's response. In the following example, the class itself implements the `SFRestDelegate` protocol, so it sets `delegate:` to `self`.

```
// Use the singleton SFRestAPI instance to send the
// request, specifying this class as the delegate.
[[SFRestAPI sharedInstance] send:request delegate:self];
```

SFRestRequest Class

Salesforce Mobile SDK provides the `SFRestRequest` interface as a convenience class for apps. `SFRestAPI` provides request methods that use your input to form a request. This request is packaged as an `SFRestRequest` instance and returned to your app. In most cases you don't manipulate the `SFRestRequest` object. Typically, you simply pass it unchanged to the `SFRestAPI:send:delegate:` method.

If you're sending a REST request that isn't directly supported by the Mobile SDK—for example, if you want to use the Chatter REST API—you can manually create and configure an `SFRestRequest` object.

Using SFRestRequest Methods

`SFRestAPI` tools support SOQL and SOSL statements natively: they understand the grammar and can format valid requests based on minimal input from your app. However, Salesforce provides some product-specific REST APIs that have no relationship to SOQL queries or SOSL searches. You can still use Mobile SDK resources to configure and send these requests. This process is similar to sending a SOQL query request. The main difference is that you create and populate your `SFRestRequest` object directly, instead of relying on `SFRestAPI` methods.

To send a non-SOQL and non-SOSL REST request using the Mobile SDK:

1. Create an instance of `SFRestRequest`.
2. Set the properties you need on the `SFRestRequest` object.
3. Call `send:delegate:` on the singleton `SFRestAPI` instance, passing in the `SFRestRequest` object you created as the first parameter.

The following example performs a GET operation to obtain all items in a specific Chatter feed.

```
SFRestRequest *request = [[SFRestRequest alloc] init];
[request setDelegate:self];
[request setEndpoint:kSFDefaultRestEndpoint];
[request setMethod:SFRestMethodGET];
[request setPath:
    [NSString stringWithFormat:@"%v26.0/chatter/feeds/record/%@/feed-items",
    recordId]];
[[SFRestAPI sharedInstance] send:request delegate:self];
```

4. Alternatively, you can create the same request using the `requestWithMethod:path:queryParams` class method.

```
SFRestRequest *request =
    [SFRestRequest
        requestWithMethod:SFRestMethodGET
            path:
                [NSString
                    stringWithFormat:
                        "%v26.0/chatter/feeds/
                        record/%@/feed-items",
                        recordId]
            queryParams:nil];
[[SFRestAPI sharedInstance] send:request delegate:self];
```

5. To perform a request with parameters, create a parameter string, and then use the `SFJsonUtils:objectFromJSONString` static method to wrap it in an `NSDictionary` object. (If you prefer, you can create your `NSDictionary` object directly, before the method call, instead of creating it inline.)

The following example performs a POST operation that adds a comment to a Chatter feed.

```
NSData params =
    [NSString stringWithFormat:
        @"{ \"body\" :
            {\"messageSegments\" :
                [{ \"type\" : \"Text\",
                    \"text\" : \"%@\"}]
            }
        }",
        comment] dataUsingEncoding:NSUTF8StringEncoding];

SFRestRequest *request =
    [SFRestRequest
        requestWithMethod:SFRestMethodPOST
        path:[NSString
            stringWithFormat:
                @"/v26.0/chatter/feeds/
                record/%@/feed-items",
                recordId]
        queryParams: nil];

[request setCustomRequestBodyData:params contentType:@"application/json"];
[[SFRestAPI sharedInstance] send:request delegate:self];
```


To do the same request with an `NSDictionary` object instead of `NSString`, use the `setCustomRequestBodyDictionary:contentType:` method.

- To set an HTTP header for your request, use the `setHeaderValue:forHeaderName` method. This method can help you when you're displaying Chatter feeds, which come pre-encoded for HTML display. If you find that your native app displays unwanted escape sequences in Chatter comments, set the `X-Chatter-Entity-Encoding` header to "false" before sending your request, as follows:

```
...
[request setHeaderValue:@"false" forHeaderName:@"X-Chatter-Entity-Encoding"];
[[SFRestAPI sharedInstance] send:request delegate:self];
```

Unauthenticated REST Requests

In certain cases, some applications must make REST calls before the user becomes authenticated. In other cases, the application must access services outside of Salesforce that don't require Salesforce authentication. To configure your `SFRestRequest` instance so that it doesn't require an authentication token, set its `requiresAuthentication` property to `NO`.

 **Note:** Unauthenticated REST requests require a full path URL. Mobile SDK doesn't prepend an instance URL to unauthenticated endpoints.

 **Example:**

```
SFRestRequest *request = [[SFRestAPI sharedInstance] requestForVersions];
request.requiresAuthentication = NO;
```

SFRestAPI (Blocks) Category

If you prefer, you can use blocks instead of a delegate to execute callback code. Salesforce Mobile SDK for native iOS provides a block corollary for each `SFRestAPI` request method. These methods are defined in the `SFRestAPI (Blocks)` category.

Block request methods look a lot like delegate request methods. They all return a pointer to `SFRestRequest`, and they require the same parameters. Block request methods differ from their delegate siblings in these ways:

1. In addition to copying the REST API parameters, each method requires two blocks: a fail block of type `SFRestFailBlock`, and a complete block of type `SFRestDictionaryResponseBlock` or type `SFRestArrayResponseBlock`, depending on the expected response data.
2. Block-based methods send your request for you, so you don't need to call a separate send method. If your request fails, you can use the `SFRestRequest * return value` to retry the request. To do this, use the `SFRestAPI:sendRESTRequest:failBlock:completeBlock:` method.

Judicious use of blocks and delegates can help fine-tune your app's readability and ease of maintenance. Prime conditions for using blocks often correspond to those that mandate inline functions in C++ or anonymous functions in Java. However, this observation is just a general suggestion. Ultimately, you need to make a judgement call based on research into your app's real-world behavior.

SFRestAPI (QueryBuilder) Category

If you're unsure of the correct syntax for a SOQL query or a SOSL search, you can get help from the `SFRestAPI (QueryBuilder)` category methods. These methods build query strings from basic conditions that you specify, and return the formatted string. You can pass the returned value to one of the following `SFRestAPI` methods.

- `requestForQuery:(NSString *)soql;`
- `requestForSearch:(NSString *)sosl;`

`SFRestAPI (QueryBuilder)` provides two static methods each for SOQL queries and SOSL searches: one takes minimal parameters, while the other accepts a full list of options.

SOSL Methods

SOSL query builder methods are:

```
+ (NSString *) SOSLSearchWithSearchTerm:(NSString *)term
                        objectScope:(NSDictionary *)objectScope;

+ (NSString *) SOSLSearchWithSearchTerm:(NSString *)term
                        fieldScope:(NSString *)fieldScope
                        objectScope:(NSDictionary *)objectScope
                        limit:(NSInteger)limit;
```

Parameters for the SOSL search methods are:

- `term` is the search string. This string can be any arbitrary value. The method escapes any SOSL reserved characters before processing the search.
- `fieldScope` indicates which fields to search. It's either `nil` or one of the IN search group expressions: "IN ALL FIELDS", "IN EMAIL FIELDS", "IN NAME FIELDS", "IN PHONE FIELDS", or "IN SIDEBAR FIELDS". A `nil` value defaults to "IN NAME FIELDS". See [Salesforce Object Search Language \(SOSL\)](#).
- `objectScope` specifies the objects to search. Acceptable values are:
 - `nil`—No scope restrictions. Searches all searchable objects.

- An `NSDictionary` object pointer—Corresponds to the SOSL RETURNING fieldspec. Each key is an `sObject` name; each value is a string that contains a field list as well as optional WHERE, ORDER BY, and LIMIT clauses for the key object.

If you use an `NSDictionary` object, each value must contain at least a field list. For example, to represent the following SOSL statement in a dictionary entry:

```
FIND {Widget Smith}
IN Name Fields
RETURNING Widget__c (name Where createddate = THIS_FISCAL_QUARTER)
```

set the key to "Widget__c" and its value to "name WHERE createddate = "THIS_FISCAL_QUARTER". For example:

```
[SFRestAPI
  SOSLSearchWithSearchTerm:@"all of these will be escaped:~{}]"
  objectScope:[NSDictionary
    dictionaryWithObject:@"name WHERE
      createddate="THIS_FISCAL_QUARTER"
    forKey:@"Widget__c"]];
```

- `NSNull`—No scope specified.
- `limit`—If you want to limit the number of results returned, set this parameter to the maximum number of results you want to receive.

SOQL Methods

SOQL QueryBuilder methods that construct SOQL strings are:

```
+ (NSString *) SOQLQueryWithFields:(NSArray *) fields
    sObject:(NSString *) sObject
    where:(NSString *) where
    limit:(NSInteger) limit;

+ (NSString *) SOQLQueryWithFields:(NSArray *) fields
    sObject:(NSString *) sObject
    where:(NSString *) where
    groupBy:(NSArray *) groupBy
    having:(NSString *) having
    orderBy:(NSArray *) orderBy
    limit:(NSInteger) limit;
```

Parameters for the SOQL methods correspond to SOQL query syntax. All parameters except `fields` and `sObject` can be set to `nil`.

Parameter name	Description
<code>fields</code>	An array of field names to be queried.
<code>sObject</code>	Name of the object to query.
<code>where</code>	An expression specifying one or more query conditions.
<code>groupBy</code>	An array of field names to use for grouping the resulting records.
<code>having</code>	An expression, usually using an aggregate function, for filtering the grouped results. Used only with <code>groupBy</code> .

Parameter name	Description
<code>orderBy</code>	An array of fields name to use for ordering the resulting records.
<code>limit</code>	Maximum number of records you want returned.

See [SOQL SELECT Syntax](#).

SOSL Sanitizing

The `QueryBuilder` category also provides a class method for cleaning SOSL search terms:

```
+ (NSString *) sanitizeSOSLSearchTerm:(NSString *)searchTerm;
```

This method escapes every SOSL reserved character in the input string, and returns the escaped version. For example:

```
NSString *soslClean = [SFRestAPI sanitizeSOSLSearchTerm:@"FIND {MyProspect}"];
```

This call returns "FIND \{MyProspect\}".


The `sanitizeSOSLSearchTerm:` method is called in the implementation of the SOSL and SOQL `QueryBuilder` methods, so you don't need to call it on strings that you're passing to those methods. However, you can use it if, for instance, you're building your own queries manually. SOSL reserved characters include:

```
\?&|!{}[]()^~*:"'+-
```

SFRestAPI (Files) Category

The `SFRestAPI (Files)` category provides methods that create file operation requests. Each method returns a new `SFRestRequest` object. Applications send this object to the Salesforce service to process the request. For example, the following code snippet calls the `requestForOwnedFilesList:page:` method to retrieve a `SFRestRequest` object. It then sends the request object to the server, specifying its owning object as the delegate that receives the response.

```
SFRestRequest *request = [[SFRestAPI sharedInstance] requestForOwnedFilesList:nil page:0];
[[SFRestAPI sharedInstance] send:request delegate:self];
```

 **Note:** This example passes `nil` to the first parameter (`userId`). This value tells the `requestForOwnedFilesList:page:` method to use the ID of the context, or logged in, user. Passing `0` to the `pageNum` parameter tells the method to fetch the first page.

See [Files and Networking](#) for a full description of the Files feature and networking functionality.

Methods

`SFRestAPI (Files)` category supports the following operations. For a full reference of this category, see [SFRestAPI \(Files\) Category—Request Methods \(iOS\)](#). For a full description of the REST request and response bodies, go to [Chatter REST API Resources > FilesResources](#) at <http://www.salesforce.com/us/developer/docs/chatterapi>.

- (`SFRestRequest*`) `requestForOwnedFilesList:(NSString*) userId page:(NSUInteger)page;`
Builds a request that fetches a page from the list of files owned by the specified user.
- (`SFRestRequest*`) `requestForFilesInUsersGroups:(NSString*)userId page:(NSUInteger)page;`
Builds a request that fetches a page from the list of files owned by the user's groups.

- (**SFRestRequest***) **requestForFilesSharedWithUser: (NSString*)userId page:(NSUInteger)page;**
Builds a request that fetches a page from the list of files that have been shared with the user.
- (**SFRestRequest***) **requestForFileDetails: (NSString*)sfdclId forVersion:(NSString*)version;**
Builds a request that fetches the file details of a particular version of a file.
- (**SFRestRequest***) **requestForBatchFileDetails: (NSArray*)sfdclIds;**
Builds a request that fetches the latest file details of one or more files in a single request.
- (**SFRestRequest***) **requestForFileRendition: (NSString*)sfdclId version:(NSString*)version renditionType: (NSString*)renditionType page:(NSUInteger)page;**
Builds a request that fetches the a preview/rendition of a particular page of the file (and version).
- (**SFRestRequest***) **requestForFileContents: (NSString*) sfdclId version:(NSString*) version;**
Builds a request that fetches the actual binary file contents of this particular file.
- (**SFRestRequest***) **requestForAddFileShare: (NSString*)fileId entityId:(NSString*)entityId shareType:(NSString*)shareType;**
Builds a request that add a file share for the specified file ID to the specified entity ID.
- (**SFRestRequest***) **requestForDeleteFileShare: (NSString*)shareId;**
Builds a request that deletes the specified file share.
- (**SFRestRequest***) **requestForFileShares: (NSString *)sfdclId page:(NSUInteger)page;**
Builds a request that fetches a page from the list of entities that share this file.
- (**SFRestRequest***) **requestForDeleteFileShare: (NSString*)shareId;**
Builds a request that deletes the specified file share.
- (**SFRestRequest***) **requestForUploadFile: (NSData*)data name:(NSString*)name description: (NSString*)description mimeType: (NSString*)mimeType;**
Builds a request that uploads a new file to the server. Creates a new file with version set to 1.

Handling Authentication Errors

Mobile SDK provides default error handlers that display messages and divert the app flow when authentication errors occur. These error handlers are instances of the `SFAuthErrorHandler` class. They're managed by the `SFAuthErrorHandlerList` class, which stores references to all authentication error handlers. Error handlers define their implementation in anonymous blocks that use the following prototype:

```
typedef BOOL (^SFAuthErrorHandlerEvalBlock) (NSError *, SFOAuthInfo *);
```

A return value of `YES` indicates that the handler was used for the current error condition, and none of the other error handlers apply. If the handler returns `NO`, the block was not used, and the error handling process continues to the next handler in the list. Implementation details for error handlers are left to the developer's discretion. To see how the Mobile SDK defines these blocks, look at the `SFAuthenticationManager.m` file in the `SalesforceSDKCore` project.

To substitute your own error handling mechanism, you can:

- Override the Mobile SDK default error handler by adding your own handler to the top of the error handler stack (at index 0):

```
SFAuthErrorHandler *authErrorHandler =
    [[SFAuthErrorHandler alloc] initWithName:@"myAuthErrorHandler"
     evalBlock:^(NSError *error, SFOAuthInfo *authInfo) {
        // Add your error-handling code here
    }];
[[SFAuthenticationManager sharedManager].authErrorHandlerList
addAuthErrorHandler:authErrorHandler atIndex:0];
```

- Remove the Mobile SDK generic “catch-all” error handler from the list. This causes authentication errors to fall through to the `launchErrorAction` block of your `SalesforceSDKManager` implementation during the launch process, or to the `failure:` block of your `loginWithCompletion:failure:` definition if you’ve implemented deferred login. Here’s how you disable the generic error handler:

```
SFAuthErrorHandler *genericHandler =  
    [SFAuthenticationManager sharedManager].genericAuthErrorHandler;  
[[SFAuthenticationManager sharedManager].authErrorHandlerList  
    removeAuthErrorHandler:genericHandler];
```

Using iOS App Extensions with Mobile SDK

iOS app extensions provide opportunities for developers to extend their app’s functionality beyond the app window. Mobile SDK supports app extensions with only a small amount of extra configuration.

About iOS App Extensions in Mobile SDK Apps

An iOS app extension is itself an app. It lives in a separate folder in your Xcode project. The app extension can access the same resources and libraries as your main app.

To enable extensions, you add special configuration in two areas:

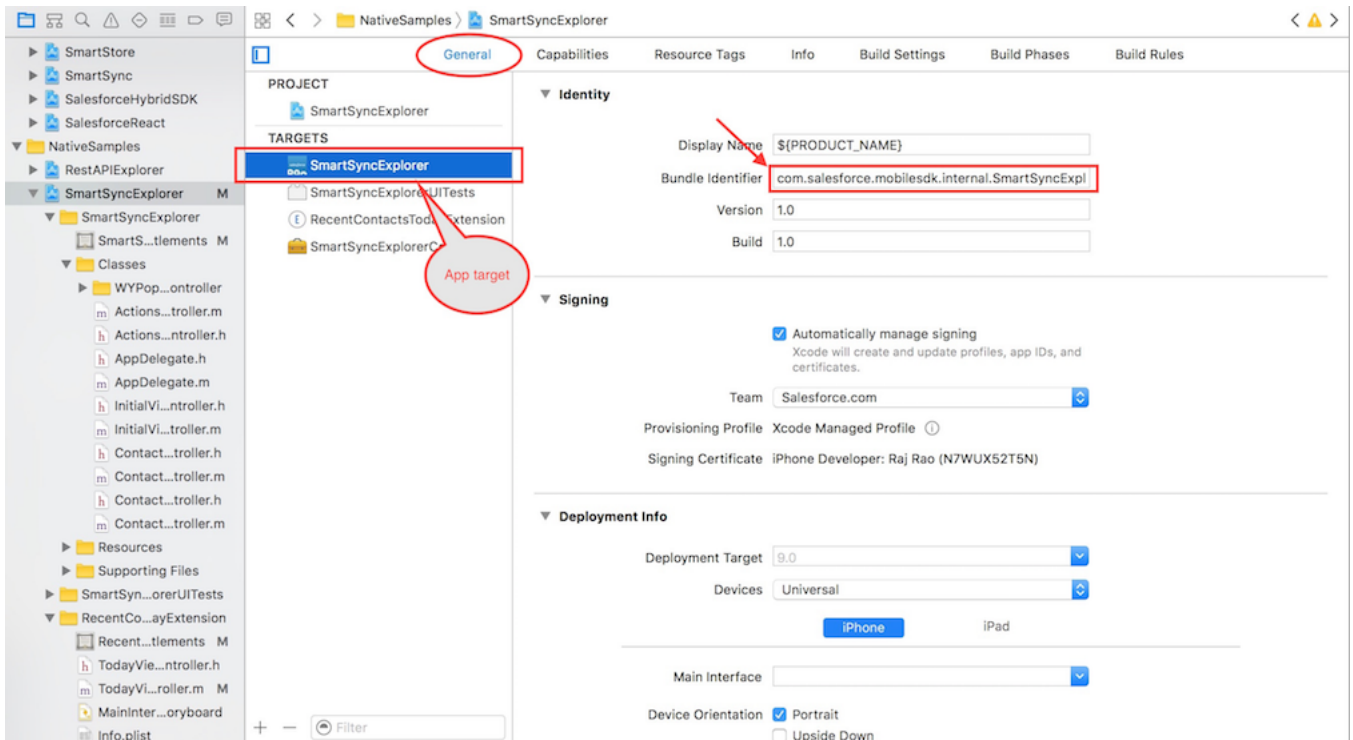
- **Workspace settings:** When you add an app extension, Xcode creates an app extension build target. You configure the existing main target and the new extension target to join the same app group and share keychains.
- **Application code:** At runtime, the two apps must share bootstrap configuration and user authentication. For this purpose, you add special bootstrapping code to both apps.

Once everything is properly configured, your app extension can run any Mobile SDK code that’s appropriate for the extension type.

Workspace Configuration

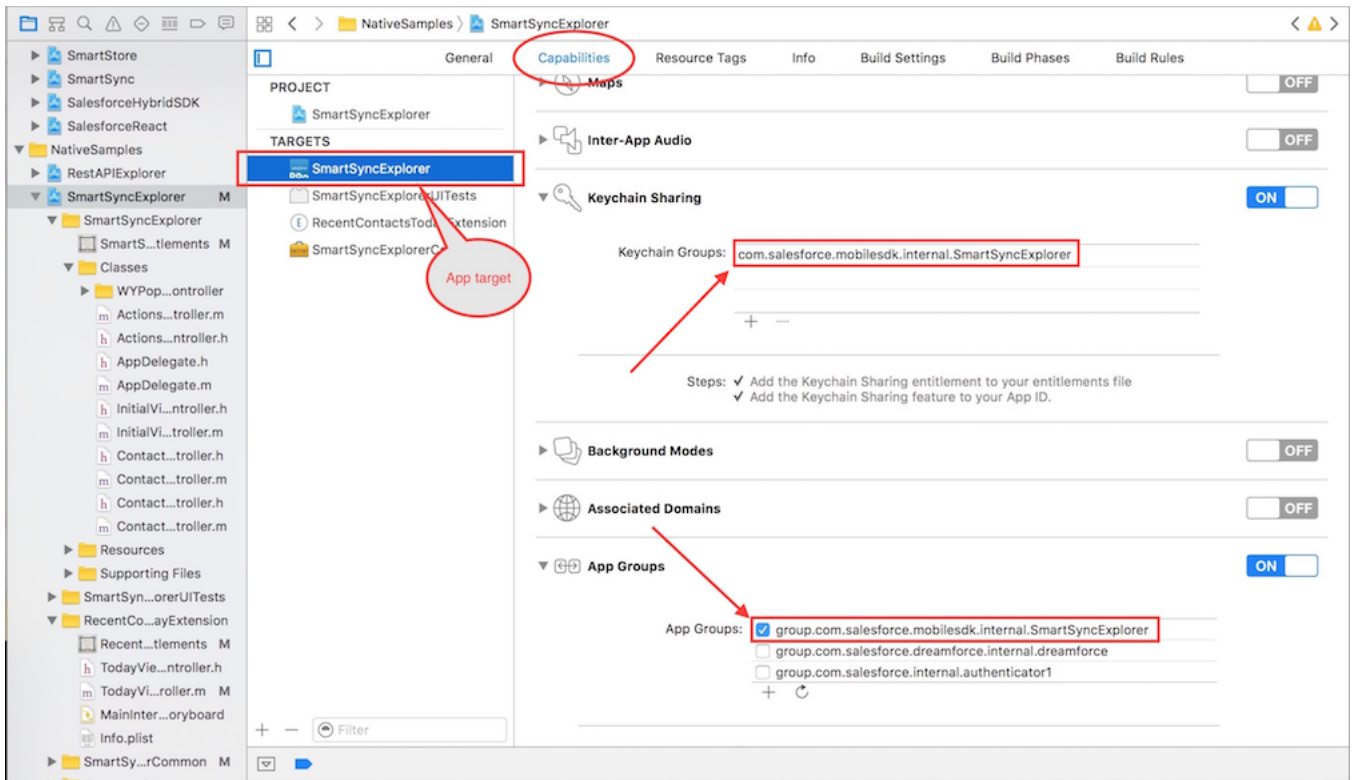
1. In your Mobile SDK app, create an extension target as described in the Apple developer documentation. How you handle this step is between you and iOS.
2. After you’ve created the target, select the top-level node of your Mobile SDK project in the Xcode Project Navigator. This step opens your app’s configuration wizard.

3. Click **General**, and then specify a unique bundle identifier for the Mobile SDK app target. Here's how it looks in Xcode 8.2.1.

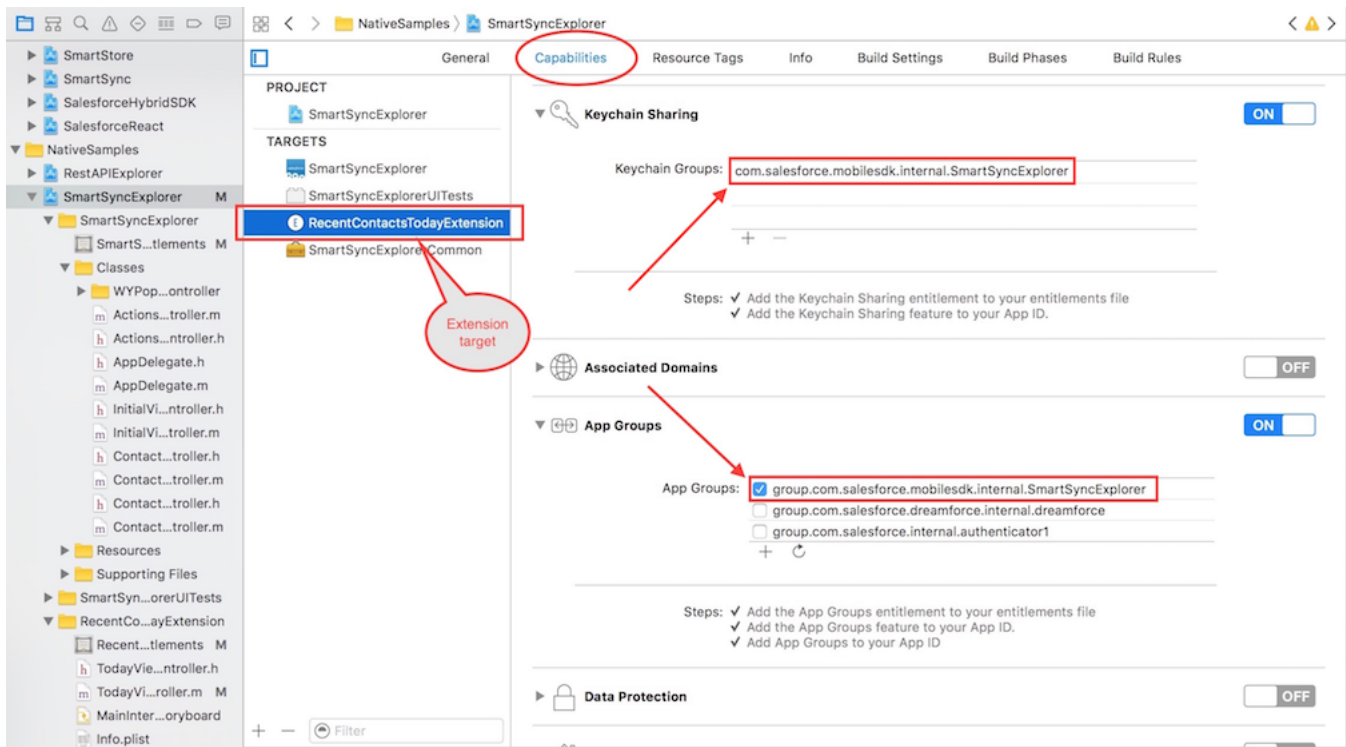


4. Repeat the bundle identifier step for the extension target. This identifier must also be unique.
5. In your app configuration, select your Mobile SDK app target and then click **Capabilities**.
6. Turn on **App Groups** and **Keychain Sharing** in your Mobile SDK target.
7. Under **App Groups**, select or create an app group. Use a unique label that identifies your app, such as "group.myapp.shared".

8. Under **Keychain Sharing**, select or create a keychain group. Use a unique label that identifies your app, such as “com.myapp.MyApp”.



9. Repeat the App Groups and Keychain Sharing steps for your extension target. The two values in the extension target must exactly match the corresponding values in the application



Application Bootstrapping

In Mobile SDK template apps, the `AppDelegate` class contains “bootstrapping” code that initializes Mobile SDK. When you incorporate an iOS app extension, you add a couple of lines that tell Mobile SDK that you’re working in an app group.

To support extensions, you change your `AppDelegate` class to make it aware of the app group that you’ve defined. You then add similar code to your app extension view controller. Mobile SDK 5.0 introduces a new class, `SFSDKDatasharingHelper`, for this purpose.

AppDelegate Code Changes

The following steps apply to the `init` method of your main app’s `AppDelegate` class.

1. In the `init` method, set `appGroupName` and `appGroupEnabled` on the `SFSDKDatasharingHelper` shared instance before setting any `SalesforceSDKManager` properties.

```
...
// Insert these two lines, using your app group name
[SFSDKDatasharingHelper sharedInstance].appGroupName = @"<your app group name>";
[SFSDKDatasharingHelper sharedInstance].appGroupEnabled = YES;

// Now it's OK to set SalesforceSDKManager properties
[SalesforceSDKManager sharedInstance].connectedAppId = @"<your consumer key>";
[SalesforceSDKManager sharedInstance].connectedAppCallbackUri = @"<your callback URL>";

[SalesforceSDKManager sharedInstance].authScopes = @[@"api", @"web", <any other scopes
your app requires>];
```

2. In the `postLaunchAction` block, use `NSUserDefaults` to cache a flag that indicates login success. Store the value with the `userLoggedIn` key.

```
[SalesforceSDKManager sharedInstance].postLaunchAction = ^(SFSDKLaunchAction
launchActionList) {
    ...
    /* Write a boolean indicating whether a user has logged into the app.
       To make the data accessible to your app extension, use NSUserDefaults
       to save it into your app group. */
    [[NSUserDefaults initWithSuiteName:@"<your app group name>"] setBool:YES
    forKey:@"userLoggedIn"];
}
```

It’s important to also reset this key in the `postLogoutAction` and `switchUserAction` blocks.

App Extension Code Changes

At runtime, your iOS app extension operates as a second app, so you have to “bootstrap” it as well. You apply the same `appGroupName` and `appGroupEnabled` changes as you did in the main app’s `AppDelegate` class. You also set the following `SalesforceSDKManager` properties in your extension view controller as you did in your `AppDelegate` class:

- `[SalesforceSDKManager sharedInstance].connectedAppId`
- `[SalesforceSDKManager sharedInstance].connectedAppCallbackUri`
- `[SalesforceSDKManager sharedInstance].authScopes`

App extensions can’t perform authentication tasks such as user logins. However, before making calls to `SalesforceSDKManager`, you must verify that a user has logged in. You do this verification by checking the `userLoggedIn` value that you captured in the `postLaunchAction` block of `AppDelegate`.

1. In your app extension's initialization entry point, set and enable the app group.

```
[SFSDKDatasharingHelper sharedInstance].appGroupName = @"<your app group name>";
[SFSDKDatasharingHelper sharedInstance].appGroupEnabled = YES;
```

2. Add the check for the `userLoggedIn` value. Continue with bootstrapping and other Mobile SDK calls only if `userLoggedIn` equals YES.

```
[SFSDKDatasharingHelper sharedInstance].appGroupName = @"<your app group name>";
[SFSDKDatasharingHelper sharedInstance].appGroupEnabled = YES;


/* Before calling SalesforceSDKManager, check whether a user has logged in
through the main app. As your condition, use the userLoggedIn Boolean value
that you set in your app's postLaunchAction block. Remember that you saved
this value in your app group usingNSUserDefaults. */
if ([[NSUserDefaults initWithSuiteName:@"<your app group name>"]
    boolForKey:@"userLoggedIn"]) {
    /* Now you can set the following SalesforceSDKManager properties
    as you did in your AppDelegate init method */
    [SalesforceSDKManager sharedInstance].connectedAppId = @"<your consumer key>"
    [SalesforceSDKManager sharedInstance].connectedAppCallbackUri =
        @"<your callback URL>";
    [SalesforceSDKManager sharedInstance].authScopes = @[@"api", @"web",
        <any other scopes your app requires>];
    // Call other Mobile SDK APIs
    ...
}
// Continue with standard extension implementation
```

If the bootstrapping succeeds, your app extension can use the current user's shared credentials to directly access Salesforce data. The following example shows typical REST API calls that you can add to an extension.

```
...
NSDictionary *fields = @{@"FirstName": @"%", @"LastName": @"%"};
SFRestRequest* request = [[SFRestAPI sharedInstance] requestForQuery:
    @"SELECT FirstName, LastName FROM Contact ORDER BY CreatedDate DESC LIMIT 5"];
[[SFRestAPI sharedInstance] send:request delegate:self];
...
```

Important:

- It's the developer's responsibility to determine the user's login status. The iOS app extension code must not attempt to invoke the `SalesforceSDKManager` object before the user successfully logs in.
- For testing iOS app extensions, there's one important restriction: You're required to use a real device. You can't test iOS app extensions in an iOS simulator.

 **Example:** The following code is taken from the `SmartSyncExplorer` native sample app. This app defines an app extension that looks up Contact records and displays a list of MRU records.

Here's the `init` method from `AppDelegate.m`. Notice that the `userLoggedIn` property must be reset for three different actions: `postLaunchAction`, `postLogoutAction`, and `switchUserAction`.

```
- (id)init
{
    self = [super init];
```

```

if (self) {
    #if defined(DEBUG)
        [SFLogger sharedLogger].logLevel = SFLogLevelDebug;
    #else
        [SFLogger sharedLogger].logLevel = SFLogLevelInfo;
    #endif
    SmartSyncExplorerConfig *config = [SmartSyncExplorerConfig sharedInstance];
    [SFSDKDatasharingHelper sharedInstance].appGroupName = config.appGroupName;
    [SFSDKDatasharingHelper sharedInstance].appGroupEnabled =
        config.appGroupsEnabled;

    // Need to use SalesforceSDKManagerWithSmartStore when using smartstore
    [SalesforceSDKManager sharedInstance].setInstanceClass:
        [SmartStoreSDKManager class];
    [SalesforceSDKManager sharedInstance].connectedAppId =
        config.remoteAccessConsumerKey;
    [SalesforceSDKManager sharedInstance].connectedAppCallbackUri =
        config.oauthRedirectURI;
    [SalesforceSDKManager sharedInstance].authScopes = config.oauthScopes;
    __weak typeof(self) weakSelf = self;
    [SalesforceSDKManager sharedInstance].postLaunchAction =
        ^(SFSDKLaunchAction launchActionList) {
            __strong typeof(weakSelf) strongSelf = weakSelf;
            //
            // If you wish to register for push notifications, uncomment the line
            // below. Note that if you want to receive push notifications from
            // Salesforce, you will also need to implement the
            // application:didRegisterForRemoteNotificationsWithDeviceToken:
            // method (below).
            //
            //[[SFPushNotificationManager sharedInstance]
            // registerForRemoteNotifications];
            //
            [strongSelf setUserLoginStatus:YES];

            [strongSelf log:SFLogLevelInfo
                format:@"Post-launch: launch actions taken: %@",
                [SalesforceSDKManager
                    sharedInstance].launchActionsStringRepresentation:launchActionList];
            [strongSelf setupRootViewController];
        };

    [SalesforceSDKManager sharedInstance].launchErrorAction = ^(NSError *error,
        SFSDKLaunchAction launchActionList) {
        __strong typeof(weakSelf) strongSelf = weakSelf;

        [strongSelf log:SFLogLevelError format:@"Error during SDK
            launch: %@", [error localizedDescription]];
        [strongSelf initializeAppViewState];
        [[SalesforceSDKManager sharedInstance] launch];
    };

    [SalesforceSDKManager sharedInstance].postLogoutAction = ^{
        __strong typeof(weakSelf) strongSelf = weakSelf;
        [strongSelf setUserLoginStatus:NO];
    };
}

```

```

        [strongSelf handleSdkManagerLogout];
    };
    [SalesforceSDKManager sharedManager].switchUserAction =
        ^(SFUserAccount *fromUser,
          SFUserAccount *toUser) {
        __strong typeof(weakSelf) strongSelf = weakSelf;
        [strongSelf setUserLoginStatus:NO];
        [strongSelf handleUserSwitch:fromUser toUser:toUser];
    };
}
return self;
}

```

The `setUserLoginStatus:` method stores the passed value in the user defaults dictionary under the `userLoggedIn` key.

```

- (void)setUserLoginStatus :(BOOL) loggedIn {
    [[NSUserDefaults msdkUserDefaults] setBool:loggedIn forKey:@"userLoggedIn"];
    [[NSUserDefaults msdkUserDefaults] synchronize];
    [self log:SFLogLevelDebug format:@"%d userLoggedIn",
     [[NSUserDefaults msdkUserDefaults] boolForKey:@"userLoggedIn"] ];
}

```

The app extension is implemented in the `RecentContactsTodayExtension/TodayViewController.m` file. For a Today extension, the entry point method is `widgetPerformUpdateWithCompletionHandler:`. The app extension only reads the `userLoggedIn` value, which it queries through the `userIsLoggedIn` “getter” method.

```

- (void)widgetPerformUpdateWithCompletionHandler:(void
 (^) (NCUpdateResult)) completionHandler {

    SmartSyncExplorerConfig *config = [SmartSyncExplorerConfig sharedInstance];

    [SFSDKDatasharingHelper sharedInstance].appGroupName = config.appGroupName;
    [SFSDKDatasharingHelper sharedInstance].appGroupEnabled = YES;
    if([self userIsLoggedIn]) {
        [self log:SFLogLevelError format:@"User has logged in"];
        [SalesforceSDKManager
         sharedInstance].setInstanceClass:[SmartStoreSDKManager class];
        [SalesforceSDKManager sharedInstance].connectedAppId =
            config.remoteAccessConsumerKey;
        [SalesforceSDKManager sharedInstance].connectedAppCallbackUri =
            config.oauthRedirectURI;
        [SalesforceSDKManager sharedInstance].authScopes = config.oauthScopes;
        [SalesforceSDKManager sharedInstance].authenticateAtLaunch =
            config.appGroupsEnabled;

        SFUserAccountIdentity *activeUserIdentity =
            [SFUserAccountManager sharedInstance].activeUserIdentity;
        SFUserAccount *currentUser = [[SFUserAccountManager sharedInstance]
            userAccountForUserIdentity:activeUserIdentity];
        [SFUserAccountManager sharedInstance].currentUser = currentUser;

        __weak typeof(self) weakSelf = self;
        void (^completionBlock)(void) = ^{
            [weakSelf refreshList];
        };
    }
}

```

```
};

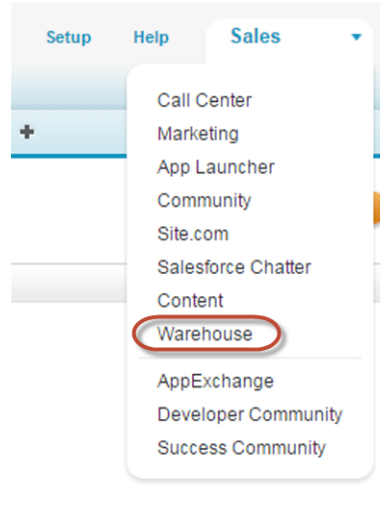
// If a current user exists, get the MRU list of Contacts
if(currentUser) {
    if (!self.dataMgr) {
        self.dataMgr = [[SObjectDataManager alloc]
            initWithDataSpec:[ContactSObjectData dataSpec]];
    }
    [self.dataMgr lastModifiedRecords:kNumberOfRecords
        completion:completionBlock];
}
completionHandler(NCUpdateResultNewData);
}

- (BOOL)userIsLoggedIn {
    SmartSyncExplorerConfig *config = [SmartSyncExplorerConfig sharedInstance];
    return [[NSUserDefaults msdkUserDefaults] boolForKey:config.userLoginStatusKey];
}
```

Tutorial: Creating a Native iOS Warehouse App

Prerequisites

- This tutorial uses a Warehouse app that contains a basic inventory database. You'll need to install this app in a DE org. If you install it in an existing DE org, be sure to delete any existing Warehouse components you've made before you install.
 1. Click the installation URL link: <http://goo.gl/1FYg90>
 2. If you aren't logged in, enter the username and password of your DE org.
 3. Select an appropriate level of visibility for your organization.
 4. Click **Install**.
 5. Click **Done**.
 6. Once the installation completes, you can select the **Warehouse** app from the app picker in the upper right corner.



7. To create data, click the **Data** tab.
 8. Click the **Create Data** button.
- Install the latest versions of Xcode and the iOS SDK.
 - Install CocoaPods as described at www.cocoapods.org. (Mobile SDK 4.0 and later)
 - Install the Salesforce Mobile SDK using npm:
 1. If you've already successfully installed Node.js and npm, skip to step 4.
 2. Install Node.js on your system. The Node.js installer automatically installs npm.
 - i. Download Node.js from www.nodejs.org.
 - ii. Run the downloaded installer to install Node.js and npm. Accept all prompts asking for permission to install.
 3. At the Terminal window, type `npm` and press *Return* to make sure your installation was successful. If you don't see a page of usage information, revisit Step 2 to find out what's missing.
 4. At the Terminal window, type `sudo npm install forceios -g`

This command uses the `forceios` package to install the Mobile SDK globally. With the `-g` option, you can run `npm install` from any directory. The npm utility installs the package under `/usr/local/lib/node_modules`, and links binary modules in `/usr/local/bin`. Most users need the `sudo` option because they lack read-write permissions in `/usr/local`.

Create a Native iOS App

In this tutorial, you learn how to get started with the Salesforce Mobile SDK, including how to install the SDK and a quick tour of the native project template using your DE org. Subsequent tutorials show you how to modify the template app and make it work with the Warehouse schema.

Step 1: Create a Connected App

In this step, you learn how to configure a Connected App in Force.com. Doing so authorizes the mobile app you will soon build to communicate securely with Force.com and access Force.com APIs on behalf of users via the industry-standard OAuth 2.0 protocol.

1. In your Developer Edition organization, from Setup, enter `Apps` in the `Quick Find` box, then select **Apps**.

2. Under **Connected Apps**, click **New** to bring up the **New Connected App** page.
3. Under **Basic Information**, complete the form as follows.
 - **Connected App Name:** *My Native iOS App*
 - **API Name:** accept the suggested value
 - **Contact Email:** enter your email address
4. Under OAuth Settings, check **Enable OAuth Settings**.
5. Set **Callback URL** to *mysampleapp://auth/success*.
6. Under **Available OAuth Scopes**, check the following:
 - Access and manage your data (api)
 - Provide access to your data via the Web (web)
 - Perform requests on your behalf at any time (refresh_token, offline_access)
7. Click **Add**.
8. Click **Save**.

After you save the configuration, notice the details of the connected app you just created.

- Note the `Callback URL` and `Consumer Key` values. You will use these when you set up your app in the next step.
- Mobile SDK apps do not use the consumer secret, so you can ignore this value.

▼ OAuth Settings			
Consumer Key	3MVG9A2kN3Bn17hssAQUXbdIGwmdDEDSODm0.8HhDzB CwVCV3IIT0SItCz.ZsHND.Tx6N.8Goli0DDYu67dG	Consumer Secret	Click to reveal
Selected OAuth Scopes	Provide access to custom applications (visualforce) Perform requests on your behalf at any time (refresh_token) Access your basic information (id) Provide access to your data via the Web (web) Access and manage your data (api) Access and manage your Chatter feed (chatter_api) Full access (full)	Callback URL	mysampleapp://auth/success

Step 2: Create a Native iOS Project

To create a new Mobile SDK project, use the `forceios` utility again in the Terminal window.

1. Change to the directory in which you want to create your project.
2. To create an iOS project, type `forceios create`.
The `forceios` utility prompts you for each configuration value.
3. For application type, enter `native`.
4. For application name, enter `MyNativeiOSApp`.
5. For package name, enter `com.acme.goodapps`.
6. For organization name, enter `GoodApps, Inc..`
7. For output directory, enter `tutorial/iOSNative`.

The input screen should look similar to this:

```
Enter your application type (native, native_swift, react_native,
  hybrid_remote, or hybrid_local): native
Enter your application name: MyNativeiOSApp
```

```
Enter the output directory for your app (defaults to the current directory):
tutorial/iOSNative
Enter the package name for your app (com.mycompany.my_app): com.acme.goodapps
Enter your organization name (Acme, Inc.): GoodApps, Inc.
Creating output folder tutorial/iOSNative
Creating app in /Users/rwhitley/SalesforceMobileSDK-iOS/tutorial/iOSNative/MyNativeiOSApp
Successfully created native app 'MyNativeiOSApp'
```

Step 3: Run the New iOS App

1. In Xcode, select **File > Open**.
2. Navigate to the output folder you specified.
3. Open your app's `xcworkspace` file.
4. Select a simulator device in the Xcode toolbar, and then click **Run**.
When you start the app, an initial splash screen appears, followed by the Salesforce login screen.
5. Log in with your DE username and password.
6. When prompted, click **Allow** to let the app access your data in Salesforce. You should see a table listing the names of users defined in your DE org.



Step 4: Explore How the iOS App Works

The native iOS app uses a straightforward Model View Controller (MVC) architecture.

- The model is the Force.com database schema
- The views come from the nib and implementation files in your project
- The controller functionality represents a joint effort between the iOS SDK classes, the Salesforce Mobile SDK, and your app

AppDelegate Class and the Root View Controller

When the app is launched, the `AppDelegate` class initially controls the execution flow. After the login process completes, the `AppDelegate` instance passes control to the root view. In the template app, the root view controller class is named `RootViewController`. This class becomes the root view for the app in the `AppDelegate.m` file, where it's subsumed by a `UINavigationController` instance that controls navigation between views:

```
- (void) setupRootViewController
{
    RootViewController *rootVC = [[RootViewController alloc]
        initWithNibName:nil bundle:nil];
    UINavigationController *navVC = [[UINavigationController alloc]
        initWithRootViewController:rootVC];
    self.window.rootViewController = navVC;
}
```

Before it's customized, though, the app doesn't include other views or touch event handlers. It simply logs into Salesforce, issues a request using Salesforce Mobile SDK REST APIs, and displays the response in the root view.

UITableViewController Class

`RootViewController` inherits the `UITableViewController` class. Because it doesn't customize the table in its inherited view, there's no need for a nib or xib file. The controller class simply loads data into the `tableView` property and lets the super class handle most of the display tasks. However, `RootViewController` does add some basic cell formatting by calling the `tableView:cellForRowAtIndexPath:` method. It creates a new cell, assigns it a generic ID (`"CellIdentifier"`), puts an icon on the left side of the cell, and adds an arrow on the right side. Most importantly, it sets the cell's label to assume the Name value of the current row from the REST response object. Here's the code:

```
// Customize the appearance of table view cells.
- (UITableViewCell *)tableView:(UITableView *)tableView_
    cellForRowAtIndexPath:(NSIndexPath *)indexPath {

    static NSString *CellIdentifier = @"CellIdentifier";

    // Dequeue or create a cell of the appropriate type.
    UITableViewCell *cell = [tableView_
        dequeueReusableCellWithIdentifier:CellIdentifier];
    if (cell == nil) {
        cell = [[UITableViewCell alloc]
            initWithStyle:UITableViewCellStyleValue1
            reuseIdentifier:CellIdentifier];
    }
    //if you want to add an image to your cell, here's how
    UIImage *image = [UIImage imageNamed:@"icon.png"];
    cell.imageView.image = image;
```

```

// Configure the cell to show the data.
NSDictionary *obj =
    [dataRows objectAtIndex:indexPath.row];
cell.textLabel.text = [obj objectForKey:@"Name"];

//this adds the arrow to the right hand side.
cell.accessoryType =
    UITableViewCellStyleAccessoryDisclosureIndicator;

return cell;
}

```

SFRestAPI Shared Object and SFRestRequest Class

You can learn how the app creates and sends REST requests by browsing the `RootViewController.viewDidLoad` method. The app defines a literal SOQL query string and passes it to the `SFRestAPI:requestForQuery:` instance method. To call this method, the app sends a message to the shared singleton `SFRestAPI` instance. The method creates and returns an appropriate, preformatted `SFRestRequest` object that wraps the SOQL query. The app then forwards this object to the server by sending the `send:delegate:` message to the shared `SFRestAPI` object:

```

SFRestRequest *request = [[SFRestAPI sharedInstance]
    requestForQuery:@"SELECT Name FROM User LIMIT 10"];
[[SFRestAPI sharedInstance] send:request delegate:self];

```

The `SFRestAPI` class serves as a factory for `SFRestRequest` instances. It defines a series of request methods that you can call to easily create request objects. If you want, you can also build `SFRestRequest` instances directly, but, for most cases, manual construction isn't necessary.

Notice that the app specifies `self` for the `delegate` argument. This tells the server to send the response to a delegate method implemented in the `RootViewController` class.

SFRestDelegate Interface

To be able to accept REST responses, `RootViewController` implements the `SFRestDelegate` interface. This interface declares four methods—one for each possible response type. The `request:didLoadResponse:delegate` method executes when the request succeeds. When `RootViewController` receives a `request:didLoadResponse:callback`, it copies the returned records into its data rows and reloads the data displayed in the view. Here's the code that implements the `SFRestDelegate` interface in the `RootViewController` class:

```

#pragma mark - SFRestDelegate

- (void)request:(SFRestRequest *)request
didLoadResponse:(id)jsonResponse {
    NSArray *records = [jsonResponse objectForKey:@"records"];
    NSLog(@"request:didLoadResponse: #records: %lu", (unsigned long)records.count);
    self.dataRows = records;
    dispatch_async(dispatch_get_main_queue(), ^{
        [self.tableView reloadData];
    });
}

```

```

- (void) request:(SFRestRequest*) request
didFailLoadWithError:(NSError*)error {
    NSLog(@"request:didFailLoadWithError: %@", error);
    //add your failed error handling here
}

- (void) requestDidCancelLoad:(SFRestRequest *) request {
    NSLog(@"requestDidCancelLoad: %@", request);
    //add your failed error handling here
}

- (void) requestDidTimeout:(SFRestRequest *) request {
    NSLog(@"requestDidTimeout: %@", request);
    //add your failed error handling here
}

```

As the comments indicate, this code fully implements only the `request:didLoadResponse: success` delegate method. For responses other than success, this template app simply logs a message.

Customize the List Screen

In this tutorial, you modify the root view controller to make the app specific to the Warehouse schema. You also adapt the existing SOQL query to obtain all the information we need from the Merchandise custom object.

Step 1: Modify the Root View Controller

To adapt the template project to our Warehouse design, let's rename the `RootViewController` class.

1. In the Project Navigator, choose the `RootViewController.h` file.
2. In the Editor, click the name "RootViewController" on this line:

```
@interface RootViewController : UITableViewController <SFRestDelegate>{
```

3. Using the Control-Click menu, choose **Refactor > Rename**. Be sure that **Rename Related Files** is checked.
4. Change "RootViewController" to "WarehouseViewController". Click **Preview**.

Xcode presents a new window that lists all project files that contain the name "RootViewController" on the left. The central pane shows a diff between the existing version and the proposed new version of each changed file.

5. Click **Save**.

The Refactoring window goes away, and you're back in your newly refactored project. Notice that the file names `RootViewController.h` and `RootViewController.m` are now `WarehouseViewController.h` and `WarehouseViewController.m`. Every instance of `RootViewController` in your project code has also been changed to `WarehouseViewController`.

Step 2: Create the App's Root View

The native iOS template app creates a SOQL query that extracts Name fields from the standard User object. For this tutorial, though, you use records from a custom object. Later, you create a detail screen that displays Name, Quantity, and Price fields. You also need the record ID.

Let's update the SOQL query to operate on the custom `Merchandise__c` object and to retrieve the fields needed by the detail screen.

1. In the Project Navigator, select `WarehouseViewController.m`.
2. Scroll to the `viewDidLoad` method.
3. Update the view's display name to "Warehouse App". Change:

```
self.title = @"Mobile SDK Sample App"
```

to

```
self.title = @"Warehouse App"
```

4. Change the SOQL query in the following line:

```
SFRestRequest *request = [[SFRestAPI sharedInstance] requestForQuery:@"SELECT Name  
FROM User LIMIT 10"];
```

to:

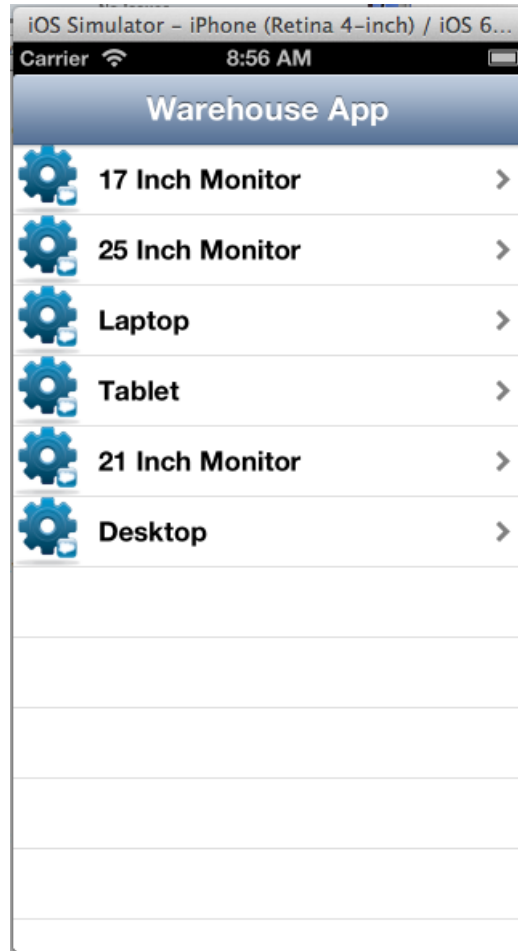
```
SELECT Name, Id, Quantity__c, Price__c FROM Merchandise__c LIMIT 10
```



Note: In some rare cases, developers create the `Merchandise` table manually. If you did this, you must preface the API name of each custom object and field with your four-letter developer prefix. This rule applies to the SOQL statement and every other usage in your app. For example, if your developer prefix is "ABCD", the `Merchandise__c` object's API name becomes `ABCD__Merchandise__c`.

Step 3: Try Out the App

Build and run the app. When prompted, log into your DE org. The initial page should look similar to the following screen.



At this point, if you click a Merchandise record, nothing happens. You'll fix that in the next tutorial.

Create the Detail Screen

In the previous tutorial, you modified the template app so that, after it starts, it lists up to ten Merchandise records. In this tutorial, you finish the job by creating a detail view and controller. You also establish communication between list view and detail view controllers.



Step 1: Create the App's Detail View Controller

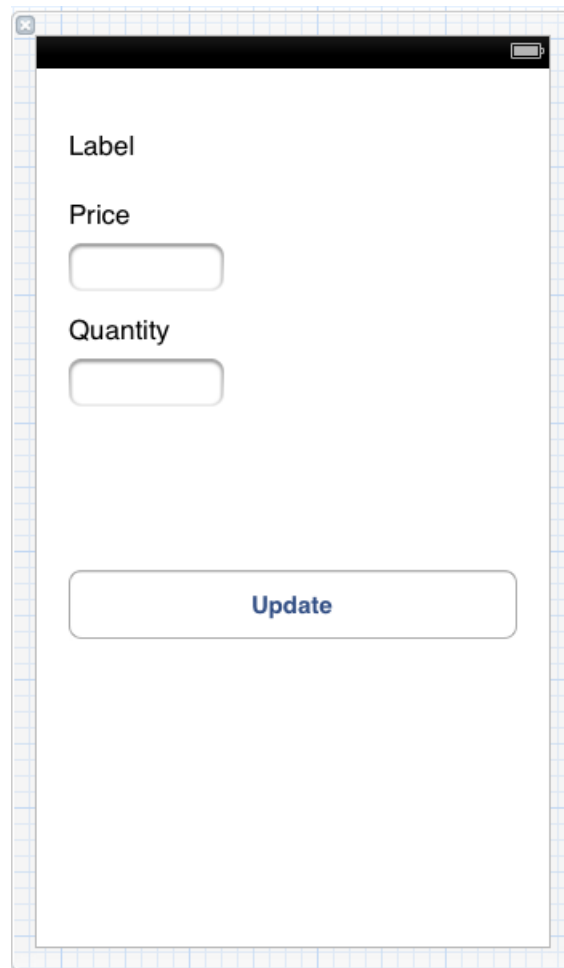
When a user taps a Merchandise record in the Warehouse view, an `IBAction` generates record-specific information and then loads a view from `DetailViewController` that displays this information. However, this view doesn't yet exist, so let's create it.

1. Click **File > New > File...** and select **Source > Cocoa Touch Class**.
2. Click **Next**.
3. Set the following properties:

Property	Value
Class	<code>DetailViewController</code>
Subclass of	<code>UIViewController</code>

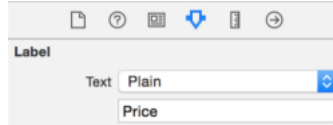
Property	Value
Also create XIB file	Checked, iPhone
Language	Objective-C

- Place the new class in the **Classes** group under **MyNativeiOSApp** in the **Groups** drop-down menu.
- Click **Create**.
Xcode creates three new files in the `Classes` folder: `DetailViewController.h`, `DetailViewController.m`, and `DetailViewController.xib`.
- Select `DetailViewController.xib` in the Project Navigator to open the Interface Builder.
- From the Utilities view , select the Attributes inspector.
- Click an empty space in the frame and then, under Simulated Metrics, select an iPhone configuration from the Size dropdown menu.
- In the lower right-hand panel, show the Object library . Drag three labels, two text fields, and one button onto the view layout. Arrange and resize the controls so that the screen looks like this:



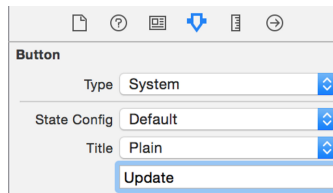
We'll refer to topmost label as the Name label. This label is dynamic. In the next tutorial, you'll add controller code that resets it at runtime to a meaningful value.

- In the Attributes inspector, set the display text for the static Price and Quantity labels to the values shown. Select each label individually in the Interface Builder and specify display text in the unnamed entry field below the Text drop-down menu.



Note: Adjust the width of the labels as necessary to see the full display text. The Name label requires about two-thirds of the screen width.

- In the Attributes inspector, set the display text for the Update button to the value shown. Select the button in the Interface Builder and specify its display text in the unnamed entry field below the Title drop-down menu.



- Build and run to check for errors. You won't yet see your changes.

The detail view design shows Price and Quantity fields, and provides a button for updating the record's Quantity. However, nothing currently works. In the next step, you learn how to connect this design to Warehouse records.

Step 2: Set Up DetailViewController

To establish connections between view elements and their view controller, you can use the Xcode Interface Builder to connect UI elements with code elements.

Add Instance Properties

- Create properties in `DetailViewController.h` to contain the values passed in by the `WarehouseViewController`: Name, Quantity, Price, and Id. Place these properties within the `@interface` block. Declare each `nonatomic` and `strong`, using these names:

```
@interface DetailViewController : UIViewController

@property (nonatomic, strong) NSNumber *quantityData;
@property (nonatomic, strong) NSNumber *priceData;
@property (nonatomic, strong) NSString *nameData;
@property (nonatomic, strong) NSString *idData;

@end
```

- In `DetailViewController.m`, just after the `@implementation` tag, synthesize each of the properties.

```
@implementation DetailViewController


@synthesize nameData;
@synthesize quantityData;
@synthesize priceData;
@synthesize idData;
```

Add IBOutlet Variables

`IBOutlet` member variables let the controller manage each non-static control. Instead of coding these manually, you can use the Interface Builder to create them. Interface Builder provides an Assistant Editor that gives you the convenience of side-by-side editing windows. To make room for the Assistant Editor, you'll usually want to reclaim screen area by hiding unused controls.

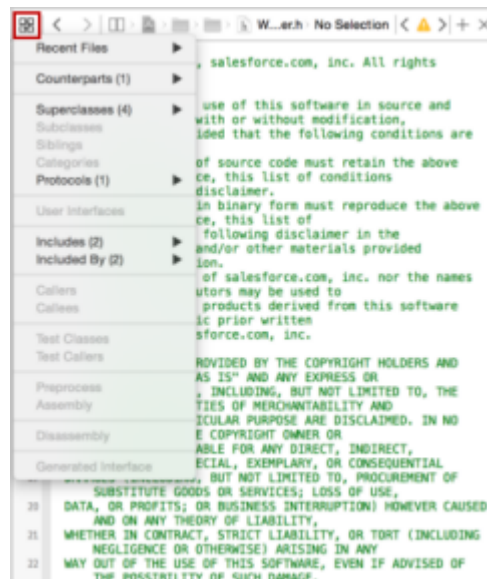
- In the Project Navigator, click the `DetailViewController.xib` file.

The `DetailViewController.xib` file opens in the Standard Editor.

- Hide the Navigator by clicking Hide or Show Navigator on the View toolbar .

- Open the Assistant Editor by clicking Show the Assistant editor in the Editor toolbar .

Make sure that the Assistant Editor shows the `DetailViewController.h` file. The Assistant Editor guesses which files are most likely to be used together. If you need to open a different file, click the Related Files control in the upper left hand corner of the Assistant Editor.



- At the top of the interface block in `DetailViewController.h`, add a pair of empty curly braces:


```
@interface DetailViewController : UIViewController <SFRestDelegate>
{
}
}
```

- In the Standard Editor, control-click the Price text field control and drag it into the new curly brace block in the `DetailViewController.h` file.
- In the popup dialog box, name the new outlet `_priceField`, and click **Connect**.
- Repeat steps 2 and 3 for the Quantity text field, naming its outlet `_quantityField`.
- Repeat steps 2 and 3 for the Name label, naming its outlet `_nameLabel`.

Your interface code now includes this block:

```
@interface DetailViewController : UIViewController
{
    __weak IBOutlet UITextField *_priceField;
    __weak IBOutlet UITextField *_quantityField;
    __weak IBOutlet UILabel *_nameLabel;
}
```

Add an Update Button Event

- In the Interface Builder, select the **Update** button and open the Connections Inspector  .
- In the Connections Inspector, select the circle next to **Touch Up Inside** and drag it into the `DetailViewController.h` file. Be sure to drop it below the closing curly brace. Name it `updateTouchUpInside`, and click **Connect**.

The Touch Up Inside event tells you that the user raised the finger touching the Update button without first leaving the button. You'll perform a record update every time this notification arrives.

Step 3: Create the Designated Initializer

Now, let's get down to some coding. Start by adding a new initializer method to `DetailViewController` that takes the name, ID, quantity, and price. The method name, by convention, must begin with "init".

- Click **Show the Standard Editor** and open the Navigator.
- Add this declaration to the `DetailViewController.h` file just above the `@end` marker:

```
- (id) initWithName:(NSString *)recordName
                subjectId:(NSString *)salesforceId
                quantity:(NSNumber *)recordQuantity
                price:(NSNumber *)recordPrice;
```

Later, we'll code `WarehouseViewController` to use this method for passing data to the `DetailViewController`.

- Open the `DetailViewController.m` file, and copy the signature you created in the previous step to the end of the file, just above the `@end` marker.
- Replace the terminating semi-colon with a pair of curly braces for your implementation block.

```
- (id) initWithName:(NSString *)recordName
                subjectId:(NSString *)salesforceId
                quantity:(NSNumber *)recordQuantity
                price:(NSNumber *)recordPrice {
}
```

- In the method body, send an `init` message to the super class. Assign the return value to `self`:

```
self = [super init];
```

This `init` message gives you a functional object with base implementation which will serve as your return value.

6. Add code to verify that the super class initialization succeeded, and, if so, assign the method arguments to the corresponding instance variables. Finally, return `self`.

```
if (self) {
    self.nameData = recordName;
    self.idData = salesforceId;
    self.quantityData = recordQuantity;
    self.priceData = recordPrice;
}
return self;
```

Here's the completed method:

```
- (id) initWithName:(NSString *)recordName
                subjectId:(NSString *)salesforceId
                quantity:(NSNumber *)recordQuantity
                price:(NSNumber *)recordPrice {

    self = [super init];
    if (self) {
        self.nameData = recordName;
        self.idData = salesforceId;
        self.quantityData = recordQuantity;
        self.priceData = recordPrice;
    }
    return self;
}
```

7. To make sure the controls are updated each time the view appears, add a new `viewWillAppear:` event handler after the `viewDidLoad` method implementation. Begin by calling the super class method.

```
- (void)viewWillAppear:(BOOL)animated {
    [super viewWillAppear:animated];
}
```

8. Copy the values of the property variables to the corresponding dynamic controls.

```
- (void)viewWillAppear:(BOOL)animated {
    [super viewWillAppear:animated];
    [_nameLabel setText:self.nameData];
    [_quantityField setText:[self.quantityData stringValue]];
    [_priceField setText:[self.priceData stringValue]];
}
```

9. Build and run your project to make sure you've coded everything without compilation errors. The app will look the same as it did at first, because you haven't yet added the code to launch the Detail view.



Note: The `[super init]` message used in the `initWithName:` method calls `[super initWithNibName:bundle:]` internally. We use `[super init]` here because we're not passing a NIB name or a bundle. If you are specifying these resources in your own projects, you'll need to call `[super initWithNibName:bundle:]` explicitly.

Step 4: Establish Communication Between the View Controllers

Any view that consumes Salesforce content relies on a `SFRestAPI` delegate to obtain that content. You can designate a single view to be the central delegate for all views in the app, which requires precise communication between the view controllers. For this exercise, let's take a slightly simpler route: Make `WarehouseViewController` and `DetailViewController` each serve as its own `SFRestAPI` delegate.

Update WarehouseViewController

First, let's equip `WarehouseViewController` to pass the quantity and price values for the selected record to the detail view, and then display that view.

1. In `WarehouseViewController.m`, above the `@implementation` block, add the following line:

```
#import "DetailViewController.h"
```

2. On a new line after the `#pragma mark - Table view data source` marker, type the following starter text to bring up a list of `UITableView` delegate methods:

```
- (void)tableView
```

3. From the list, select the `tableView:didSelectRowAtIndexPath:` method.

4. Change the `tableView` parameter name to `itemTableView`.

```
- (void)tableView:(UITableView *)itemTableView didSelectRowAtIndexPath:(NSIndexPath *)indexPath
```

5. At the end of the signature, type an opening curly brace (`{`) and press return to stub in the method implementation block.
6. At the top of the method body, per standard iOS coding practices, add the following call to deselect the row.

```
[itemTableView deselectRowAtIndexPath:indexPath animated:NO];
```

7. Next, retrieve a pointer to the `NSDictionary` object associated with the selected data row.

```
NSDictionary *obj = [self.dataRows objectAtIndex:indexPath.row];
```

8. At the end of the method body, create a local instance of `DetailViewController` by calling the `DetailViewController.initWithName:salesforceId:quantity:price:` method. Use the data stored in the `NSDictionary` object to set the name, Salesforce ID, quantity, and price arguments. The finished call looks like this:

```
DetailViewController *detailController =
    [[DetailViewController alloc]
     initWithName:[obj objectForKey:@"Name"]
     objectId:[obj objectForKey:@"Id"]
     quantity:[obj objectForKey:@"Quantity__c"]
     price:[obj objectForKey:@"Price__c"]];
```

9. To display the Detail view, add code that pushes the initialized `DetailViewController` onto the `UINavigationController` stack:

```
[[self navigationController] pushViewController:detailController animated:YES];
```

Great! Now you're using a `UINavigationController` stack to handle a set of two views. The root view controller is always at the bottom of the stack. To activate any other view, you just push its controller onto the stack. When the view is dismissed, you pop its controller, which brings the view below it back into the display.

10. Build and run your app. Click on any Warehouse item to display its details.

Add Update Functionality

Now that the `WarehouseViewController` is set up, we need to modify the `DetailViewController` class to send the user's updates to Salesforce via a REST request.

1. In the `DetailViewController.h` file, add an instance method to `DetailViewController` that lets a user update the price and quantity fields. This method needs to send a record ID, the names of the fields to be updated, the new quantity and price values, and the name of the object to be updated. Add this declaration after the interface block and just above the `@end` marker.

```
- (void)updateWithObjectType:(NSString *)objectType
    objectId:(NSString *)objectId
    quantity:(NSString *)quantity
    price:(NSString *)price;
```

To implement the method, you create an `SFRestRequest` object using the input values, then send the request object to the shared instance of the `SFRestAPI`.

2. In the `DetailViewController.h` file, add the following import statement just above the `@interface` declaration.

```
#import "SFRestAPI.h"
```

3. At the end of the `DetailViewController.h` file, just above the `@end` marker, copy the `updateWithObjectType:objectId:quantity:price:` signature, followed by a pair of curly braces:

```
- (void)updateWithObjectType:(NSString *)objectType
    objectId:(NSString *)objectId
    quantity:(NSString *)quantity
    price:(NSString *)price {
}
```

4. In the implementation block, create a new `NSDictionary` object to contain the Quantity and Price fields. To allocate this object, use the `dictionaryWithObjectsAndKeys: ... NSDictionary` class method with the desired list of fields.

```
- (void)updateWithObjectType:(NSString *)objectType
    objectId:(NSString *)objectId
    quantity:(NSString *)quantity
    price:(NSString *)price
{
    NSDictionary *fields = [NSDictionary
        dictionaryWithObjectsAndKeys: quantity, @"Quantity__c",
        price, @"Price__c",
        nil];
}
```

5. Create a `SFRestRequest` object. To allocate this object, use the `requestForUpdateWithObjectType:objectId:fields:` instance method on the `SFRestAPI` shared instance.

```
- (void)updateWithObjectType:(NSString *)objectType
    objectId:(NSString *)objectId
    quantity:(NSString *)quantity
    price:(NSString *)price
{
    NSDictionary *fields = [NSDictionary
        dictionaryWithObjectsAndKeys: quantity, @"Quantity__c",
        price, @"Price__c",
        nil];

    SFRestRequest *request = [[SFRestAPI sharedInstance]
        requestForUpdateWithObjectType:objectType
        objectId:objectId
        fields:fields];
}
```

6. Finally, send the new `SFRestRequest` object to the service by calling `send:delegate:` on the `SFRestAPI` shared instance. For the `delegate` argument, be sure to specify `self`, since `DetailViewController` is the `SFRestDelegate` in this case.

```
- (void)updateWithObjectType:(NSString *)objectType
    objectId:(NSString *)objectId
    quantity:(NSString *)quantity
    price:(NSString *)price
{
    NSDictionary *fields = [NSDictionary
        dictionaryWithObjectsAndKeys: quantity, @"Quantity__c",
        price, @"Price__c",
        nil];

    SFRestRequest *request = [[SFRestAPI sharedInstance]
        requestForUpdateWithObjectType:objectType
        objectId:objectId
        fields:fields];
    [[SFRestAPI sharedInstance] send:request delegate:self];
}
```

7. Edit the `updateTouchUpInside:` action method to call the `updateWithObjectType:objectId:quantity:price:` method when the user taps the **Update** button.

```
- (IBAction)updateTouchUpInside:(id) sender {
    // For Update button
    [self updateWithObjectType:@"Merchandise__c"
        objectId:self.idData
        quantity:[_quantityField text]
        price:[_priceField text]];
}
```

 **Note:**

- **Extra credit:** Improve your app's efficiency by performing updates only when the user has actually changed the quantity value.

Add SFRestDelegate to DetailViewController

We're almost there! We've issued the REST request, but still need to provide code to handle the response.

1. Open the `DetailViewController.h` file and change the `DetailViewController` interface declaration to include `<SFRestDelegate>`

```
@interface DetailViewController : UIViewController <SFRestDelegate>
```

2. Open the `WarehouseViewController.m` file.
3. Find the pragma that marks the `SFRestAPIDelegate` section.

```
#pragma mark - SFRestAPIDelegate
```

 **Note:** `SFRestAPIDelegate` is a typo in the template. The name of the protocol is `SFRestDelegate`. Hopefully, it'll be fixed by the time you read this!

4. Copy the four methods under this pragma into the `DetailViewController.m` file.

```
- (void)request:(SFRestRequest *)request didLoadResponse:(id)jsonResponse {
    NSArray *records = [jsonResponse objectForKey:@"records"];
    NSLog(@"request:didLoadResponse: #records: %d",
          records.count);
    self.dataRows = records;
    [self.tableView reloadData];
}

- (void)request:(SFRestRequest*)request didFailLoadWithError:(NSError*)error {
    NSLog(@"request:didFailLoadWithError: %@", error);
    //add your failed error handling here
}

- (void)requestDidCancelLoad:(SFRestRequest *)request {
    NSLog(@"requestDidCancelLoad: %@", request);
    //add your failed error handling here
}

- (void)requestDidTimeout:(SFRestRequest *)request {
    NSLog(@"requestDidTimeout: %@", request);
    //add your failed error handling here
}
```

These methods are all we need to implement the `SFRestAPI` interface. For this tutorial, we can retain the simplistic handling of error, cancel, and timeout conditions. However, the `request:didLoadResponse:` method is generating compiler errors.

We need to change the `request:didLoadResponse:` method to suit the detail view purposes. Let's eliminate the errors and then use the `UINavigationController` stack to return to the list view after an update occurs.

5. In the `DetailViewController.m` file, delete the existing code in the `request:didLoadResponse:` delegate method. In its place, add code that logs a success message and then pops back to the root view controller. The revised method looks like this.

```
- (void)request:(SFRestRequest *)request
didLoadResponse:(id)jsonResponse {
```



```

    NSLog(@"1 record updated");
    dispatch_async(dispatch_get_main_queue(), ^{
        [self.navigationController popViewControllerAnimated:YES];
    });
}

```

- Build and run your app. In the Warehouse view, click one of the items. You're now able to access the Detail view and edit its quantity, but there's a problem: the keyboard won't go away when you want it to. You need to add a little finesse to make the app truly functional.

Refreshing the Query with viewWillAppear

The `viewDidLoad` method lets you configure the view when it first loads. In the `WarehouseViewController` implementation, this method contains the REST API query that populates both the list view and the detail view. However, since `WarehouseViewController` represents the root view, the `viewDidLoad` notification is called only once—when the view is initialized. What does this mean? When a user updates a quantity in the detail view and returns to the list view, the query is not refreshed. Thus, if the user returns to the same record in the detail view, the updated value does not display, and the user is not happy.

You need a different method to handle the query. The `viewWillAppear` method is called each time its view is displayed. Let's add this method to `WarehouseViewController` and move the SOQL query into it.

- In the `WarehouseViewController.m` file, add the following code after the `viewDidLoad` implementation.

```

- (void)viewWillAppear:(BOOL)animated {
    [super viewWillAppear:animated];
}

```

- Cut the following lines from the `viewDidLoad` method and paste them into the `viewWillAppear:` method, after the call to `super:`

```

SFRestRequest *request =
    [[SFRestAPI sharedInstance] requestForQuery:
        @"SELECT Name, ID, Price__c, Quantity__c "
        "FROM Merchandise__c LIMIT 10"];
[[SFRestAPI sharedInstance] send:request delegate:self];

```

The final `viewDidLoad` and `viewWillAppear:` methods look like this.

```

- (void)viewDidLoad{
    [super viewDidLoad];
    self.title = @"Warehouse App";
}

- (void)viewWillAppear:(BOOL)animated {
    [super viewWillAppear:animated];
    SFRestRequest *request = [[SFRestAPI sharedInstance]
        requestForQuery:@"SELECT Name, ID, Price__c, "
            "Quantity__c "
            "FROM Merchandise__c LIMIT 10"];
    [[SFRestAPI sharedInstance] send:request delegate:self];
}

```

The `viewWillAppear:` method refreshes the query each time the user navigates back to the list view. Later, when the user revisits the detail view, the list view controller updates the detail view with the refreshed data.

Step 5: Try Out the App

1. Build your app and run it in the iPhone emulator. If you did everything correctly, a detail page appears when you click a Merchandise record in the Warehouse screen.
2. Update a record's quantity and price. Be sure to click the **Update** button in the detail view after you edit the values. When you navigate back to the detail view, the updated values display.
3. Log into your DE org and view the record using the browser UI to see the updated values.

iOS Sample Applications

The app you created in [Run the Xcode Project Template App](#) is itself a sample application, but it only does one thing: issue a SOQL query and return a result. The native iOS sample apps demonstrate more functionality you can examine and work into your own apps.

- **RestAPIExplorer** exercises all native REST API wrappers. It resides in Mobile SDK for iOS under `native/SampleApps/RestAPIExplorer`.
- **SmartSyncExplorer** demonstrates the power of the native SmartSync Data Framework library on iOS. It resides in Mobile SDK for iOS under `native/SampleApps/SmartSyncExplorer`.

Mobile SDK provides iOS wrappers for the following hybrid apps.

- **AccountEditor**: Demonstrates how to synchronize offline data using the `smartsync.js` library.
- **NoteSync**: Demonstrates how to use non-REST APIs to retrieve Salesforce Notes.
- **SmartSyncExplorerHybrid**: Demonstrates how to synchronize offline data using the SmartSync Data Framework plugin.

CHAPTER 9 Native Android Development

In this chapter ...

- [Android Native Quick Start](#)
- [Native Android Requirements](#)
- [Creating an Android Project with Forcedroid](#)
- [Setting Up Sample Projects in Android Studio](#)
- [Developing a Native Android App](#)
- [Tutorial: Creating a Native Android Warehouse Application](#)
- [Android Sample Applications](#)

Salesforce Mobile SDK for Android provides source code, build scripts, and native sample apps to get you off and running. It gives you template apps that implement two basic features of any Mobile SDK app:

- Automation of the OAuth2 authentication flow, making it easy to integrate the process with your app.
- Access to the Salesforce REST API, with utility classes that simplify that access.

Sample native applications show you basic techniques for implementing login, REST API calls, and other Mobile SDK features.

Android Native Quick Start

Use the following procedure to get started quickly.

1. Make sure you meet all of the [native Android requirements](#).
2. Install [Mobile SDK for Android](#). If you prefer, you can install Mobile SDK from the [Mobile SDK GitHub Repositories](#) instead.
3. At the command line, run the forcedroid application to create a new [Android project](#), and then run that app in Android Studio or from the command line.
4. Follow the instructions at [Setting Up Sample Projects in Android Studio](#).

Native Android Requirements

The following software is required for all Mobile SDK development.

- [Node.js](#)
- Npm version 3.10 or later (installed with Node.js).
- A Salesforce [Developer Edition organization](#) with a [connected app](#).

Mobile SDK 6.0 Android development also requires the following software.

- Java JDK 1.8.x or later—www.oracle.com/downloads.
- forcedroid npm package, version 6.0.
- Android Studio 3.0 or later—developer.android.com/sdk.
- Android SDK and Android SDK Tools—Install from within Android Studio.
 1. In the Android Studio menu, click **Tools > Android > SDK Manager**.
 2. Click the **SDK Platforms** tab.
 3. Install at least the following required SDK levels and all intervening levels:
 - Minimum API: Android KitKat (API 21)
 - Target API: Android Oreo (API 27)
 4. Click the **SDK Tools** tab.
 5. Install the latest Android SDK Tools version.
- Android Virtual Device (AVD)—Install from within Android Studio.
 1. In the Android Studio menu, click **Tools > Android > AVD Manager**.
 2. Click **Create Virtual Device...**
 3. Install at least one AVD that targets Android KitKat (API 21) and above. To learn how to set up an AVD in Android Studio, follow the instructions at developer.android.com/guide/developing/devices/managing-avds.html.

On the Salesforce side, you also need:

- Salesforce Mobile SDK 6.0 or later for Android. See [Android Preparation](#).
- A Salesforce [Developer Edition organization](#) with a [connected app](#).

The `salesforcesdk` project is built with the Android KitKat (API 21) library.

 Tip:

- For best results, install all Android SDK versions recommended by the Android SDK Manager, and all available versions of Android SDK tools.
- On Windows, be sure to run Android Studio as administrator.
- For detailed Android Studio requirements, see developer.android.com/sdk.

Creating an Android Project with Forcedroid

To create an app, use forcedroid in a terminal window or at a Windows command prompt. The forcedroid utility gives you two ways to create your app.

- Specify the type of application you want, along with basic configuration data.

OR

- Use an existing Mobile SDK app as a template. You still provide the basic configuration data.

You can use forcedroid in interactive mode with command-line prompts, or in script mode with command-line arguments. To see command usage information, type `forcedroid` without arguments.

Forcedroid Project Types

The `forcedroid create` command requires you to specify one of the following project types:

App Type	Architecture	Language
<code>native</code>	Native	Java
<code>native_kotlin</code>	Native	Kotlin

To develop a native Android app in Java, specify `native`.

Using forcedroid create Interactively

To enter application options interactively at a command prompt, type `forcedroid create`. The forcedroid utility then prompts you for each configuration option. For example:

```
$ forcedroid create
Enter your application type (native, native_kotlin): native
Enter your application name: testNative
Enter the package name for your app (com.mycompany.myapp): com.bestapps.android
Enter your organization name (Acme, Inc.): BestApps
Enter output directory for your app (leave empty for the current directory): testNative
```

This command creates a native Java Android app named “testNative” in the `testNative\` subdirectory of your current directory.

Using `forcedroid create` in Script Mode

In script mode, you can use `forcedroid` without interactive prompts. For example, to create a native app written in Java:

```
$ forcedroid create --apptype="native" --appname="package-test"
--packagename="com.acme.mobile_apps"
  --organization="Acme Widgets, Inc." --outputdir="PackageTest"
```

Or, to create a native app written in Kotlin:

```
$ forcedroid create --apptype="native_kotlin" --appname="package-test"
--packagename="com.acme.mobile_apps"
  --organization="Acme Widgets, Inc." --outputdir="PackageTest"
```

Each of these calls creates a native app named “package-test” and places it in the `PackageTest/` subdirectory of your current directory.

Creating an App from a Template

The `forcedroid createWithTemplate` command is identical to `forcedroid create` except that it asks for a GitHub repo URI instead of an app type. You set this URI to point to any repo directory that contains a Mobile SDK app that can be used as a template. Your template app can be any supported Mobile SDK app type. The script changes the template’s identifiers and configuration to match the values you provide for the other parameters.

Here’s command-line usage information for `forcedroid createWithTemplate`:

```
Usage:
forcedroid createWithTemplate
  --templaterepouri=<Template repo URI> (e.g.
https://github.com/forcedotcom/SmartSyncExplorerReactNative) ]
  --appname=<Application Name>
  --packagename=<App Package Identifier> (e.g. com.mycompany.myapp)
  --organization=<Organization Name> (Your company's/organization's name)
  --outputdir=<Output directory> (Leave empty for current directory)]
```

You can use `forcedroid createWithTemplate` interactively or in script mode. For example, here’s a script mode call:

```
forcedroid createWithTemplate
--templaterepouri=https://github.com/forcedotcom/SmartSyncExplorerReactNative
--appname=MyReact
--packagename=com.mycompany.react
--organization="Acme Software, Inc."
--outputdir=testWithTemplate
```

This call creates a React Native app with the same source code and resources as the `SmartSyncExplorerReactNative` sample app. `Forcedroid` places the new app in the `testWithTemplate/` subdirectory of your current directory. It also changes the name “`SmartSyncExplorerReactNative`” to “`MyReact`” throughout the app.

Checking the Forcedroid Version

To find out which version of `forcedroid` you’ve installed, run the following command:

```
forcedroid version
```

Import and Build Your App in Android Studio

1. Open the project in Android Studio.
 - From the Welcome screen, click **Import Project (Eclipse ADT, Gradle, etc.)**.
OR
 - From the File menu, click **File > New > Import Project...**
2. Browse to your project directory and click **OK**.
Android Studio automatically builds your workspace. This process can take several minutes. When the status bar reports “Gradle build successful”, you’re ready to run the project.
3. Click **Run <project_name>**, or press SHIFT+F10. For native projects, the project name is the app name that you specified.
Android Studio launches your app in the emulator or on your connected Android device.

Building and Running Your App from the Command Line

After the command-line returns to the command prompt, the forcedroid script prints instructions for running Android utilities to configure and clean your project. Follow these instructions if you want to build and run your app from the command line.

1. Build the new application.

- **Windows:**

```
cd <your_project_directory>
gradlew assembleDebug
```

- **Mac:**

```
cd <your_project_directory>
./gradlew assembleDebug
```

When the build completes successfully, you can find your signed APK debug file in the project’s `build/outputs/apk` directory.

2. If you’re using an emulator that isn’t running, use the Android AVD Manager to start it. If you’re using a physical device, connect it.
3. Install the APK file on the emulator or device.

- **Windows:**

```
adb install <path_to_your_app>\build\outputs\apk\<app_name>.apk
```

- **Mac:**

```
./adb install <path_to_your_app>/build/outputs/apk/<app_name>.apk
```

If you can’t find your newly installed app, try restarting your emulator or device. For more information, see “Building and Running from the Command Line” at developer.android.com.

How the Forcedroid Script Generates New Apps

- The script downloads templates at runtime from a GitHub repo.

- For the `forcedroid create` command, the script uses the default templates in the [SalesforceMobileSDK-Templates](#) GitHub repo.
- Generated apps use Gradle.
- The script uses npm at runtime to download Mobile SDK libraries. The `settings.gradle` file points to these libraries under `node_modules`.

SEE ALSO:

[Updating Mobile SDK Apps \(5.0 and Later\)](#)

Using a Custom Template to Create Apps

About Mobile SDK Templates

Mobile SDK defines a template for each architecture it supports on iOS and Android. These templates are maintained in the [github.com/forcedotcom/SalesforceMobileSDK-Templates](#) repo. When a customer runs the `forcedroid` or `forceios create` command, the script copies the appropriate built-in template from the repo and transforms this copy into the new app. Apps created this way are basic Mobile SDK apps with little functionality.

Perhaps you'd like to create your own template, with additional functionality, resources, or branding. You can harness the same Mobile SDK mechanism to turn your own app into a template. You can then tell `forcedroid` or `forceios` to use that template instead of its own.

How to Use a Custom Template

In addition to `forcedroid` and `forceios create`, Mobile SDK defines a `createWithTemplate` command. When you run `forcedroid` or `forceios createWithTemplate`, you specify a template app repo instead of an app type, followed by the remaining app creation parameters. The template app repo contains a Mobile SDK app that the script recognizes as a template. To create a new Mobile SDK app from this template, the script copies the template app to a new folder and applies your parameter values to the copied code.

The `template.js` File

To accept your unknown app as a template, `forceios` and `forcedroid` require you to define a `template.js` configuration file. You save this file in the root of your template app repo. This file tells the script how to perform its standard app refactoring tasks—moving files, replacing text, removing and renaming resources. However, you might have even more extensive changes that you want to apply. In such cases, you can also adapt `template.js` to perform customizations beyond the standard scope. For example, if you insert your app name in classes other than the main entry point class, you can use `template.js` to perform those changes.

A `template.js` file contains two parts: a JavaScript “prepare” function for preparing new apps from the template, and a declaration of exports.

The `template.js` Prepare Function

Most of a `template.js` file consists of the “prepare” function. By default, prepare functions use the following signature:

```
function prepare(config, replaceInFiles, moveFile, removeFile)
```

You can rename this function, as long as you remember to specify the updated name in the list of exports. The Mobile SDK script calls the function you export with the following arguments:

- `config`: A dictionary identifying the platform (iOS or Android), app name, package name, organization, and Mobile SDK version.

- `replaceInFiles`: Helper function to replace a string in files.
- `moveFile`: Helper function to move files and directories.
- `removeFile`: Helper function to remove files and directories.

The default prepare function found in Mobile SDK templates replaces strings and moves and removes the files necessary to personalize a standard template app. If you intend to add functionality, place your code within the prepare function. Note, however, that the helper functions passed to your prepare function can only perform the tasks of a standard template app. For custom tasks, you'll have to implement and call your own methods.

Exports Defined in `template.js`

Each `template.js` file defines the following two exports.

appType

Assign one of the following values:

- `'native'`
- `'native_kotlin'` (forcedroid only)
- `'native_swift'` (forceios only)
- `'react_native'`
- `'hybrid_local'`
- `'hybrid_remote'`

prepare

The handle of your prepare function (listed without quotation marks).

Here's an example of the export section of a `template.js` file. This template is for a native app that defines a prepare function named `prepare`:

```
//
// Exports
//
module.exports = {
  appType: 'native',
  prepare: prepare
};
```

In this case, the prepare function's handle is, in fact, "prepare":

```
function prepare(config, replaceInFiles, moveFile, removeFile)
```

Template App Identification in `template.js` (Native and React Native Apps)

For native and React native apps, a template app's prepare function defines an app name, a package name, and an organization or company name. These values identify the template app itself—not a new custom app created from the template. At runtime, the Mobile SDK script uses these values to find the strings to be replaced with the script's input values. Here's an example of the settings for these `iOSNativeTemplate` template app:


```
// Values in template
var templateAppName = 'iOSNativeTemplate';
var templatePackageName = 'com.salesforce.iosnativetemplate';
var templateOrganization = 'iOSNativeTemplateOrganizationName';
```

Examples of `template.js` Files

Mobile SDK defines the following `template.js` files in the github.com/forcedotcom/SalesforceMobileSDK-Templates repo:

- `iOSNativeTemplate/template.js` (forceios only)
- `iOSNativeSwiftTemplate/template.js` (forceios only)
- `ReactNativeTemplate/template.js`
- `HybridLocalTemplate/template.js`
- `HybridRemoteTemplate/template.js`
- `AndroidNativeTemplate/template.js` (forcedroid only)

These templates are the bare bones apps used by `forceios create` and `forcedroid create`. Their level of complexity is intentionally low. For an example of a more complex template repo created from a full-fledged app, check out github.com/forcedotcom/SmartSyncExplorerReactNative.

 **Note:** Always match the script command to the template. Use iOS-specific templates with `forceios createWithTemplate` only, and Android-specific templates with `forcedroid createWithTemplate` only. This restriction doesn't apply to hybrid and React native templates.

Define a Basic `template.js` File

The following steps describe the quickest way to create a basic `template.js` file.

1. Copy a `template.js` file from the github.com/forcedotcom/SalesforceMobileSDK-Templates repo to the root of your custom template app repo. Be sure to choose the template that matches the type of app your template should build.
2. For native or React native apps only, update the app name, package name, and organization to reflect your template app.
3. If necessary, update the `appType` and `prepare` settings in the `module.exports` object, as described earlier. Although this step isn't required for this basic example, you might need it later if you create your own `template.js` files.

Restrictions and Guidelines

A few restrictions apply to custom templates.

- The template app can be any valid Mobile SDK app that targets any supported platform and architecture.
- A primary requirement is that the template repo and your local Mobile SDK repo must be on the same Mobile SDK version. You can use git version tags to sync both repos to a specific earlier version, but doing so isn't recommended.
- Always match the script command to the template. Use iOS-specific templates with `forceios createWithTemplate` only, and Android-specific templates with `forcedroid createWithTemplate` only. This restriction doesn't apply to hybrid and React native templates.

Setting Up Sample Projects in Android Studio

The `SalesforceMobileSDK-Android` GitHub repository contains sample apps you can build and run.

1. If you haven't already done so, clone the `SalesforceMobileSDK-Android` GitHub repository.
 - **Mac:**

```
git clone https://github.com/forcedotcom/SalesforceMobileSDK-Android.git
./install.sh
```

- **Windows:**

```
git clone https://github.com/forcedotcom/SalesforceMobileSDK-Android.git
cscript install.vbs
```

2. Open the project in Android Studio.
 - From the Welcome screen, click **Import Project (Eclipse ADT, Gradle, etc.)**.OR
 - From the File menu, click **File > New > Import Project...**
3. Browse to `<path_to_SalesforceMobileSDK-Android>/native/NativeSampleApps/` or `<path_to_SalesforceMobileSDK-Android>/hybrid/HybridSampleApps/`
4. Select one of the listed sample apps and click **OK**.
5. When the project finishes building, select the sample project in the Select Run/Debug Configurations drop-down menu.
6. Press `SHIFT-F10`.

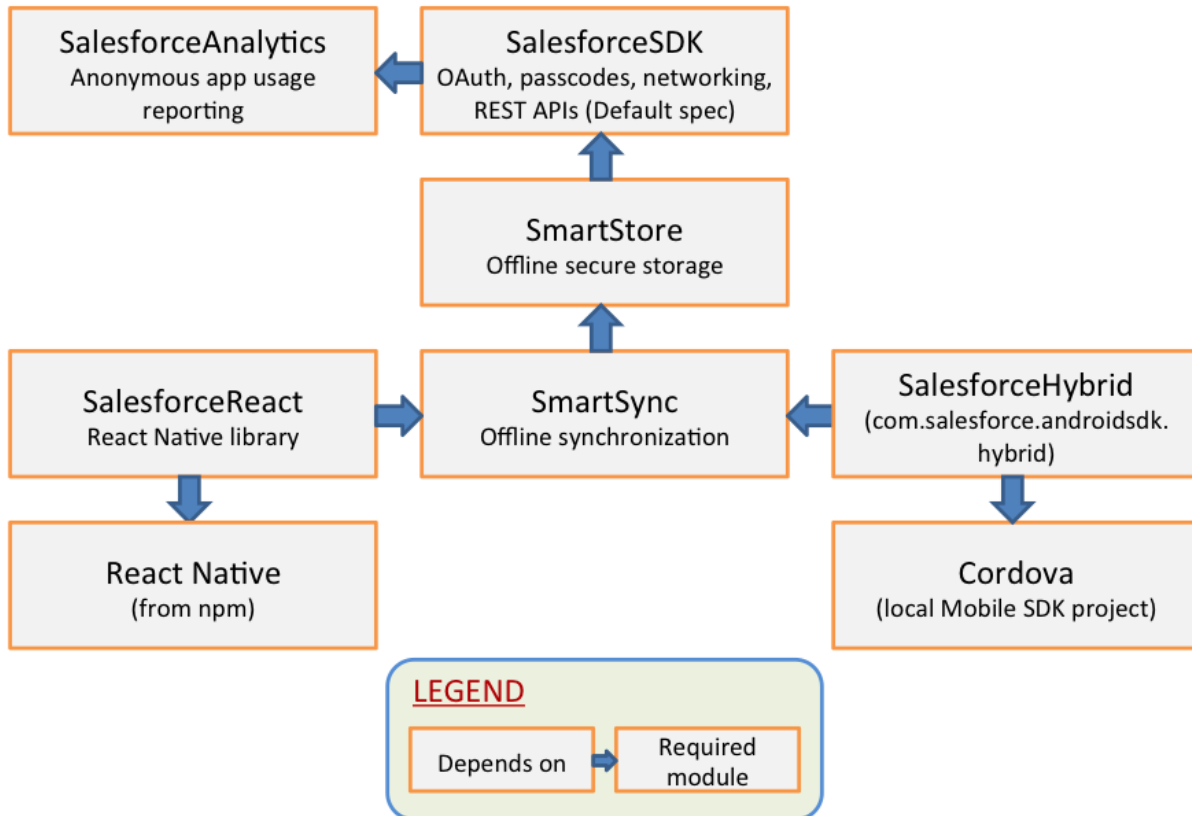
Android Project Files

When you browse a native app in the Project window of Android Studio, you can find these library projects:

- `libs/SalesforceAnalytics`—Analytics project. Reports non-sensitive data on Mobile SDK app usage to Salesforce.
- `libs/SalesforceSDK`—Salesforce Mobile SDK project. Provides support for OAuth2 and REST API calls
- `libs/SmartStore`—SmartStore project. Provides an offline storage solution
- `libs/SmartSync`—SmartSync Data Framework project. Implements offline data synchronization tools

Mobile SDK libraries reference each other in a dependency hierarchy, as shown in the following diagram.

Android Library Hierarchy



Developing a Native Android App

The native Android version of the Salesforce Mobile SDK empowers you to create rich mobile apps that directly use the Android operating system on the host device. To create these apps, you need to understand Java and Android development well enough to write code that uses Mobile SDK native classes.

Android Application Structure

Native Android apps that use the Mobile SDK typically require:

- An application entry point class that extends `android.app.Application`.
- At least one activity that extends `android.app.Activity`.

With Mobile SDK, you:

- Create a stub class that extends `android.app.Application`.
- Implement `onCreate()` in your `Application` stub class to call `SalesforceSDKManager.initNative()`.

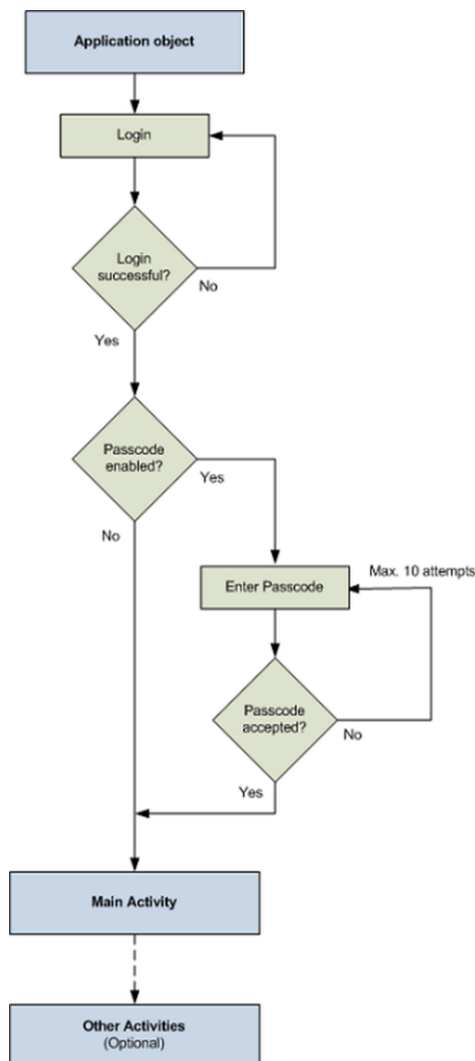
- Extend `SalesforceActivity`, `SalesforceListActivity`, or `SalesforceExpandableListActivity`. This extension is optional but recommended.

The top-level `SalesforceSDKManager` class implements passcode functionality for apps that use passcodes, and fills in the blanks for those that don't. It also sets the stage for login, cleans up after logout, and provides a special event watcher that informs your app when a system-level account is deleted. OAuth protocols are handled automatically with internal classes.

The `SalesforceActivity`, `SalesforceListActivity`, and `SalesforceExpandableListActivity` classes offer free handling of application pause and resume events and related passcode management. We recommend that you extend one of these classes for all activities in your app—not just the main activity. If you use a different base class for an activity, you're responsible for replicating the pause and resume protocols found in `SalesforceActivity`.

Within your activities, you interact with Salesforce objects by calling Salesforce REST APIs. The Mobile SDK provides the `com.salesforce.androidsdk.rest` package to simplify the REST request and response flow.

You define and customize user interface layouts, image sizes, strings, and other resources in XML files. Internally, the SDK uses an `R` class instance to retrieve and manipulate your resources. However, the Mobile SDK makes its resources directly accessible to client apps, so you don't need to write code to manage these features.



Native API Packages

Salesforce Mobile SDK groups native Android APIs into Java packages. For a quick overview of these packages and points of interest within them, see [Android Packages and Classes](#).

Overview of Native Classes

This overview of the Mobile SDK native classes give you a look at pertinent details of each class and a sense of where to find what you need.

SalesforceSDKManager Class

The `SalesforceSDKManager` class is the entry point for all native Android applications that use the Salesforce Mobile SDK. It provides mechanisms for:

- Login and logout
- Passcodes
- Encryption and decryption of user data
- String conversions
- User agent access
- Application termination
- Application cleanup

initNative() Method

During startup, you initialize the singleton `SalesforceSDKManager` object by calling its static `initNative()` method. This method takes four arguments:

Parameter Name	Description
<code>applicationContext</code>	An instance of <code>Context</code> that describes your application's context. In an <code>Application</code> extension class, you can satisfy this parameter by passing a call to <code>getApplicationContext()</code> .
<code>keyImplementation</code>	An instance of your implementation of the <code>KeyInterface</code> Mobile SDK interface. You are required to implement this interface.
<code>mainActivity</code>	The descriptor of the class that displays your main activity. The main activity is the first activity that displays after login.
<code>loginActivity</code>	(Optional) The class descriptor of your custom <code>LoginActivity</code> class.

Here's an example from the `TemplateApp`:

```
SalesforceSDKManager.initNative(getApplicationContext(), new KeyImpl(), MainActivity.class);
```

In this example, `KeyImpl` is the app's implementation of `KeyInterface`. `MainActivity` subclasses `SalesforceActivity` and is designated here as the first activity to be called after login.

logout() Method

The `SalesforceSDKManager.logout()` method clears user data. For example, if you've introduced your own resources that are user-specific, you don't want them to persist into the next user session. SmartStore destroys user data and account information automatically at logout.

Always call the superclass method somewhere in your method override, preferably after doing your own cleanup. Here's a pseudo-code example.

```
@Override
public void logout(Activity frontActivity) {
    // Clean up all persistent and non-persistent app artifacts
    // Call superclass after doing your own cleanup
    super.logout(frontActivity);
}
```

getLoginActivityClass() Method

This method returns the descriptor for the login activity. The login activity defines the `WebView` through which the Salesforce server delivers the login dialog.

getUserAgent() Methods

The Mobile SDK builds a user agent string to publish the app's versioning information at runtime. This user agent takes the following form.

```
SalesforceMobileSDK/<salesforceSDK version> android/<android OS version> appName/appVersion
<Native|Hybrid>
```

Here's a real-world example.

```
SalesforceMobileSDK/2.0 android mobile/4.2 RestExplorer/1.0 Native
```

To retrieve the user agent at runtime, call the `SalesforceSDKManager.getUserAgent()` method.

isHybrid() Method

Imagine that your Mobile SDK app creates libraries that are designed to serve both native and hybrid clients. Internally, the library code switches on the type of app that calls it, but you need some way to determine the app type at runtime. To determine the type of the calling app in code, call the boolean `SalesforceSDKManager.isHybrid()` method. True means hybrid, and false means native.

KeyInterface Interface

KeyInterface is a required interface that you implement and pass into the `SalesforceSDKManager.initNative()` method.

getKey() Method

You are required to return a Base64-encoded encryption key from the `getKey()` abstract method. Use the `Encryptor.hash()` and `Encryptor.isBase64Encoded()` helper methods to generate suitable keys. The Mobile SDK uses your key to encrypt app data and account information.

PasscodeManager Class

The `PasscodeManager` class manages passcode encryption and displays the passcode page as required. It also reads mobile policies and caches them locally. This class is used internally to handle all passcode-related activities with minimal coding on your part. As a rule, apps call only these three `PasscodeManager` methods:

- `public void onPause(Activity ctx)`
- `public boolean onResume(Activity ctx)`
- `public void recordUserInteraction()`

These methods must be called in any native activity class that

- Is in an app that requires a passcode, and
- Does not extend `SalesforceActivity`, `SalesforceListActivity`, or `SalesforceExpandableListActivity`.

You get this implementation for free in any activity that extends `SalesforceActivity`, `SalesforceListActivity`, or `SalesforceExpandableListActivity`.

onPause() and onResume()

These methods handle the passcode dialog box when a user pauses and resumes the app. Call each of these methods in the matching methods of your activity class. For example, `SalesforceActivity.onPause()` calls `PasscodeManager.onPause()`, passing in its own class descriptor as the argument, before calling the superclass.

```
@Override
public void onPause() {
    passcodeManager.onPause(this);
    super.onPause();
}
```

Use the boolean return value of `PasscodeManager.onResume()` method as a condition for resuming other actions. In your app's `onResume()` implementation, be sure to call the superclass method before calling the `PasscodeManager` version. For example:

```
@Override
public void onResume() {
    super.onResume();
    // Bring up passcode screen if needed
    passcodeManager.onResume(this);
}
```

recordUserInteraction()

This method saves the time stamp of the most recent user interaction. Call `PasscodeManager.recordUserInteraction()` in the activity's `onUserInteraction()` method. For example:

```
@Override
public void onUserInteraction() {
    passcodeManager.recordUserInteraction();
}
```


Encryptor class

The `Encryptor` helper class provides static helper methods for encrypting and decrypting strings using the hashes required by the SDK. It's important for native apps to remember that all keys used by the Mobile SDK must be Base64-encoded. No other encryption patterns are accepted. Use the `Encryptor` class when creating hashes to ensure that you use the correct encoding.

Most `Encryptor` methods are for internal use, but apps are free to use this utility as needed. For example, if an app implements its own database, it can use `Encryptor` as a free encryption and decryption tool.

SalesforceActivity, SalesforceListActivity, and SalesforceExpandableListActivity Classes

`SalesforceActivity`, `SalesforceListActivity`, and `SalesforceExpandableListActivity` are the skeletal base classes for native SDK activities. They extend `android.app.Activity`, `android.app.ListActivity`, and `android.app.ExpandableListActivity`, respectively.

Each of these classes provides a free implementation of `PasscodeManager` calls. When possible, it's a good idea to extend one of these classes for all of your app's activities, even if your app doesn't currently use passcodes.

For passcode-protected apps: If any of your activities don't extend `SalesforceActivity`, `SalesforceListActivity`, or `SalesforceExpandableListActivity`, you'll need to add a bit of passcode protocol to each of those activities. See [Using Passcodes](#)

Each of these activity classes contain a single abstract method:

```
public abstract void onResume(RestClient client);
```

This method overloads the `Activity.onResume()` method, which is implemented by the class. The class method calls your overload after it instantiates a `RestClient` instance. Use this method to cache the client that's passed in, and then use that client to perform your REST requests.

UI Classes

Activities in the `com.salesforce.androidsdk.ui` package represent the UI resources that are common to all Mobile SDK apps. You can style, skin, theme, or otherwise customize these resources through XML. With the exceptions of `SalesforceActivity`, `SalesforceListActivity`, and `SalesforceExpandableListActivity`, do not override these activity classes with intentions of replacing the resources at runtime.

ClientManager Class

`ClientManager` works with the Android `AccountManager` class to manage user accounts. More importantly for apps, it provides access to `RestClient` instances through two methods:

- `getRestClient()`
- `peekRestClient()`

The `getRestClient()` method asynchronously creates a `RestClient` instance for querying Salesforce data. Asynchronous in this case means that this method is intended for use on UI threads. The `peekRestClient()` method creates a `RestClient` instance synchronously, for use in non-UI contexts.

Once you get the `RestClient` instance, you can use it to send REST API calls to Salesforce.

RestClient Class

As its name implies, the `RestClient` class is an Android app's liaison to the Salesforce REST API.

You don't explicitly create new instances of the `RestClient` class. Instead, you use the `ClientManager` factory class to obtain a `RestClient` instance. Once you get the `RestClient` instance, you can use it to send REST API calls to Salesforce. The method you call depends on whether you're calling from a UI context. See [ClientManager Class](#).

Use the following `RestClient` methods to send REST requests:

- `sendAsync()` —Call this method if you obtained your `RestClient` instance by calling `ClientManager.getRestClient()`.
- `sendSync()` —Call this method if you obtained your `RestClient` instance by calling `ClientManager.peekRestClient()`.

sendSync() Method

You can choose from three overloads of `RestClient.sendSync()`, depending on the degree of information you can provide for the request.

sendAsync() Method

The `RestClient.sendAsync()` method wraps your `RestRequest` object in a new instance of `WrappedRestRequest`. It then adds the `WrappedRestRequest` object to the request queue and returns that object. If you wish to cancel the request while it's pending, call `cancel()` on the `WrappedRestRequest` object.

getRequestQueue() Method

You can access the underlying `RequestQueue` object by calling `restClient.getRequestQueue()` on your `RestClient` instance. With the `RequestQueue` object you can directly cancel and otherwise manipulate pending requests. For example, you can cancel an entire pending request queue by calling `restClient.getRequestQueue().cancelAll()`. See a code example at [Managing the Request Queue](#).

RestRequest Class

The `RestRequest` class creates and formats REST API requests from the data your app provides. It is implemented by Mobile SDK and serves as a factory for instances of itself.

Don't directly create instances of `RestRequest`. Instead, call an appropriate `RestRequest` static factory method such as `RestRequest.getRequestForCreate()`. To send the request, pass the returned `RestRequest` object to `RestClient.sendAsync()` or `RestClient.sendSync()`. See [Using REST APIs](#).

The `RestRequest` class natively handles the standard Salesforce data operations offered by the Salesforce REST API and SOAP API. Supported operations are:

Operation or Resource	Parameters	Description
Versions	None	Returns Salesforce version metadata
Batch request	API version, flag telling the batch process whether to halt in the case of error, list of subrequests	Returns a <code>RestRequest</code> object containing a batch of up to 25 subrequests specified in a list of <code>RestRequest</code> objects. Each subrequest counts against rate limits.

Operation or Resource	Parameters	Description
Resources	API version	Returns available resources for the specified API version, including resource name and URI
Metadata	API version, object type	Returns the object's complete metadata collection
DescribeGlobal	API version	Returns a list of all available objects in your org and their metadata
Describe	API version, object type	Returns a description of a single object type
Create	API version, object type, map of field names to value objects	Creates a new record in the specified object
CompositeRequest	API version, "all or none" flag that indicates whether to treat all requests as a transactional block in error conditions, hash map of subrequests (values) and their reference ID (keys)	Returns a <code>RestRequest</code> object that you use to execute the composite request. Regardless of the number of subrequests, each composite request counts as one API call. See "Composite" in the REST API Developer Guide .
Retrieve	API version, object type, object ID, list of fields	Retrieves a record by object ID
Search	API version, SOQL query string	Executes the specified SOQL search
SearchResultLayout	API version, list of objects	Returns search result layout information for the specified objects
SearchScopeAndOrder	API version	Returns an ordered list of objects in the default global search scope of a logged-in user
SObject Tree	API version, object type, list of SObject tree nodes	Returns a <code>RestRequest</code> object for an SObject tree based on the given list of SObject tree nodes.
Update	API version, object type, object ID, map of field names to value objects, <code>If-Unmodified-Since</code> date (optional)	Updates an object with the given map. For conditional updates, Mobile SDK supports <code>If-Unmodified-Since</code> requests.
Upsert	API version, object type, external ID field, external ID, map of field names to value objects	Updates or inserts an object from external data, based on whether the external ID currently exists in the external ID field. If you set the name of the external ID field to "Id" and the external ID to null, a new record is created.
Delete	API version, object type, object ID	Deletes the object of the given type with the given ID

To obtain an appropriate `RestRequest` instance, call the `RestRequest` static method that matches the operation you want to perform. Here are the `RestRequest` static methods.

- `getBatchRequest()`
- `getRequestForCreate()`
- `getRequestForDelete()`
- `getRequestForDescribe()`
- `getRequestForDescribeGlobal()`
- `getRequestForMetadata()`
- `getRequestForQuery()`
- `getRequestForResources()`
- `getRequestForRetrieve()`
- `getRequestForSearch()`
- `getRequestForSearchResultLayout()`
- `getRequestForSearchScopeAndOrder()`
- `getRequestForObjectTree()`
- `getRequestForUpdate()`
- `getRequestForUpsert()`
- `getRequestForVersions()`

These methods return a `RestRequest` object which you pass to an instance of `RestClient`. The `RestClient` class provides synchronous and asynchronous methods for sending requests: `sendSync()` and `sendAsync()`. Use `sendAsync()` when you're sending a request from a UI thread. Use `sendSync()` only on non-UI threads, such as a service or a worker thread spawned by an activity.



Example: For sample calls, see

`/libs/test/SalesforceSDKTest/src/com/salesforce/androidsdk/rest/RestRequestTest.java`
at github.com/forcedotcom/SalesforceMobileSDK-Android.

FileRequests Class

The `FileRequests` class provides methods that create file operation requests. Each method returns a new `RestRequest` object. Applications send this object to the Salesforce service to process the request. For example, the following code snippet calls the `ownedFilesList()` method to retrieve a `RestRequest` object. It then sends the `RestRequest` object to the server using `RestClient.sendAsync()`:

```
RestRequest ownedFilesRequest = FileRequests.ownedFilesList(null, null);
RestClient client = this.client;
client.sendAsync(ownedFilesRequest, new AsyncRequestCallback() {
    // Do something with the response
});
```



Note: This example passes null to the first parameter (`userId`). This value tells the `ownedFilesList()` method to use the ID of the context, or logged in, user. The second null, for the `pageNum` parameter, tells the method to fetch the first page of results.

See [Files and Networking](#) for a full description of `FileRequests` methods.

Methods

For a full reference of `FileRequests` methods, see [FileRequests Methods \(Android\)](#). For a full description of the REST request and response bodies, go to **Chatter REST API Resources > Files Resources** at <http://www.salesforce.com/us/developer/docs/chatterapi>.

Method Name	Description
<code>ownedFilesList</code>	Builds a request that fetches a page from the list of files owned by the specified user.
<code>filesInUsersGroups</code>	Builds a request that fetches a page from the list of files owned by the user's groups.
<code>filesSharedWithUser</code>	Builds a request that fetches a page from the list of files that have been shared with the user.
<code>fileDetails</code>	Builds a request that fetches the file details of a particular version of a file.
<code>batchFileDetails</code>	Builds a request that fetches the latest file details of one or more files in a single request.
<code>fileRendition</code>	Builds a request that fetches the a preview/rendition of a particular page of the file (and version).
<code>fileContents</code>	Builds a request that fetches the actual binary file contents of this particular file.
<code>fileShares</code>	Builds a request that fetches a page from the list of entities that this file is shared to.
<code>addFileShare</code>	Builds a request that add a file share for the specified file ID to the specified entity ID.
<code>deleteFileShare</code>	Builds a request that deletes the specified file share.
<code>uploadFile</code>	Builds a request that uploads a new file to the server. Creates a new file.

OkHttp: The Underlying Network Library

Beginning with Mobile SDK 4.2, the Android REST request system uses OkHttp (v3.2.0), an open-source external library from Square Open Source, as its underlying architecture. This library replaces the Google Volley library from past releases. As a result, Mobile SDK no longer defines the `WrappedRestRequest` class.



Example: The following examples show how to perform some common network operations with `OkHttpClient`.

Common Imports

```
import okhttp3.Headers;
import okhttp3.HttpUrl;
import okhttp3.OkHttpClient;
import okhttp3.Call;
import okhttp3.Dispatcher;
```

```
import okhttp3.Request;
import okhttp3.RequestBody;
import okhttp3.Response;
```

Obtain the Current OkHttpClient Handle

To get the handle of the `OkHttpClient` that the current `RestClient` instance is using:

```
OkHttpClient okClient = restClient.getOkHttpClient();
```

Obtain the OkHttpClient Dispatcher

```
Dispatcher dispatcher = restClient.getOkHttpClient().dispatcher();
```

Cancel All Pending Calls

```
Dispatcher dispatcher = restClient.getOkHttpClient().dispatcher();
dispatcher.cancelAll();
```

Store the OkHttpClient Handle to a REST Request

```
Call call = restClient.sendAsync(restRequest, callback);
```

Cancel a Specific REST Request Using a Stored Handle

```
Call call = restClient.sendAsync(restRequest, callback);
...
call.cancel();
```

For more information, see square.github.io/okhttp/.

LoginActivity Class

`LoginActivity` defines the login screen. The login workflow is worth describing because it explains two other classes in the activity package. In the login activity, if you press the Menu button, you get three options: **Clear Cookies, Reload**, and **Pick Server**. **Pick Server** launches an instance of the `ServerPickerActivity` class, which displays **Production, Sandbox**, and **Custom Server** options. When a user chooses **Custom Server**, `ServerPickerActivity` launches an instance of the `CustomServerURLEditor` class. This class displays a popover dialog that lets you type in the name of the custom server.

Other UI Classes

Several other classes in the `ui` package are worth mentioning, although they don't affect your native API development efforts.

The `PasscodeActivity` class provides the UI for the passcode screen. It runs in one of three modes: Create, CreateConfirm, and Check. Create mode is presented the first time a user attempts to log in. It prompts the user to create a passcode. After the user submits the passcode, the screen returns in CreateConfirm mode, asking the user to confirm the new passcode. Thereafter, that user sees the screen in Check mode, which simply requires the user to enter the passcode.

`SalesforceR` is a deprecated class. This class was required when the Mobile SDK was delivered in JAR format, to allow developers to edit resources in the binary file. Now that the Mobile SDK is available as a library project, `SalesforceR` is not needed. Instead, you can override resources in the SDK with your own.

`SalesforceDroidGapActivity` and `SalesforceGapViewClient` are used only in hybrid apps.

UpgradeManager Class

`UpgradeManager` provides a mechanism for silently upgrading the SDK version installed on a device. This class stores the SDK version information in a shared preferences file on the device. To perform an upgrade, `UpgradeManager` queries the current `SalesforceSDKManager` instance for its SDK version and compares its version to the device's version information. If an upgrade is necessary—for example, if there are changes to a database schema or to encryption patterns—`UpgradeManager` can take the necessary steps to upgrade SDK components on the device. This class is intended for future use. Its implementation in Mobile SDK 2.0 simply stores and compares the version string.

Utility Classes

Though most of the classes in the `util` package are for internal use, several of them can also benefit third-party developers.

Class	Description
<code>EventsObservable</code>	See the source code for a list of all events that the Mobile SDK for Android propagates.
<code>EventsObserver</code>	Implement this interface to eavesdrop on any event. This functionality is useful if you're doing something special when certain types of events occur.
<code>UriFragmentParser</code>	You can directly call this static helper class. It parses a given URI, breaks its parameters into a series of key/value pairs, and returns them in a map.

ForcePlugin Class

All classes in the `com.salesforce.androidsdk.phonegap` package are intended for hybrid app support. Most of these classes implement Javascript plug-ins that access native code. The base class for these Mobile SDK plug-ins is `ForcePlugin`. If you want to implement your own Javascript plug-in in a Mobile SDK app, extend `ForcePlugin`, and implement the abstract `execute()` function.

`ForcePlugin` extends `CordovaPlugin`, which works with the Javascript framework to let you create a Javascript module that can call into native functions. PhoneGap provides the bridge on both sides: you create a native plug-in with `CordovaPlugin` and then you create a Javascript file that mirrors it. Cordova calls the plug-in's `execute()` function when a script calls one of the plug-in's Javascript functions.

Using Passcodes

User data in Mobile SDK apps is secured by encryption. The administrator of your Salesforce org has the option of requiring the user to enter a passcode for connected apps. In this case, your app uses that passcode as an encryption hash key. If the Salesforce administrator doesn't require a passcode, you're responsible for providing your own key.

Salesforce Mobile SDK does all the work of implementing the passcode workflow. It calls the passcode manager to obtain the user input, and then combines the passcode with prefix and suffix strings into a hash for encrypting the user's data. It also handles decrypting and re-encrypting data when the passcode changes. If an organization changes its passcode requirement, the Mobile SDK detects the change at the next login and reacts accordingly. If you choose to use a passcode, your only responsibility is to implement the `SalesforceSDKManager.getKey()` method. All your implementation has to do in this case is return a Base64-encoded string that can be used as an encryption key.


Internally, passcodes are stored as Base64-encoded strings. The SDK uses the `Encryptor` class for creating hashes from passcodes. You should also use this class to generate a hash when you provide a key instead of a passcode. Passcodes and keys are used to encrypt and decrypt SmartStore data as well as OAuth tokens, user identification strings, and related security information. To see exactly what security data is encrypted with passcodes, browse the `ClientManager.changePasscode()` method.

Mobile policy defines certain passcode attributes, such as the length of the passcode and the timing of the passcode dialog. Mobile policy files for connected apps live on the Salesforce server. If a user enters an incorrect passcode more than ten consecutive times, the user is logged out. The Mobile SDK provides feedback when the user enters an incorrect passcode, apprising the user of how many more attempts are allowed. Before the screen is locked, the `PasscodeManager` class stores a reference to the front activity so that the same activity can be resumed if the screen is unlocked.

If you define activities that don't extend `SalesforceActivity`, `SalesforceListActivity`, or `SalesforceExpandableListActivity` in a passcode-protected app, be sure to call these three `PasscodeManager` methods from each of those activity classes:

- `PasscodeManager.onPause()`
- `PasscodeManager.onResume(Activity)`
- `PasscodeManager.recordUserInteraction()`

Call `onPause()` and `onResume()` from your activity's methods of the same name. Call `recordUserInteraction()` from your activity's `onUserInteraction()` method. Pass your activity class descriptor to `onResume()`. These calls ensure that your app enforces passcode security during these events. See [PasscodeManager Class](#).

 **Note:** The `SalesforceActivity`, `SalesforceListActivity`, and `SalesforceExpandableListActivity` classes implement these mandatory methods for you for free. Whenever possible, base your activity classes on one of these classes.

Resource Handling

Salesforce Mobile SDK resources are configured in XML files that reside in the `libs/SalesforceSDK/res` folder. You can customize many of these resources by making changes in this folder.

Resources in the `/res` folder are grouped into categories, including:

- Drawables—Backgrounds, drop shadows, image resources such as PNG files
- Layouts—Screen configuration for any visible component, such as the passcode screen
- Values—Strings, colors, and dimensions that are used by the SDK

Two additional resource types are mostly for internal use:

- Menus
- XML

Drawable, layout, and value resources are subcategorized into folders that correspond to a variety of form factors. These categories handle different device types and screen resolutions. Each category is defined in its folder name, which allows the resource file name to remain the same for all versions. For example, if the developer provides various sizes of an icon named `icon1.png`, for example, the smart phone version goes in one folder, the low-end phone version goes in another folder, while the tablet icon goes into a third folder. In each folder, the file name is `icon1.png`. The folder names use the same root but with different suffixes.

The following table describes the folder names and suffixes.

Folder name	Usage
<code>drawable</code>	Generic versions of drawable resources
<code>drawable-hdpi</code>	High resolution; for most smart phones

Folder name	Usage
<code>drawable-ldpi</code>	Low resolution; for low-end feature phones
<code>drawable-mdpi</code>	Medium resolution; for low-end smart phones
<code>drawable-xhdpi</code>	Resources for extra high-density screens (~320dpi)
<code>drawable-xlarge</code>	For tablet screens in landscape orientation
<code>drawable-xlarge-port</code>	For tablet screens in portrait orientation
<code>drawable-xxhdpi-port</code>	Resources for extra-extra high density screens (~480 dpi)
<code>layout</code>	Generic versions of layouts
<code>menus</code>	Add Connection dialog and login menu for phones
<code>values</code>	Generic styles and values
<code>xml</code>	General app configuration

The compiler looks for a resource in the folder whose name matches the target device configuration. If the requested resource isn't in the expected folder (for example, if the target device is a tablet, but the compiler can't find the requested icon in the `drawables-xlarge` or `drawables-xlarge-port` folder) the compiler looks for the icon file in the generic `drawable` folder.

Layouts

Layouts in the Mobile SDK describe the screen resources that all apps use. For example, layouts configure dialog boxes that handle logins and passcodes.

The name of an XML node in a layout indicates the type of control it describes. For example, the following `EditText` node from `res/layout/sf__passcode.xml` describes a text edit control:

```
<EditText android:id="@+id/sf__passcode_text"
    style="@style/SalesforceSDK.Passcode.Text.Entry"
    android:inputType="textPassword" />
```

In this case, the `EditText` control uses an `android:inputType` attribute. Its value, "textPassword", tells the operating system to obfuscate the typed input.

The style attribute references a global style defined elsewhere in the resources. Instead of specifying style attributes in place, you define styles defined in a central file, and then reference the attribute anywhere it's needed. The value `@style/SalesforceSDK.Passcode.Text.Entry` refers to an SDK-owned style defined in `res/values/sf__styles.xml`. Here's the style definition.

```
<style name="SalesforceSDK.Passcode.Text.Entry">
    <item name="android:layout_width">wrap_content</item>
    <item name="android:lines">1</item>
    <item name="android:maxLength">10</item>
    <item name="android:minWidth">
        @dimen/sf__passcode_text_min_width</item>
    <item name="android:imeOptions">actionGo</item>
</style>
```

You can override any style attribute with a reference to one of your own styles. Rather than changing `sf__styles.xml`, define your styles in a different file, such as `xyzcorp__styles.xml`. Place your file in the `res/values` for generic device styles, or the `res/values-xlarge` folder for tablet devices.

Values

The `res/values` and `res/values-xlarge` folders contain definitions of style components, such as `dimens` and `colors`, string resources, and custom styles. File names in this folder indicate the type of resource or style component. To provide your own values, create new files in the same folders using a file name prefix that reflects your own company or project. For example, if your developer prefix is `XYZ`, you can override `sf__styles.xml` in a new file named `XYZ__styles.xml`.

File name	Contains
<code>sf__colors.xml</code>	Colors referenced by Mobile SDK styles
<code>sf__dimens.xml</code>	Dimensions referenced by Mobile SDK styles
<code>sf__strings.xml</code>	Strings referenced by Mobile SDK styles; error messages can be overridden
<code>sf__styles.xml</code>	Visual styles used by the Mobile SDK
<code>strings.xml</code>	App-defined strings

You can override the values in `strings.xml`. However, if you used the `create_native` script to create your app, strings in `strings.xml` already reflect appropriate values.

Other Resources

Two other folders contain Mobile SDK resources.

- `res/menu` defines menus used internally. If your app defines new menus, add them as resources here in new files.
- `res/xml` includes one file that you must edit: `servers.xml`. In this file, change the default Production and Sandbox servers to the login servers for your org. The other files in this folder are for internal use. The `authenticator.xml` file configures the account authentication resource, and the `config.xml` file defines PhoneGap plug-ins for hybrid apps.

SEE ALSO:

[Android Resources](#)

Using REST APIs

To query, describe, create, or update data from a Salesforce org, Mobile SDK apps call Salesforce REST APIs. Salesforce REST APIs honor SOQL and SOSL strings and can accept and return data in either JSON or XML format. Mobile SDK wraps REST requests in methods that handle the low-level HTTP configuration for you. For other Salesforce APIs, Mobile SDK provides methods for manually creating a custom request object and receiving the response. You can even use Mobile SDK REST API methods to make unauthenticated and external API calls.

Salesforce supports an ever-growing variety of REST APIs. For an overview of our offerings, see [Which API Do I Use?](#) in Salesforce Help. For information on REST request and response formats, see [REST API Developer Guide](#).

Coding REST Interactions

With Android native apps, you do minimal coding to access Salesforce data through REST calls. The classes in the `com.salesforce.androidsdk.rest` package initialize the communication channels and encapsulate low-level HTTP plumbing. These classes, all of which are implemented by Mobile SDK, include:

- `ClientManager`—Serves as a factory for `RestClient` instances. It also handles account logins and handshakes with the Salesforce server.
- `RestClient`—Handles protocol for sending REST API requests to the Salesforce server.
Don't directly create instances of `RestClient`. Instead, call the `ClientManager.getRestClient()` method.
- `RestRequest`—Formats REST API requests from the data your app provides. Also serves as a factory for instances of itself.
Don't directly create instances of `RestRequest`. Instead, call an appropriate `RestRequest` static getter function such as `RestRequest.getRequestForCreate()`.
- `RestResponse`—Formats the response content in the requested format, returns the formatted response to your app, and closes the content stream. The `RestRequest` class creates instances of `RestResponse` and returns them to your app through your implementation of the `RestClient.AsyncRequestCallback` interface.

Here's the basic procedure for using the REST classes on a UI thread:

1. Create an instance of `ClientManager`.
 - a. Use the `SalesforceSDKManager.getInstance().getAccountType()` method to obtain the value to pass as the second argument of the `ClientManager` constructor.
 - b. For the `LoginOptions` parameter of the `ClientManager` constructor, call `SalesforceSDKManager.getInstance().getLoginOptions()`.
2. Implement the `ClientManager.RestClientCallback` interface.
3. Call `ClientManager.getRestClient()` to obtain a `RestClient` instance, passing it an instance of your `RestClientCallback` implementation. This code from the `native/SampleApps/RestExplorer` sample app implements and instantiates `RestClientCallback` inline.

```
String accountType =
    SalesforceSDKManager.getInstance().getAccountType();

LoginOptions loginOptions =
    SalesforceSDKManager.getInstance().getLoginOptions();
// Get a rest client
new ClientManager(this, accountType, loginOptions,
    SalesforceSDKManager.getInstance().
    shouldLogoutWhenTokenRevoked()).
    getRestClient(this, new RestClientCallback() {
        @Override
        public void
        authenticatedRestClient(RestClient client) {
            if (client == null) {
                SalesforceSDKManager.getInstance().
                    logout(ExplorerActivity.this);
                return;
            }
            // Cache the returned client
            ExplorerActivity.this.client = client;
        }
    });
```

```

    }
}
);

```

4. Call a static `RestRequest ()` getter method to obtain the appropriate `RestRequest` object for your needs. For example, to get a description of a Salesforce object:

```
request = RestRequest.getRequestForDescribe(apiVersion, objectType);
```

5. Pass the `RestRequest` object you obtained in the previous step to `RestClient.sendAsync ()` or `RestClient.sendSync ()`. If you're on a UI thread and therefore calling `sendAsync ()`:
 - a. Implement the `ClientManager.AsyncRequestCallback` interface.
 - b. Pass an instance of your implementation to the `sendAsync ()` method.
 - c. Receive the formatted response through your `ASyncRequestCallback.onSuccess ()` method. Before using the response, double-check that it's valid by calling `RestResponse.isSuccess ()`.

The following code implements and instantiates `AsyncRequestCallback` inline.

```

private void sendFromUiThread(RestRequest restRequest) {
    client.sendAsync(restRequest, new AsyncRequestCallback() {
        private long start = System.nanoTime();
        @Override
        public void onSuccess(RestRequest request, RestResponse result) {
            // Network component doesn't report app layer status.
            // Use the Mobile SDK RestResponse.isSuccess() method to check
            // whether the REST request itself succeeded.
            if (result.isSuccess()) {
                try {
                    // Do something with the result
                }
                catch (Exception e) {
                    printException(e);
                }
                EventsObservable.get().notifyEvent(EventType.RenditionComplete);
            }
        }
        @Override
        public void onError(Exception exception)
        {
            printException(exception);
            EventsObservable.get().notifyEvent(EventType.RenditionComplete);
        }
    });
}

```

If you're calling the `sendSync ()` method from a service, use the same procedure with the following changes.


1. To obtain a `RestClient` instance call `ClientManager.peekRestClient ()` instead of `ClientManager.getRestClient ()`.
2. Retrieve your formatted REST response from the `sendSync ()` method's return value.

Unauthenticated REST Requests

In certain cases, some applications must make REST calls before the user becomes authenticated. In other cases, the application must access services outside of Salesforce that don't require Salesforce authentication. To implement such requirements, use a special `RestClient` instance that doesn't require an authentication token.

To obtain an unauthenticated `RestClient` on Android, use one of the following `ClientManager` factory methods:

```
/**
 * Method to created an unauthenticated RestClient asynchronously
 * @param activityContext
 * @param restClientCallback
 */
public void getUnauthenticatedRestClient(Activity activityContext, RestClientCallback
restClientCallback);
/**
 * Method to create an unauthenticated RestClient.
 * @return
 */
public RestClient peekUnauthenticatedRestClient();
```

 **Note:** A REST request sent through either of these `RestClient` objects requires a full path URL. Mobile SDK doesn't prepend an instance URL to unauthenticated endpoints.

 **Example:**

```
RestClient unauthenticatedRestClient = clientManager.peekUnauthenticatedRestClient();
RestRequest request = new RestRequest(RestMethod.GET,
    "https://api.spotify.com/v1/search?q=James%20Brown&type=artist", null);
RestResponse response = unauthenticatedRestClient.sendSync(request);
```

Deferring Login in Native Android Apps

When you create Mobile SDK apps using forcedroid, forcedroid bases your project on a template app that gives you lots of free standard functionality. For example, you don't have to implement authentication—login and passcode handling are built into your launcher activity. This design works well for most apps, and the free code is a big time-saver. However, after you've created your forcedroid app you might find reasons for deferring Salesforce authentication until some point after the launcher activity runs.

You can implement deferred authentication easily while keeping the template app's built-in functionality. Here are the guidelines and caveats:

- Replace the launcher activity (named `MainActivity` in the template app) with an activity that does *not* extend any of the following Mobile SDK activities:
 - `SalesforceActivity`
 - `SalesforceListActivity`
 - `SalesforceExpandableListActivity`


This rule likewise applies to any other activities that run before you authenticate with Salesforce.

- Do not call the `peekRestClient()` or the `getRestClient()` `ClientManager` method from your launcher activity or from any other pre-authentication activities.
- Do not change the `initNative()` call in the `TemplateApp` class. It must point to the activity class that launches after authentication (`MainActivity` in the template app).

- When you're ready to authenticate with Salesforce, launch the `MainActivity` class.

The following example shows how to place a non-Salesforce activity ahead of Salesforce authentication. You can of course expand and embellish this example with additional pre-authentication activities, observing the preceding guidelines and caveats.

1. Create an XML layout for the pre-authentication landing page of your application. For example, the following layout file, `launcher.xml`, contains only a button that triggers the login flow.

 **Note:** The following example uses a string resource, `@string/login`, that is defined in the `res/strings.xml` file as follows:

```
<string name="login">Login</string>
```

```
<?xml version="1.0" encoding="utf-8"?>

<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:orientation="vertical"
    android:background="@android:color/white"
    android:id="@+id/root">

    <Button android:id="@+id/login_button"
        android:layout_width="80dp"
        android:layout_height="60dp"
        android:text="@string/login"
        android:textColor="@android:color/black"
        android:textStyle="bold"
        android:gravity="center"
        android:layout_gravity="center"
        android:textSize="18sp"
        android:onClick="onLoginClicked" />

</LinearLayout>
```

2. Create a landing screen activity. For example, here's a landing screen activity named `LauncherActivity`. This screen simply inflates the XML layout defined in `launcher.xml`. This class must not extend any of the Salesforce activities or call `peekRestClient()` or `getRestClient()`, since these calls trigger the authentication flow. When the user taps the login button, the `onLoginClicked()` button handler launches `MainActivity`, and login ensues.

```
package com.salesforce.samples.smartsyncexplorer.ui;

import com.salesforce.samples.smartsyncexplorer.R;

import android.app.Activity;
import android.content.Intent;
import android.os.Bundle;
import android.view.View;

public class LauncherActivity extends Activity {
    @Override
    public void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.launcher);
    }
}
```

```

/**
 * Callback received when the 'Delete' button is clicked.
 *
 * @param v View that was clicked.
 */
public void onLoginClicked(View v) {
    /**
     * TODO: Add logic here to determine if we are already
     * logged in, and skip this screen by calling
     * 'finish()', if that is the case.
     */
    final Intent mainIntent =
        new Intent(this, MainActivity.class);
    mainIntent.addCategory(Intent.CATEGORY_DEFAULT);
    startActivity(mainIntent);
    finish();
}
}

```

3. Modify the `AndroidManifest.xml` to specify `LauncherActivity` as the activity to be launched when the app first starts.

```

<!-- Launcher screen -->
<activity android:name=
    "com.salesforce.samples.smartsyncexplorer.ui.LauncherActivity"
    android:label="@string/app_name"
    android:theme="@style/SalesforceSDK.ActionBarTheme">
    <intent-filter>
        <action android:name="android.intent.action.MAIN" />
        <category
            android:name="android.intent.category.LAUNCHER" />
    </intent-filter>
</activity>

<!-- Main screen -->
<activity android:name=
    "com.salesforce.samples.smartsyncexplorer.ui.MainActivity"
    android:label="@string/app_name"
    android:theme="@style/SalesforceSDK.ActionBarTheme">
    <intent-filter>
        <category android:name=
            "android.intent.category.DEFAULT" />
    </intent-filter>
</activity>

```

When you start the application, the `LauncherActivity` screen appears. Click the login button to initiate the Salesforce authentication flow. After authentication completes, the app launches `MainActivity`.

Android Template App: Deep Dive

The `TemplateApp` sample project implements everything you need to create a basic native Android app. Because it's a "bare bones" example, it also serves as the template that the Mobile SDK's `create_native` ant script uses to set up new native Android projects. By studying this app, you can gain a quick understanding of native apps built with Mobile SDK for Android.

The `TemplateApp` project defines two classes: `TemplateApp` and `MainActivity`.

- The `TemplateApp` class extends `Application` and calls `SalesforceSDKManager.initNative()` in its `onCreate()` override.
- The `MainActivity` class subclasses the `SalesforceActivity` class.

These two classes are all you need to create a running mobile app that displays a login screen and a home screen.

Despite containing only about 200 lines of code, `TemplateApp` is more than just a “Hello World” example. In its main activity, it retrieves Salesforce data through REST requests and displays the results on a mobile page. You can extend `TemplateApp` by adding more activities, calling other components, and doing anything else that the Android operating system, the device, and security restraints allow.

TemplateApp Class

Every native Android app requires an instance of `android.app.Application`. The `TemplateApp` class accomplishes two main tasks:

- Calls `initNative()` to initialize the app
- Passes in the app’s implementation of `KeyInterface`

Here’s the entire class:

```
package com.salesforce.samples.templateapp;

import android.app.Application;

import com.salesforce.androidsdk.app.SalesforceSDKManager;

/**
 * Application class for our application.
 */
public class TemplateApp extends Application {

    @Override
    public void onCreate() {
        super.onCreate();
        SalesforceSDKManager.initNative(getApplicationContext(),
            new KeyImpl(), MainActivity.class);
    }
}
```

Most native Android apps can use similar code. For this small amount of work, your app gets free implementations of passcode and login/logout mechanisms, plus a few other benefits. See [SalesforceActivity](#), [SalesforceListActivity](#), and [SalesforceExpandableListActivity Classes](#).

MainActivity Class

In Mobile SDK apps, the main activity begins immediately after the user logs in. Once the main activity is running, it can launch other activities, which in turn can launch sub-activities. When the application exits, it does so by terminating the main activity. All other activities terminate in a cascade from within the main activity.

The template app’s `MainActivity` class extends the abstract Mobile SDK activity class, `com.salesforce.androidsdk.ui.SalesforceActivity`. This superclass gives you free implementations of mandatory passcode and login protocols. If you use another base activity class instead, you’re responsible for implementing those protocols. `MainActivity` initializes the app’s UI and implements its UI buttons.

The `MainActivity` UI includes a list view that can show the user's Salesforce Contacts or Accounts. When the user clicks one of these buttons, the `MainActivity` object performs a couple of basic queries to populate the view. For example, to fetch the user's Contacts from Salesforce, the `onFetchContactsClick()` message handler sends a simple SOQL query:

```
public void onFetchContactsClick(View v) throws UnsupportedOperationException {
    sendRequest("SELECT Name FROM Contact");
}
```

Internally, the private `sendRequest()` method formulates a server request using the `RestRequest` class and the given SOQL string:

```
private void sendRequest(String soql) throws UnsupportedOperationException
{
    RestRequest restRequest =
        RestRequest.getRequestForQuery(
            getString(R.string.api_version), soql);
    client.sendAsync(restRequest, new AsyncRequestCallback()
    {
        @Override
        public void onSuccess(RestRequest request,
            RestResponse result) {
            // Network component doesn't report app layer status.
            // Use the Mobile SDK RestResponse.isSuccess() method to check
            // whether the REST request itself succeeded.
            if (result.isSuccess()) {
                try {
                    listAdapter.clear();
                    JSONArray records =
                        result.asJSONObject().getJSONArray("records");
                    for (int i = 0; i < records.length(); i++) {
                        listAdapter.add(
                            records.getJSONObject(i).getString("Name"));
                    }
                } catch (Exception e) {
                    onError(e);
                }
            }
        }
        @Override
        public void onError(Exception exception)
        {
            Toast.makeText(MainActivity.this,
                MainActivity.this.getString(
                    SalesforceSDKManager.getInstance().
                        getSalesforceR().stringGenericError(),
                    exception.toString()),
                Toast.LENGTH_LONG).show();
        }
    });
}
```

This method uses an instance of the `com.salesforce.androidsdk.rest.RestClient` class, `client`, to process its SOQL query. The `RestClient` class relies on two helper classes—`RestRequest` and `RestResponse`—to send the query and process its result. The `sendRequest()` method calls `RestClient.sendAsync()` to process the SOQL query asynchronously.

To support the `sendAsync()` call, the `sendRequest()` method constructs an instance of `com.salesforce.androidsdk.rest.RestRequest`, passing it the API version and the SOQL query string. The resulting object is the first argument for `sendAsync()`. The second argument is a callback object. When `sendAsync()` has finished running the query, it sends the results to this callback object. If the query is successful, the callback object uses the query results to populate a UI list control. If the query fails, the callback object displays a toast popup to display the error message.

Overriding the Default API Version

For Android, Mobile SDK core libraries define a hard-coded default API version. This value matches the Salesforce API version on the date of the current Mobile SDK release. You can override the default version in your app by setting `api_version` in the `strings.xml` resource file.

If you override the default version, be careful when calling methods such as `RestRequest.getRequestForQuery()` that require an API version argument. It's tempting to pass `ApiVersionStrings.getVersionNumber()`, but in some cases this call returns unexpected values. Here are some tips.

- To return either your overridden version or the default value if no override exists, set the `context` argument to a valid subclass of `Context`. High-level subclasses include extensions of `Activity`, `Service`, and `Application`.
- If you're calling `getVersionNumber()` from a class that isn't a `Context` subclass, you can pass `SalesforceSDKManager.getInstance().getAppContext()` as the `context` argument.
- If you set the `context` argument to null, `getVersionNumber()` always returns the hard-coded default value.

Using an Anonymous Class in Java

In the call to `RestClient.sendAsync()` the code instantiates a new `AsyncRequestCallback` object as its second argument. However, the `AsyncRequestCallback` constructor is followed by a code block that overrides a couple of methods: `onSuccess()` and `onError()`. If that code looks strange to you, take a moment to see what's happening.

`AsyncRequestCallback` is defined as an interface, so it has no implementation. In order to instantiate it, the code implements the two `AsyncRequestCallback` methods inline to create an anonymous class object. This technique gives `TemplateApp` a `sendAsync()` implementation of its own that can never be called from another object and doesn't litter the API landscape with a group of specialized class names.

TemplateApp Manifest

A look at the `AndroidManifest.xml` file in the `TemplateApp` project reveals the components required for Mobile SDK native Android apps. The only required component is the activity named `.MainActivity`. This component represents the first activity that is called after login. The class by this name is defined in the project. Here's an example from `AndroidManifest.xml`:

Name	Type	Description
<code>MainActivity</code>	Activity	The first activity to be called after login. The name and the class are defined in the project.

Because any app created by forcedroid is based on the `TemplateApp` project, the `MainActivity` component is already included in its manifest. As with any Android app, you can add other components, such as custom activities or services, by editing the manifest in Android Studio.

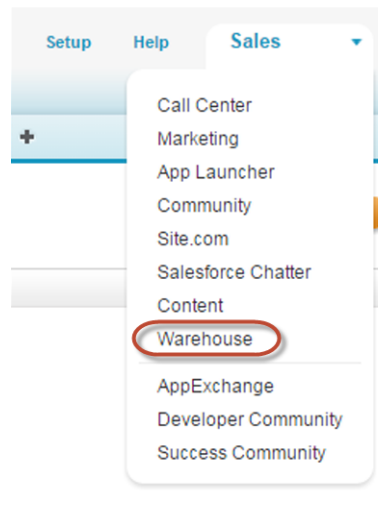
Tutorial: Creating a Native Android Warehouse Application

Apply your knowledge of the native Android SDK by building a mobile inventory management app. This tutorial demonstrates a simple master-detail architecture that defines two activities. It demonstrates Mobile SDK application setup, use of REST API wrapper classes, and Android SDK integration.

Prerequisites

This tutorial requires the following tools and packages.

- This tutorial uses a Warehouse app that contains a basic inventory database. You'll need to install this app in a Developer Edition org. If you install it in an existing DE org, be sure to delete any existing Warehouse components you've made before you install.
 1. Click the installation URL link: <http://goo.gl/1FYg90>
 2. If you aren't logged in, enter the username and password of your DE org.
 3. Select an appropriate level of visibility for your organization.
 4. Click **Install**.
 5. Click **Done**.
 6. Once the installation completes, you can select the **Warehouse** app from the app picker in the upper right corner.



7. To create data, click the **Data** tab.
 8. Click the **Create Data** button.
- Install the latest versions of:
 - Java JDK 1.8.x or later—www.oracle.com/downloads.
 - forcedroid npm package, version 6.0.
 - Android Studio 3.0 or later—developer.android.com/sdk.
 - Android SDK and Android SDK Tools—Install from within Android Studio.
 1. In the Android Studio menu, click **Tools > Android > SDK Manager**.
 2. Click the **SDK Platforms** tab.

3. Install at least the following required SDK levels and all intervening levels:
 - Minimum API: Android KitKat (API 21)
 - Target API: Android Oreo (API 27)
 4. Click the **SDK Tools** tab.
 5. Install the latest Android SDK Tools version.
- Android Virtual Device (AVD)—Install from within Android Studio.
 1. In the Android Studio menu, click **Tools > Android > AVD Manager**.
 2. Click **Create Virtual Device...**
 3. Install at least one AVD that targets Android KitKat (API 21) and above. To learn how to set up an AVD in Android Studio, follow the instructions at developer.android.com/guide/developing/devices/managing-avds.html.
 - Install the Salesforce Mobile SDK using npm:
 1. If you've already successfully installed Node.js and npm, skip to step 4.
 2. Install Node.js on your system. The Node.js installer automatically installs npm.
 - i. Download Node.js from www.nodejs.org/download.
 - ii. Run the downloaded installer to install Node.js and npm. Accept all prompts asking for permission to install.
 3. At the Terminal window, type `npm` and press *Return* to make sure your installation was successful. If you don't see a page of usage information, revisit Step 2 to find out what's missing.
 4. At the Terminal window, type `sudo npm install forcedroid -g`
 This command uses the forcedroid package to install the Mobile SDK globally. With the `-g` option, you can run `npm install` from any directory. The npm utility installs the package under `/usr/local/lib/node_modules`, and links binary modules in `/usr/local/bin`. Most users need the `sudo` option because they lack read-write permissions in `/usr/local`.

Create a Native Android App


In this tutorial, you learn how to get started with the Salesforce Mobile SDK, including how to install the SDK and a quick tour of the native project template using your DE org. Subsequent tutorials show you how to modify the template app and make it work with the Warehouse schema.

Step 1: Create a Connected App

A connected app authorizes your mobile app to communicate securely with Lightning Platform. It's required for accessing Salesforce services and Lightning Platform APIs. An interesting thing to know about connected apps is that they allow access to any valid Salesforce org—not just the org where the connected app is defined.

1. In your Developer Edition org, from Setup, enter `Apps` in the `Quick Find` box, then select **Apps**.
2. Under **Connected Apps**, click **New** to bring up the **New Connected App** page.
3. Under **Basic Information**, fill out the form as follows:
 - **Connected App Name:** `My Native Android App`
 - **API Name:** accept the suggested value
 - **Contact Email:** enter your email address

4. Under OAuth Settings, check the **Enable OAuth Settings** checkbox.
5. Set **Callback URL** to: `mysampleapp://auth/success`
6. Under **Available OAuth Scopes**, check “Access and manage your data (api)” and “Perform requests on your behalf at any time (refresh_token)”.
7. Click **Add**, and then click **Save**.

 **Important:** Here are some important points to consider about your connected app.

- Copy the callback URL and consumer key. You use these values to set up your native app.
- Mobile SDK apps do not use the consumer secret, so you can ignore this value.
- Changes to a connected app take several minutes to go into effect.


Step 2: Create a Native Android Project

To create a new Mobile SDK project, use the `forcedroid` utility again in the Terminal window.

1. Change to the directory in which you want to create your project.
2. To create an Android project, type `forcedroid create`.
The `forcedroid` utility prompts you for each configuration value.
3. For application type, enter `native`.
4. For application name, enter `Warehouse`.
5. For output directory, enter `tutorial/AndroidNative`.
6. For package name, enter `com.samples.warehouse`.

Step 3: Run the New Android App

Now that you’ve successfully created an Android app, build and run it to verify your configuration.

 **Note:** If you run into problems, first check the Android SDK Manager to make sure that you’ve got the latest Android SDK, build tools, and development tools. You can find the Android SDK Manager under **Tools > Android > SDK Manager** in Android Studio. After you’ve installed anything that’s missing, close and restart Android SDK Manager to make sure you’re up-to-date.

Importing and Building Your App in Android Studio

The `forcedroid` script prints instructions for running the new app in the Android Studio editor.

1. Launch Android Studio and select **Import project (Eclipse ADT, Gradle, etc.)** from the Welcome screen.
2. Select the `tutorial/AndroidNative` folder and click **OK**.
3. If you see the message “Unregistered VCS roots detected”, click **Add roots**.

Android Studio automatically builds your workspace. This process can take several minutes. When the status bar reports a successful build, you’re ready to run the app.

1. From the target drop-down menu, select **Warehouse**.
2. Click **Run** or press `SHIFT+F10`.

Android Studio launches your app in the emulator or on your connected Android device.

Step 4: Explore How the Android App Works

The native Android app uses a straightforward Model View Controller (MVC) architecture.

- The model is the Warehouse database schema
- The views come from the activities defined in your project
- The controller functionality represents a joint effort between the Android SDK classes, the Salesforce Mobile SDK, and your app

Within the view, the finished tutorial app defines two Android activities in a master-detail relationship. MainActivity lists records from the Merchandise custom objects. DetailActivity, which you access by clicking on an item in MainActivity, lets you view and edit the fields in the selected record.

MainActivity Class

When the app is launched, the `WarehouseApp` class initially controls the execution flow. After the login process completes, the `WarehouseApp` instance passes control to the main activity class, via the `SalesforceSDKManager` singleton.

In the template app that serves as the basis for your new app, and also in the finished tutorial, the main activity class is named `MainActivity`. This class subclasses `SalesforceActivity`, which is the Mobile SDK base class for all activities.

Before it's customized, though, the app doesn't include other activities or touch event handlers. It simply logs into Salesforce, issues a request using Salesforce Mobile SDK REST APIs, and displays the response in the main activity. In this tutorial you replace the template app controls and repurpose the SOQL REST request to work with the Merchandise custom object from the Warehouse schema.

DetailActivity Class

The `DetailActivity` class also subclasses `SalesforceActivity`, but it demonstrates more interesting customizations. `DetailActivity` implements text editing using standard Android SDK classes and XML templates. It also demonstrates how to update a database object in Salesforce using the `RestClient` and `RestRequest` classes from the Mobile SDK.

RestClient and RestRequest Classes

Mobile SDK apps interact with Salesforce data through REST APIs. However, you don't have to construct your own REST requests or work directly at the HTTP level. You can process SOQL queries, do SOSL searches, and perform CRUD operations with minimal coding by using static convenience methods on the `RestRequest` class. Each `RestRequest` convenience method returns a `RestRequest` object that wraps the formatted REST request.

To send the request to the server, you simply pass the `RestRequest` object to the `sendAsync()` or `sendSync()` method on your `RestClient` instance. You don't create `RestClient` objects. If your activity inherits a Mobile SDK activity class such as `SalesforceActivity`, Mobile SDK passes an instance of `RestClient` to the `onResume()` method. Otherwise, you can call `ClientManager.getRestClient()`. Your app uses the connected app information from your `bootconfig.xml` file so that the `RestClient` object can send REST requests on your behalf.

Customize the List Screen

In this tutorial, you modify the main activity and its layout to make the app specific to the Warehouse schema. You also adapt the existing SOQL query to obtain all the information we need from the Merchandise custom object.

Step 1: Remove Existing Controls

The template code provides a main activity screen that doesn't suit our purposes. Let's gut it to make room for our code.

1. From the Project window in Android Studio, open the `res/layout/main.xml` file. Make sure to set the view to text mode. This XML file contains a `<LinearLayout>` root node, which contains three child nodes: an `<include>` node, a nested `<LinearLayout>` node, and a `<ListView>` node.
2. Delete the nested `<LinearLayout>` node that contains the three `<Button>` nodes. The edited file looks like this:

```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout
  xmlns:android="http://schemas.android.com/apk/res/android"
  android:orientation="vertical"
  android:layout_width="match_parent"
  android:layout_height="match_parent"
  android:background="#454545"
  android:id="@+id/root">

  <include layout="@layout/header" />

  <ListView
    android:id="@+id/contacts_list"
    android:layout_width="match_parent"
    android:layout_height="match_parent" />
</LinearLayout>
```

3. Save the file and then open the `src/com.samples.warehouse/MainActivity.java` file.
4. Delete the `onClearClick()`, `onFetchAccountsClick()`, and `onFetchContactsClick()` methods. If the compiler warns you that the `sendRequest()` method is never used locally, that's OK. You just deleted all calls to that method, but you'll fix that in the next step.

Step 2: Update the SOQL Query

The `sendRequest()` method provides code for sending a SOQL query as a REST request. You can reuse some of this code while customizing the rest to suit your new app.

1. Rename `sendRequest()` to `fetchDataForList()`. Replace

```
private void sendRequest(String soql) throws UnsupportedOperationException
```

with

```
private void fetchDataForList()
```

Note that you've removed the `throw` declaration. You'll reinstate it within the method body to keep the exception handling local. You'll add a `try...catch` block around the call to `RestRequest.getRequestForQuery()`, rather than throwing exceptions to the `fetchDataForList()` caller.

2. Add a hard-coded SOQL query that returns up to 10 records from the `Merchandise__c` custom object:

```
private void fetchDataForList() {
    String soql = "SELECT Name, Id, Price__c, Quantity__c
    FROM Merchandise__c LIMIT 10";
```

3. Wrap a `try...catch` block around the call to `RestRequest.getRequestForQuery()`. Replace this:

```
RestRequest restRequest = RestRequest.getRequestForQuery(getString(R.string.api_version),
    soql);
```

with this:

```
RestRequest restRequest = null;
try {
    restRequest =
        RestRequest.getRequestForQuery(getString(R.string.api_version), soql);
} catch (UnsupportedEncodingException e) {
    showError(MainActivity.this, e);
    return;
}
```

Here's the completed version of what was formerly the `sendRequest()` method:

```
private void fetchDataForList() {
    String soql = "SELECT Name, Id, Price__c, Quantity__c FROM
        Merchandise__c LIMIT 10";
    RestRequest restRequest = null;
    try {
        restRequest =
            RestRequest.getRequestForQuery(
                getString(R.string.api_version), soql);
    } catch (UnsupportedEncodingException e) {
        showError(MainActivity.this, e);
        return;
    }

    client.sendAsync(restRequest, new AsyncRequestCallback() {
        @Override
        public void onSuccess(RestRequest request,
            RestResponse result) {

            // Network component doesn't report app layer status.
            // Use the Mobile SDK RestResponse.isSuccess() method to check
            // whether the REST request itself succeeded.

            if (result.isSuccess()) {
                try {
                    listAdapter.clear();
                    JSONArray records =
                        result.asJSONObject().getJSONArray("records");
                    for (int i = 0; i < records.length(); i++) {
                        listAdapter.add(records.
                            getJSONObject(i).getString("Name"));
                    }
                } catch (Exception e) {
                    onError(e);
                }
            }
        }
    });

    @Override
    public void onError(Exception exception) {
        Toast.makeText(MainActivity.this,
            MainActivity.this.getString(
                SalesforceSDKManager.getInstance().
```



```

                getSalesforceR().stringGenericError(),
                exception.toString()),
                Toast.LENGTH_LONG).show();
        }
    });
}

```

We'll call `fetchDataForList()` when the screen loads, after authentication completes.

4. In the `onResume(RestClient client)` method, add the following line at the end of the method body:

```

@Override
public void onResume(RestClient client) {
    // Keeping reference to rest client
    this.client = client;

    // Show everything
    findViewById(R.id.root).setVisibility(View.VISIBLE);
    // Fetch data for list
    fetchDataForList();
}

```

5. Finally, implement the `showError()` method to report errors through a given activity context. At the top of the file, add the following line to the end of the list of imports:

```
import android.content.Context;
```

6. At the end of the `MainActivity` class definition add the following code:

```

public static void showError(Context context, Exception e) {
    Toast toast = Toast.makeText(context,
        context.getString(
            SalesforceSDKManager.getInstance().
                getSalesforceR().stringGenericError(),
            e.toString()),
        Toast.LENGTH_LONG);
    toast.show();
}

```

7. Save the `MainActivity.java` file.

Step 3: Try Out the App

Build and run your app in Android Studio. When the Android emulator displays, wait a few minutes as it loads. Unlock the screen and wait a while longer for the Salesforce login screen to appear. After you log into Salesforce successfully, click **Allow** to give the app the permissions it requires.

At this point, if you click a Merchandise record, nothing happens. You'll fix that in the next tutorial.

Create the Detail Screen

In the previous step, you modified the template app so that the main activity presents a list of up to ten Merchandise records. In this step, you finish the job by creating a detail activity and layout. You then link the main activity and the detail activity.

Step 1: Create the Detail Screen

To start, design the layout of the detail activity by creating an XML file named `res/layout/detail.xml`.

1. In Package Explorer, expand `res/layout`.
2. Control-click the layout folder and select **New > Android XML File**.
3. In the **File** field, type `detail.xml`.
4. Under **Root Element**, select **LinearLayout**.
5. Click **Finish**.

In the new file, define layouts and resources to be used in the detail screen. Start by adding fields and labels for name, price, and quantity.

6. Replace the contents of the new file with the following XML code.

```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:id="@+id/root"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:background="#454545"
    android:orientation="vertical" >

    <include layout="@layout/header" />

    <LinearLayout
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:orientation="horizontal" >

        <TextView
            android:layout_width="wrap_content"
            android:layout_height="wrap_content"
            android:text="@string/name_label"
            android:width="100dp" />

        <EditText
            android:id="@+id/name_field"
            android:layout_width="match_parent"
            android:layout_height="wrap_content"
            android:inputType="text" />
    </LinearLayout>

    <LinearLayout
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:orientation="horizontal" >

        <TextView
            android:layout_width="wrap_content"
            android:layout_height="wrap_content"
            android:text="@string/price_label"
            android:width="100dp" />
```

```

        <EditText
            android:id="@+id/price_field"
            android:layout_width="match_parent"
            android:layout_height="wrap_content"
            android:inputType="numberDecimal" />
    </LinearLayout>

    <LinearLayout
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:orientation="horizontal" >

        <TextView
            android:layout_width="wrap_content"
            android:layout_height="wrap_content"
            android:text="@string/quantity_label"
            android:width="100dp" />

        <EditText
            android:id="@+id/quantity_field"
            android:layout_width="match_parent"
            android:layout_height="wrap_content"
            android:inputType="number" />
    </LinearLayout>
</LinearLayout>

```

7. Save the file.
8. To finish the layout, define the display names for the three labels (`name_label`, `price_label`, and `quantity_label`) referenced in the `TextView` elements.

Add the following to `res/values/strings.xml` just before the close of the `<resources>` node:

```

<!-- Detail screen -->
<string name="name_label">Name</string>
<string name="price_label">Price</string>
<string name="quantity_label">Quantity</string>

```

9. Save the file and then open the `AndroidManifest.xml` file in text view. If you don't get the text view, click the **AndroidManifest.xml** tab at the bottom of the editor screen.
10. Declare the new activity in `AndroidManifest.xml` by adding the following in the `<application>` section:

```

<!-- Merchandise detail screen -->
<activity android:name="com.samples.warehouse.DetailActivity"
    android:theme="@android:style/Theme.NoTitleBar.Fullscreen">
</activity>

```

Except for a button that we'll add later, you've finished designing the layout and the string resources for the detail screen. To implement the screen's behavior, you define a new activity.

Step 2: Create the DetailActivity Class

In this module we'll create a new class file named `DetailActivity.java` in the `com.samples.warehouse` package.

1. In Package Explorer, expand the **WarehouseApp** > **src** > **com.samples.warehouse** node.
2. Control-click the `com.samples.warehouse` folder and select **New** > **Class**.
3. In the **Name** field, enter **DetailActivity**.
4. In the **Superclass** field, enter or browse for `com.salesforce.androidsdk.ui.SalesforceActivity`.
5. Click **Finish**.

The compiler provides a stub implementation of the required `onResume()` method. Mobile SDK passes an instance of `RestClient` to this method. Since you need this instance to create REST API requests, it's a good idea to cache a reference to it.

6. Add the following declaration to the list of member variables at the top of the new class:

```
private RestClient client;
```

7. In the `onResume()` method body, add the following code:

```
@Override
public void onResume(RestClient client) {
    // Keeping reference to rest client
    this.client = client;
}
```

Step 3: Customize the DetailActivity Class

To complete the activity setup, customize the `DetailActivity` class to handle editing of Merchandise field values.

1. Add the following imports to the list of imports at the top of `DetailActivity.java`:

```
import android.widget.EditText;
import android.os.Bundle;
```

2. At the top of the class body, add private `EditText` members for the three input fields.

```
private EditText nameField;
private EditText priceField;
private EditText quantityField;
```

3. Add a variable to contain a record ID from the Merchandise custom object. You'll add code to populate it later when you link the main activity and the detail activity.

```
private String merchandiseId;
```

4. Add an `onCreate()` method that configures the view to use the `detail.xml` layout you just created. Place this method just before the end of the class definition.

```
@Override
protected void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);

    // Setup view
    setContentView(R.layout.detail);
    nameField = (EditText) findViewById(R.id.name_field);
    priceField = (EditText) findViewById(R.id.price_field);
    quantityField = (EditText)
```

```

        findViewById(R.id.quantity_field);
    }

```

Step 4: Link the Two Activities, Part 1: Create a Data Class

Next, you need to hook up `MainActivity` and `DetailActivity` classes so they can share the fields of a selected Merchandise record. When the user clicks an item in the inventory list, `MainActivity` needs to launch `DetailActivity` with the data it needs to display the record's fields.

Right now, the list adapter in `MainActivity.java` is given only the names of the Merchandise fields. Let's store the values of the standard fields (`id` and `name`) and the custom fields (`quantity`, and `price`) locally so you can send them to the detail screen.

To start, define a static data class to represent a Merchandise record.

1. In the Package Explorer, open **src > com.samples.warehouse > MainActivity.java**.
2. Add the following class definition at the end of the `MainActivity` definition:

```

/**
 * Simple class to represent a Merchandise record
 */
static class Merchandise {
    public final String name;
    public final String id;
    public final int quantity;
    public final double price;

    public Merchandise(String name, String id, int quantity, double price) {
        this.name = name;
        this.id = id;
        this.quantity = quantity;
        this.price = price;
    }

    public String toString() {
        return name;
    }
}

```

3. To put this class to work, modify the main activity's list adapter to take a list of Merchandise objects instead of strings. In the `listAdapter` variable declaration, change the template type from `String` to `Merchandise`:

```
private ArrayAdapter<Merchandise> listAdapter;
```

4. To match the new type, change the `listAdapter` instantiation in the `onResume()` method:

```
listAdapter = new ArrayAdapter<Merchandise>(this, android.R.layout.simple_list_item_1,
    new ArrayList<Merchandise>());
```

Next, modify the code that populates the `listAdapter` object when the response for the SQL call is received.

5. Add the following import to the existing list at the top of the file:

```
import org.json.JSONObject;
```

6. Change the `onSuccess()` method in `fetchDataForList()` to use the new `Merchandise` object:

```
public void onSuccess(RestRequest request, RestResponse result) {
    // Network component doesn't report app layer status.
    // Use the Mobile SDK RestResponse.isSuccess() method to check
    // whether the REST request itself succeeded.
    if (result.isSuccess()) {
        try {
            listAdapter.clear();
            JSONArray records = result.asJSONObject().getJSONArray("records");
            for (int i = 0; i < records.length(); i++) {
                JSONObject record = records.getJSONObject(i);
                Merchandise merchandise =
                    new Merchandise(record.getString("Name"),
                        record.getString("Id"), record.getInt("Quantity__c"),
                        record.getDouble("Price__c"));
                listAdapter.add(merchandise);
            }
        } catch (Exception e) {
            onError(e);
        }
    }
}
```

Step 5: Link the Two Activities, Part 2: Implement a List Item Click Handler

Next, you need to catch click events and launch the detail screen when these events occur. Let's make `MainActivity` the listener for clicks on list view items.

1. Open the `MainActivity.java` file in the editor.
2. Add the following import:

```
import android.widget.AdapterView.OnItemClickListener;
```

3. Change the class declaration to implement the `OnItemClickListener` interface:

```
public class MainActivity extends SalesforceActivity implements OnItemClickListener {
```

4. Add a private member for the list view:

```
private ListView listView;
```

5. Add the following code in bold to the `onResume()` method just before the `super.onResume()` call:

```
public void onResume() {
    // Hide everything until we are logged in
    findViewById(R.id.root).setVisibility(View.INVISIBLE);

    // Create list adapter
    listAdapter = new ArrayAdapter<Merchandise>(
        this, android.R.layout.simple_list_item_1, new ArrayList<Merchandise>());
    ((ListView) findViewById(R.id.contacts_list)).setAdapter(listAdapter);

    // Get a handle for the list view
}
```

```

    listView = (ListView) findViewById(R.id.contacts_list);
    listView.setOnItemClickListener(this);

    super.onResume();
}

```

Now that you've designated a listener for list item clicks, you're ready to add the list item click handler.

6. Add the following imports:

```

import android.widget.AdapterView;
import android.content.Intent;

```

7. Just before the `Merchandise` class definition, add an `onItemClick()` method.

```

public void onItemClick(AdapterView<?> parent, View view, int position, long id) {
}

```

8. Get the selected item from the list adapter in the form of a `Merchandise` object.

```

public void onItemClick(AdapterView<?> parent, View view, int position, long id) {
    Merchandise merchandise = listAdapter.getItem(position);
}

```

9. Create an Android intent to start the detail activity, passing the merchandise details into it.

```

public void onItemClick(AdapterView<?> parent, View view, int position, long id) {
    Merchandise merchandise = listAdapter.getItem(position);
    Intent intent = new Intent(this, DetailActivity.class);
    intent.putExtra("id", merchandise.id);
    intent.putExtra("name", merchandise.name);
    intent.putExtra("quantity", merchandise.quantity);
    intent.putExtra("price", merchandise.price);
    startActivity(intent);
}

```

Let's finish by updating the `DetailActivity` class to extract the merchandise details from the intent.

10. In the Package Explorer, open `src > com.samples.warehouse > DetailActivity.java`.

11. In the `onCreate()` method, assign values from the list screen selection to their corresponding data members in the detail activity:

```

protected void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);

    // Setup view
    setContentView(R.layout.detail);
    nameField = (EditText) findViewById(R.id.name_field);
    priceField = (EditText) findViewById(R.id.price_field);
    quantityField = (EditText)
        findViewById(R.id.quantity_field);
    // Populate fields with data from intent
    Bundle extras = getIntent().getExtras();
    merchandiseId = extras.getString("id");
}

```

```

nameField.setText(extras.getString("name"));
priceField.setText(extras.getDouble("price") + "");
quantityField.setText(extras.getInt("quantity") + "");
}

```

Step 6: Implement the Update Button

You're almost there! The only part of the UI that's missing is a button that writes the user's edits to the server. You need to:

- Add the button to the layout
 - Define the button's label
 - Implement a click handler
 - Implement functionality that saves the edits to the server
1. Reopen `detail.xml` and add the following `<Button>` node as the last node in the outermost layout.

```

<Button
    android:id="@+id/update_button"
    android:layout_width="match_parent"
    android:layout_height="wrap_content"
    android:onClick="onUpdateClick"
    android:text="@string/update_button" />

```

2. Save the `detail.xml` file, then open `strings.xml`.
3. Add the following button label string to the end of the list of strings:

```

<string name="update_button">Update</string>

```

4. Save the `strings.xml` file and then open `DetailActivity.java`.

In the `DetailActivity` class, add a handler for the Update button's `onClick` event. The handler's name must match the `android:onClick` value in the `<Button>` node that you just added to `detail.xml`. In this case, the name is `onUpdateClick`. This method simply creates a map that matches `Merchandise__c` field names to corresponding values in the detail screen. Once the values are set, it calls the `saveData()` method to write the changes to the server.

5. To support the handler, add the following imports to the existing list at the top of the file:

```

import java.util.HashMap;
import java.util.Map;
import android.view.View;

```

6. Add the following method to the `DetailActivity` class definition:

```

public void onUpdateClick(View v) {
    Map<String, Object> fields = new HashMap<String, Object>();
    fields.put("Name", nameField.getText().toString());
    fields.put("Quantity__c", quantityField.getText().toString());
    fields.put("Price__c", priceField.getText().toString());
    saveData(merchandiseId, fields);
}

```

The compiler reminds you that `saveData()` isn't defined. Let's fix that. The `saveData()` method creates a REST API update request to update the `Merchandise__c` object with the user's values. It then sends the request asynchronously to the server

using the `RestClient.sendAsync()` method. The callback methods that receive the server response (or server error) are defined inline in the `sendAsync()` call.

7. Add the following imports to the existing list at the top of the file:

```
import com.salesforce.androidsdk.rest.RestRequest;
import com.salesforce.androidsdk.rest.RestResponse;
```

8. Implement the `saveData()` method in the `DetailActivity` class definition:

```
private void saveData(String id, Map<String, Object> fields) {
    RestRequest restRequest;
    try {
        restRequest = RestRequest.getRequestForUpdate(
            getString(R.string.api_version),
            "Merchandise__c", id, fields);
    } catch (Exception e) {
        // You might want to log the error or show it to the user
        return;
    }

    client.sendAsync(restRequest, new RestClient.AsyncRequestCallback() {
        @Override
        public void onSuccess(RestRequest request, RestResponse result) {
            // Network component doesn't report app layer status.
            // Use the Mobile SDK RestResponse.isSuccess() method to check
            // whether the REST request itself succeeded.
            if (result.isSuccess()) {
                try {
                    DetailActivity.this.finish();
                } catch (Exception e) {
                    // You might want to log the error
                    // or show it to the user
                }
            }
        }
        @Override
        public void onError(Exception e) {
            // You might want to log the error
            // or show it to the user
        }
    });
}
```

That's it! Your app is ready to run and test.

Step 7: Try Out the App

1. Build your app and run it in the Android emulator. If you did everything correctly, a detail page appears when you click a Merchandise record in the Warehouse screen.
2. Update a record's quantity and price. Be sure to click the **Update** button in the detail view after you edit the values. When you navigate back to the detail view, the updated values display.
3. Log into your DE org and view the record using the browser UI to see the updated values.

Android Sample Applications

Salesforce Mobile SDK includes the following native Android sample applications.

- **RestExplorer** demonstrates the OAuth and REST API functions of Mobile SDK. It's also useful for investigating REST API actions from a tablet.
- **SmartSyncExplorer** demonstrates the power of the native SmartSync Data Framework library on Android. It resides in Mobile SDK for Android under `native/NativeSampleApps/SmartSyncExplorer`.

Mobile SDK also provides Android wrappers for a few hybrid apps under `hybrid/HybridSampleApps/`.

- **AccountEditor**: Demonstrates how to synchronize offline data using the `smartsync.js` library.
- **NoteSync**: Demonstrates how to use non-REST APIs to retrieve Salesforce Notes.
- **SmartSyncExplorerHybrid**: Demonstrates how to synchronize offline data using the SmartSync Data Framework plugin.

CHAPTER 10 HTML5 and Hybrid Development

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HTML5 lets you create lightweight mobile interfaces without installing software on the target device. Any mobile, touch or desktop device can access these mobile interfaces. HTML5 now supports advanced mobile functionality such as camera and GPS, making it simple to use these popular device features in your Salesforce mobile app.

You can create an HTML5 application that leverages the Lightning Platform by:

- Using Visualforce to deliver the HTML content
- Using JavaScript remoting to invoke Apex controllers for fetching records from Salesforce

In addition, you can repurpose HTML5 code in a standalone Mobile SDK hybrid app, and then distribute it through an app store. To convert to hybrid, you use the third-party Cordova command line to create a Mobile SDK container project, and then import your HTML5, JavaScript, and CSS files into that project.

Getting Started

If you're already a web developer, you're set up to write HTML5 apps that access Salesforce. HTML5 apps can run in a browser and don't require the Salesforce Mobile SDK. You simply call Salesforce APIs, capture the return values, and plug them into your logic and UI. The same advantages and challenges of running any app in a mobile browser apply. However, Salesforce and its partners provide tools that help streamline mobile web design and coding.

If you want to build your HTML5 app as standalone in a hybrid container and distribute it in the Apple® AppStore® or an Android marketplace, you'll need to create a hybrid app using the Mobile SDK.

Using HTML5 and JavaScript

You don't need a professional development environment such as Xcode or Microsoft® Visual Studio® to write HTML5 and JavaScript code. Most modern browsers include sophisticated developer features including HTML and JavaScript debuggers. You can literally write your application in a text editor and test it in a browser. However, you do need a good knowledge of popular industry libraries that can help to minimize your coding effort.

The recent growth in mobile development has led to an explosion of new web technology toolkits. Often, these JavaScript libraries are open-source and don't require licensing. Most of the tools provided by Salesforce for HTML5 development are built on these third-party technologies.

HTML5 Development Requirements

If you're planning to write a browser-based HTML5 Salesforce application, you don't need Salesforce Mobile SDK.

- You'll need a Lightning Platform organization.
- Some knowledge of Apex and Visualforce is necessary.

 **Note:** This type of development uses Visualforce. You can't use Database.com.

Multi-Device Strategy

With the worldwide proliferation of mobile devices, HTML5 mobile applications must support a variety of platforms, form factors, and device capabilities. Developers who write device-independent mobile apps in Visualforce face these key design questions:

- Which devices and form factors should my app support?
- How does my app detect various types of devices?
- How should I design a Salesforce application to best support multiple device types?

Which Devices and Form Factors Should Your App Support?

The answer to this question is dependent on your specific use case and end-user requirements. It is, however, important to spend some time thinking about exactly which devices, platforms, and form factors you do need to support. Where you end up in the spectrum of 'Support all platforms/devices/form factors' to 'Support only desktop and iPhone' (as an example) plays a major role in how you answer the subsequent two questions.

As can be expected, important trade-offs have to be made when making this decision. Supporting multiple form factors obviously increases the reach for your application. But, it comes at the cost of additional complexity both in terms of initially developing the application, and maintaining it over the long-term.

Developing true cross-device applications is not simply a question of making your web page look (and perform) optimally across different form factors and devices (desktop vs phone vs tablet). You really need to rethink and customize the user experience for each specific device/form factor. The phone or tablet version of your application very often does not need all the bells and whistles supported by your existing desktop-optimized Web page (e.g., uploading files or supporting a use case that requires many distinct clicks).

Conversely, the phone/tablet version of your application can support features like geolocation and taking pictures that are not possible in a desktop environment. There are even significant differences between the phone and tablet versions of the better designed applications like LinkedIn and Flipboard (e.g., horizontal navigation in a tablet version vs single hand vertical scrolling for a phone version). Think of all these consideration and the associated time and cost it will take you to support them when deciding which devices and form factors to support for your application.

Once you've decided which devices to support, you then have to detect which device a particular user is accessing your Web application from.

Client-Side Detection

The client-side detection approach uses JavaScript (or CSS media queries) running on the client browser to determine the device type. Specifically, you can detect the device type in two different ways.

- **Client-Side Device Detection with the User-Agent Header** — This approach uses JavaScript to parse out the User-Agent HTTP header and determine the device type based on this information. You could of course write your own JavaScript to do this. A better option is to reuse an existing JavaScript. A cursory search of the Internet will result in many reusable JavaScript snippets that can detect the device type based on the User-Agent header. The same cursory search, however, will also expose you to some of the perils of using this approach. The list of all possible User-Agents is huge and ever growing and this is generally considered to be a relatively unreliable method of device detection.
- **Client-Side Device Detection with Screen Size and/or Device Features** — A better alternative to sniffing User-Agent strings in JavaScript is to determine the device type based on the device screen size and or features (e.g., touch enabled). One example of this approach can be found in the open-source Contact Viewer HTML5 mobile app that is built entirely in Visualforce. Specifically, the `MobileAppTemplate.page` includes a simple JavaScript snippet at the top of the page to distinguish between phone and tablet clients based on the screen size of the device. Another option is to use a library like `Device.js` or `Modernizr` to detect the device type. These libraries use some combination of CSS media queries and feature detection (e.g., touch enabled) and are therefore a more reliable option for detecting device type. A simple example that uses the `Modernizr` library to accomplish this can be found at <http://www.html5rocks.com/static/demos/cross-device/feature/index.html>. A more complete example that uses the `Device.js` library and integrates with Visualforce can be found in this GitHub repo: <https://github.com/sbhanot-sfdc/Visualforce-Device.js>. Here is a snippet from the `DesktopVersion.page` in that repo.

```
<apex:page docType="html-5.0" sidebar="false" showHeader="false" standardStylesheets="false"
  cache="false" >

<head>
  <!-- Every version of your webapp should include a list of all
  versions. -->
  <link rel="alternate" href="/apex/DesktopVersion" id="desktop"
    media="only screen and (touch-enabled: 0)"/>
  <link rel="alternate" href="/apex/PhoneVersion" id="phone"
    media="only screen and (max-device-width: 640px)"/>
  <link rel="alternate" href="/apex/TabletVersion" id="tablet"
    media="only screen and (min-device-width: 641px)"/>

  <meta name="viewport" content="width=device-width, user-scalable=no"/>
  <script src="{!URLFOR($Resource.Device_js) }"/>
</head>
```

```

<body>
  <ul>
    <li><a href="?device=phone">Phone Version</a></li>
    <li><a href="?device=tablet">Tablet Version</a></li>
  </ul>
  <h1> This is the Desktop Version</h1>
</body>
</apex:page>

```

The snippet above shows how you can simply include a `<link>` tag for each device type that your application supports. The `Device.js` library then automatically redirects users to the appropriate Visualforce page based on device type detected. There is also a way to override the default `Device.js` redirect by using the `'?device=xxx'` format shown above.

Server-Side Device Detection

Another option is to detect the device type on the server (i.e., in your Apex controller/extension class). Server-side device detection is based on parsing the User-Agent HTTP header and here is a small code snippet of how you can detect if a Visualforce page is being viewed from an iPhone client.

```

<apex:page docType="html-5.0"
  sidebar="false"
  showHeader="false"
  cache="false"
  standardStylesheets="false"
  controller="ServerSideDeviceDetection"
  action="{!detectDevice}">
  <h1> This is the Desktop Version</h1>
</apex:page>

```

```

public with sharing class ServerSideDeviceDetection {
    public boolean isIPhone {get;set;}
    public ServerSideDeviceDetection() {
        String userAgent =
            System.currentPageReference().
                getHeaders().get('User-Agent');
        isIPhone = userAgent.contains('iPhone');
    }
    public PageReference detectDevice() {
        if (isIPhone)
            return Page.PhoneVersion.setRedirect(true);
        else
            return null;
    }
}

```

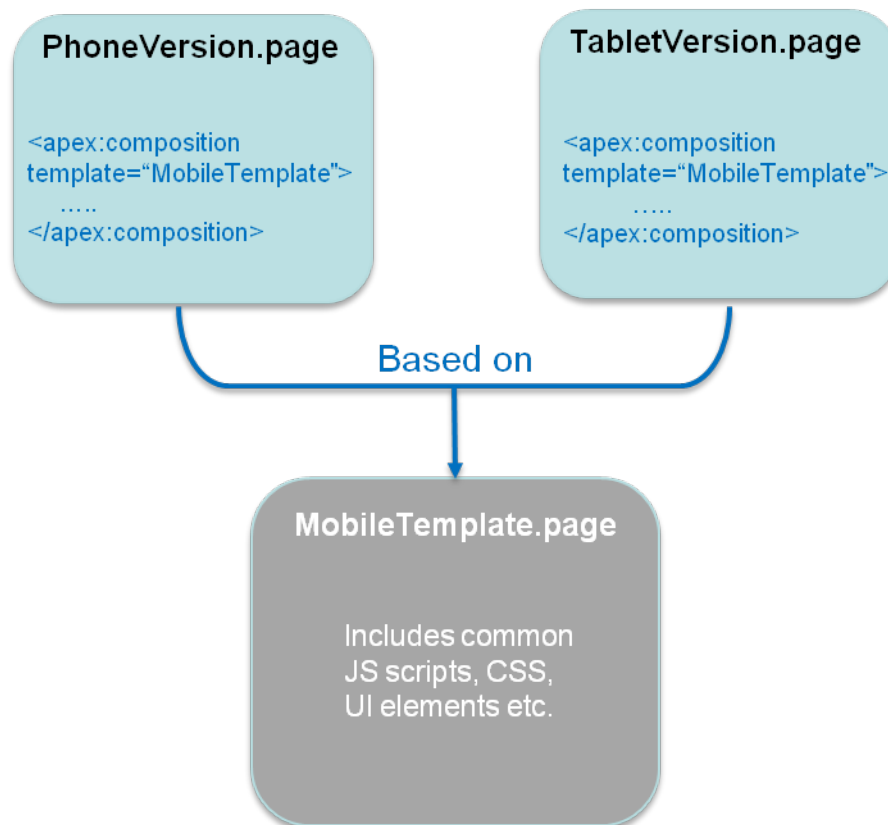
Note that User-Agent parsing in the code snippet above is far from comprehensive and you should implement something more robust that detects all the devices that you need to support based on regular expression matching. A good place to start is to look at the RegEx included in the detectmobilebrowsers.com code snippets.

How Should You Design a Salesforce Application to Best Support Multiple Device Types?

Finally, once you know which devices you need to support and how to distinguish between them, what is the optimal application design for delivering a customized user experiences for each device/form factor? Again, a couple of options to consider.

For simple applications where all you need is for the same Visualforce page to display well across different form factors, a responsive design approach is an attractive option. In a nutshell, Responsive design uses CCS3 media queries to dynamically reformat a page to fit the form factor of the client browser. You could even use a responsive design framework like Twitter Bootstrap to achieve this.

Another option is to design multiple Visualforce pages, each optimized for a specific form factor and then redirect users to the appropriate page using one of the strategies described in the previous section. Note that having separate Visualforce pages does not, and should not, imply code/functionality duplication. A well architected solution can maximize code reuse both on the client-side (by using Visualforce strategies like Components, Templates etc.) as well as the server-side (e.g., encapsulating common business logic in an Apex class that gets called by multiple page controllers). An excellent example of such a design can be found in the same open-source Contact Viewer application referenced before. Though the application has separate pages for its phone and tablet version (`ContactsAppMobile.page` and `ContactsApp.page` respectively), they both share a common template (`MobileAppTemplate.page`), thus maximizing code and artifact reuse. The figure below is a conceptual representation of the design for the Contact Viewer application.



Lastly, it is also possible to service multiple form factors from a single Visualforce page by doing server-side device detection and making use of the 'rendered' attribute available in most Visualforce components (or more directly, the CSS 'display:none/block' property on a `<div>` tag) to selectively show/hide page elements. This approach however can result in bloated and hard-to-maintain code and should be used sparingly.

HTML5 Development Tools

Modern Web developers frequently leverage open source tools to speed up their app development cycles. These tools can make HTML5 coding surprisingly simple. For example, to create Salesforce-enabled apps in only a few hours, you can couple Google's Polymer framework with Lightning Platform JavaScript libraries. Salesforce provides a beta open source library—Mobile UI Elements—that does exactly that.

To investigate and get started with Mobile UI Elements, see [Mobile UI Elements with Polymer](#).

Delivering HTML5 Content With Visualforce

Traditionally, you use Visualforce to create custom websites for the desktop environment. When combined with HTML5, however, Visualforce becomes a viable delivery mechanism for mobile Web apps. These apps can leverage third-party UI widget libraries such as Sencha, or templating frameworks such as AngularJS and Backbone.js, that bind to data inside Salesforce.

To set up an HTML5 Apex page, change the `docType` attribute to "html-5.0", and use other settings similar to these:

```
<apex:page docType="html-5.0" sidebar="false" showHeader="false" standardStylesheets="false"
  cache="true" >

</apex:page>
```

This code sets up an Apex page that can contain HTML5 content, but, of course, it produces an empty page. With the use of static resources and third-party libraries, you can add HTML and JavaScript code to build a fully interactive mobile app.

Accessing Salesforce Data: Controllers vs. APIs

In an HTML5 app, you can access Salesforce data two ways.

- By using JavaScript remoting to invoke your Apex controller.
- By accessing the Salesforce API with `force.js`.

Using JavaScript Remoting to Invoke Your Apex Controller

Apex supports the following two means of invoking Apex controller methods from JavaScript:

- `apex:actionFunction`
- JavaScript remoting

Both techniques use an AJAX request to invoke Apex controller methods directly from JavaScript. The JavaScript code must be hosted on a Visualforce page.

In comparison to `apex:actionFunction`, JavaScript remoting offers several advantages.

- It offers greater flexibility and better performance than `apex:actionFunction`.
- It supports parameters and return types in the Apex controller method, with automatic mapping between Apex and JavaScript types.
- It uses an asynchronous processing model with callbacks.
- Unlike `apex:actionFunction`, the AJAX request does not include the view state for the Visualforce page. This results in a faster round trip.

Compared to `apex:actionFunction`, however, JavaScript remoting requires you to write more code.

The following example inserts JavaScript code in a `<script>` tag on the Visualforce page. This code calls the `invokeAction()` method on the Visualforce remoting manager object. It passes `invokeAction()` the metadata needed to call a function named `getItemId()` on the Apex controller object `objName`. Because `invokeAction()` runs asynchronously, the code also defines a callback function to process the value returned from `getItemId()`. In the Apex controller, the `@RemoteAction` annotation exposes the `getItemId()` function to external JavaScript code.

```
//Visualforce page code
<script type="text/javascript">
    Visualforce.remoting.Manager.invokeAction(
        '{!$RemoteAction.MyController.getItemId}',
        objName,
        function(result, event){
            //process response here
        },
        {escape: true}
    );
</script>

//Apex Controller code

@RemoteAction
global static String getItemId(String objectName) { ... }
```

See https://developer.salesforce.com/docs/atlas.en-us.apexcode.meta/apexcode/apex_classes_annotation_RemoteAction.htm to learn more about `@RemoteAction` annotations.

Accessing the Salesforce API with Force.js

The following sample code queries Salesforce records from Apex by using the `cordova.js` and `force.js` libraries. To add these resources to your Apex page:

1. Create an archive file, such as a ZIP file, that contains `cordova.js`, `force.js`, and any other static resources your project requires.

If you're developing for Android 19 and using Mobile SDK promise-based APIs, include this file:

<https://www.promisejs.org/polyfills/promise-7.0.4.min.js>. Mobile SDK promised-based APIs include:

- The `smartstoreclient` Cordova plugin (`com.salesforce.plugin.smartstore.client`)
- `force+promise.js`
- `smartsync.js`

2. In Salesforce, upload the archive file via **Your Name > App Setup > Develop > Static Resources**.

The sample code uses an instance of the `force.js` library to log in to Salesforce. It then calls the `force.query()` method to process a SOQL query. The query callback function displays the `Name` fields returned by the query as HTML in an object with ID "users." At the end of the Apex page, the HTML5 content defines the `users` element as a simple `` tag.

```
<apex:page docType="html-5.0" sidebar="false" showHeader="false"
    contentType="text/html" applyHtmlTag="false" applyBodyTag="false"
    standardStylesheets="false" cache="true">
<html>
    <head>
        <meta charset="utf-8"></meta>
```

```

    <meta name="viewport"
      content="initial-scale=1, maximum-scale=1, user-scalable=no"></meta>

    <apex:includeScript value="{!URLFOR($Resource.Easy,
      'cordova/cordova.js')}"
    <apex:includeScript value="{!URLFOR($Resource.Easy,
      'libs/force.js')}" />

    <script>
(function() {
  /* Do login */
  force.login(
    function() {
      console.log("Auth succeeded");
      showUsersList();
    },
    function(error) {
      console.log("Auth failed: " + error);
    }
  );

  /* This method will render a list of users from current salesforce org */
  var showUsersList = function() {

    fetchRecords(function(data) {
      var users = data.records;

      var listItemsHtml = '';
      for (var i=0; i < users.length; i++) {
        listItemsHtml += ('<li class="table-view-cell"><
          div class="media-body">' + users[i].Name + '</div></li>');
      }

      document.querySelector('#users').innerHTML = listItemsHtml;
    })
  }

  /* This method will fetch a list of user records from salesforce.
  Just change the soql query to fetch another sobject. */
  var fetchRecords = function (successHandler) {
    var soql = 'SELECT Id, Name FROM User LIMIT 10';
    force.query(soql, successHandler, function(error) {
      alert('Failed to fetch users: ' + error);
    });
  };

})();
</script>
</head>
<body>

  <header>
    <h1>Hello, Visualforce!</h1>
  </header>

```

```
        <!-- Placeholder to add users list -->

        <ul id="users">
        </ul>

        <p>Welcome to Mobile SDK.</p>
    </body>
</html>

</apex:page>
```

Note:

- Using the REST API—even from a Visualforce page—consumes API calls.
- Salesforce API calls made through a Mobile SDK container or through a Cordova webview do not require proxy services. Cordova webviews disable same-origin policy, so you can make API calls directly. This exemption applies to all Mobile SDK hybrid and native apps.

Additional Options

You can use the SmartSync Data Framework in HTML5 apps. Just include the required JavaScript libraries as static resources. Take advantage of the model and routing features. Offline access is disabled for this use case. See [Using SmartSync Data Framework to Access Salesforce Objects](#).

Salesforce Developer Marketing provides developer [mobile packs](#) that can help you get a quick start with HTML5 apps.

Offline Limitations

Read these articles for tips on using HTML5 with Lightning Platform offline.

- <https://developer.salesforce.com/blogs/developer-relations/2011/06/using-html5-offline-with-forcecom.html>
- <http://developer.salesforce.com/blogs/developer-relations/2013/03/using-javascript-with-force-com.html>


Hybrid Apps Quick Start

Hybrid apps give you the ease of JavaScript and HTML5 development while leveraging Salesforce Mobile SDK

If you're comfortable with the concept of hybrid app development, use the following steps to get going quickly.

1. To develop Android hybrid apps for Mobile SDK 6.0, you need:
 - Cordova 7.0.0.
 - Cordova CLI 7.0.0 or later.
 - Java JDK 1.8.x or later—www.oracle.com/downloads.
 - forcedroid npm package, version 6.0.
 - Android Studio 3.0 or later—developer.android.com/sdk.
 - Android SDK and Android SDK Tools—Install from within Android Studio.
 - a. In the Android Studio menu, click **Tools > Android > SDK Manager**.
 - b. Click the **SDK Platforms** tab.

- c. Install at least the following required SDK levels and all intervening levels:
 - Minimum API: Android KitKat (API 21)
 - Target API: Android Oreo (API 27)
- d. Click the **SDK Tools** tab.
- e. Install the latest Android SDK Tools version.
- Android Virtual Device (AVD)—Install from within Android Studio.
 - a. In the Android Studio menu, click **Tools > Android > AVD Manager**.
 - b. Click **Create Virtual Device...**
 - c. Install at least one AVD that targets Android KitKat (API 21) and above. To learn how to set up an AVD in Android Studio, follow the instructions at developer.android.com/guide/developing/devices/managing-avds.html.
2. To develop iOS hybrid apps for Mobile SDK 6.0, you need:
 - Cordova 4.5.4.
 - Cordova CLI 7.0.0 or later.
 - Xcode version 9 or later. (We recommend the latest version.)
 - iOS 10 or later.
 - CocoaPods version 1.2 or later (cocoapods.org).
3. Install Mobile SDK.
 - [Android Preparation](#)
 - [iOS Preparation](#)
4. If you don't already have a connected app, see [Creating a Connected App](#). For OAuth scopes, select `api`, `web`, and `refresh_token`.

 **Note:** When specifying the Callback URL, there's no need to use a real address. Use any value that looks like a URL, such as `myapp:///mobilesdk/oauth/done`.
5. Create a hybrid app.
 - Follow the steps at [Create Hybrid Apps](#). Use `hybrid_local` for the application type.
6. Run your new app.
 - [Build and Run Your Hybrid App on Android](#)
 - [Build and Run Your Hybrid App On iOS](#)

Creating Hybrid Apps

Hybrid apps combine the ease of HTML5 Web app development with the power and features of the native platform. They run within a Salesforce mobile container—a native layer that translates the app into device-specific code—and define their functionality in HTML5 and JavaScript files. These apps fall into one of two categories:

- **Hybrid local**—Hybrid apps developed with the `force.js` library wrap a Web app inside the mobile container. These apps store their HTML, JavaScript, and CSS files on the device.

- **Hybrid remote** — Hybrid apps developed with Visualforce technology deliver Apex pages through the mobile container. These apps store some or all of their HTML, JavaScript, and CSS files either on the Salesforce server or on the device (at `http://localhost`).

In addition to providing HTML and JavaScript code, you also must maintain a minimal container app for your target platform. These apps are little more than native templates that you configure as necessary.

If you're creating libraries or sample apps for use by other developers, we recommend posting your public modules in a version-controlled online repository such as GitHub (<https://github.com>). For smaller examples such as snippets, GitHub provides *gist*, a low-overhead code sharing forum (<https://gist.github.com>).

SEE ALSO:

[Updating Mobile SDK Apps \(5.0 and Later\)](#)

About Hybrid Development

Developing hybrid apps with the Mobile SDK container requires you to recompile and rebuild after you make changes. JavaScript development in a browser is easier. After you've altered the code, you merely refresh the browser to see your changes. For this reason, we recommend you develop your hybrid app directly in a browser, and only run your code in the container in the final stages of testing.

We recommend developing in a browser such as Google Chrome that comes bundled with developer tools. These tools let you access the symbols and code of your web application during runtime.

Building Hybrid Apps With Cordova

Salesforce Mobile SDK 6.0 provides a hybrid container that uses a specific version of Apache Cordova for each platform (4.5.4 for iOS, 7.0.0 for Android). Architecturally, Mobile SDK hybrid apps are Cordova apps that use Salesforce Mobile SDK as a Cordova plug-in. Cordova provides a simple command line tool for updating the plug-in in an app. To read more about Cordova benefits, see <https://cordova.apache.org/>.

Using Forcehybrid

For creating hybrid apps, Mobile SDK provides the `forcehybrid` npm utility. This utility works with the Cordova command line to build hybrid Mobile SDK projects. With `forcehybrid`, you can create hybrid projects for iOS, Android, or both in a single pass.

Forcehybrid gives you two ways to create your app.

- Specify the type of application you want, along with basic configuration data.

OR

- Use an existing Mobile SDK app as a template. You still provide the basic configuration data.

You can use `forcehybrid` interactively at the command line, or in script mode with command line parameters. To see usage information, type `forcehybrid` without arguments.

Using `forcehybrid create` Interactively

To enter application options interactively at a command prompt, type `forcehybrid create`. The `forcehybrid` utility then prompts you for each configuration option. For example:


```
$ forcehybrid create
Enter the target platform(s) separated by commas (ios, android): ios,android
```

```

Enter your application type (hybrid_local, hybrid_remote): hybrid_local
Enter your application name: LocalHybridTest
Enter your package name: com.myhybrid.ios
Enter your organization name (Acme, Inc.): BestApps.com
Enter output directory for your app (leave empty for the current directory): LocalHybridTest

```

This example creates a hybrid local app named “LocalHybridTest” in the `./LocalHybridTest/` directory, with iOS and Android targets.

 **Note:** Although `forcehybrid create` sets up hybrid projects for the platforms you specify, the app isn’t ready for building until you’ve finished the setup at the Cordova command line. See [Create Hybrid Apps](#)

Using `forcehybrid create` in Script Mode

In script mode, you enter your parameters in a single command line instruction:

```

$ forcehybrid create --platform=ios,android --apptype=hybrid_local --appname=packagetest
--packagename=com.test.my_new_app --organization="Acme Widgets, Inc."
--outputdir=PackageTest

```

This example creates a hybrid local app named “packagetest” in the `./PackageTest/` directory, with iOS and Android targets. Here’s a description of the available options.

```

Usage:

# create ios/android hybrid_local or hybrid_remote mobile application
forcehybrid create
  --platform=Comma separated platforms (ios, android)
  --apptype=Application Type (hybrid_local, hybrid_remote)
  --appname=Application Name
  --packagename=App Package Identifier (e.g. com.mycompany.myapp)
  --organization=Organization Name (Your company's/organization's name)
  [--startpage=App Start Page (The start page of your remote app. Only required for
hybrid_remote)]
  [--outputdir=Output Directory (Leave empty for current directory)]

```

Using `forcehybrid createWithTemplate`

The `forcehybrid createWithTemplate` command is identical to `forcehybrid create` except that it asks for a GitHub repo URI instead of an app type. You set this path to point to any repo directory that contains a Mobile SDK app that can be used as a template. Your template app can be any supported Mobile SDK app type. The force script changes the template’s identifiers and configuration to match the values you provide for the other parameters.

Here’s command line usage information for `forcehybrid createWithTemplate`:

```

# create ios/android hybrid_local or hybrid_remote mobile application from a template
forcehybrid createWithTemplate
  --platform=Comma separated platforms (ios, android)
  --templaterepouri=Template repo URI
  --appname=Application Name
  --packagename=App Package Identifier (e.g. com.mycompany.myapp)
  --organization=Organization Name (Your company's/organization's name)
  [--outputdir=Output Directory (Leave empty for current directory)]

```

For example, consider the following command line call:

```
forcehybrid createWithTemplate
--platform=android
--templaterepouri=https://github.com/forcedotcom/SmartSyncExplorerReactNative
--appname=MyHybrid
--packagename=com.mycompany.react
--organization="Acme Software, Inc."
```

This call replicates the SmartSyncExplorerReactNative sample app. It recreates the React Native app in the current directory with the same source code and resources as the sample app. However, forcehybrid changes the app name to “MyHybrid”.

How the Forcehybrid Script Generates New Apps

The forcehybrid script


- Generates apps with the Cordova command line.
- Downloads the template app and a `bootconfig.json` file from GitHub.
- Downloads the SalesforceMobileSDK Cordova plugin from GitHub. This plugin delivers the Mobile SDK libraries as Android library projects.

Create Hybrid Apps

Once you’ve installed forcehybrid and the Cordova command line, you’re ready to create functioning hybrid apps.

Set Up Your Tools

If you haven’t already set up the required tools, use the following instructions. Or, if you prefer, complete the [Set Up Your Mobile SDK Developer Tools](#) Trailhead project and win Trailhead points for your efforts. Afterwards, return here and pick up at [Create a Hybrid Mobile SDK App](#).

 **Note:** Some of the following steps use the `sudo` keyword. This keyword is required in Mac OS X if you lack read/write permissions. Omit the `sudo` command if you’re sure you don’t need it or if you’re installing on Windows.

1. Make sure that you meet the requirements listed at [Development Prerequisites for Android and iOS](#) on page 18. Hybrid development requires at least one native environment, which can be either iOS or Android.
2. Open a command prompt or terminal window.
3. Run `cordova -v`.
4. If `cordova -v` reports that the command is not found, install the Cordova command line, version 7.0.0 or later:

```
sudo npm install -g cordova
```

5. Install the forcehybrid npm package:

```
sudo npm install -g forcehybrid
```

If you previously installed an earlier version of forcehybrid, be sure to uninstall it before reinstalling forcehybrid.

Create a Hybrid Mobile SDK App

1. At a command prompt or terminal window, run `forcehybrid create`.
 - For platform, enter “ios”, “android”, or “ios,android”.

- For application type:
 - Specify `hybrid_local` for a Cordova hybrid app that stores its code on the mobile device.
 - Specify `hybrid_remote` for a Cordova hybrid app that runs a Visualforce app on the server.
 - Provide your own app name, package name, and organization strings.
 - (Hybrid remote apps only) For start page, specify the relative URL of your Apex landing page—for example, `apex/BasicVFPage`.
2. If you're importing HTML, JavaScript, CSS, or `bootconfig.json` files, put them in your project's `<outputdir>/www/` directory.

 **Important:**

- Do not include `cordova.js`, `cordova.force.js`, or any Cordova plug-ins.
 - If you're developing for Android 19 and using Mobile SDK promise-based APIs, include this file: <https://www.promisejs.org/polyfills/promise-7.0.4.min.js>. Mobile SDK promised-based APIs include:
 - The `smartstoreclient` Cordova plugin (`com.salesforce.plugin.smartstore.client`)
 - `force+promise.js`
 - `smartsync.js`
3. In your project directory, open the `www/bootconfig.json` file in a UTF-8 compliant text editor and replace the values of the following properties:
 - `remoteAccessConsumerKey`—Replace the default value with the consumer key from your connected app
 - `oauthRedirectURI`—Replace the default value with the callback URL from your connected app
 4. `cd` to your app's project directory. The `force` script prints the directory name to the screen when it has finished creating your project. For example: "Your application project is ready in `<project directory name>`."
 5. For each additional Cordova plug-in you want to add, type:

```
cordova plugin add <plug-in repo or plug-in name>
```

 **Note:** Go to <https://plugins.cordova.io> to search for available plug-ins.

6. If you've added other Cordova plug-ins, remove and then readd the Salesforce Cordova plug-in:

```
cordova plugin remove com.salesforce
cordova plugin add https://github.com/forcedotcom/SalesforceMobileSDK-CordovaPlugin
--force
```

For example, to add the `cordova-plugin-contacts` and `cordova-plugin-statusbar` plug-ins:

```
cordova plugin add cordova-plugin-contacts
cordova plugin add cordova-plugin-statusbar
cordova plugin remove com.salesforce
cordova plugin add https://github.com/forcedotcom/SalesforceMobileSDK-CordovaPlugin
--force
```

 **Important:** Be sure to include the `--force` parameter when you readd the Salesforce plug-in.

7. (Optional—Mac only) To add a second platform "after the fact":

- To add iOS support, type:

```
cordova platform add ios@4.5.4
```

- To add Android support, type:

```
cordova platform add android@7.0.0
```

8. Type:

```
cordova prepare
```

to deploy your web assets to their respective platform-specific directories under the `www/` directory.

- ❗ **Important:** During development, always run `cordova prepare` after you've changed the contents of the `www/` directory, to deploy your changes to the platform-specific project folders.

See "The Command-Line Interface" in the [Cordova 3.5 documentation](#) for more information on the Cordova command line.

Build and Run Your Hybrid App on Android

Before building, be sure that you've installed Android Studio, including Android SDK and at least one Android emulator. Refer to the Android requirements for Mobile SDK to make sure you install the correct versions of the Android components.

After you've run `cordova prepare`, build and run the project.

To run the app in Android Studio:

1. Launch Android Studio.
2. From the welcome screen, select **Import project (Eclipse ADT, Gradle, etc.)**. Or, if Android Studio is already running, select **File > New > Import Project**.
3. Select `<your_project_dir>/platforms/android` and click **OK**. If you're prompted to use the Gradle wrapper, accept the prompt.
4. After the build finishes, select the `android` target and click **Run 'android'** from either the menu or the toolbar.
5. Select a connected Android device or emulator.

- ❗ **Important:** If Android Studio offers to update your Gradle wrapper version, accept the offer. After the process finishes, Android Studio automatically re-imports your project.

Build and Run Your Hybrid App On iOS

After you've run `cordova prepare` on an iOS hybrid app, you can open the project in Xcode to run the app in an iOS simulator.

To run the app in Xcode:

1. In Xcode, select **File > Open**.
2. Navigate to the `platforms/ios/` directory in your new app's directory.
3. Double-click the `<app_name>.xcodeworkspace` file.
4. Click the Run button in the upper left corner, or press `COMMAND-R`.

Developing Hybrid Remote Apps

You can easily convert the FileExplorer SDK sample

(github.com/forcedotcom/SalesforceMobileSDK-Shared/tree/master/samples/fileexplorer), which is a hybrid local app, into a hybrid remote app. To convert the app, you redefine the main HTML page as a Visualforce page that is delivered from the server. You can then bundle the CSS and JavaScript resources with the app so that they're stored on the device.

Let's start by creating the Visualforce page.

1. In your Salesforce Developer Edition org, create a Visualforce page named "FileExplorer" with the following attributes.

```
<apex:page docType="html-5.0" showHeader="false" sidebar="false">
<!-- Paste content of FileExplorer.html here, but remove the "<!DOCTYPE html>" directive
-->
</apex:page>
```

2. Copy the contents of the `samples/fileexplorer/FileExplorer.html` file into the FileExplorer Visualforce page.
3. Delete the `<!DOCTYPE html>` directive at the top of the inserted content.
4. Save your work.

Next, create a hybrid remote app to contain the sample code.

1. `cd` to the directory where you want to develop your app. The only requirement is that this directory cannot already contain a subdirectory named "fileexplorer".
2. In a Terminal window or command prompt, run `forcehybrid create` with the following values:

Platform:	<code>ios,android</code>
Application type:	<code>hybrid_remote</code>
Application name:	<code>fileexplorer</code>
Package name:	<code>com.salesforce.fileexplorer</code>
Organization name:	<code>Acme Apps, Inc.</code>
Start page:	<code>apex/FileExplorer</code>
Output directory:	<code><press RETURN></code>

3. In a text editor, open `fileexplorer/www/bootconfig.json` and change the following properties as follows:

```
"isLocal": false,
"startPage": "apex/FileExplorer",
```

These settings configure your app to be a hybrid remote app.

4. Return to your Terminal window or command prompt, and then type:

```
cordova prepare
```

Done! To run the Android target, import the `<my_app_directory>/fileexplorer/platforms/android` folder into Android Studio and run the app. Or, to run the iOS target, import the

`<my_app_directory>/fileexplorer/platforms/ios/fileexplorer.xcworkspace` file into Xcode and run the app. When you test this sample, be sure to log in to the organization where you created the Visualforce page.

Using App Resources Stored on localhost

For hybrid remote applications, you are no longer required to host `cordova.js` or any plug-ins on the server. Instead, you can include `cordova.js` as `https://localhost/cordova.js` in your HTML source. For example:

```
<script src="https://localhost/cordova.js"></script>
```

You can also use `https://localhost` for all your CSS and JavaScript resources. You can then bundle those files with the app, rather than delivering them from the server. This approach gives your hybrid remote apps a performance boost while letting you develop with Visualforce and Apex.

Note:

- Mobile SDK 2.3 and later automatically whitelists `https://localhost` in hybrid remote apps. If your app was developed in an earlier version of Mobile SDK, you can manually whitelist `https://localhost` in your `config.xml` file.
- A Visualforce page that uses `https://localhost` to include source files works only in the Salesforce Mobile SDK container application. To make the page also run in a web browser, examine the user agent in Apex and detect whether the client is a Mobile SDK container. Based on your findings, use the appropriate script include tags.

Using localhost in Hybrid Remote Apps for iOS

Beginning with version 5.0, Mobile SDK follows Apple's mandate and deprecates the `UIWebView` class in favor of `WKWebView`. These classes provide the means by which Mobile SDK displays Visualforce pages in iOS hybrid remote apps.


`WKWebView` offers significant graphics performance improvements. It also lets you disable JavaScript when you're loading a web page. There's a catch, though. With `UIWebView`, apps could choose to access their web app files through localhost, thus avoiding many roundtrips to the server. `WKWebView` enforces a stricter content security protocol than its predecessor and does not support localhost. This restriction obviously defeats hybrid remote apps that store their web app files locally.

All hope is not gone, however: If your app uses localhost, you can simply switch back to `UIWebView`. Here are the steps for making that switch.

1. In Xcode, open your hybrid remote project.
2. In the Project Navigator, expand the `Plugins` folder.
3. Select the `AppDelegate+SalesforceHybridSDK.m` file.
4. In the code editor, find the `setupRootViewController` method definition.
5. On the right-hand side of the `self.viewController` assignment, add a `userUIWebView:YES` argument to the end of the parameter list:

```
self.viewController = [[SFHybridViewController alloc]
    initWithConfig: (SFHybridViewConfig*)
        [SalesforceSDKManager sharedManager].appConfig
    useUIWebView:YES];
```

This code change persists unless you recreate your app with `forceios create`. If you do recreate your app, don't forget to add this code to the freshly generated `AppDelegate+SalesforceHybridSDK.m` file.

 **Important:** Before switching to `UIWebView`, be sure to read up on the differences between the two classes. You can find information on sites such as blog.initlabs.com, stackexchange.com, and forums.developer.apple.com.

Hybrid Sample Apps

Salesforce Mobile SDK provides hybrid samples that demonstrate how to use Mobile SDK features in JavaScript. We provide hybrid samples two ways:

- As platform-specific apps with native wrappers. We provide these wrappers for a limited subset of our hybrid samples. You can access the iOS samples through the Mobile SDK workspace (`SalesforceMobileSDK.xcodeproj`) in the root directory of the SalesforceMobileSDK-iOS GitHub repository. Also, you can access the Android samples from the `hybrid/SampleApps` directory of the SalesforceMobileSDK-Android repository.
- As platform-agnostic web apps including only the HTML5, JavaScript, CSS source code. These apps include all of our hybrid samples and provide the basis for the platform-specific hybrid apps. You can download these sample apps from the SalesforceMobileSDK-Shared GitHub repo and build them using the Cordova command line.

Android Hybrid Sample Wrappers

- **AccountEditor:** Demonstrates how to synchronize offline data using the `smartsync.js` library.
- **NoteSync:** Demonstrates how to use non-REST APIs to retrieve Salesforce Notes.
- **SmartSyncExplorerHybrid:** Demonstrates how to synchronize offline data using the SmartSync Data Framework plugin.

iOS Hybrid Sample Wrappers

- **AccountEditor:** Demonstrates how to synchronize offline data using the `smartsync.js` library.
- **NoteSync:** Demonstrates how to use non-REST APIs to retrieve Salesforce Notes.
- **SmartSyncExplorerHybrid:** Demonstrates how to synchronize offline data using the SmartSync Data Framework plugin.


Source-only Hybrid Sample Apps

Salesforce Mobile SDK provides the following platform-agnostic hybrid sample apps in the the SalesforceMobileSDK-Shared GitHub repository.

- **accounteditor:** Uses the SmartSync Data Framework to access Salesforce data.
- **contactexplorer:** Uses Cordova to retrieve local device contacts. It also uses the `force.js` toolkit to implement REST transactions with the Salesforce REST API. The app uses the OAuth2 support in Salesforce SDK to obtain OAuth credentials and then propagates those credentials to `force.js` by sending a javascript event.
- **fileexplorer:** Demonstrates the Files API.
- **notesync:** Uses non-REST APIs to retrieve Salesforce Notes.
- **simplesyncreact:** Demonstrates a React Native app that uses the SmartSync Data Framework plug-in.
- **smartstoreexplorer:** Lets you explore SmartStore APIs.
- **smartsynceexplorer:** Demonstrates using `smartsync.js`, rather than the SmartSync Data Framework plug-in, for offline synchronization.
- **userandgroupsearch:** Lets you search for users in groups.
- **userlist:** Lists users in an organization. This is the simplest hybrid sample app.
- **usersearch:** Lets you search for users in an organization.
- **vfconnector:** Wraps a Visualforce page in a native container. This example assumes that your org has a Visualforce page called `BasicVFTest`. The app first obtains OAuth login credentials using the Salesforce SDK OAuth2 support and then uses those credentials to set appropriate webview cookies for accessing Visualforce pages.

Build Hybrid Sample Apps

To build hybrid apps from the `samples` directory of the [SalesforceMobileSDK-Shared](#) repository, you use `forcehybrid` and the Cordova command line. You create a `hybrid_local` or `hybrid_remote` app and then add the web assets—HTML, JavaScript, and CSS files—and the `bootconfig.json` file from the Shared repo.

 **Note:** The ContactExplorer sample requires the `cordova-plugin-contacts` and `cordova-plugin-statusbar` plug-ins.

The other hybrid sample apps do not require special Cordova plug-ins.

To build one of the sample apps:

1. Open a command prompt or terminal window.
2. Clone the shared repo:

```
git clone https://github.com/forcedotcom/SalesforceMobileSDK-Shared
```

3. Use `forcehybrid` to create an app.
 - For platform, enter one or both platform names: “ios”, “android”, or “ios,android”.
 - For application type (or the `apptype` parameter), enter “hybrid_local”.

4. Change to your new app directory:

```
cd <app_target_directory>
```

5. For each additional Cordova plug-in you want to add, type:

```
cordova plugin add <plug-in repo or plug-in name>
```

 **Note:** Go to <https://plugins.cordova.io> to search for available plug-ins.

6. If you’ve added other Cordova plug-ins, remove and then readd the Salesforce Cordova plug-in:

```
cordova plugin remove com.salesforce
cordova plugin add https://github.com/forcedotcom/SalesforceMobileSDK-CordovaPlugin
--force
```

For example, to add the `cordova-plugin-contacts` and `cordova-plugin-statusbar` plug-ins:

```
cordova plugin add cordova-plugin-contacts
cordova plugin add cordova-plugin-statusbar
cordova plugin remove com.salesforce
cordova plugin add https://github.com/forcedotcom/SalesforceMobileSDK-CordovaPlugin
--force
```

 **Important:** Be sure to include the `--force` parameter when you readd the Salesforce plug-in.

7. (Optional—Mac only) To add iOS support to an Android project “after the fact”:

```
cordova platform add ios@4.5.4
```

8. (Optional—Mac only) To add Android support to an iOS project “after the fact”:

```
cordova platform add android@7.0.0
```

- Copy the sample source files to the `www` folder of your new project directory.

On Mac:

```
cp -RL <local path to SalesforceMobileSDK-Shared>/SampleApps/<template>/.* www/
```

On Windows:

```
copy <local path to SalesforceMobileSDK-Shared>\SampleApps\<template>\*.* www
```

If you're asked, affirm that you want to overwrite existing files.

- Do the final Cordova preparation:

```
cordova prepare
```

Note:

- Android Studio refers to forcehybrid projects by the platform name ("android"). For example, to run your project, select "android" as the startup project and then click Run.
- On Windows, Android Studio sets the default project encoding to `windows-1252`. This setting conflicts with the `UTF-8` encoding of the forcehybrid Gradle build files. For best results, change the default project encoding to `UTF-8`.
- On Windows, be sure to run Android Studio as administrator.

Running the ContactExplorer Hybrid Sample

Let's look at the ContactExplorer sample app, which is included in Mobile SDK. You can do this exercise on Mac OS or Windows, but you can fully validate the iOS target only on a Mac.

Before starting this exercise, be sure that you have:

- A directory to contain the `SalesforceMobileSDK-Shared` cloned repo—your root directory, or any other easily accessible location.
- A directory for creating and developing Mobile SDK hybrid projects. Since Cordova projects can contain both Android and iOS targets, it's a good idea to put them in a platform-neutral directory.

Source code for sample apps lives on GitHub, so let's start by cloning the shared repository.

- Open a command prompt or Terminal window.
- Clone the shared repo:

```
git clone https://github.com/forcedotcom/SalesforceMobileSDK-Shared
```

- `cd` to your app's project directory. The force script prints the directory name to the screen when it has finished creating your project. For example: "Your application project is ready in `<project directory name>`."
- Run `forcehybrid create` with the following values:

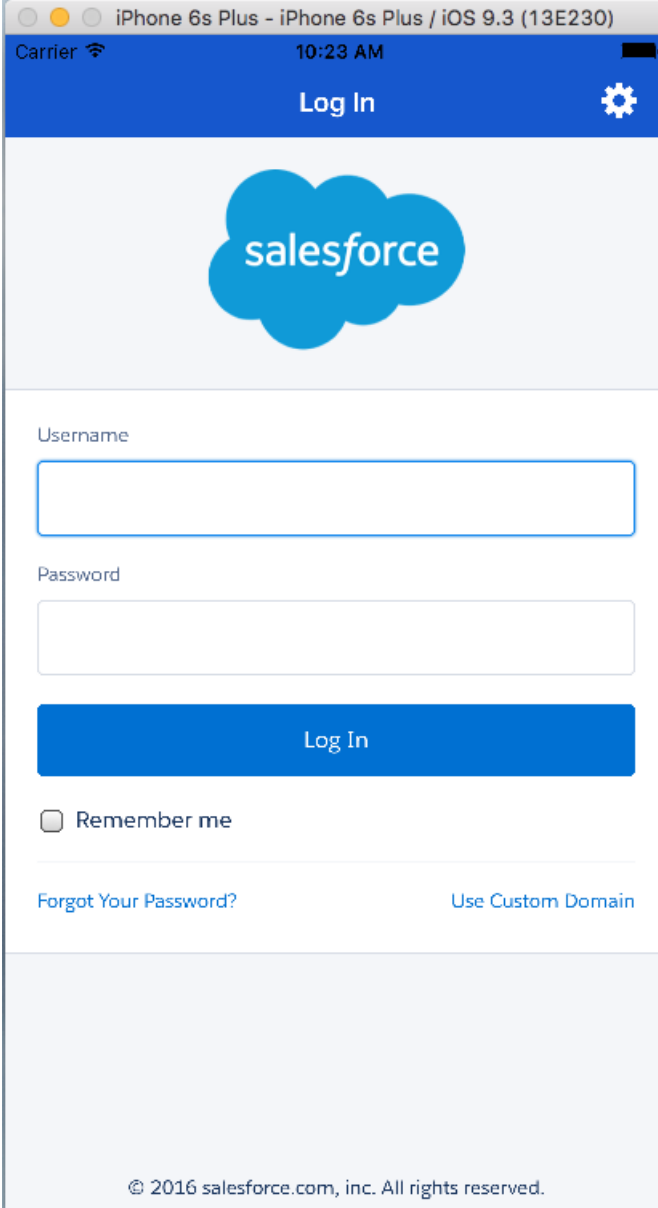
```
Enter the target platform(s) separated by commas (ios, android): ios,android
Enter your application type (hybrid_local, hybrid_remote): hybrid_local
Enter your application name: contactsApp
Enter the package name for your app (com.mycompany.myapp): com.salesforce.contactexplorer
Enter your organization name (Acme, Inc.): AcmeApps.com
Enter output directory for your app (leave empty for the current directory): <press
RETURN>
```

5. After forcehybrid finishes, run the following commands. **Windows users:** To run the script on Windows, replace the `cp` command with the Windows `copy` command. Be aware, however, that the JS and CSS files are merely aliases to the “real” files. Make sure that you copy the aliased files rather than their links. Also, remove the `cordova platform add ios` command, which isn't Windows-compatible.

```
cd contactsApp
cordova plugin add cordova-plugin-contacts
cordova plugin add cordova-plugin-statusbar
cordova plugin remove com.salesforce
cordova plugin add https://github.com/forcedotcom/SalesforceMobileSDK-CordovaPlugin
--force
cp -RL <local path to SalesforceMobileSDK-Shared>/samples/contactexplorer/* www/
cordova prepare
```

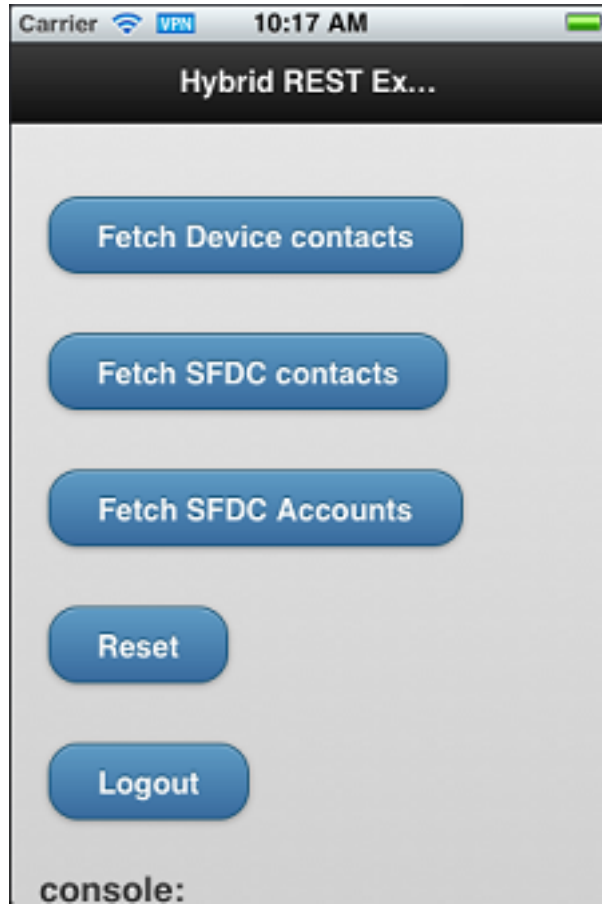
The script creates an iOS project and an Android project, both of which wrap the ContactExplorer sample app. Now we're ready to run the app on one of these platforms. If you're using an iOS device, you must configure a profile for the simulator, as described in the Xcode User Guide at developer.apple.com/library. Similarly, Android devices must be set up as described at developer.android.com/tools.

When you run the app, after an initial splash screen, you see the Salesforce login screen.

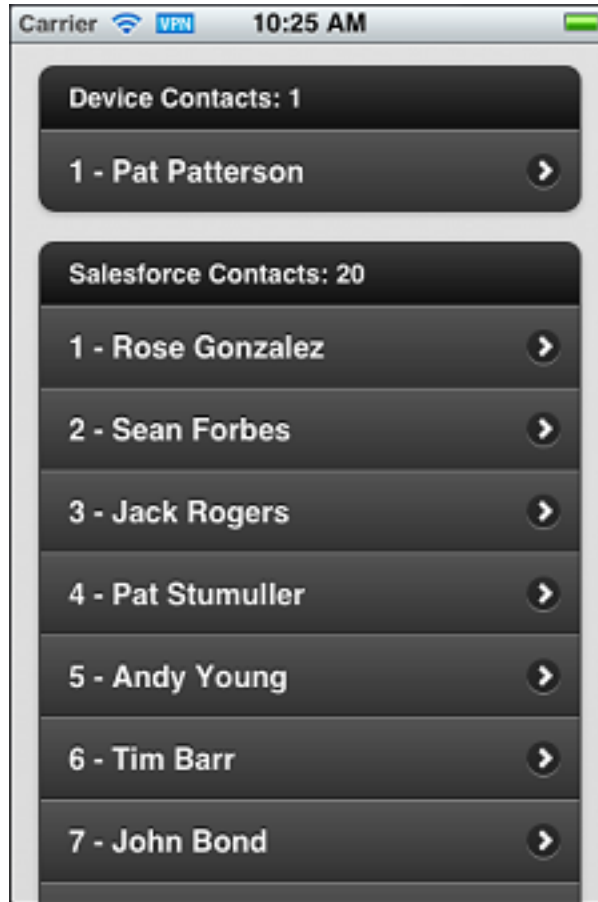


The screenshot shows the Salesforce login interface on an iPhone 6s Plus. The status bar at the top indicates the carrier, signal strength, Wi-Fi, and battery levels, along with the time 10:23 AM. The app's title bar is blue with the text "Log In" and a settings gear icon. Below this is the Salesforce logo, a blue cloud with the word "salesforce" in white. The main form area contains two input fields: "Username" and "Password". Below the password field is a blue "Log In" button. Underneath the button is a "Remember me" checkbox. At the bottom of the form are two links: "Forgot Your Password?" and "Use Custom Domain". The footer of the app displays the copyright notice: "© 2016 salesforce.com, inc. All rights reserved."

Log in with your Developer Edition org username and password. To allow the app to access your Salesforce data, tap **Allow**. Now that you're in the app, you can retrieve lists of contacts and accounts. Tap **Fetch SFDC contacts** to retrieve Salesforce contact names or **Fetch SFDC Accounts** to retrieve account names from your DE organization.



With each tap, the app appends rows to an infinite list. Scroll down to see the full list.



Let's take a closer look at how the app works.

To initiate a user session with `force.js`, you call `force.login()`. After the user logs in to an app running in the container, the network plug-in refreshes tokens as necessary when the app tries to access Salesforce resources. The following code, adapted from the ContactExplorer sample, demonstrates a typical `force.login()` implementation.

When the device notifies that it's ready, you call the `force.login()` method to post the login screen.

```
/* Do login */
force.login(
  function() {
    console.log("Auth succeeded");
    // Call your app's entry point
    // ...
  },
  function(error) {
    console.log("Auth failed: " + error);
  }
);
```

After completing the login process, the sample app displays `index.html` (located in the `www` folder). When the page has completed loading and the mobile framework is ready, the `jQuery(document).ready()` function calls `regLinkClickHandlers()`.

This function (in `inline.js`) sets up click handlers for the various functions in the sample app. For example, the `#link_fetch_sfdc_contacts` handler runs a query using the `force` object.

```
$j('#link_fetch_sfdc_contacts').click(function() {
    logToConsole("link_fetch_sfdc_contacts clicked");
    force.query("SELECT Name FROM Contact",
        onSuccessSfdcContacts, onErrorSfdc);
});
```

The `force` object is set up during the initial OAuth 2.0 interaction, and gives access to the REST API in the context of the authenticated user. Here, we retrieve the names of all the contacts in the DE organization. `onSuccessSfdcContacts()` then renders the contacts as a list on the `index.html` page.

```
$j('#link_fetch_sfdc_accounts').click(function() {
    logToConsole("link_fetch_sfdc_accounts clicked");
    force.query("SELECT Name FROM Account",
        onSuccessSfdcAccounts, onErrorSfdc);
});
```

Similarly to the `#link_fetch_sfdc_contacts` handler, the `#link_fetch_sfdc_accounts` handler fetches Account records via the REST API. The `#link_reset` and `#link_logout` handlers clear the displayed lists and log out the user, respectively.

Notice that the app can also retrieve contacts from the device—something that an equivalent web app would be unable to do. The following click handler retrieves device contact query by calling the Cordova contacts plug-in.

```
$j('#link_fetch_device_contacts').click(function() {
    logToConsole("link_fetch_device_contacts clicked");
    var contactOptionsType = cordova.require(
        "org.apache.cordova.contacts.ContactFindOptions");
    var options = new contactOptionsType();
    options.filter = ""; // empty search string returns all contacts
    options.multiple = true;
    var fields = ["name"];
    var contactsObj = cordova.require(
        "org.apache.cordova.contacts.contacts");
    contactsObj.find(fields, onSuccessDevice,
        onErrorDevice, options);
});
```

This handler calls `find()` on the `org.apache.cordova.contacts.contacts` object to retrieve the contact list from the device. The `onSuccessDevice()` function (not shown here) renders the contact list into the `index.html` page.

Get the complete ContactExplorer sample application here:

<https://github.com/forcedotcom/SalesforceMobileSDK-Shared/tree/master/samples/contactexplorer>

SEE ALSO:

[Build and Run Your Hybrid App On iOS](#)

[Build and Run Your Hybrid App on Android](#)

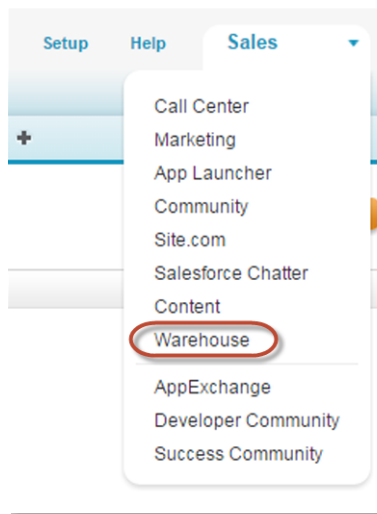
Create a Mobile Page to List Information

The ContactExplorer sample hybrid app is useful in many respects, and serves as a good starting point to learn hybrid mobile app development. You can have more fun with it by modifying it to display merchandise records from a custom Salesforce schema named

Warehouse. You'll need to install this app in a Developer Edition org. If you install it in an existing DE org, be sure to delete any existing Warehouse components you've made before you install.

To install the Warehouse app:

1. Click the installation URL link: <http://goo.gl/1FYg90>
2. If you aren't logged in, enter the username and password of your DE org.
3. Select an appropriate level of visibility for your organization.
4. Click **Install**.
5. Click **Done**.
6. Once the installation completes, you can select the **Warehouse** app from the app picker in the upper right corner.



7. To create data, click the **Data** tab.
8. Click the **Create Data** button.

Note:

- If you're modifying a Cordova iOS project in Xcode, you may need to copy your code to the `staging/www/` project folder to test your changes. If you use only the Cordova command line instead of Xcode to build Cordova iOS apps, you should modify only the `<projectname>/www/` folder.

Modify the App's Initialization Block (index.html)

In this section, you modify the view file (`index.html`) and the controller (`inline.js`) to make the app specific to the Warehouse schema and display all records in the Merchandise custom object.

In your app, you want a list of Merchandise records to appear on the default Home page of the mobile app. Consequently, the first thing to do is to modify what happens automatically when the app calls the `jQuery(document).ready` function. Comment out the call to `regLinkClickHandlers()` in the `jQuery(document).ready` function. Then, add the following code immediately after this now-commented line.

```
logToConsole("Auth succeeded");
// regLinkClickHandlers();
```

```
// retrieve Merchandise records, including the Id for links
force.query("SELECT Id, Name, Price__c, Quantity__c
            FROM Merchandise__c", onSuccessSfdcMerchandise, onErrorSfdc);
```

Notice that this JavaScript code leverages the `force.js` library to process a SOQL statement that retrieves records from the Merchandise custom object. On success, the function calls the JavaScript function `onSuccessSfdcMerchandise` (which you add in a moment).

Create the App's mainpage View (index.html)

To display the Merchandise records in a standard mobile, touch-oriented user interface, scroll down in `index.html` and replace the entire contents of the `<body>` tag with the following HTML.

```
<!-- Main page, to display list of Merchandise once app starts -->
<div data-role="page" data-theme="b" id="mainpage">
  <!-- page header -->
  <div data-role="header">
    <!-- button for logging out -->
    <a href="#" id="link_logout" data-role="button"
      data-icon='delete'>
      Log Out
    </a>
    <!-- page title -->
    <h2>List</h2>
  </div>
  <!-- page content -->
  <div id="#content" data-role="content">
    <!-- page title -->
    <h2>Mobile Inventory</h2>
    <!-- list of merchandise, links to detail pages -->
    <div id="div_merchandise_list">
      <!-- built dynamically by function onSuccessSfdcMerchandise -->
    </div>
  </div>
</div>
```

Overall, notice that the updated view uses standard HTML tags and jQuery Mobile markup (e.g., `data-role`, `data-theme`, `data-icon`) to format an attractive touch interface for your app. Developing hybrid-based mobile apps is straightforward if you already know some basic standard Web development technology, such as HTML, CSS, JavaScript, and jQuery.

Modify the App's Controller (inline.js)

In the previous section, the initialization block in the view defers to the `onSuccessSfdcMerchandise` function of the controller to dynamically generate the HTML that renders Merchandise list items in the encompassing div, `div_merchandise_list`. In this step, you build the `onSuccessSfdcMerchandise` function.

Open the `inline.js` file and add the following controller action, which is somewhat similar to the sample functions.

! **Important:** Be careful if you cut and paste this or any code from a binary file! It's best to purify it first by pasting it into a plain text editor and then copying it from there. Also, remove any line breaks that occur in the middle of code statements.

```
// handle successful retrieval of Merchandise records
function onSuccessSfdcMerchandise(response) {
  // avoid jQuery conflicts
```

```

var $j = jQuery.noConflict();
var logToConsole =
    cordova.require("com.salesforce.util.logger").logToConsole;
// debug info to console
logToConsole("onSuccessSfdcMerchandise: received " +
    response.totalSize + " merchandise records");

// clear div_merchandise_list HTML
$j("#div_merchandise_list").html("");

// set the ul string var to a new UL
var ul = $j('<ul data-role="listview" data-inset="true"
    data-theme="a" data-dividertheme="a"></ul>');

// update div_merchandise_list with the UL
$j("#div_merchandise_list").append(ul);

// set the first li to display the number of records found
// formatted using list-divider
ul.append($j('<li data-role="list-divider">Merchandise records: '
    + response.totalSize + '</li>'));

// add an li for the merchandise being passed into the function
// create array to store record information for click listener
inventory = new Array();
// loop through each record, using vars i and merchandise
$j.each(response.records, function(i, merchandise) {
    // create an array element for each merchandise record
    inventory[merchandise.Id] = merchandise;
    // create a new li with the record's Name
    var newLi = $j("<li class='detailLink' data-id='" +
        merchandise.Id + "'><a href='#'>" +
        merchandise.Name + "</a></li>");
    ul.append(newLi);
});

// render (create) the list of Merchandise records
$j("#div_merchandise_list").trigger( "create" );
// send the rendered HTML to the log for debugging
logToConsole($j("#div_merchandise_list").html());

// set up listeners for detailLink clicks
$j(".detailLink").click(function() {
    // get the unique data-id of the record just clicked
    var id = $j(this).attr('data-id');
    // using the id, get the record from the array created above
    var record = inventory[id];

    // use this info to set up various detail page information
    $j("#name").html(record.Name);
    $j("#quantity").val(record.Quantity__c);
    $j("#price").val(record.Price__c);
    $j("#detailpage").attr("data-id",record.Id);

```

```

    // change the view to the detailpage
    $j.mobile.changePage('#detailpage', {changeHash: true});

});
}

```

The comments in the code explain each line. Notice the call to `logToConsole()`; the JavaScript outputs rendered HTML to the console log so that you can see what the code creates. Here's an excerpt of some sample output.

```

<ul data-role="listview" data-inset="true" data-theme="a"
  data-dividertHEME="a" class="ui-listview ui-listview-inset
  ui-corner-all ui-shadow">
  <li data-role="list-divider" role="heading"
    class=
      "ui-li ui-li-divider ui-btn ui-bar-a ui-corner-top">
    Merchandise records: 6
  </li>
  <li class="detailLink ui-btn ui-btn-up-a ui-btn-icon-right ui-li"
    data-id="a00E0000003BzSfIAK" data-theme="a">
    <div class="ui-btn-inner ui-li">
      <div class="ui-btn-text">
        <a href="#" class="ui-link-inherit">Tablet</a>
      </div>
    </div>
  </li>
  <li class="detailLink ui-btn ui-btn-up-a ui-btn-icon-right ui-li"
    data-id="a00E0000003BuUpIAK" data-theme="a">
    <div class="ui-btn-inner ui-li">
      <div class="ui-btn-text">
        <a href="#" class="ui-link-inherit">Laptop</a>
      </div>
    </div>
  </li>
  ...
</ul>

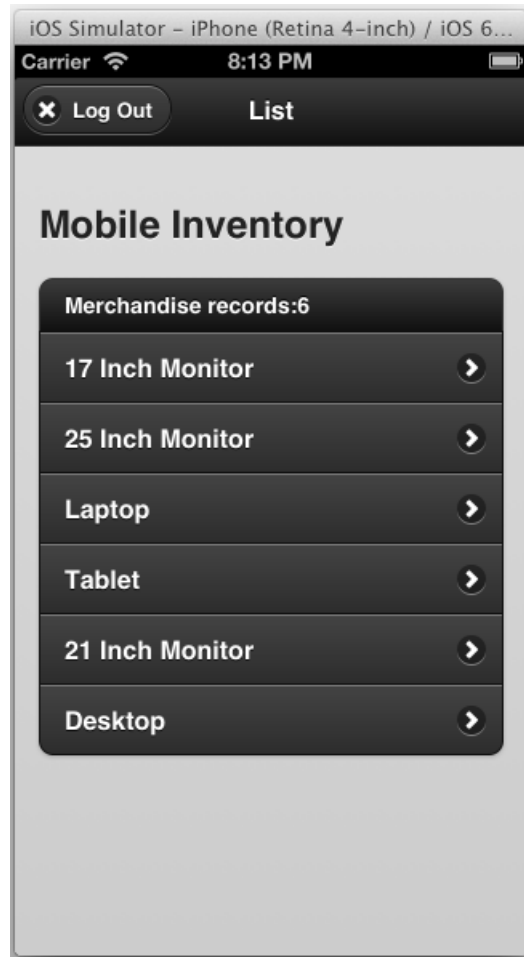
```

In particular, notice how the code:

- creates a list of Merchandise records for display on the app's primary page
- creates each list item to display the Name of the Merchandise record
- creates each list item with unique link information that determines what the target detail page displays

Test the New App

Restart the simulator for your mobile app. When you do, the initial page should look similar to the following screen.



If you click any particular Merchandise record, nothing happens yet. The list functionality is useful, but even better when paired with the detail view. The next section helps you build the *detailpage* that displays when a user clicks a specific Merchandise record.

Create a Mobile Page for Detailed Information

In the previous topic, you modified the sample hybrid app so that, after it starts, it lists all Merchandise records and provides links to detail pages. In this topic, you finish the job by creating a *detailpage* view and updating the app's controller.

Create the App's detailpage View (index.html)

When a user clicks on a Merchandise record in the app's *mainpage* view, click listeners generate record-specific information and then load a view named *detailpage* that displays this information. To create the *detailpage* view, add the following div tag after the *mainpage* div tag.

```
<!-- Detail page, to display details when user clicks specific Merchandise record -->
<div data-role="page" data-theme="b" id="detailpage">
  <!-- page header -->
  <div data-role="header">
    <!-- button for going back to mainpage -->
    <a href='#mainpage' id="backInventory"
```



```

        class='ui-btn-left' data-icon='home'>
            Home
        </a>
        <!-- page title -->
        <h1>Edit</h1>
    </div>
    <!-- page content -->
    <div id="#content" data-role="content">
        <h2 id="name"></h2>
        <label for="price">
            Price ($):</label>
        <input type="text" id="price" readonly="readonly"></input>
        <br/>
        <label for="quantity">
            Quantity:</label>
        <!-- note that number is not universally supported -->
        <input type="number" id="quantity"></input>
        <br/>
        <a href="#" data-role="button" id="updateButton"
            data-theme="b">Update</a>
    </div>
</div>

```

The comments explain each part of the HTML. Basically, the view is a form that lets the user see a Merchandise record's Price and Quantity fields, and optionally update the record's Quantity.

Recall, the jQuery calls in the last part of the `onSuccessSfdcMerchandise` function (in `inline.js`) update the detail page elements with values from the target Merchandise record. Review that code, if necessary.

Modify the App's Controller (`inline.js`)

What happens when a user clicks the Update button in the new *detailpage* view? Nothing, yet. You need to modify the app's controller (`inline.js`) to handle clicks on that button.

In `inline.js`, add the following JavaScript to the tail end of the `onSuccessSfdcMerchandise` function.

```

// handle clicks to Update on detailpage
$( "#updateButton" ).click( function() {
    // update local information in the inventory array
    inventory[$j("#detailpage").attr("data-id")].Quantity__c = $j("#quantity").val();
    currentRecord = inventory[$j("#detailpage").attr("data-id")];

    // repackage the ID with the quantity value before updating the database
    var data = new Object();
    data.Quantity__c = $j("#quantity").val();
    data.Id = currentRecord.Id;

    // update the database
    force.update("Merchandise__c", data, updateSuccess, onErrorSfdc);
});

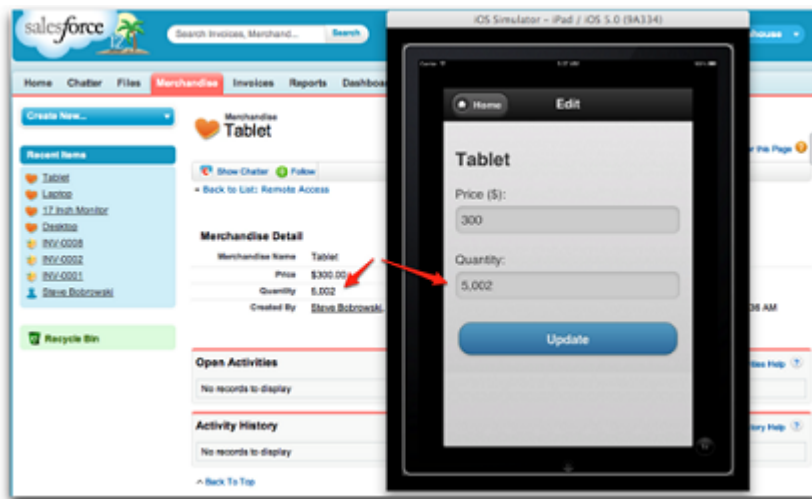
```

The comments in the code explain each line. On success, the new handler calls the `updateSuccess` function, which is not currently in place. Add the following simple function to `inline.js`.

```
function updateSuccess(message) {
    alert("Item Updated");
}
```

Test the App

Restart the simulator for your mobile app. When you do, a detail page should appear when you click a specific Merchandise record and look similar to the following screen.



Feel free to update a record's quantity, and then check that you see the same quantity when you log into your DE org and view the record using the app UI (see above).

Debugging Hybrid Apps On a Mobile Device

You can debug hybrid apps while they're running on a mobile device. How you do it depends on your development platform.

If you run into bugs that show up only when your app runs on a real device, you'll want to use your desktop developer tools to troubleshoot those issues. It's not always obvious to developers how to connect the two runtimes, and it's not well documented in some cases. Here are general platform-specific steps for attaching a Web app debugger on your machine to a running app on a connected device.

Debugging a Hybrid App On an Android Device

To debug hybrid apps on Android devices, use Google Chrome.

The following steps summarize the full instructions posted at <https://developer.chrome.com/devtools/docs/remote-debugging>

1. Enable USB debugging on your device: <https://developer.chrome.com/devtools/docs/remote-debugging>
2. Open Chrome on your desktop (development) machine and navigate to: `chrome://inspect`
3. Select **Discover USB Devices**.
4. Select your device.
5. To use your device to debug a web application that's running on your development machine:

- a. Click **Port forwarding...**
- b. Set the device port and the localhost port.
- c. Select **Enable port forwarding**. See <https://developer.chrome.com/devtools/docs/remote-debugging#port-forwarding> for details.

Debugging a Hybrid App Running On an iOS Device

To debug hybrid apps on real or simulated iOS devices, use Safari on the desktop and the device.

1. Open Safari on the desktop.
2. Select **Safari > Preferences**.
3. Click the **Advanced** tab.
4. Click **Show Develop menu in menu bar**.
5. If you're using the iOS simulator:
 - If Xcode is open, press CONTROL and click the Xcode icon in the task bar and then select **Open Developer Tool > iOS Simulator**.
 - Or, in a Terminal window, type `open -a iOS\ Simulator`.
6. In the iOS Simulator menu, select **Hardware > Device**.
7. Select a device.
8. Open Safari from the home screen of the device or iOS Simulator.
9. Navigate to the location of your web app.
10. In Safari on your desktop, select **Developer > <your device>**, and then select the URL that you opened in Safari on the device or simulator.

The Web Inspector window opens and attaches itself to the running Safari instance on your device.

PhoneGap provides instructions for debugging PhoneGap (Cordova) hybrid apps on iOS [here](#). See https://developer.apple.com/library/ios/documentation/IDEs/Conceptual/iOS_Simulator_Guide/.

Controlling the Status Bar in iOS 7 Hybrid Apps

In iOS 7 you can choose to show or hide the status bar, and you can control whether it overlays the web view. You use the Cordova status bar plug-in to configure these settings. By default, the status bar is shown and overlays the web view in Salesforce Mobile SDK 2.3 and later.

To hide the status bar, add the following keys to the application plist:

```
<key>UIStatusBarHidden</key>
<true/>
<key>UIViewControllerBasedStatusBarAppearance</key>
<false/>
```

For an example of a hidden status bar, see the AccountEditor sample app.

To control status bar appearance--overlying, background color, translucency, and so on--add `org.apache.cordova.statusbar` to your app:

```
cordova plugin add org.apache.cordova.statusbar
```

You control the appearance either from the `config.xml` file or from JavaScript. See <https://github.com/apache/cordova-plugin-statusbar> for full instructions. For an example of a status bar that doesn't overlay the web view, see the ContactExplorer sample app.

SEE ALSO:

[Hybrid Sample Apps](#)

JavaScript Files for Hybrid Apps

External Dependencies

Mobile SDK uses the following external dependencies for various features of hybrid apps.

External JavaScript File	Description
<code>jquery.js</code>	Popular HTML utility library
<code>underscore.js</code>	SmartSync Data Framework support
<code>backbone.js</code>	SmartSync Data Framework support

Which JavaScript Files Do I Include?

Beginning with Mobile SDK 2.3, the Cordova utility copies the Cordova plug-in files your application needs to your project's platform directories. You don't need to add those files to your `www/` folder.

Files that you include in your HTML code (with a `<script>` tag) depend on the type of hybrid project. For each type described here, include all files in the list.

For basic hybrid apps:

- `cordova.js`

To make REST API calls from a basic hybrid app:

- `cordova.js`
- `force.js`

To use SmartSync Data Framework in a hybrid app:

- `jquery.js`
- `underscore.js`
- `backbone.js`
- `cordova.js`
- `force.js`
- `smartsync.js`

Versioning and JavaScript Library Compatibility

In hybrid applications, client JavaScript code interacts with native code through Cordova (formerly PhoneGap) and SalesforceSDK plug-ins. When you package your JavaScript code with your mobile application, your testing assures that the code works with native code. However, if the JavaScript code comes from the server—for example, when the application is written with VisualForce—harmful conflicts can occur. In such cases you must be careful to use JavaScript libraries from the version of Cordova that matches the Mobile SDK version you're using.

For example, suppose you shipped an application with Mobile SDK 1.2, which uses PhoneGap 1.2. Later, you ship an update that uses Mobile SDK 1.3. The 1.3 version of the Mobile SDK uses Cordova 1.8.1 rather than PhoneGap 1.2. You must make sure that the JavaScript code in your updated application accesses native components only through the Cordova 1.8.1 and Mobile SDK 1.3 versions of the JavaScript libraries. Using mismatched JavaScript libraries can crash your application.

You can't force your customers to upgrade their clients, so how can you prevent crashes? First, identify the version of the client. Then, you can either deny access to the application if the client is outdated (for example, with a "Please update to the latest version" warning), or, preferably, serve compatible JavaScript libraries.

The following table correlates Cordova and PhoneGap versions to Mobile SDK versions.

Mobile SDK version	Cordova or PhoneGap version
1.2	PhoneGap 1.2
1.3	Cordova 1.8.1
1.4	Cordova 2.2
1.5	Cordova 2.3
2.0	Cordova 2.3
2.1	Cordova 2.3
2.2	Cordova 2.3
2.3	Cordova 3.5
3.0	Cordova 3.6
3.1	Cordova 3.6
3.2	Cordova 3.6
3.3	Cordova 3.6
4.0	Cordova 5.0.0 (for Android), 3.9.2 (for iOS)
4.1	Cordova 5.0.0 (for Android), 3.9.2 (for iOS)
4.2	Cordova 5.0.0 (for Android), 3.9.2 (for iOS)
4.3	Cordova 5.0.0 (for Android), 4.2.0 (for iOS)

Finding the Mobile SDK Version with the User Agent

You can leverage the user agent string to look up the Mobile SDK version. The user agent starts with `SalesforceMobileSDK/<version>`. Once you obtain the user agent, you can parse the returned string to find the Mobile SDK version.

You can obtain the user agent on the server with the following Apex code:

```
userAgent = ApexPages.currentPage().getHeaders().get('User-Agent');
```

On the client, you can do the same in JavaScript using the `navigator` object:

```
userAgent = navigator.userAgent;
```

Detecting the Mobile SDK Version with the `sdkinfo` Plugin

In JavaScript, you can also retrieve the Mobile SDK version and other information by using the `sdkinfo` plug-in. This plug-in, which is defined in the `cordova.force.js` file, offers one method:

```
getInfo(callback)
```

This method returns an associative array that provides the following information:

Member name	Description
<code>sdkVersion</code>	Version of the Salesforce Mobile SDK used to build to the container. For example: "1.4".
<code>appName</code>	Name of the hybrid application.
<code>appVersion</code>	Version of the hybrid application.
<code>forcePluginsAvailable</code>	Array containing the names of Salesforce plug-ins installed in the container. For example: "com.salesforce.oauth", "com.salesforce.smartstore", and so on.

The following code retrieves the information stored in the `sdkinfo` plug-in and displays it in alert boxes.

```
var sdkinfo = cordova.require("com.salesforce.plugin.sdkinfo");
sdkinfo.getInfo(new function(info) {
    alert("sdkVersion->" + info.sdkVersion);
    alert("appName->" + info.appName);
    alert("appVersion->" + info.appVersion);
    alert("forcePluginsAvailable->" +
        JSON.stringify(info.forcePluginsAvailable));
});
```

SEE ALSO:

[Example: Serving the Appropriate Javascript Libraries](#)

Example: Serving the Appropriate Javascript Libraries


To provide the correct version of Javascript libraries, create a separate bundle for each Salesforce Mobile SDK version you use. Then, provide Apex code on the server that downloads the required version.

1. For each Salesforce Mobile SDK version that your application supports, do the following.

- a. Create a ZIP file containing the Javascript libraries from the intended SDK version.
- b. Upload the ZIP file to your org as a static resource.

For example, if you ship a client that uses Salesforce Mobile SDK v. 1.3, add these files to your ZIP file:

- `cordova.force.js`
- `SalesforceOAuthPlugin.js`
- `bootconfig.js`
- `cordova-1.8.1.js`, which you should rename as `cordova.js`

 **Note:** In your bundle, it's permissible to rename the Cordova Javascript library as `cordova.js` (or `PhoneGap.js` if you're packaging a version that uses a `PhoneGap-x.x.js` library.)

2. Create an Apex controller that determines which bundle to use. In your controller code, parse the user agent string to find which version the client is using.

- a. In your org, from Setup, click **Develop > Apex Class**.
- b. Create a new Apex controller named `SDKLibController` with the following definition.

```
public class SDKLibController {
    public String getSDKLib() {
        String userAgent =
            ApexPages.currentPage().
                getHeaders().get('User-Agent');

        if (userAgent.contains('SalesforceMobileSDK/1.3')) {
            return 'sdklib13';
        }
        // Add if statements for other SalesforceSDK versions
        // for which you provide library bundles.
    }
}
```

3. Create a Visualforce page for each library in the bundle, and use that page to redirect the client to that library.


For example, for the `SalesforceOAuthPlugin` library:

- a. In your org, from Setup, enter *Visualforce Pages* in the Quick Find box, then select **Visualforce Pages**.
- b. Create a new page called "SalesforceOAuthPlugin" with the following definition.

```
<apex:page controller="SDKLibController"
    action="{!URLFor($Resource[SDKLib],
    'SalesforceOAuthPlugin.js')}">
</apex:page>
```

- c. Reference the VisualForce page in a `<script>` tag in your HTML code. Be sure to point to the page you created in step 3b. For example:

```
<script type="text/javascript"
  src="/apex/SalesforceOAuthPlugin" />
```

 **Note:** Provide a separate `<script>` tag for each library in your bundle.


Managing Sessions in Hybrid Apps

To help resolve common issues that often affect mobile apps, Mobile SDK wraps hybrid apps in native containers. These containers provide seamless authentication and session management by internally managing OAuth token exchanges. However, as popular mobile app architectures evolve, this “one size fits all” approach proves to be too limiting in some cases. For example, if a mobile app uses JavaScript remoting in Visualforce, Salesforce cookies can be lost if the user lets the session expire. These cookies can be retrieved only when the user manually logs back in.

Modern versions of Mobile SDK use reactive session management. “Reactive” means that apps can participate in session management, rather than letting the container do all the work. Apps created before Mobile SDK 1.4, however, used proactive, or container controlled, session management. In the proactive scenario, some types of apps would restart when the session expired, resulting in a less than satisfactory user experience. In the reactive scenario, your app can prevent such restarts by refreshing the session token without interrupting the runtime flow.

If you’re upgrading an app from version 1.3 to any later version, you’re required to switch to reactive management. To switch to reactive management, adjust your session management settings according to your app’s architecture. This table summarizes the behaviors and recommended approaches for common architectures.

App Architecture	Reactive Behavior in Mobile SDK 5.0 and Later	Steps for Upgrading Code
REST API	Refresh from JavaScript using the <code>com.salesforce.plugin.network</code> plug-in	No coding is required for apps that use <code>force.js</code> , which handles network calls natively through the <code>com.salesforce.plugin.network</code> plug-in. Apps that use other frameworks should also adopt the <code>com.salesforce.plugin.network</code> plug-in for network calls.
JavaScript Remoting in Visualforce	Refresh session and CSRF token from JavaScript	Catch the session timeout event, and then either reload the page or load a new <code>iFrame</code> .

 **Note:** In Mobile SDK 5.0 and later, JQuery Mobile, which some hybrid apps use for networking, is no longer supported as a networking option.

The following sections provide code examples for supported architectures.

REST APIs (Including Apex2REST)

Hybrid apps that use REST APIs are required to refresh expired access tokens before each REST call. You can meet this requirement simply by using `force.js`, which refreshes sessions implicitly through the `com.salesforce.plugin.network` plug-in. With `force.js`, your app doesn't have to add refresh code.

To initiate a user session with `force.js`, you call `force.login()`. After the user logs in to an app running in the container, the network plug-in refreshes tokens as necessary when the app tries to access Salesforce resources. The following code, adapted from the ContactExplorer sample, demonstrates a typical `force.login()` implementation.

- When the device notifies that it's ready, call the `force.login()` method to post the login screen.

```
/* Do login */
force.login(
  function() {
    console.log("Auth succeeded");
    // Call your app's entry point
    // ...
  },
  function(error) {
    console.log("Auth failed: " + error);
  }
);
```

Get the complete ContactExplorer sample application here:

<https://github.com/forcedotcom/SalesforceMobileSDK-Shared/tree/master/samples/contactexplorer>

JavaScript Remoting in Visualforce

For mobile apps that use JavaScript remoting to access Visualforce pages, incorporate the session refresh code into the method parameter list. In JavaScript, use the Visualforce remote call to check the session state and adjust accordingly.

```
<Controller>.<Method>(
  <params>,
  function(result, event) {
    if (hasSessionExpired(event)) {
      // Reload will try to redirect to login page
      // Container will intercept the redirect and
      // refresh the session before reloading the
      // origin page
      window.location.reload();
    } else {
      // Everything is OK.
      // Go ahead and use the result.
      // ...
    },
    {escape: true}
  );
```

This example defines `hasSessionExpired()` as:

```
function hasSessionExpired(event) {
  return (event.type == "exception" &&
    event.message.indexOf("Logged in?") != -1);
}
```

Advanced use case: Reloading the entire page doesn't always provide the best user experience. To avoid reloading the entire page, you'll need to:

1. Refresh the access token
2. Refresh the Visualforce domain cookies
3. Finally, refresh the CSRF token

Instead of fully reloading the page as follows:

```
window.location.reload();
```

Do something like this:

```
// Refresh oauth token
cordova.require("com.salesforce.plugin.oauth").authenticate(
  function(creds) {
    // Reload hidden iframe that points to a blank page to
    // to refresh Visualforce domain cookies
    var iframe = document.getElementById("blankIframeId");
    iframe.src = src;

    // Refresh CSRF cookie
    // Get the provider array
    var providers = Visualforce.remoting.Manager.providers;
    // Get the last provider in the arrays (usually only one)
    var provider = Visualforce.remoting.last;
    provider.refresh(function() {
      //Retry call for a seamless user experience
    });
  },
  function(error) {
    console.log("Refresh failed");
  }
);
```

Defer Login

Mobile SDK hybrid apps always present a Salesforce login screen at startup. Sometimes, however, these apps can benefit from deferring authentication until some later point. With a little configuration, you can defer login to any logical place in your app.

Deferred login implementation with `force.js` is a two-step process:

1. Configure the project to skip authentication at startup.
2. In your JavaScript code, call the `force.init()` function, followed by the `force.login()` function, at the point where you plan to initiate authentication.

Step 1: Configure the Project to Skip Authentication

1. In your platform-specific project, open the `www/bootconfig.json` file.
2. Set the `shouldAuthenticate` property to `"false"`.

Step 2: Initiate Authentication in JavaScript

To initiate the authentication process, call the `force.js login()` functions at the point of deferred login. The `force.init()` method is usually necessary only for testing or other non-production scenarios.

```
/* Do login */
force.login(
  function() {
    console.log("Auth succeeded");
    // Call your app's entry point
    // ...
  },
  function(error) {
    console.log("Auth failed: " + error);
  }
);
```

The `force.login()` function takes two arguments: a success callback function and a failure callback function. If authentication fails, your failure callback is invoked. If authentication succeeds, the `force` object caches the access token in its `oauth.access_token` configuration property and invokes your success callback.

CHAPTER 11 Offline Management

In this chapter ...

- [Using SmartStore to Securely Store Offline Data](#)
- [Using SmartSync Data Framework to Access Salesforce Objects](#)

Salesforce Mobile SDK provides two modules that help you store and synchronize data for offline use:

- SmartStore lets you store app data in encrypted databases, or *soups*, on the device. When the device goes back online, you can use SmartStore APIs to synchronize data changes with the Salesforce server.
- SmartSync Data Framework provides a mechanism for easily fetching Salesforce data, modeling it as JavaScript objects, and caching it for offline use. When it's time to upload offline changes to the Salesforce server, SmartSync Data Framework gives you highly granular control over the synchronization process. SmartSync Data Framework is built on the popular `Backbone.js` open source library and uses SmartStore as its default cache.

Using SmartStore to Securely Store Offline Data

Mobile devices can lose connection at any time, and environments such as hospitals and airplanes often prohibit connectivity. To handle these situations, it's important that your mobile apps continue to function when they go offline.

Mobile SDK provides SmartStore, a multithreaded, secure solution for offline storage on mobile devices. With SmartStore, your customers can continue working with data in a secure environment even when the device loses connectivity.

IN THIS SECTION:

[About SmartStore](#)

SmartStore provides the primary features of non-relational desktop databases—data segmentation, indexing, querying—along with caching for offline storage.

[Enabling SmartStore in Hybrid and Native Apps](#)

To use SmartStore in hybrid Android apps, you perform a few extra steps.

[Adding SmartStore to Existing Android Apps](#)

Hybrid projects created with Mobile SDK 4.0 or later automatically include SmartStore. If you used Mobile SDK 4.0+ to create an Android native project without SmartStore, you can easily add it later.

[Creating and Accessing User-based Stores](#)

When an app initializes SmartStore, it creates an instance of a store. It then uses the store to register and populate soups and manipulate soup data. For a user-based store, SmartStore manages the store's life cycle—you don't need to think about cleaning up after the user's session ends. For global stores, though, your app is responsible for deleting the store's data when the app terminates.

[Using Global SmartStore](#)

Although you usually tie a SmartStore instance to a specific customer's credentials, you can also access a global instance for special requirements.

[Registering a Soup](#)

Before you try to access a soup, you're required to register it.

[Using Arrays in Index Paths](#)

Index paths can contain arrays, but certain rules apply.

[Populating a Soup](#)

To add Salesforce records to a soup for offline access, use the REST API in conjunction with SmartStore APIs.

[Retrieving Data from a Soup](#)

SmartStore provides a set of helper methods that build query strings for you.

[Smart SQL Queries](#)

To exert full control over your queries—or to reuse existing SQL queries—you can define custom SmartStore queries.

[Using Full-Text Search Queries](#)

To perform efficient and flexible searches in SmartStore, you use full-text queries. Full-text queries yield significant performance advantages over "like" queries when you're dealing with large data sets.

[Working with Query Results](#)

Mobile SDK provides mechanisms on each platform that let you access query results efficiently, flexibly, and dynamically.

[Inserting, Updating, and Upserting Data](#)

SmartStore defines standard fields that help you track entries and synchronize soups with external servers.

[Using External Storage for Large Soup Elements](#)

If your soup includes large elements, you can get better performance by using external encrypted storage. For example, if you see warnings that you've exceeded an index limit, try switching to external storage. Trade-offs are minimal.

[Removing Soup Elements](#)

Traditionally, SmartStore methods let you remove soup elements by specifying an array of element IDs. To do so, you usually run a preliminary query to retrieve the candidate IDs, then call the method that performs the deletion. In Mobile SDK 4.2, SmartStore ups the game by adding a query option to its element deletion methods. With this option, you provide only a query, and SmartStore deletes all elements that satisfy that query. This approach delivers a performance boost because both the query and the deletion operation occur in a single call.

[Managing Soups](#)

SmartStore provides utility functionality that lets you retrieve soup metadata and perform other soup-level operations. This functionality is available for hybrid, Android native, and iOS native apps.

[Managing Stores](#)

If you create global stores, you're required to perform cleanup when the app exits. Also, if you create multiple user stores, you can perform cleanup if you're no longer using particular stores. SmartStore provides methods deleting named and global stores. For hybrid apps, SmartStore also provides functions for getting a list of named stores.

[Testing with the SmartStore Inspector](#)

Verifying SmartStore operations during testing can become a tedious and time-consuming effort. SmartStore Inspector comes to the rescue.

[Using the Mock SmartStore](#)

To facilitate developing and testing code that makes use of the SmartStore while running outside the container, you can use an emulated SmartStore.

About SmartStore

SmartStore provides the primary features of non-relational desktop databases—data segmentation, indexing, querying—along with caching for offline storage.

To provide offline synchronization and conflict resolution services, SmartStore uses StoreCache, a Mobile SDK caching mechanism. We recommend that you use StoreCache to manage operations on Salesforce data.



Note: Pure HTML5 apps store offline information in a browser cache. Browser caching isn't part of Mobile SDK, and we don't document it here. SmartStore uses storage functionality on the device. This strategy requires a native or hybrid development path.

About the Sample Code

Code snippets in this chapter use Account and Opportunity objects, which are predefined in every Salesforce organization. Accounts and opportunities are linked through a master-detail relationship. An account can be the master for more than one opportunity.

IN THIS SECTION:

[SmartStore Soups](#)

SmartStore soups let you partition your offline content.

[SmartStore Stores](#)

SmartStore puts encrypted soup data in an underlying system database known as the *store*. The store is where all soup data is stored, encrypted, related, and indexed. If the device loses connectivity, the user can continue to work on data in the store until the Salesforce cloud is again accessible.

[SmartStore Data Types](#)

Like any database, SmartStore defines a set of data types that you use to create soups. SmartStore data types mirror the underlying SQLite database.

SEE ALSO:

[Using StoreCache For Offline Caching](#)

[Conflict Detection](#)


[Smart SQL Queries](#)

SmartStore Soups

SmartStore soups let you partition your offline content.

SmartStore stores offline data in logical collections known as *soups*. A SmartStore soup represents a single table in the underlying SQLite database, or *store*, and typically maps to a standard or custom Salesforce object. Soups contain *soup elements*. Each element is a JSON object that mirrors a single database row. To streamline data access, you define indexes for each soup. You use these indexes to query the soup with either SmartStore helper methods or SmartStore's Smart SQL query language. SmartStore indexes also makes your life easier by supporting full-text search queries.

It's helpful to think of soups as tables, and stores as databases. You can define as many soups as you like in an application. As self-contained data sets, soups don't have predefined relationships to each other, but you can use Smart SQL joins to query across them. Also, in native apps you can write to multiple soups within a transaction.

 **Warning:** SmartStore data is volatile. Its lifespan is tied to the authenticated user and to OAuth token states. When the user logs out of the app, SmartStore deletes all soup data associated with that user. Similarly, when the OAuth refresh token is revoked or expires, the user's app state is reset, and all data in SmartStore is purged. When designing your app, consider the volatility of SmartStore data, especially if your organization sets a short lifetime for the refresh token.

SmartStore Stores

SmartStore puts encrypted soup data in an underlying system database known as the *store*. The store is where all soup data is stored, encrypted, related, and indexed. If the device loses connectivity, the user can continue to work on data in the store until the Salesforce cloud is again accessible.

When you initialize SmartStore, you specify the name of a store to open. You assign a custom name or use a standard name, such as `kDefaultSmartStoreName` in iOS native apps, to define the store. Named stores are user-specific—like soups, the store persists only while the user's session remains valid.

In a traditional SmartStore session, all soups reference, organize, and manipulate content from a single store. Single-store configuration is the best choice for many apps. However, if an app queries large quantities of data from many objects, performance can begin to degrade. To avoid slower response time, you can create multiple named stores and partition your data between them. For example, if your app defines tasks that operate on clear-cut domains of Salesforce data, you can create a store for each task. Runtime access to a smaller store can make a big difference in user satisfaction.

Some use cases require a store that isn't tied to a user's login credentials and can persist between user and app sessions. SmartStore accommodates this requirement by supporting *global stores*. Global stores are also named stores, but you create and remove them through a different set of APIs.

SEE ALSO:

[Using Global SmartStore](#)

[Creating and Accessing User-based Stores](#)

SmartStore Data Types

Like any database, SmartStore defines a set of data types that you use to create soups. SmartStore data types mirror the underlying SQLite database.

SmartStore supports the following data types for declaring *index specs*. In a SmartStore soup definition, an index spec defines the data type that SmartStore expects to find in the given field.

Type	Description
<code>integer</code>	Signed integer, stored in 4 bytes (SDK 2.1 and earlier) or 8 bytes (SDK 2.2 and later)
<code>floating</code>	Floating point value, stored as an 8-byte IEEE floating point number
<code>string</code>	Text string, stored with database encoding (UTF-8)
<code>full_text</code>	String that supports full-text searching
<code>JSON1</code>	Index type based on the SQLite JSON1 extension. Can be used in place of integer, floating, and string types. Behaves identically to those types of index specs, except that JSON1 does not support index paths that traverse arrays.

IN THIS SECTION:

[Date Representation](#)

SEE ALSO:

[Using Arrays in Index Paths](#)

Date Representation

SmartStore does not define a date/time data type. When you create index specs for date/time fields, choose a SmartStore type that matches the format of your JSON input. For example, Salesforce sends dates as strings, so always use a string index spec for Salesforce date fields. To choose an index type for non-Salesforce or custom date fields, consult the following table.


Type	Format As	Description
<code>string</code>	An ISO 8601 string	"YYYY-MM-DD HH:MM:SS.SSS"
<code>floating</code>	A Julian day number	The number of days since noon in Greenwich on November 24, 4714 BC according to the proleptic Gregorian calendar. This value can include partial days that are expressed as decimal fractions.
<code>integer</code>	Unix time	The number of seconds since 1970-01-01 00:00:00 UTC

Enabling SmartStore in Hybrid and Native Apps

To use SmartStore in hybrid Android apps, you perform a few extra steps.

Hybrid apps access SmartStore through JavaScript. To enable offline access in a hybrid app, your Visualforce or HTML page must include the `cordova.js` library file.

In iOS and Android native apps, SmartStore is always included.

 **Note:** The SmartStore plugin, `com.salesforce.plugin.smartstore.client`, uses promises. If you're developing for Android 19 and using Mobile SDK promise-based APIs, include this file: <https://www.promisejs.org/polyfills/promise-7.0.4.min.js>.

SEE ALSO:

[Creating an Android Project with Forcedroid](#)

[Creating an iOS Project with Forceios](#)

Adding SmartStore to Existing Android Apps

Hybrid projects created with Mobile SDK 4.0 or later automatically include SmartStore. If you used Mobile SDK 4.0+ to create an Android native project without SmartStore, you can easily add it later.

To add SmartStore to an existing native Android project (Mobile SDK 4.0 or later):

1. Add the SmartStore library project to your project. In Android Studio, open your project's `build.gradle` file and add a compile directive for `:libs:SmartStore` in the `dependencies` section. If the `dependencies` section doesn't exist, create it.

```
dependencies {  
    ...  
    compile project(':libs:SmartStore')  
}
```

2. In your `<projectname>App.java` file, import the `SmartStoreSDKManager` class instead of `SalesforceSDKManager`. Replace this statement:

```
import com.salesforce.androidsdk.  
    app.SalesforceSDKManager
```

with this one:

```
import com.salesforce.androidsdk.smartstore.app.SmartStoreSDKManager
```

3. In your `<projectname>App.java` file, change your App class to extend the `SmartStoreSDKManager` class rather than `SalesforceSDKManager`.

 **Note:**

1. To add SmartStore to apps created with Mobile SDK 3.x or earlier, begin by upgrading to the latest version of Mobile SDK.
2. The SmartStore plugin, `com.salesforce.plugin.smartstore.client`, uses promises internally. If you're developing for Android 19 and using Mobile SDK promise-based APIs, include this file: <https://www.promisejs.org/polyfills/promise-7.0.4.min.js>.

SEE ALSO:

[Migrating from Previous Releases](#)

Creating and Accessing User-based Stores

When an app initializes SmartStore, it creates an instance of a store. It then uses the store to register and populate soups and manipulate soup data. For a user-based store, SmartStore manages the store's life cycle—you don't need to think about cleaning up after the user's session ends. For global stores, though, your app is responsible for deleting the store's data when the app terminates.

Android Native Apps

Android requires you to first get an instance of `SmartStoreSDKManager` which you then use to create stores.

```
SmartStoreSDKManager sdkManager =
    SmartStoreSDKManager.getInstance();

SmartStore smartStore = sdkManager.getSmartStore(); // Creates a default store for the
current user
```

A call to `SmartStoreSDKManager.getSmartStore()` without arguments always accesses the default anonymous store. To create a named user-based store, call the following method.

```
public SmartStore getSmartStore(String dbNamePrefix, UserAccount account, String communityId)
```

Both `account` and `communityId` can be null. You can call these methods as many times as necessary to create additional stores.

iOS Native Apps

For creating stores, iOS provides the `sharedStoreWithName:` class message.

```
- (SFSmartStore *)store
{
    return [SFSmartStore sharedStoreWithName:kDefaultSmartStoreName]; // Creates a default
store for the current user
}
```

You can create a store with a custom name by passing in any string other than `kDefaultSmartStoreName`. You can call this method as many times as necessary to create additional stores.

Hybrid Apps

In hybrid apps, you access user-based stores and global stores the same way. Rather than creating stores explicitly, you automatically create stores that don't already exist when you call `registerSoup()`. To use a named store—for subsequent direct references, for example—you call this function with a `StoreConfig` object as the first argument. This function object takes a store name and a Boolean value that indicates whether the store is global.

```
var StoreConfig = function (storeName, isGlobalStore) {
    this.storeName = storeName;
    this.isGlobalStore = isGlobalStore;
};
```

You can pass this object as the optional first argument to most soup functions. If used, the `StoreConfig` object configures the execution context. Either `storeName` or `isGlobalStore` can be optional—you can specify one or both. SmartStore evaluates `StoreConfig` objects as follows:

- If `storeName` is not specified, `this.storeName` is set to the SmartStore default store name.
- If `isGlobalStore` is not specified, `this.isGlobalStore` is set to `false`.

- Store names aren't necessarily unique. A single store name can be used twice—once for a user-based store, and once for a global store.
- If you provide a store name that doesn't exist in the space indicated by your `isGlobalStore` setting, SmartStore creates it.

The following example creates a user-based store named "Store1" that contains the `soupName` soup.

```
navigator.smartstore.registerSoup({storeName: "Store1", isGlobalStore:false}, soupName, indexSpecs, successCallback, errorCallback)
```

You can call `registerSoup()` with as many different soup names as necessary. If you call a soup function without passing in `StoreConfig`, SmartStore always performs the operation on the default user-based (non-global) store. This behavior applies even if you've created named stores. The following example creates a soup named `soupName`, with the provided index specs, in the current user's default store.

```
var sfSmartstore = function() {  
    return cordova.require("com.salesforce.plugin.smartstore");  
};  
sfSmartstore().registerSoup(soupName, indexSpecs, successCallback, errorCallback);
```

SEE ALSO:


[SmartStore Stores](#)

Using Global SmartStore

Although you usually tie a SmartStore instance to a specific customer's credentials, you can also access a global instance for special requirements.

Under certain circumstances, some applications require access to a SmartStore instance that is not tied to Salesforce authentication. This situation can occur in apps that store application state or other data that does not depend on a Salesforce user, organization, or community. To address this situation, Mobile SDK supports global stores that persists beyond the app's life cycle.

Data stored in global stores does not depend on user authentication and therefore is not deleted at logout. Since a global store remains intact after logout, you are responsible for deleting its data when the app exits. Mobile SDK provides APIs for this purpose.

 **Important:** Do not store user-specific data in global SmartStore. Doing so violates Mobile SDK security requirements because user data can persist after the user logs out.

Android APIs

In Android, you access global SmartStore through an instance of `SmartStoreSDKManager`.

- ```
public SmartStore getGlobalSmartStore(String dbName)
```

Returns a global SmartStore instance with the specified database name. You can set `dbName` to any string other than “smartstore”. Set `dbName` to null to use the default global SmartStore database.

- ```
public boolean hasGlobalSmartStore(String dbName)
```

Checks if a global SmartStore instance exists with the specified database name. Set `dbName` to null to verify the existence of the default global SmartStore.

- ```
public void removeGlobalSmartStore(String dbName)
```

Deletes the specified global SmartStore database. You can set this name to any string other than “smartstore”. Set `dbName` to null to remove the default global SmartStore.

## iOS APIs

In iOS, you access global SmartStore through an instance of `SFSmartStore`.

- ```
+ (id)sharedGlobalStoreWithName:(NSString *)storeName
```

Returns a global SmartStore instance with the specified database name. You can set `storeName` to any string other than “defaultStore”. Set `storeName` to `kDefaultSmartStoreName` to use the default global SmartStore.

- ```
+ (void)removeSharedGlobalStoreWithName:(NSString *)storeName
```

Deletes the specified global SmartStore database. You can set `storeName` to any string other than “defaultStore”. Set `storeName` to `kDefaultSmartStoreName` to use the default global SmartStore.

## Hybrid APIs

Most SmartStore JavaScript soup methods take an optional first argument that specifies whether to use global SmartStore. This argument can be a Boolean value or a `StoreConfig` object. If this argument is absent, Mobile SDK uses the default user store.

For example:

```
querySoup([isGlobalStore,]soupName, querySpec,
 successCB, errorCallback);
querySoup([storeConfig,]soupName, querySpec,
 successCB, errorCallback);
```

SmartStore defines the following functions for removing stores. Each function takes success and error callbacks. The `removeStore()` function also requires either a `StoreConfig` object that specifies the store name, or just the store name as a string.

```
removeStore(storeConfig, successCB, errorCallback)
removeAllGlobalStores(successCB, errorCallback)
removeAllStores(successCB, errorCallback)
```

SEE ALSO:

[SmartStore Stores](#)

[Managing Stores](#)


[Creating and Accessing User-based Stores](#)

## Registering a Soup

Before you try to access a soup, you're required to register it.

To register a soup, you provide a soup name and a list of one or more index specifications. Each of the following examples—hybrid, Android, and iOS—builds an index spec array consisting of name, ID, and owner (or parent) ID fields.

You index a soup on one or more fields found in its entries. SmartStore makes sure that these indices reflect any insert, update, and delete operations. Always specify at least one index field when registering a soup. For example, if you are using the soup as a simple key-value store, use a single index specification with a string type.

 **Note:** If your soup contains unusually large elements (> 1 MB), consider registering it to use external storage. See [Using External Storage for Large Soup Elements](#).

## Hybrid Apps

The JavaScript function for registering a soup requires callback functions for success and error conditions.

```
var sfSmartstore = function() {
 return cordova.require("com.salesforce.plugin.smartstore");
};
sfSmartstore().registerSoup(soupName, indexSpecs, successCallback, errorCallback);
```

If the soup does not exist, this function creates it. If the soup exists, registering lets you access it.

### indexSpecs

Use the `indexSpecs` array to create the soup with predefined indexing. Entries in the `indexSpecs` array specify how to index the soup. Each entry consists of a `path:type` pair. `path` is the name of an index field; `type` is either "string", "integer", "floating", "full\_text", or "json1".

```
var indexSpecs = [
 {path:"Name",type:"string"},
 {path:"Id",type:"string"}
];
```

### Note:

- Index paths are case-sensitive and can include compound paths, such as `Owner.Name`.
- Index entries that are missing any fields described in an `indexSpecs` array are not tracked in that index.
- The type of the index applies only to the index. When you query an indexed field (for example, "select {soup:path} from {soup}"), the query returns data of the type that you specified in the index specification.
- Index columns can contain null fields.
- Beginning in Mobile SDK 4.1, you can specify index paths that point to *internal* (non-leaf) nodes. You can use these paths with `like` and `match` (full-text) queries. Use the `string` type when you define internal node paths.

For example, consider this element in a soup named "spies":

```
{
 "first_name":"James",
 "last_name":"Bond",
 "address":{
 "street_number":10,
 "street_name":"downing",
 "city":"london"
 }
}
```

```
}
}
```

In this case, “address” is an internal node because it has children. Through the index on the path “address”, you can use a `like` or `match` query to find the “city” value—“london”—in “address”. For example:

```
SELECT {spies:first_name, spies:last_name} FROM spies WHERE {spies:address} LIKE
'london'
```

- Beginning in Mobile SDK 4.1, you can include arrays in index paths, with some restrictions. See [Using Arrays in Index Paths](#).

### successCallback

The success callback function you supply takes one argument: the soup name. For example:

```
function(soupName) { alert("Soup " + soupName + " was successfully created"); }
```

When the soup is successfully created, `registerSoup()` calls the success callback function to indicate that the soup is ready. Wait to complete the transaction and receive the callback before you begin any activity. If you register a soup under the passed name, the success callback function returns the soup.

### errorCallback

The error callback function takes one argument: the error description string.

```
function(err) { alert ("registerSoup failed with error: " + err); }
```

During soup creation, errors can happen for various reasons, including:

- An invalid or bad soup name
- No index (at least one index must be specified)
- Other unexpected errors, such as a database error

To find out if a soup exists, use:

```
navigator.smartstore.soupExists(soupName, successCallback, errorCallback);
```

## Android Native Apps

For Android, you define index specs in an array of type `com.salesforce.androidsdk.smartstore.store.IndexSpec`. Each index spec comprises a path—the name of an index field—and a type. Index spec types are defined in the `SmartStore.Type` enum and include the following values:

- `string`
- `integer`
- `floating`
- `full_text`
- `json1`

```
public class OfflineStorage extends SalesforceActivity {
 private SmartStore smartStore;
 final IndexSpec[] ACCOUNTS_INDEX_SPEC = {
 new IndexSpec("Name", SmartStore.Type.string),
 new IndexSpec("Id", SmartStore.Type.string),
 new IndexSpec("OwnerId", SmartStore.Type.string)
 };
};
```

```

public OfflineStorage() {
 smartStore = SmartStoreSDKManager.getInstance().getSmartStore();
 smartStore.registerSoup("Account", ACCOUNTS_INDEX_SPEC);
}

// ...
}

```

## iOS Native Apps

For iOS, you define index specs in an array of `SFSoupIndex` objects. Each index spec comprises a path—the name of an index field—and a type. Index spec types are defined as constants in the `SFSoupIndex` class and include the following values:

- `kSoupIndexTypeString`
- `kSoupIndexTypeInteger`
- `kSoupIndexTypeFloating`
- `kSoupIndexTypeFullText`
- `kSoupIndexTypeJSON1`

```

NSString* const kAccountSoupName = @"Account";

...
- (SFSmartStore *)store
{
 return [SFSmartStore sharedStoreWithName:kDefaultSmartStoreName];
}

...
- (void)createAccountsSoup {
 if (![self.store soupExists:kAccountSoupName]) {
 NSArray *keys = @[@"path", @"type"];
 NSArray *nameValues = @[@"Name", kSoupIndexTypeString];
 NSDictionary *nameDictionary = [NSDictionary
 dictionaryWithObjects:nameValues forKeys:keys];

 NSArray *idValues = @[@"Id", kSoupIndexTypeString];
 NSDictionary *idDictionary =
 [NSDictionary dictionaryWithObjects:idValues forKeys:keys];

 NSArray *ownerIdValues = @[@"OwnerId", kSoupIndexTypeString];
 NSDictionary *ownerIdDictionary =
 [NSDictionary dictionaryWithObjects:ownerIdValues
 forKeys:keys];

 NSArray *accountIndexSpecs =
 [SFSoupIndex asArraySoupIndexes:[nameDictionary,
 idDictionary, ownerIdDictionary]];

 NSError* error = nil;
 [self.store registerSoup:kAccountSoupName
 withIndexSpecs:accountIndexSpecs

```

```

 error:&error];
 if (error) {
 NSLog(@"Cannot create SmartStore soup '%@\nError: '%@'",
 kAccountSoupName, error.localizedDescription);
 }
}
}
}

```

#### IN THIS SECTION:

##### [Preparing Soups for SmartSync Data Framework](#)

Soups that exchange information with the Salesforce cloud typically use SmartSync Data Framework for synchronization. To support SmartSync Data Framework, most app types require you to create and manage special soup fields for “sync up” operations.

##### [Registering Soups with Configuration Files](#)

Mobile SDK 6.0 introduces the ability to define your SmartStore schemas through configuration files rather than code. Since all platforms and app types use the same configuration files, you can describe your schema in a single file and then import it into any Mobile SDK app.

#### SEE ALSO:

[SmartStore Data Types](#)

[Using Full-Text Search Queries](#)

## Preparing Soups for SmartSync Data Framework

Soups that exchange information with the Salesforce cloud typically use SmartSync Data Framework for synchronization. To support SmartSync Data Framework, most app types require you to create and manage special soup fields for “sync up” operations.

Types of apps that require you to code these special fields include:

- Hybrid apps that do not use `Force.SObject` (from `SmartSync.js`) to create and manage local records
- Native apps
- React Native apps

If your hybrid app uses `Force.SObject` for local records, SmartSync Data Framework automatically creates and manages these fields for you. You can ignore the rest of this discussion.

### Required Fields

If you’re required to do so, add the following four fields to your soup elements. The first three are operation type fields:

#### **\_\_locally\_created\_\_**

Set this field to true on elements that your app *creates* locally.

#### **\_\_locally\_updated\_\_**

Set this field to true after your app *updates* an element locally.

#### **\_\_locally\_deleted\_\_**

Set this field to true when your app *is deleting* an element locally.

Be sure to set the appropriate field to true for every create, update, or delete operation.

The fourth field is a control field:



**\_\_local\_\_**

This field indicates that some local change has occurred. You're required to:

- Set this field to true when any of the operation type fields is true.
- Add a string index spec on this field.

## SmartSync Data Framework Behavior

During sync up operations, SmartSync Data Framework looks for soup elements with `__local__` set to true. For each match, it evaluates the operation type fields and then performs the operation indicated by the following precedence hierarchy.

| Precedence  | Field                            | If set to true...                                                                                                                                                                                                                                                                                             |
|-------------|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 (highest) | <code>__locally_deleted__</code> | <ul style="list-style-type: none"> <li>• <code>__locally_created__</code> and <code>__locally_updated__</code> flags are ignored.</li> <li>• SmartSync Data Framework deletes the local record and, if it exists, the server record. If the server record does not exist, no remote action occurs.</li> </ul> |
| 2           | <code>__locally_created__</code> | <ul style="list-style-type: none"> <li>• <code>__locally_updated__</code> flag is ignored.</li> <li>• If <code>__locally_deleted__</code> is not true, SmartSync Data Framework creates the record on the server.</li> </ul>                                                                                  |
| 3           | <code>__locally_updated__</code> | <ul style="list-style-type: none"> <li>• Ignored if either <code>__locally_deleted__</code> or <code>__locally_created__</code> is true.</li> <li>• Otherwise, SmartSync Data Framework writes the updated record to the server.</li> </ul>                                                                   |

Finally, SmartSync Data Framework resets all four fields to false.



**Example:** The following examples are taken from the various language versions of the SmartSyncExplorer sample app.

### iOS Native

This Objective-C example sets system fields by sending `updateSoupForFieldName:fieldValue:` messages to an `SObjectData` object. Using `SFSmartSyncSyncManager` constants for the field names, it sets the `__local__` and `__locally_created__` fields before upserting the new element. You can find the `SObjectData` definition in the iOS sample app.

```
- (void)createLocalData:(SObjectData *)newData {
 [newData updateSoupForFieldName:kSyncManagerLocal fieldValue:@YES];
 [newData updateSoupForFieldName:kSyncManagerLocallyCreated fieldValue:@YES];
 [self.store upsertEntries:[newData.soupDict] toSoup:[newData class]
dataSpec].soupName];
}
```

### Android Native

The following Java example handles created and updated elements, but not deletions. It calls the `JSONObject.put()` method to create and initialize the system fields, using `SyncManager` constants for the field names. After the fields are properly assigned, it either creates or upserts the element based on the `isCreate` control flag.

```
contact.put(SyncManager.LOCAL, true);
contact.put(SyncManager.LOCALLY_UPDATED, !isCreate);
contact.put(SyncManager.LOCALLY_CREATED, isCreate);
contact.put(SyncManager.LOCALLY_DELETED, false);
if (isCreate) {
 smartStore.create(ContactListLoader.CONTACT_SOUP, contact);
} else {
 smartStore.upsert(ContactListLoader.CONTACT_SOUP, contact);
}
```

### Hybrid with the SmartSync Data Framework Plug-in and React Native

The following React Native code can easily be adapted for hybrid apps that use the SmartSync Data Framework plug-in. This example shows how to update and delete—or undelete—a contact. The `onSaveContact()` function marks the record as updated, sets `__local__` to true, and then saves the changes. The `onDeleteUndeleteContact()` function flips the `__locally_deleted__` field. It then sets the `__local__` field to match the operation type value and saves the changes.

The `storeMgr` object is defined in the sample project as a wrapper around SmartStore and the SmartSync Data Framework plug-in. Its `saveContact()` function accepts a contact object and a callback, and upserts the contact into the soup. The callback shown here calls `navigator.pop()`, which is specific to React Native. Hybrid apps can replace the `saveContact()` function with any code that calls the SmartStore `upsert()` function.

```
onSaveContact: function() {
 var contact = this.state.contact;
 contact.__locally_updated__ = contact.__local__ = true;
 storeMgr.saveContact(contact, () => {navigator.pop();});
},

onDeleteUndeleteContact: function() {
 var contact = this.state.contact;
 contact.__locally_deleted__ = !contact.__locally_deleted__;
 contact.__local__ = contact.__locally_deleted__ || contact.__locally_updated__ ||
 contact.__locally_created__;
 storeMgr.saveContact(contact, () => {navigator.pop();});
},
```

## Registering Soups with Configuration Files

Mobile SDK 6.0 introduces the ability to define your SmartStore schemas through configuration files rather than code. Since all platforms and app types use the same configuration files, you can describe your schema in a single file and then import it into any Mobile SDK app.

### Overview

SmartStore configuration files use JSON objects to express soup schemata. Hybrid apps load the configuration files automatically, while other apps load them with a single line of code. To keep the mechanism simple, Mobile SDK enforces the following file naming conventions:

- To define soups for the default global store, provide a file named `globalstore.json`.
- To define soups for the default user store, provide a file named `userstore.json`.

 **Note:**

- The JSON used to define soups is the same for all app types and platforms.
- Configuration file locations required by Mobile SDK vary according to app type and platform.
- If a configuration file defines a soup that already exists, Mobile SDK ignores the configuration file. In this case, you can set up and manage your soups only through code.
- Configuration files can define only the default global store and default user store. For other named stores, you register the soup through code.
- Configuration files cannot be used to set up externally stored soups.

## Using Configuration Files in iOS Native Apps

You load soup configuration files in iOS native apps by calling a method on the `SmartStoreSDKManager` object. (Before Mobile SDK 6.0, `SmartStoreSDKManager` went by the name `SalesforceSDKManagerWithSmartStore`.)

### Load a Default User Store

```
[[SmartStoreSDKManager sharedManager] setupUserStoreFromDefaultConfig];
```

### Load a Default Global Store

```
[[SmartStoreSDKManager sharedManager] setupGlobalStoreFromDefaultConfig];
```

## Using Configuration Files in Android Native Apps

You load soup configuration files in Android native apps by calling a method on the `SmartStoreSDKManager` object. (Before Mobile SDK 6.0, `SmartStoreSDKManager` went by the name `SalesforceSDKManagerWithSmartStore`.)

### Load a Default User Store

```
SmartStoreSDKManager.getInstance().setupUserStoreFromDefaultConfig();
```

### Load a Default Global Store

```
SmartStoreSDKManager.getInstance().setupGlobalStoreFromDefaultConfig();
```

## Configuration File Format

The JSON format is self evident as illustrated in the following example.

```
{ "soups": [
 {
 "soupName": "soup1",
 "indexes": [
 { "path": "stringField1", "type": "string"},
 { "path": "integerField1", "type": "integer"},
 { "path": "floatingField1", "type": "floating"},
 { "path": "json1Field1", "type": "json1"},
 { "path": "ftsField1", "type": "full_text"}
]
 },
 {
 "soupName": "soup2",
 "indexes": [
 { "path": "stringField2", "type": "string"},
 { "path": "integerField2", "type": "integer"},
 { "path": "floatingField2", "type": "floating"}
]
 }
]
```

```

 { "path": "json1Field2", "type": "json1"},
 { "path": "ftsField2", "type": "full_text"}
]
}
]
}

```

Expected locations of configuration files are:

## iOS

### For native applications:

Under / in the Resources bundle

### For hybrid applications:

Under /www in the Resources bundle

## Android

### For native applications:

Under the /res/raw project folder

### For hybrid applications:

Under the /assets/www project folder

## Sample code

SmartSyncExplorer and SmartSyncExplorerHybrid sample apps use a config file to setup SmartStore soups.

## Setup on iOS

Excerpt from SObjectDataManager.m from iOS SmartSyncExplorer native sample app:

```

- (id)initWithDataSpec:(SObjectDataSpec *)dataSpec {
 self = [super init];
 if (self) {
 (...)
 [[SmartStoreSDKManager sharedManager] setupUserStoreFromDefaultConfig];
 (...)
 }
 return self;
}

```

## Setup on Android

Excerpt from ContactListLoader.java from Android SmartSyncExplorer native sample app:

```

public ContactListLoader(Context context, UserAccount account) {
 super(context);
 (...)
 SmartStoreSDKManager.getInstance().setupUserStoreFromDefaultConfig();
 (...)
}

```

## Configuration file

### Example: Configuration file

SmartStore uses the same configuration file—`userconfig.json`—for all four sample apps: SmartSyncExplorer for iOS and Android, SmartSyncExplorerHybrid for iOS and Android.

```
{
 "soups": [
 {
 "soupName": "contacts",
 "indexes": [
 { "path": "Id", "type": "string"},
 { "path": "FirstName", "type": "string"},
 { "path": "LastName", "type": "string"},
 { "path": "__local__", "type": "string"},
 { "path": "__locally_created__", "type": "string"},
 { "path": "__locally_updated__", "type": "string"},
 { "path": "__locally_deleted__", "type": "string"}
]
 }
]
}
```

### iOS Native

From `SObjectDataManager.m` in the SmartSyncExplorer native sample app:

```
- (id)initWithDataSpec:(SObjectDataSpec *)dataSpec {
 self = [super init];
 if (self) {
 ...
 [[SmartStoreSDKManager sharedManager] setupUserStoreFromDefaultConfig];
 ...
 }
 return self;
}
```

### Android Native

From `ContactListLoader.java` in the SmartSyncExplorer native sample app:


```
public ContactListLoader(Context context, UserAccount account) {
 super(context);
 ...
 SmartStoreSDKManager.getInstance().setupUserStoreFromDefaultConfig();
 ...
}
```


## Using Arrays in Index Paths

Index paths can contain arrays, but certain rules apply.

Before Mobile SDK 4.1, index paths supported only maps—in other words, dictionaries or associative arrays. For example, in a path such as `a.b.c`, SmartStore required both `b` and `c` to be maps. Otherwise, when evaluating the path, SmartStore returned nothing.

In Mobile SDK 4.1 and later, index paths can contain arrays and maps. In the `a.b.c` example, if the value of `b` is an array, SmartStore expects the array to contain maps that define `c`. SmartStore then returns an array containing values of `c` keys found in the `b` array's maps.

 **Note:** You can't use index paths that traverse arrays with JSON1 index specs.

 **Example:** The following table shows various examples of `a.b.c` paths and the values returned by a SmartStore query.

| Description                                                                                                                                                        | Example soup element                                                                                                                                                                                | Value for path <code>a.b.c</code>                                                              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| No arrays                                                                                                                                                          | <pre data-bbox="646 520 1029 688"> {   "a": {     "b": { "c": 1 }   } }                     </pre>                                                                                                  | <pre data-bbox="1052 510 1063 535">1</pre>                                                     |
| c points to an array (internal node).                                                                                                                              | <pre data-bbox="646 735 1029 961"> {   "a": {     "b": {       "c": [1, 2, 3]     }   } }                     </pre>                                                                                | <pre data-bbox="1052 741 1442 909"> [   1,   2,   3 ]                     </pre>               |
| b points to an array of maps. Some maps contain the c key. Other maps are ignored.                                                                                 | <pre data-bbox="646 1018 1029 1497"> {   "a": {     "b": [       {         "c": 1       },       {         "c": 2       },       {         "no-c": 3       }     ]   } }                     </pre> | <pre data-bbox="1052 1024 1442 1150"> [   1,   2 ]                     </pre>                  |
| a points to an array of maps. In some maps, b points to a map containing a key. In other maps, b points to an array of maps. Only values from c keys are returned. | <pre data-bbox="646 1543 1029 1864"> {   "a": [     {       "b": {         "c": 0       }     },     {       "b": [         {                     </pre>                                            | <pre data-bbox="1052 1549 1442 1780"> [   0,   [     1,     2   ] ]                     </pre> |

| Description | Example soup element                                                                                                                                                          | Value for path <code>a.b.c</code> |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
|             | <pre>                 "c":1             },             {                 "c":2             },             {                 "no-c":3             }         ]     } ] } </pre> |                                   |

## Populating a Soup

To add Salesforce records to a soup for offline access, use the REST API in conjunction with SmartStore APIs.

When you register a soup, you create an empty named structure in memory that's waiting for data. You typically initialize the soup with data from a Salesforce organization. To obtain the Salesforce data, use Mobile SDK's standard REST request mechanism. When a successful REST response arrives, extract the data from the response object and then upsert it into your soup.

## Hybrid Apps

Hybrid apps use SmartStore functions defined in the `force.js` library. In this example, the click handler for the Fetch Contacts button calls `force.query()` to send a simple SOQL query (`"SELECT Name, Id FROM Contact"`) to Salesforce. This call designates `onSuccessSfdcContacts(response)` as the callback function that receives the REST response. The `onSuccessSfdcContacts(response)` function iterates through the returned records in `response` and populates UI controls with Salesforce values. Finally, it upserts all records from the response into the sample soup.

```

// Click handler for the "fetch contacts" button
$('#link_fetch_sfdc_contacts').click(function() {
 logToConsole("link_fetch_sfdc_contacts clicked");
 force.query("SELECT Name,Id FROM Contact",
 onSuccessSfdcContacts, onErrorSfdc);
});
var sfSmartstore = function() {
 return cordova.require("com.salesforce.plugin.smartstore");};

function onSuccessSfdcContacts(response) {
 logToConsole("onSuccessSfdcContacts: received " +
 response.totalSize + " contacts");
 var entries = [];

 $('#div_sfdc_contact_list').html("");
 var ul = $('<ul data-role="listview" data-inset="true"
 data-theme="a" data-dividertheme="a">');
 $('#div_sfdc_contact_list').append(ul);
}

```

```

ul.append(
 $('<li data-role="list-divider">Salesforce Contacts: ' +
 response.totalSize + ''));
$.each(response.records, function(i, contact) {
 entries.push(contact);
 logToConsole() ("name: " + contact.Name);
 var newLi = $('' + (i+1) + " - " +
 contact.Name + "");
 ul.append(newLi);
});

if (entries.length > 0) {
 sfSmartstore().upsertSoupEntries(SAMPLE_SOUP_NAME,
 entries,
 function(items) {
 var statusTxt = "upserted: " + items.length +
 " contacts";
 logToConsole() (statusTxt);
 $("#div_soup_status_line").html(statusTxt);
 $("#div_sfdc_contact_list").trigger("create");
 },
 onErrorUpsert);
}
}
function onErrorUpsert(param) {
 logToConsole() ("onErrorUpsert: " + param);
 $("#div_soup_status_line").html("Soup upsert ERROR");
}
}

```

## iOS Native Apps

iOS native apps use the SFRestAPI protocol for REST API interaction. The following code creates and sends a REST request for the SOQL query `SELECT Name, Id, OwnerId FROM Account`. If the request is successful, Salesforce sends the REST response to the `requestForQuery:send:delegate:delegate` method. The response is parsed, and each returned record is upserted into the SmartStore soup.

```

- (void)requestAccounts
{
 SFRestRequest *request = [[SFRestAPI sharedInstance]
 requestForQuery:@"SELECT Name, Id, OwnerId FROM Account"];
 [[SFRestAPI sharedInstance] send:request delegate:self];
}

//SFRestAPI protocol for successful response
- (void)request:(SFRestRequest *)request didLoadResponse:(id)dataResponse
{
 NSArray *records = dataResponse[@"records"];
 if (nil != records) {
 for (int i = 0; i < records.count; i++) {
 [self.store upsertEntries:[records[i]]
 toSoup:kAccountSoupName];
 }
 }
}

```



```

 }
}

```

## Android Native Apps

For REST API interaction, Android native apps typically use the `RestClient.sendAsync()` method with an anonymous inline definition of the `AsyncRequestCallback` interface. The following code creates and sends a REST request for the SOQL query `SELECT Name, Id, OwnerId FROM Account`. If the request is successful, Salesforce sends the REST response to the provided `AsyncRequestCallback.onSuccess()` callback method. The response is parsed, and each returned record is upserted into the SmartStore soup.

```

private void sendRequest(String soql, final String obj)
throws UnsupportedOperationException {
 final RestRequest restRequest =
 RestRequest.getRequestForQuery(
 getString(R.string.api_version),
 "SELECT Name, Id, OwnerId FROM Account", "Account");
 client.sendAsync(restRequest, new AsyncRequestCallback() {
 @Override
 public void onSuccess(RestRequest request,
 RestResponse result) {
 // Network component doesn't report app layer status.
 // Use the Mobile SDK RestResponse.isSuccess() method to check
 // whether the REST request itself succeeded.
 if (result.isSuccess()) {
 try {
 final JSONArray records =
 result.asJSONObject().getJSONArray("records");
 insertAccounts(records);
 } catch (Exception e) {
 onError(e);
 } finally {
 Toast.makeText(MainActivity.this,
 "Records ready for offline access.",
 Toast.LENGTH_SHORT).show();
 }
 }
 }
 @Override
 public void onError(Exception e) {
 // You might want to log the error
 // or show it to the user
 }
 });
}

/**
 * Inserts accounts into the accounts soup.
 *
 * @param accounts Accounts.
 */
public void insertAccounts(JSONArray accounts) {
 try {

```

```

 if (accounts != null) {
 for (int i = 0; i < accounts.length(); i++) {
 if (accounts[i] != null) {
 try {
 smartStore.upsert(
 ACCOUNTS_SOUP, accounts[i]);
 } catch (JSONException exc) {
 Log.e(TAG,
 "Error occurred while attempting "
 + "to insert account. Please verify "
 + "validity of JSON data set.");
 }
 }
 }
 }
} catch (JSONException e) {
 Log.e(TAG, "Error occurred while attempting to "
 + "insert accounts. Please verify validity "
 + "of JSON data set.");
}
}

```

## Retrieving Data from a Soup


SmartStore provides a set of helper methods that build query strings for you.

For retrieving data from a soup, SmartStore provides helper functions that build query specs for you. A query spec is similar to an index spec, but contains more information about the type of query and its parameters. Query builder methods produce specs that let you query:

- Everything (“all” query)
- Using a Smart SQL
- For exact matches of a key (“exact” query)
- For full-text search on given paths (“match” query)
- For a range of values (“range” query)
- For wild-card matches (“like” query)

To query for a set of records, call the query spec factory method that suits your specifications. You can optionally define the index field, sort order, and other metadata to be used for filtering, as described in the following table:

| Parameter                                                | Description                                                                                                                                                        |
|----------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>selectPaths</code> or <code>withSelectPaths</code> | (Optional in JavaScript) Narrows the query scope to only a list of fields that you specify. See <a href="#">Narrowing the Query to Return a Subset of Fields</a> . |
| <code>indexPath</code> or <code>path</code>              | Describes what you’re searching for; for example, a name, account number, or date.                                                                                 |
| <code>beginKey</code>                                    | (Optional in JavaScript) Used to define the start of a range query.                                                                                                |
| <code>endKey</code>                                      | (Optional in JavaScript) Used to define the end of a range query.                                                                                                  |
| <code>matchKey</code>                                    | (Optional in JavaScript) Used to specify the search string in an exact or match query.                                                                             |

| Parameter              | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>orderPath</code> | (Optional in JavaScript—defaults to the value of the <code>path</code> parameter) For exact, range, and like queries, specifies the indexed path field to be used for sorting the result set. To query without sorting, set this parameter to a null value.<br><br> <b>Note:</b> Mobile SDK versions 3.2 and earlier sort all queries on the indexed path field specified in the query. |
| <code>order</code>     | (Optional in JavaScript) <ul style="list-style-type: none"> <li>JavaScript: Either “ascending” (default) or “descending.”</li> <li>iOS: Either <code>kSFSoupQuerySortOrderAscending</code> or <code>kSFSoupQuerySortOrderDescending</code>.</li> <li>Android: Either <code>Order.ascending</code> or <code>Order.descending</code>.</li> </ul>                                                                                                                           |
| <code>pageSize</code>  | (Optional in JavaScript. If not present, the native plug-in calculates an optimal value for the resulting <code>Cursor.pageSize</code> ) Number of records to return in each page of results.                                                                                                                                                                                                                                                                            |

For example, consider the following `buildRangeQuerySpec()` JavaScript call:

```
navigator.smartstore.buildRangeQuerySpec(
 "name", "Aardvark", "Zoroastrian", "ascending", 10, "name");
```

This call builds a range query spec that finds entries with names between Aardvark and Zoroastrian, sorted on the `name` field in ascending order:

```
{
 "querySpec": {
 "queryType": "range",
 "indexPath": "name",
 "beginKey": "Aardvark",
 "endKey": "Zoroastrian",
 "orderPath": "name",
 "order": "ascending",
 "pageSize": 10
 }
}
```

In JavaScript `build*` functions, you can omit optional parameters only at the end of the function call. You can't skip one or more parameters and then specify the next without providing a dummy or null value for each option you skip. For example, you can use these calls:

- `buildAllQuerySpec(indexPath)`
- `buildAllQuerySpec(indexPath, order)`
- `buildAllQuerySpec(indexPath, order, pageSize)`
- `buildAllQuerySpec(indexPath, order, pageSize, selectPaths)`

However, you can't use this call because it omits the `order` parameter:


```
buildAllQuerySpec(indexPath, pageSize)
```

 **Note:** All parameterized queries are single-predicate searches. Only Smart SQL queries support joins.

## Query Everything

Traverses everything in the soup.

See [Working with Query Results](#) for information on page sizes.

 **Note:** As a base rule, set `pageSize` to the number of entries you want displayed on the screen. For a smooth scrolling display, you can to increase the value to two or three times the number of entries shown.

### JavaScript:

`buildAllQuerySpec(indexPath, order, pageSize, selectPaths)` returns all entries in the soup, with no particular order. `order` and `pageSize` are optional, and default to “ascending” and 10, respectively. The `selectPaths` argument is also optional.

### iOS native:

```
+ (SFQuerySpec*) newAllQuerySpec:(NSString*) soupName
 withPath:(NSString*) path
 withOrder:(SFSoupQuerySortOrder) order
 withPageSize:(NSUInteger) pageSize;

+ (SFQuerySpec*) newAllQuerySpec:(NSString*) soupName
 withSelectPaths:(NSArray*) selectPaths
 withOrderPath:(NSString*) orderPath
 withOrder:(SFSoupQuerySortOrder) order
 withPageSize:(NSUInteger) pageSize;
```

### Android native:

```
public static QuerySpec buildAllQuerySpec(
 String soupName,
 String path,
 Order order,
 int pageSize)

public static QuerySpec buildAllQuerySpec(
 String soupName,
 String[] selectPaths,
 String orderPath,
 Order order,
 int pageSize);
```

## Query with a Smart SQL SELECT Statement

Executes the query specified by the given Smart SQL statement. This function allows greater flexibility than other query factory functions because you provide your own SELECT statement. See [Smart SQL Queries](#).

The following sample code shows a Smart SQL query that calls the SQL `COUNT` function.

### JavaScript:

```
var querySpec =
 navigator.smartstore.buildSmartQuerySpec(
 "select count(*) from {employees}", 1);

navigator.smartstore.runSmartQuery(querySpec, function(cursor) {
```

```

 // result should be [[n]] if there are n employees
 });

```

In JavaScript, `pageSize` is optional and defaults to 10.

#### iOS native:

```

SFQuerySpec* querySpec =
 [SFQuerySpec
 newSmartQuerySpec:@"select count(*) from {employees}"
 withPageSize:1];
NSArray* result = [_store queryWithQuerySpec:querySpec pageIndex:0 error:nil];
// result should be [[n]] if there are n employees

```

#### Android native:

```

try {
 JSONArray result =
 store.query(QuerySpec.buildSmartQuerySpec(
 "select count(*) from {Accounts}", 1), 0);
 // result should be [[n]] if there are n employees
 Log.println(Log.INFO, "REST Success!", "\nFound " +
 result.getString(0) + " accounts.");
} catch (JSONException e) {
 Log.e(TAG, "Error occurred while counting the number of account records. "
 + "Please verify validity of JSON data set.");
}

```

## Query by Exact

Finds entries that exactly match the given `matchKey` for the `indexPath` value. You use this method to find child entities of a given ID. For example, you can find opportunities by `Status`.

#### JavaScript:

In JavaScript, you can set the `order` parameter to either "ascending" or "descending". `order`, `pageSize`, and `orderPath` are optional, and default to "ascending", 10, and the `path` argument, respectively. The `selectPaths` argument is also optional.

```

navigator.smartstore.buildExactQuerySpec(
 path, matchKey, pageSize, order, orderPath, selectPaths)

```

The following JavaScript code retrieves children by ID:

```

var querySpec = navigator.smartstore.buildExactQuerySpec(
 "sfdcId",
 "some-sfdc-id");
navigator.smartstore.querySoup("Catalogs",
 querySpec, function(cursor) {
 // we expect the catalog to be in:
 // cursor.currentPageOrderedEntries[0]
});

```

The following JavaScript code retrieves children by parent ID:

```

var querySpec = navigator.smartstore.buildExactQuerySpec("parentSfdcId", "some-sfdc-id");
navigator.smartstore.querySoup("Catalogs", querySpec, function(cursor) {});

```

#### iOS native:

In iOS, you can set the `order` parameter to either `kSFSoupQuerySortOrderAscending` or `kSFSoupQuerySortOrderDescending`. To narrow the query's scope to certain fields, use the second form and pass an array of field names through the `withSelectPaths` parameter.

```
+ (SFQuerySpec*) newExactQuerySpec: (NSString*) soupName
 withPath: (NSString*) path
 withMatchKey: (NSString*) matchKey
 withOrderPath: (NSString*) orderPath
 withOrder: (SFSoupQuerySortOrder) order
 withPageSize: (NSUInteger) pageSize;

+ (SFQuerySpec*) newExactQuerySpec: (NSString*) soupName
 withSelectPaths: (NSArray*) selectPaths
 withPath: (NSString*) path
 withMatchKey: (NSString*) matchKey
 withOrderPath: (NSString*) orderPath
 withOrder: (SFSoupQuerySortOrder) order
 withPageSize: (NSUInteger) pageSize;
```

#### Android native:

In Android, you can set the `order` parameter to either `Order.ascending` or `Order.descending`. To narrow the query's scope to certain fields, use the second form and pass an array of field names through the `selectPaths` parameter.

```
public static QuerySpec buildExactQuerySpec(
 String soupName, String path, String exactMatchKey,
 String orderPath, Order order, int pageSize)

public static QuerySpec buildExactQuerySpec(
 String soupName, String[] selectPaths, String path,
 String exactMatchKey, String orderPath,
 Order order, int pageSize);
```

## Query by Match

Finds entries that exactly match the full-text search query in `matchKey` for the `indexPath` value. See [Using Full-Text Search Queries](#).

#### JavaScript:

In JavaScript, you can set the `order` parameter to either "ascending" or "descending". `order`, `pageSize`, and `orderPath` are optional, and default to "ascending", 10, and the `path` argument, respectively. The `selectPaths` argument is also optional.

```
navigator.smartstore.buildMatchQuerySpec(
 path, matchKey, order, pageSize, orderPath, selectPaths)
```

#### iOS native:

In iOS, you can set the `order` parameter to either `kSFSoupQuerySortOrderAscending` or `kSFSoupQuerySortOrderDescending`. To narrow the query's scope to certain fields, use the second form and pass an array of field names through the `withSelectPaths` parameter.

```
+ (SFQuerySpec*) newMatchQuerySpec: (NSString*) soupName
 withPath: (NSString*) path
 withMatchKey: (NSString*) matchKey
 withOrderPath: (NSString*) orderPath
 withOrder: (SFSoupQuerySortOrder) order
 withPageSize: (NSUInteger) pageSize;
```

```
+ (SFQuerySpec*) newMatchQuerySpec: (NSString*) soupName
 withSelectPaths: (NSArray*) selectPaths
 withPath: (NSString*) path
 withMatchKey: (NSString*) matchKey
 withOrderPath: (NSString*) orderPath
 withOrder: (SFSoupQuerySortOrder) order
 withPageSize: (NSUInteger) pageSize;
```

**Android native:**

In Android, you can set the `order` parameter to either `Order.ascending` or `Order.descending`. To narrow the query's scope to certain fields, use the second form and pass an array of field names through the `selectPaths` parameter.

```
public static QuerySpec buildMatchQuerySpec(
 String soupName, String path, String exactMatchKey,
 String orderPath, Order order, int pageSize)

public static QuerySpec buildMatchQuerySpec(
 String soupName, String[] selectPaths, String path,
 String matchKey, String orderPath, Order order,
 int pageSize)
```

## Query by Range

Finds entries whose `indexPath` values fall into the range defined by `beginKey` and `endKey`. Use this function to search by numeric ranges, such as a range of dates stored as integers.

By passing null values to `beginKey` and `endKey`, you can perform open-ended searches:

- To find all records where the field at `indexPath` is greater than or equal to `beginKey`, pass a null value to `endKey`.
- To find all records where the field at `indexPath` is less than or equal to `endKey`, pass a null value to `beginKey`.
- To query everything, pass a null value to both `beginKey` and `endKey`.

**JavaScript:**

In JavaScript, you can set the `order` parameter to either "ascending" or "descending". `order`, `pageSize`, and `orderPath` are optional, and default to "ascending", 10, and the `path` argument, respectively. The `selectPaths` argument is also optional.

```
navigator.smartstore.buildRangeQuerySpec(
 path, beginKey, endKey, order, pageSize, orderPath, selectPaths)
```

**iOS native:**

In iOS, you can set the `order` parameter to either `kSFSoupQuerySortOrderAscending` or `kSFSoupQuerySortOrderDescending`. To narrow the query's scope to certain fields, use the second form and pass an array of field names through the `withSelectPaths` parameter.

```
+ (SFQuerySpec*) newRangeQuerySpec: (NSString*) soupName
 withPath: (NSString*) path
 withBeginKey: (NSString*) beginKey
 withEndKey: (NSString*) endKey
 withOrderPath: (NSString*) orderPath
 withOrder: (SFSoupQuerySortOrder) order
 withPageSize: (NSUInteger) pageSize;
```

```
+ (SFQuerySpec*) newRangeQuerySpec: (NSString*) soupName
 withSelectPaths: (NSArray*) selectPaths
 withPath: (NSString*) path
 withBeginKey: (NSString*) beginKey
 withEndKey: (NSString*) endKey
 withOrderPath: (NSString*) orderPath
 withOrder: (SFSoupQuerySortOrder) order
 withPageSize: (NSUInteger) pageSize;
```

**Android native:**

In Android, you can set the `order` parameter to either `Order.ascending` or `Order.descending`. To narrow the query's scope to certain fields, use the second form and pass an array of field names through the `selectPaths` parameter.

```
public static QuerySpec buildRangeQuerySpec(
 String soupName, String path, String beginKey,
 String endKey, String orderPath, Order order, int pageSize)


public static QuerySpec buildRangeQuerySpec(
 String soupName, String[] selectPaths, String path,
 String beginKey, String endKey, String orderPath,
 Order order, int pageSize);
```

## Query by Like

Finds entries whose `indexPath` values are like the given `likeKey`. You can use the `"%"` wild card to search for partial matches as shown in these syntax examples:

- To search for terms that begin with your keyword: `"foo%"`
- To search for terms that end with your keyword: `"%foo"`
- To search for your keyword anywhere in the `indexPath` value: `"%foo%"`

. Use this function for general searching and partial name matches. Use the query by "match" method for full-text queries and fast queries over large data sets.

 **Note:** Query by "like" is the slowest query method.

**JavaScript:**

In JavaScript, you can set the `order` parameter to either `"ascending"` or `"descending"`. `order`, `pageSize`, and `orderPath` are optional, and default to `"ascending"`, `10`, and the `path` argument, respectively. The `selectPaths` argument is also optional.

```
navigator.smartstore.buildLikeQuerySpec(
 path, likeKey, order, pageSize, orderPath, selectPaths)
```

**iOS native:**

In iOS, you can set the `order` parameter to either `kSFSoupQuerySortOrderAscending` or `kSFSoupQuerySortOrderDescending`. To narrow the query's scope to certain fields, use the second form and pass an array of field names through the `withSelectPaths` parameter.

```
+ (SFQuerySpec*) newLikeQuerySpec: (NSString*) soupName
 withPath: (NSString*) path
 withLikeKey: (NSString*) likeKey
 withOrderPath: (NSString*) orderPath
 withOrder: (SFSoupQuerySortOrder) order
```



```

 withPageSize: (NSUInteger)pageSize;
+ (SFQuerySpec*) newLikeQuerySpec: (NSString*) soupName
 withSelectPaths: (NSArray*) selectPaths
 withPath: (NSString*) path
 withLikeKey: (NSString*) likeKey
 withOrderPath: (NSString*) orderPath
 withOrder: (SFSoupQuerySortOrder) order
 withPageSize: (NSUInteger) pageSize;

```

**Android native:**

In Android, you can set the `order` parameter to either `Order.ascending` or `Order.descending`. To narrow the query's scope to certain fields, use the second form and pass an array of field names through the `selectPaths` parameter.

```

public static QuerySpec buildLikeQuerySpec(
 String soupName, String path, String likeKey,
 String orderPath, Order order, int pageSize)

public static QuerySpec buildLikeQuerySpec(
 String soupName, String[] selectPaths,
 String path, String likeKey, String orderPath,
 Order order, int pageSize)

```

## Executing the Query

In JavaScript, queries run asynchronously and return a cursor to your success callback function, or an error to your error callback function. The success callback takes the form `function(cursor)`. You use the `querySpec` parameter to pass your query specification to the `querySoup` method.

```

navigator.smartstore.querySoup(soupName, querySpec,
 successCallback, errorCallback);

```

## Narrowing the Query to Return a Subset of Fields

In Smart SQL query specs, you can limit the list of fields that the query returns by specifying the fields in the Smart SQL statement. For other types of query specs, you can do the same thing with the `selectPaths` parameter. When this argument is used, the method returns an array of arrays that contains an array for each element that satisfies the query. Each element array includes only the fields specified in `selectPaths`. This parameter is available for "all", "exact", "match", "range", and "like" query specs.

Here's an example. Consider a soup that contains elements such as the following:

```

{"_soupEntryId":1, "name":"abc", "status":"active", ...},
{"_soupEntryId":2, "name":"abd", "status":"inactive", ...}, ...

```

Let's run a "like" query that uses "ab%" as the LIKE key and `name` as the path. This query returns an array of objects, each of which contains an entire element:

```

[{"_soupEntryId":1, "name": "abc", "status":"active",...},
 {"_soupEntryId":2, "name":"abd", "status":"inactive",...},
 ...]

```

Now let's refine the query by adding `_soupEntryId` and `name` as selected paths. The query now returns a more efficient array of arrays with only the `_soupEntryId` and `name` field values:

```
[[1, "abc"], [2, "abd"], ...]
```

## Retrieving Individual Soup Entries by Primary Key

All soup entries are automatically given a unique internal ID (the primary key in the internal table that holds all entries in the soup). That ID field is made available as the `_soupEntryId` field in the soup entry.

To look up soup entries by `_soupEntryId` in JavaScript, use the `retrieveSoupEntries` function. This function provides the fastest way to retrieve a soup entry, but it's usable only when you know the `_soupEntryId`:

```
navigator.smartStore.retrieveSoupEntries(soupName, indexSpecs,
 successCallback, errorCallback)
```

The return order is not guaranteed. Also, entries that have been deleted are not returned in the resulting array.

## Smart SQL Queries

To exert full control over your queries—or to reuse existing SQL queries—you can define custom SmartStore queries.

Beginning with Salesforce Mobile SDK version 2.0, SmartStore supports a Smart SQL query language for free-form SELECT statements. Smart SQL queries combine standard SQL SELECT grammar with additional descriptors for referencing soups and soup fields. This approach gives you maximum control and flexibility, including the ability to use joins. Smart SQL supports all standard SQL SELECT constructs.

## Smart SQL Restrictions

- Smart SQL supports only SELECT statements and only indexed paths.
- You can't write MATCH queries with Smart SQL. For example, the following query doesn't work: `SELECT {soupName: _soup} FROM {soupName} WHERE {soupName:name} MATCH 'cat'`

## Syntax

Syntax is identical to the standard SQL SELECT specification but with the following adaptations:

| Usage                                         | Syntax                              |
|-----------------------------------------------|-------------------------------------|
| To specify a column                           | {< soupName>:<path>}                |
| To specify a table                            | {< soupName>}                       |
| To refer to the entire soup entry JSON string | {< soupName>:_soup}                 |
| To refer to the internal soup entry ID        | {< soupName>:_soupEntryId}          |
| To refer to the last modified date            | {< soupName>:_soupLastModifiedDate} |

## Sample Queries

Consider two soups: one named `Employees`, and another named `Departments`. The `Employees` soup contains standard fields such as:

- First name (`firstName`)
- Last name (`lastName`)
- Department code (`deptCode`)
- Employee ID (`employeeId`)
- Manager ID (`managerId`)

The Departments soup contains:

- Name (`name`)
- Department code (`deptCode`)

Here are some examples of basic Smart SQL queries using these soups:

```
select {employees:firstName}, {employees:lastName}
from {employees} order by {employees:lastName}

select {departments:name}
from {departments}
order by {departments:deptCode}
```

## Joins

Smart SQL also allows you to use joins. For example:

```
select {departments:name}, {employees:firstName} || ' ' || {employees:lastName}
from {employees}, {departments}
where {departments:deptCode} = {employees:deptCode}
order by {departments:name}, {employees:lastName}
```

You can even do self joins:

```
select mgr.{employees:lastName}, e.{employees:lastName}
from {employees} as mgr, {employees} as e
where mgr.{employees:employeeId} = e.{employees:managerId}
```

 **Note:** Doing a join on a JSON1 index requires a slightly extended syntax. For example, instead of

```
select {soup1:path1} from {soup1}, {soup2}
```

use

```
select {soup1}.{soup1:path1} from {soup1}, {soup2}
```

## Aggregate Functions

Smart SQL support the use of aggregate functions such as:

- COUNT
- SUM
- AVG

For example:

```
select {account:name},
 count({opportunity:name}),
 sum({opportunity:amount}),
 avg({opportunity:amount}),
 {account:id},
 {opportunity:accountid}
from {account},
 {opportunity}
where {account:id} = {opportunity:accountid}
group by {account:name}
```

## Using Full-Text Search Queries

To perform efficient and flexible searches in SmartStore, you use full-text queries. Full-text queries yield significant performance advantages over “like” queries when you’re dealing with large data sets.

Beginning with Mobile SDK 3.3, SmartStore supports full-text search. Full-text search is a technology that internet search engines use to collate documents placed on the web.

### About Full-Text

Here’s how full-text search works: A customer inputs a term or series of terms. Optionally, the customer can connect terms with binary operators or group them into phrases. A full-text search engine evaluates the given terms, applying any specified operators and groupings. The search engine uses the resulting search parameters to find matching documents, or, in the case of SmartStore, matching soup elements. To support full text search, SmartStore provides a full-text index spec for defining soup fields, and a query spec for performing queries on those fields.

Full-text queries, or “match” queries, are more efficient than “like” queries. “Like” queries require full index scans of all keys, with run times proportional to the number of rows searched. “Match” queries find the given term or terms in the index and return the associated record IDs. The full-text search optimization is negligible for fewer than 1000 records, but, beyond that threshold, run time stays nearly constant as the number of records increases. If you’re searching through tens of thousands of records, “match” queries can be 10–100 times faster than “like” queries.

Keep these points in mind when using full-text fields and queries:

- Insertions with a full-text index field take longer than ordinary insertions.
- You can’t perform MATCH queries in a Smart SQL statement. For example, the following query is **not supported**:

```
SELECT {soupName: _soup} FROM {soupName} WHERE {soupName:name} MATCH 'cat'
```

Instead, use a “match” query spec.

### Staying Current with Full-Text Search

In Mobile SDK 4.2, SmartStore updates its full-text search version from FTS4 to FTS5. This upgrade lets Mobile SDK take advantage of full-text index specs.

If you upgrade an app from Mobile SDK 4.1 to 4.2, existing FTS4 virtual tables remain intact. On the other hand, new soups that you create after upgrading use FTS5 virtual tables. These soups all work seamlessly together, but you can choose to upgrade legacy soups. Simply call `alterSoup` and pass in your original set of index specs. This call uses FTS5 to recreate the virtual tables that back full-text index specs.

See “Appendix A” at [www.sqlite.org/fts5.html](http://www.sqlite.org/fts5.html) for a comparison of FTS4 to FTS5.

#### IN THIS SECTION:

##### [Full-Text Search Index Specs](#)

To use full-text search, you register your soup with one or more full-text-indexed paths. SmartStore provides a *full\_text* index spec for designating index fields.

##### [Full-Text Query Specs](#)

To perform a full-text query, you create a SmartStore “match” query spec using your platform’s match query method. For the `matchKey` argument, you provide a full-text search query.

##### [Full-Text Query Syntax](#)

Mobile SDK full-text queries use SQLite’s enhanced query syntax. With this syntax, you can use logical operators to refine your search.

## Full-Text Search Index Specs

To use full-text search, you register your soup with one or more full-text-indexed paths. SmartStore provides a *full\_text* index spec for designating index fields.

When you define a path with a full-text index, you can also use that path for non-full-text queries. These other types of queries—“all”, “exact”, “:like”, “range”, and “smart” queries—interpret full-text indexed fields as string indexed fields.

The following examples show how to instantiate a full-text index spec.

#### Example: iOS:

```
[[SFSoupIndex alloc]
 initWithDictionary:@{kSoupIndexPath: @"some_path",
 kSoupIndexType: kSoupIndexTypeFullText}]
```

#### Android:

```
new IndexSpec("some_path", Type.full_text)
```

#### JavaScript:

```
new navigator.smartstore.SoupIndexSpec("some_path", "full_text")
```

## Full-Text Query Specs

To perform a full-text query, you create a SmartStore “match” query spec using your platform’s match query method. For the `matchKey` argument, you provide a full-text search query.

Use the following methods to create full-text query specs.

#### iOS:

```
+ (SFQuerySpec*) newMatchQuerySpec:(NSString*) soupName
 withPath:(NSString*) path
 withMatchKey:(NSString*) matchKey
 withOrderPath:(NSString*) orderPath
 withOrder:(SFSoupQuerySortOrder) order
 withPageSize:(NSUInteger) pageSize;
```

```
+ (SFQuerySpec*) newMatchQuerySpec: (NSString*) soupName
 withSelectPaths: (NSArray*) selectPaths
 withPath: (NSString*) path
 withMatchKey: (NSString*) matchKey
 withOrderPath: (NSString*) orderPath
 withOrder: (SFSoupQuerySortOrder) order
 withPageSize: (NSUInteger) pageSize;
```

**Android:**

```
public static QuerySpec buildMatchQuerySpec(
 String soupName, String path, String exactMatchKey,
 String orderPath, Order order, int pageSize)

public static QuerySpec buildMatchQuerySpec(
 String soupName, String[] selectPaths, String path,
 String matchKey, String orderPath, Order order,
 int pageSize)
```


**JavaScript:**

```
navigator.smartstore.buildMatchQuerySpec(
 path, matchKey, order, pageSize, orderPath, selectPaths)
```

## Full-Text Query Syntax

Mobile SDK full-text queries use SQLite's enhanced query syntax. With this syntax, you can use logical operators to refine your search.

The following table shows the syntactical options that Mobile SDK queries support. Following the table are keyed examples of the various query styles and sample output. For more information, see Sections 3.1, "Full-text Index Queries," and 3.2, "Set Operations Using The Enhanced Query Syntax," at [sqlite.org](http://sqlite.org).

| Query Option                                             | SmartStore Behavior                                                                                                                                                                                                                                                                                                     | Related Examples  |
|----------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| Specify one or more full-text indexed paths              | Performs match against values only at the paths you defined.                                                                                                                                                                                                                                                            | g, h, i, j, and k |
| Set the path to a null value                             | Performs match against all full-text indexed paths<br><br> <b>Note:</b> If your path is null, you can still specify a target field in the <code>matchKey</code> argument. Use this format:<br><code>{ soupName: path } : term</code> | a,b,c,d,e, and f  |
| Specify more than one term without operators or grouping | Assumes an "AND" between terms                                                                                                                                                                                                                                                                                          | b and h           |
| Place a star at the end of a term                        | Matches rows containing words that start with the query term                                                                                                                                                                                                                                                            | d and j           |
| Use "OR" between terms                                   | Finds one or both terms                                                                                                                                                                                                                                                                                                 | c and i           |
| Use the unary "NOT" operator before a term               | Ignores rows that contain that term                                                                                                                                                                                                                                                                                     | e, f, and k       |

| Query Option                                                                  | SmartStore Behavior                                                                             | Related Examples |
|-------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|------------------|
| Specify a phrase search by placing multiple terms within double quotes (" "). | Returns soup elements in which the entire phrase occurs in one or more full-text indexed fields |                  |

 **Example:** For these examples, a soup named "animals" contains the following records. The name and color fields are indexed as full\_text.

```
{ "id": 1, "name": "cat", "color": "black" }
{ "id": 2, "name": "cat", "color": "white" }
{ "id": 3, "name": "dog", "color": "black" }
{ "id": 4, "name": "dog", "color": "brown" }
{ "id": 5, "name": "dog", "color": "white" }
```

**Table 6: Query Syntax Examples**

| Example | Path    | Match Key                       | Selects...                                                                                                          | Records Returned |
|---------|---------|---------------------------------|---------------------------------------------------------------------------------------------------------------------|------------------|
| a.      | null    | "black"                         | Records containing the word "black" in any full-text indexed field                                                  | 1, 3             |
| b.      | null    | "black cat"                     | Records containing the words "black" and "cat" in any full-text indexed field                                       | 1                |
| c.      | null    | "black OR cat"                  | Records containing either the word "black" or the word "cat" in any full-text indexed field                         | 1, 2, 3          |
| d.      | null    | "b*"                            | Records containing a word starting with "b" in any full-text indexed field                                          | 1, 3             |
| e.      | null    | "black NOT cat"                 | Records containing the word "black" but not the word "cat" in any full-text indexed field                           | 3                |
| f.      | null    | "{animals:color}:black NOT cat" | Records containing the word "black" in the color field and not having the word "cat" in any full-text indexed field | 3                |
| g.      | "color" | "black"                         | Records containing the word "black" in the color field                                                              | 1, 3             |
| h.      | "color" | "black cat"                     | Records containing the words "black" and "cat" in the color field                                                   | No records       |

| Example | Path    | Match Key       | Selects...                                                                                   | Records Returned |
|---------|---------|-----------------|----------------------------------------------------------------------------------------------|------------------|
| i.      | "color" | "black OR cat"  | Records containing either the word "black" or the word "cat" in the <code>color</code> field | 1, 3             |
| j.      | "color" | "b*"            | Records containing a word starting with "b" in the <code>color</code> field                  | 1, 3             |
| k.      | "color" | "black NOT cat" | Records containing the word "black" but not the word "cat" in the <code>color</code> field   | 1, 3             |

## Working with Query Results

Mobile SDK provides mechanisms on each platform that let you access query results efficiently, flexibly, and dynamically.

Often, a query returns a result set that is too large to load all at once into memory. In this case, Mobile SDK initially returns a small subset of the results—a single *page*, based on a size that you specify. You can then retrieve more pages of results and navigate forwards and backwards through the result set.

### JavaScript:

When you perform a query in JavaScript, SmartStore returns a cursor object that lets you page through the query results. Your code can move forward and backwards through the cursor's pages. To navigate through cursor pages, use the following functions.

- `navigator.smartstore.moveCursorToPageIndex(cursor, newPageIndex, successCallback, errorCallback)`—Move the cursor to the page index given, where 0 is the first page, and `totalPages - 1` is the last page.
- `navigator.smartstore.moveCursorToNextPage(cursor, successCallback, errorCallback)`—Move to the next entry page if such a page exists.
- `navigator.smartstore.moveCursorToPreviousPage(cursor, successCallback, errorCallback)`—Move to the previous entry page if such a page exists.
- `navigator.smartstore.closeCursor(cursor, successCallback, errorCallback)`—Close the cursor when you're finished with it.

### Note:

- The `successCallback` function accepts one argument: the updated cursor.
- Cursors are not static snapshots of data—they are dynamic. The only data the cursor holds is the original query and your current position in the result set. When you move your cursor, the query runs again. If you change the soup while paging through the cursor, the cursor shows those changes. You can even access newly created soup entries, assuming they satisfy the original query.

### iOS native:

Internally, iOS native apps use the third-party `FMResultSet` class to obtain query results. When you call a SmartStore query spec method, use the `pageSize` parameter to control the amount of data that you get back from each call. To traverse pages of results, iteratively call the `queryWithQuerySpec:pageIndex:withDB:` or `queryWithQuerySpec:pageIndex:error:`



method of the `SFSmartStore` class with the same query spec object while incrementing or decrementing the zero-based `pageIndex` argument.

#### Android native:

Internally, Android native apps use the `android.database.Cursor` interface for cursor manipulations. When you call a SmartStore query spec method, use the `pageSize` parameter to control the amount of data that you get back from each call. To traverse pages of results, iteratively call the `SmartStore.query()` method with the same query spec object while incrementing or decrementing the zero-based `pageIndex` argument.

## Inserting, Updating, and Upserting Data

SmartStore defines standard fields that help you track entries and synchronize soups with external servers.

### System Fields: `_soupEntryId` and `_soupLastModifiedDate`

To track soup entries for insert, update, and delete actions, SmartStore adds a few fields to each entry:

- `_soupEntryId`—This field is the primary key for the soup entry in the table for a given soup.
- `_soupLastModifiedDate`, `_soupCreatedDate`—The number of milliseconds since 1/1/1970.
  - To convert a date value to a JavaScript date, use `new Date(entry._soupLastModifiedDate)`.
  - To convert a date to the corresponding number of milliseconds since 1/1/1970, use `date.getTime()`.

When you insert or update soup entries, SmartStore automatically sets these fields. When you remove or retrieve specific entries, you can reference them by `_soupEntryId`.

Beginning with Mobile SDK 4.2, SmartStore creates indexes on the `_soupLastModifiedDate` and `_soupCreatedDate` fields. These indexes provide a performance boost for queries that use these fields. In older soups, the `_soupLastModifiedDate` and `_soupCreatedDate` fields exist but are not indexed. To create these indexes to legacy soups, simply call `alterSoup` and pass in your original set of index specs.

## About Upserting

To insert or update soup entries—letting SmartStore determine which action is appropriate—you use an *upsert* method.

If `_soupEntryId` is already set in any of the entries presented for upsert, SmartStore updates the soup entry that matches that ID. If an upsert entry doesn't have a `_soupEntryId` slot, or if the provided `_soupEntryId` doesn't match an existing soup entry, SmartStore inserts the entry into the soup and overwrites its `_soupEntryId`.

## Upserting with an External ID

If your soup entries mirror data from an external system, you usually refer to those entries by their external primary key IDs. For that purpose, SmartStore supports upsert with an external ID. When you perform an upsert, you can designate any index field as the external ID field. SmartStore looks for existing soup entries with the same value in the designated field with the following results:

- If no field with the same value is found, SmartStore creates a soup entry.
- If the external ID field is found, SmartStore updates the entry with the matching external ID value.
- If more than one field matches the external ID, SmartStore returns an error.

To create an entry locally, set the external ID field to a value that you can query when uploading the new entries to the server.

When you update the soup with external data, always use the external ID. Doing so guarantees that you don't end up with duplicate soup entries for the same remote record.

SmartStore also lets you track inter-object relationships. For example, imagine that you create a product offline that belongs to a catalog that doesn't yet exist on the server. You can capture the product's relationship with the catalog entry through the `parentSoupEntryId` field. Once the catalog exists on the server, you can capture the external relationship by updating the local product record's `parentExternalId` field.

## Upsert Methods

### JavaScript:

The `cordova.force.js` library provides two JavaScript upsert functions, each with one overload:

```
navigator.smartStore.upsertSoupEntries(isGlobalStore, soupName,
 entries[], successCallback, errorCallback)
navigator.smartStore.upsertSoupEntries(storeConfig, soupName,
 entries[], successCallback, errorCallback)
```

```
navigator.smartStore.upsertSoupEntriesWithExternalId(isGlobalStore, soupName,
 entries[], externalPathId, successCallback, errorCallback)
navigator.smartStore.upsertSoupEntriesWithExternalId(storeConfig, soupName,
 entries[], externalPathId, successCallback, errorCallback)
```

To upsert local data only, use the first `upsert()` function. To upsert data from an external server, use the second function, which supports the `externalPathId` parameter.

### iOS native:

The iOS `SFSmartStore` class provides two instance methods for upserting. The first lets you specify all available options:

- Soup name
- `NSArray` object containing index specs
- Path for an external ID field name
- An output `NSError` object to communicate errors back to the app

```
- (NSArray *)upsertEntries:(NSArray *)entries
 toSoup:(NSString *)soupName
withExternalIdPath:(NSString *)externalIdPath
 error:(NSError **)error;
```

The second method uses the `_soupEntryId` field for the external ID path:

```
- (NSArray *)upsertEntries:(NSArray *)entries
 toSoup:(NSString *)soupName;
```

### Android native:

Android provides three overloads of its `upsert()` method. The first overload lets you specify all available options:

- Soup name
- JSON object containing one or more entries for upserting
- Path for an arbitrary external ID field name
- Flag indicating whether to use a transactional model for inserts and updates


```
public JSONObject upsert(
 String soupName, JSONObject soupElt, String externalIdPath,
 boolean handleTx)
 throws JSONException
```

The second overload enforces the use of a transactional model for inserts and updates:

```
public JSONObject upsert(
 String soupName, JSONObject soupElt, String externalIdPath)
 throws JSONException
```

The third overload enforces the transactional model and uses the `_soupEntryId` field for the external ID path:

```
public JSONObject upsert(
 String soupName, JSONObject soupElt)
 throws JSONException
```

 **Example:** The following JavaScript code contains sample scenarios. First, it calls `upsertSoupEntries` to create an account soup entry. In the success callback, the code retrieves the new record with its newly assigned soup entry ID. It then changes the account description and calls `forcetk.mobilesdk` methods to create the account on the server and then update it. The final call demonstrates an upsert with external ID. To make the code more readable, no error callbacks are specified. Also, because all SmartStore calls are asynchronous, real applications perform each step in the success callback of the previous step.

This code uses the value `new` for the `id` field because the record doesn't yet exist on the server. When the app comes online, it can query for records that exist only locally (by looking for records where `id == "new"`) and upload them to the server. Once the server returns IDs for the new records, the app can update their `id` fields in the soup.

```
var sfSmartstore =
 function() {return cordova.require("com.salesforce.plugin.smartstore");};
// ...
// Specify data for the account to be created
var acc = {id: "new", Name: "Cloud Inc",
 Description: "Getting started"};

// Create account in SmartStore
// This upsert does a "create" because
// the account has no _soupEntryId field
sfSmartstore().upsertSoupEntries("accounts", [acc],
 function(accounts) {
 acc = accounts[0];
 // acc should now have a _soupEntryId field
 // (and a _lastModifiedDate as well)
 });

// Update account's description in memory
acc["Description"] = "Just shipped our first app ";

// Update account in SmartStore
// This does an "update" because acc has a _soupEntryId field
sfSmartstore().upsertSoupEntries("accounts", [acc],
 function(accounts) {
 acc = accounts[0];
 });

// Create account on server
// (sync client -> server for entities created locally)
force.create("account", {
 "Name": acc["Name"],
 "Description": acc["Description"]},
```

```

function(result) {
 acc["id"] = result["id"];
 // Update account in SmartStore
 sfSmartstore().upsertSoupEntries("accounts", [acc]);
});

// Update account's description in memory
acc["Description"] = "Now shipping for iOS and Android";

// Update account's description on server
// Sync client -> server for entities existing on server
force.update("account", acc["id"],
 {"Description": acc["Description"]});

// Later, there is an account (with id: someSfdcId) that you want
// to get locally

// There might be an older version of that account in the
// SmartStore already

// Update account on client
// sync server -> client for entities that might or might not
// exist on client
force.retrieve(
 "account", someSfdcId, "id,Name,Description",
 function(result) {
 // Create or update account in SmartStore
 // (looking for an account with the same sfdcId)
 sfSmartstore().upsertSoupEntriesWithExternalId(
 "accounts", [result], "id");
 });

```

## Using External Storage for Large Soup Elements


If your soup includes large elements, you can get better performance by using external encrypted storage. For example, if you see warnings that you've exceeded an index limit, try switching to external storage. Trade-offs are minimal.

When you populate a soup, SmartStore formats your data elements as JSON strings and writes the soup data to the underlying SQLite database. This strategy proves efficient and easy to use for most cases. However, if your JSON blobs are 1 MB or larger, you can direct SmartStore to store them, encrypted, in the device file system. Mobile SDK 4.3 and later define a special SmartStore feature, *external storage*, for this use case.

Using external storage for large elements can reduce memory usage and, hence, improve SmartStore performance. This benefit grows with the size of the soup elements. We don't recommend external storage for soup elements smaller than 1 MB.

To use external storage, you:

1. Create a soup spec object. Configure this object with the soup name and a list of features that includes external storage.
2. Register the soup using a soup registration method that takes a soup spec object rather than the soup name.
3. To change the soup specs after you register the soup, use an `alterSoup` method that takes a soup spec object.

 **Important:** SmartStore treats external elements exactly as normal soup elements, with one exception: You cannot use JSON1 indexes with external storage. If you attempt to register a soup that uses external storage and JSON1 indexes, SmartStore throws an error.

#### IN THIS SECTION:

##### [Soup Specs](#)

To register or alter a soup that uses special SmartStore features such as external storage, you provide a *soup spec* rather than just a soup name. SmartStore provides methods for creating and retrieving soup spec objects.

##### [Register a Soup with External Storage](#)

Soup registration for external storage requires different APIs than ordinary soup registration. You use a registration method that takes a soup spec object.

##### [Alter a Soup with External Storage](#)

To alter a soup that uses a special feature such as external storage, use an `alterSoup` method that takes a soup spec object.

## Soup Specs

To register or alter a soup that uses special SmartStore features such as external storage, you provide a *soup spec* rather than just a soup name. SmartStore provides methods for creating and retrieving soup spec objects.

In your soup spec object, you specify the soup name and a list of the SmartStore special features that your soup uses. You can then pass the soup spec object to a `registerSoupWithSpec` method or an `alterSoup` method.

 **Note:** Currently, SmartStore defines only one special feature: external storage.

## Android Native

### **Soup spec creation methods (*SoupSpec.java*)**

```
public SoupSpec(String soupName) // for future use
public SoupSpec(String soupName, String... features)
```

### **Soup spec retrieval method (*SmartStore.java*)**

```
public SoupSpec getSoupSpec(String soupName)
```

## iOS Native

### **Soup spec creation methods (*SFSoupSpec.h*)**

```
+ (SFSoupSpec *)newSoupSpec:(NSString *)soupName withFeatures:(NSArray *)features;
+ (SFSoupSpec *)newSoupSpecWithDictionary:(NSDictionary *)dictionary;
```

### **Soup spec retrieval method (*SFSmartStore.h*)**

```
- (SFSoupSpec*)attributesForSoup:(NSString*)soupName;
```

## JavaScript

### **Soup spec creation methods (*cordova.force.smartstore.js, react.force.smartstore.js*)**

```
SoupSpec(soupName, features)
```

**Soup spec retrieval method (*cordova.force.smartstore.js*, *react.force.smartstore.js*)**

```
getSoupSpecs (soupName)
```

## Register a Soup with External Storage

Soup registration for external storage requires different APIs than ordinary soup registration. You use a registration method that takes a soup spec object.

A soup spec is an object that contains the soup name along with a list of special features for the soup to support. In this case, you set the feature list to include the Mobile SDK platform-specific identifier for “external storage”. All identifiers resolve to the string “externalStorage”.

| Platform             | Constant Identifier                            |
|----------------------|------------------------------------------------|
| iOS native           | kSoupFeatureExternalStorage                    |
| Android native       | <code>SoupSpec.FEATURE_EXTERNAL_STORAGE</code> |
| Hybrid, React Native | “externalStorage” (no constant defined)        |

## Android Native

**Soup spec registration methods (*SmartStore.java*)**

```
public void registerSoupWithSpec (
 SoupSpec soupSpec,
 IndexSpec[] indexSpecs)
```

## iOS Native

**Soup spec registration methods (*SFSmartStore.h*)**

```
- (BOOL) registerSoupWithSpec: (SFSoupSpec*) soupSpec
 withIndexSpecs: (NSArray*) indexSpecs
 error: (NSError**) error;
```

## JavaScript

**Soup spec registration methods (*cordova.force.smartstore.js*, *react.force.smartstore.js*)**

```
registerSoupWithSpec (storeSpec, soupSpec, indexSpecs,
 successCB, errorCallback)
```

## Alter a Soup with External Storage

To alter a soup that uses a special feature such as external storage, use an `alterSoup` method that takes a soup spec object.

## Android Native

### **Soup spec alteration methods (SmartStore.java)**

```
public void alterSoup(
 String soupName,
 SoupSpec soupSpec,
 IndexSpec[] indexSpecs,
 boolean reIndexData)
 throws JSONException
```

## iOS Native

### **Soup spec alteration methods (SFSmartStore.h)**

```
- (BOOL) alterSoup:(NSString*) soupName
 withSoupSpec:(SFSoupSpec*) soupSpec
 withIndexSpecs:(NSArray*) indexSpecs
 reIndexData:(BOOL) reIndexData;
```

## JavaScript

### **Soup spec alteration methods (cordova.force.smartstore.js, react.force.smartstore.js)**

```
alterSoupWithSpec(storeSpec, soupName, soupSpec,
 indexSpecs, reIndexData, successCB, errorCallback)
```

## Removing Soup Elements

Traditionally, SmartStore methods let you remove soup elements by specifying an array of element IDs. To do so, you usually run a preliminary query to retrieve the candidate IDs, then call the method that performs the deletion. In Mobile SDK 4.2, SmartStore ups the game by adding a query option to its element deletion methods. With this option, you provide only a query, and SmartStore deletes all elements that satisfy that query. This approach delivers a performance boost because both the query and the deletion operation occur in a single call.

## Hybrid Apps

In hybrid apps, you use the third parameter to pass either an ID array or a SmartStore query spec.

```
removeFromSoup([isGlobalStore,]soupName, entryIdsOrQuerySpec,
 successCB, errorCallback)
removeFromSoup([storeConfig,]soupName, entryIdsOrQuerySpec,
 successCB, errorCallback)
```

In addition to success and error callbacks, this function takes the following arguments:

**Table 7: Parameters**

| Parameter Name             | Argument Description                                                                                                                            |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>isGlobalStore</code> | (Optional) Boolean that indicates whether this operation occurs in a global or user-based SmartStore database. Defaults to <code>false</code> . |

| Parameter Name      | Argument Description                                                                                                  |
|---------------------|-----------------------------------------------------------------------------------------------------------------------|
| storeConfig         | (Optional) <code>StoreConfig</code> object that specifies a store name and whether the store is global or user-based. |
| soupName            | String. Pass in the name of the soup.                                                                                 |
| entryIdsOrQuerySpec | Array or <code>QuerySpec</code> object. Pass in the name of the soup.                                                 |

## Android Native Apps

Android native methods for removing entries give you the option of either handling the transaction yourself, or letting the method handle the transaction transparently. If you set the `handleTx` argument to `false`, you're responsible for starting the transaction before the call and ending it afterwards. If you use the overload that doesn't include `handleTx`, or if you set `handleTx` to `false`, Mobile SDK handles the transaction for you.

To remove entries by ID array in Android native apps, call either of the following methods:

```
public void delete(String soupName, Long... soupEntryIds)
public void delete(String soupName, Long[] soupEntryIds, boolean handleTx)
```

To remove entries by query in Android native apps, call either of the following methods:

```
public void deleteByQuery(String soupName, QuerySpec querySpec)
public void deleteByQuery(String soupName, QuerySpec querySpec, boolean handleTx)
```

## iOS Native Apps

To remove entries by ID array in iOS native apps, call:

```
- (void)removeEntries:(NSArray*)entryIds fromSoup:(NSString*)soupName error:(NSError**)error;
```

To remove entries by query in iOS native apps, call either of the following methods:

```
- (void)removeEntriesByQuery:(SFQuerySpec*)querySpec
 fromSoup:(NSString*)soupName;
- (void)removeEntriesByQuery:(SFQuerySpec*)querySpec
 fromSoup:(NSString*)soupName
 error:(NSError**)error;
```

## Managing Soups

SmartStore provides utility functionality that lets you retrieve soup metadata and perform other soup-level operations. This functionality is available for hybrid, Android native, and iOS native apps.

### Hybrid Apps

Each soup management function in JavaScript takes two callback functions: a success callback that returns the requested data, and an error callback. Success callbacks vary according to the soup management functions that use them. Error callbacks take a single argument, which contains an error description string. For example, you can define an error callback function as follows:

```
function(e) { alert("ERROR: " + e);}
```



To call a soup management function in JavaScript, first invoke the Cordova plug-in to initialize the SmartStore object. You then use the SmartStore object to call the soup management function. The following example defines named callback functions discretely, but you can also define them inline and anonymously.

```
var sfSmartstore = function() {
 return cordova.require("com.salesforce.plugin.smartstore");};

function onSuccessRemoveSoup(param) {
 logToConsole() ("onSuccessRemoveSoup: " + param);
 $("#div_soup_status_line").html ("Soup removed: "
 + SAMPLE_SOUP_NAME);
}

function onErrorRemoveSoup(param) {
 logToConsole() ("onErrorRemoveSoup: " + param);
 $("#div_soup_status_line").html ("removeSoup ERROR");
}

sfSmartstore().removeSoup (SAMPLE_SOUP_NAME,
 onSuccessRemoveSoup,
 onErrorRemoveSoup);
```

## Android Native Apps

To use soup management APIs in a native Android app that's SmartStore-enabled, you call methods on the shared SmartStore instance:

```
SmartStore smartStore =
 SmartStoreSDKManager.getInstance().getSmartStore();
smartStore.clearSoup ("user1Soup");
```

## iOS Native Apps

To use soup management APIs in a native iOS app, import `SFSmartStore.h`. You call soup management methods on a `SFSmartStore` shared instance. Obtain the shared instance by using one of the following `SFSmartStore` class methods.

### Using the SmartStore instance for the current user:

```
+ (id)sharedStoreWithName:(NSString*)storeName;
```

### Using the SmartStore instance for a specified user:

```
+ (id)sharedStoreWithName:(NSString*)storeName
 user:(SFUserAccount *)user;
```

For example:

```
self.store = [SFSmartStore sharedStoreWithName:kDefaultSmartStoreName];
if ([self.store soupExists:@"Accounts"]) {
 [self.store removeSoup:@"Accounts"];
}
```

## IN THIS SECTION:

[Get the Database Size](#)

To query the amount of disk space consumed by the database, call the database size method.

[Clear a Soup](#)

To remove all entries from a soup, call the soup clearing method.

[Retrieve a Soup's Index Specs](#)

If you want to examine or display the index specifications for a soup, call the applicable index specs retrieval method.

[Change Existing Index Specs on a Soup](#)

To change existing index specs, call the applicable soup alteration method.

[Reindex a Soup](#)

Use reindexing if you previously altered a soup without reindexing the data, but later you want to make sure all elements in the soup are properly indexed. Both `alterSoup()` and `reindexSoup()` perform better for conversion to, or creation of, JSON1 index specs than for other index spec types.

[Remove a Soup](#)

Removing a soup deletes it. When a user signs out, all soups are deleted automatically. For other occasions in which you want to delete a soup, call the applicable soup removal method.

## SEE ALSO:

[Adding SmartStore to Existing Android Apps](#)

## Get the Database Size

To query the amount of disk space consumed by the database, call the database size method.

## Hybrid Apps

In hybrid apps, call:

```
navigator.smartstore.getDatabaseSize(successCallback, errorCallback)
```

The success callback supports a single parameter that contains the database size in bytes. For example:

```
function(dbSize) { alert("db file size is:" + dbSize + " bytes"); }
```

## Android Native Apps

In Android apps, call:

```
public int getDatabaseSize ()
```

## iOS Native Apps

In Android apps, call:

```
- (long) getDatabaseSize
```

## Clear a Soup

To remove all entries from a soup, call the soup clearing method.

### Hybrid Apps

In hybrid apps, call:

```
navigator.smartstore.clearSoup(soupName, successCallback, errorCallback)
```

The success callback supports a single parameter that contains the soup name. For example:

```
function(soupName) { alert("Soup " + soupName + " was successfully emptied."); }
```

### Android Apps

In Android apps, call:

```
public void clearSoup (String soupName)
```

### iOS Apps

In iOS apps, call:

```
- (void)clearSoup:(NSString*) soupName;
```

## Retrieve a Soup's Index Specs

If you want to examine or display the index specifications for a soup, call the applicable index specs retrieval method.

### Hybrid Apps

In hybrid apps, call:

```
getSoupIndexSpecs()
```

In addition to the success and error callback functions, this function takes a single argument, `soupName`, which is the name of the soup. For example:

```
navigator.smartstore.getSoupIndexSpecs(soupName, successCallback, errorCallback)
```

The success callback supports a single parameter that contains the array of index specs. For example:

```
function(indexSpecs) { alert("Soup " + soupName + " has the following indexes:" + JSON.stringify(indexSpecs)); }
```

### Android Apps

In Android apps, call:

```
public IndexSpec [] getSoupIndexSpecs (String soupName)
```

## iOS Apps

In iOS apps, call:

```
- (NSArray*) indicesForSoup: (NSString*) soupName
```

## Change Existing Index Specs on a Soup

To change existing index specs, call the applicable soup alteration method.

Keep these important performance tips in mind when reindexing data:

- The `reIndexData` argument is optional, because reindexing can be expensive. When `reIndexData` is set to false, expect your throughput to be faster by an order of magnitude.
- Altering a soup that already contains data can degrade your app's performance. Setting `reIndexData` to true worsens the performance hit.
- As a performance guideline, expect the `alterSoup()` operation to take one second per 1000 records when `reIndexData` is set to true. Individual performance varies according to device capabilities, the size of the elements, and the number of indexes.
- `alterSoup()` and `reindexSoup()` perform better for conversion to, or creation of, JSON1 index specs than for other index spec types.
- Insert performance tends to be faster with JSON1 index specs.
- Database size is smaller with JSON1 index specs.
- Query performance is typically unaffected by JSON1 index specs.
- Other SmartStore operations must wait for the soup alteration to complete.
- If the operation is interrupted—for example, if the user exits the application—the operation automatically resumes when the application reopens the SmartStore database.

## Changing Index Specs with External Storage

If you've registered a soup to use the external storage feature, use the `alterSoup` methods described in [Alter a Soup with External Storage](#).

## Hybrid Apps

In hybrid apps, call:

```
navigator.smartstore.alterSoup(soupName, indexSpecs, reIndexData,
 successCallback, errorCallback)
```

In addition to success and error callbacks, this function takes the following arguments:

**Table 8: Parameters**

| Parameter Name           | Argument Description                                                                                           |
|--------------------------|----------------------------------------------------------------------------------------------------------------|
| <code>soupName</code>    | String. Pass in the name of the soup.                                                                          |
| <code>indexSpecs</code>  | Array. Pass in the set of index entries in the index specification.                                            |
| <code>reIndexData</code> | Boolean. Indicate whether you want the function to re-index the soup after replacing the index specifications. |

The success callback supports a single parameter that contains the soup name. For example:


```
function(soupName) { alert("Soup " + soupName +
 " was successfully altered"); }
```

The following example demonstrates a simple soup alteration. To start, the developer defines a soup that's indexed on `name` and `address` fields, and then upserts an agent record.

```
navigator.smartstore.registerSoup("myAgents",
 [{path:'name', type:'string'},
 {path:'address', type:'string'}]);
navigator.smartstore.upsertSoupEntries("myAgents",
 [{name:'James Bond',
 address:'1 market st',
 agentNumber:"007"}]);
```

When time and experience show that users really wanted to query their agents by "agentNumber" rather than `address`, the developer decides to drop the index on `address` and add an index on `agentNumber`.

```
navigator.smartstore.alterSoup("myAgents", [{path:'name', type:'string'}, {path:'agentNumber',
 type:'string'}], true);
```

 **Note:** If the developer sets the `reIndexData` parameter to false, a query on `agentNumber` does not find the already inserted entry ("James Bond"). However, you can query that record by `name`. To support queries by `agentNumber`, you'd first have to call `navigator.smartstore.reIndexSoup("myAgents", ["agentNumber"])`

## Android Native Apps

In an Android native app, call:

```
public void alterSoup(String soupName, IndexSpec [] indexSpecs, boolean reIndexData) throws
 JSONException
```

## iOS Native Apps

In an iOS native app, call:

```
- (BOOL) alterSoup:(NSString*) soupName withIndexSpecs:(NSArray*) indexSpecs
reIndexData:(BOOL) reIndexData;
```

## Reindex a Soup

Use reindexing if you previously altered a soup without reindexing the data, but later you want to make sure all elements in the soup are properly indexed. Both `alterSoup()` and `reindexSoup()` perform better for conversion to, or creation of, JSON1 index specs than for other index spec types.

## Hybrid Apps

In hybrid apps, call:

```
navigator.smartstore.reIndexSoup(soupName, listOfPaths, successCallback, errorCallback)
```

In addition to the success and error callback functions, this function takes a single argument, `soupName`, which is the name of the soup. For example: this function takes additional arguments:

| Parameter Name | Argument Description                                      |
|----------------|-----------------------------------------------------------|
| soupName       | String. Pass in the name of the soup.                     |
| listOfPaths    | Array. List of index paths on which you want to re-index. |

The success callback supports a single parameter that contains the soup name. For example:

```
function(soupName) { alert("Soup " + soupName +
 " was successfully re-indexed."); }
```

## Android Apps

In Android apps, call:

```
public void reIndexSoup(String soupName, String[] indexPaths, boolean handleTx)
```

## iOS Apps

In iOS apps, call:

```
- (BOOL) reIndexSoup:(NSString*) soupName
 withIndexPaths:(NSArray*) indexPaths
```

## Remove a Soup

Removing a soup deletes it. When a user signs out, all soups are deleted automatically. For other occasions in which you want to delete a soup, call the applicable soup removal method.

## Hybrid Apps

In hybrid apps, call:

```
navigator.smartstore.removeSoup(soupName, successCallback, errorCallback);
```

## Android Apps

In Android apps, call:

```
public void dropSoup (String soupName)
```

## iOS Apps

In iOS apps, call:

```
- (void) removeSoup:(NSString*) soupName
```

## Managing Stores

If you create global stores, you're required to perform cleanup when the app exits. Also, if you create multiple user stores, you can perform cleanup if you're no longer using particular stores. SmartStore provides methods deleting named and global stores. For hybrid apps, SmartStore also provides functions for getting a list of named stores.

### Android Native Apps

Mobile SDK for Android defines the following `SmartStoreSDKManager` methods for removing stores.

```
public void removeGlobalSmartStore(String dbName)
public void removeSmartStore()
public void removeSmartStore(UserAccount account)
public void removeSmartStore(UserAccount account, String communityId)
public void removeSmartStore(String dbNamePrefix, UserAccount account, String communityId)
```

In addition, SmartStore provides the following methods for retrieving store names.

```
public List<String> getGlobalStoresPrefixList()
public List<String> getUserStoresPrefixList()
```

### iOS Native Apps

Mobile SDK for iOS defines the following `SFSmartStore` class methods for removing stores.

```
+ (void)removeSharedStoreWithName:(NSString *)storeName;
+ (void)removeSharedStoreWithName:(NSString *)storeName forUser:(SFUserAccount *)user;
+ (void)removeSharedGlobalStoreWithName:(NSString *)storeName;
+ (void)removeAllStores;
+ (void)removeAllStoresForUser:(SFUserAccount *)user;
+ (void)removeAllGlobalStores;
```

In addition, SmartStore provides the following methods for retrieving store names.

```
+ (NSArray *)allStoreNames;
+ (NSArray *)allGlobalStoreNames;
```

### Hybrid Apps

SmartStore defines the following functions for removing stores. Each function takes success and error callbacks. The `removeStore()` function also requires either a `StoreConfig` object that specifies the store name, or just the store name as a string.

```
removeStore(storeConfig, successCB, errorCB)
removeAllGlobalStores(successCB, errorCB)
removeAllStores(successCB, errorCB)
```

In addition, the hybrid version of SmartStore provides the following functions for retrieving the `StoreConfig` objects for defined stores.

```
getAllStores(successCB, errorCB)
getAllGlobalStores(successCB, errorCB)
```


```
getAllStores(successCB, errorCallback)
getAllGlobalStores(successCB, errorCallback)
```

## Testing with the SmartStore Inspector

Verifying SmartStore operations during testing can become a tedious and time-consuming effort. SmartStore Inspector comes to the rescue.

During testing, it's helpful to see if your code is handling SmartStore data as you intended. The SmartStore Inspector provides a mobile UI class for that purpose. With the SmartStore Inspector you can:

- Examine soup metadata, such as soup names and index specs for any soup
- Clear a soup's contents
- Perform Smart SQL queries

 **Note:** SmartStore Inspector is for testing and debugging only. Be sure to remove all references to SmartStore Inspector before you build the final version of your app.

## Hybrid Apps

To launch the SmartStore Inspector, call `showInspector()` on the SmartStore plug-in object. In HTML:

```
<!-- include Cordova -->
<script src="cordova.js"></script>
```

In a `<script>` block or a referenced JavaScript library:

```
var sfSmartstore = function() {return
cordova.require("com.salesforce.plugin.smartstore");};sfSmartstore().showInspector();
```

## Android Native Apps

In native Android apps, use the `SmartStoreInspectorActivity` class to launch the SmartStore Inspector:

```
this.startActivity(SmartStoreInspectorActivity.getIntent(this, false, null));
```

## iOS Native Apps

In native iOS apps, send the `presentViewController` message of the current view controller to launch the SmartStore Inspector:

```
#import <SalesforceSDKCore/SFSmartStoreInspectorViewController.h>
...
SFSmartStoreInspectorViewController *inspector =
 [[SFSmartStoreInspectorViewController alloc] initWithStore:self.store];
[self presentViewController:inspector animated:NO completion:nil];
```

where `self` is itself a view controller. The `SFSmartStoreInspectorViewController` class typically manages its own life cycle, so you're typically not required to dismiss it explicitly.



## Using the Mock SmartStore

To facilitate developing and testing code that makes use of the SmartStore while running outside the container, you can use an emulated SmartStore.

MockSmartStore is a JavaScript implementation of SmartStore that stores data in local storage (or optionally just in memory).

In the `external/shared/test` directory, you'll find the following files:

- `MockCordova.js`—A minimal implementation of Cordova functions intended only for testing plug-ins outside the container. Intercepts Cordova plug-in calls.
- `MockSmartStore.js`—A JavaScript implementation of SmartStore intended only for development and testing outside the container. Also intercepts SmartStore Cordova plug-in calls and handles them using a MockSmartStore.

When you're developing an application using SmartStore, make the following changes to test your app outside the container:

- Include `MockCordova.js` instead of `cordova.js`.
- Include `MockSmartStore.js`.

To see a MockSmartStore example, check out `external/shared/test/test.html`.

## Same-Origin Policies

Same-origin policy permits scripts running on pages originating from the same site to access each other's methods and properties with no specific restrictions; it also blocks access to most methods and properties across pages on different sites. Same-origin policy restrictions are not an issue when your code runs inside the container, because the container disables same-origin policy in the webview. However, if you call a remote API, you need to worry about same-origin policy restrictions.

Fortunately, browsers offer ways to turn off same-origin policy, and you can research how to do that with your particular browser. If you want to make XHR calls against Lightning Platform from JavaScript files loaded from the local file system, you should start your browser with same-origin policy disabled. The following article describes how to disable same-origin policy on several popular browsers: [Getting Around Same-Origin Policy in Web Browsers](#).

## Authentication

For authentication with MockSmartStore, you will need to capture access tokens and refresh tokens from a real session and hand code them in your JavaScript app. You'll also need these tokens to initialize the `force.js` JavaScript toolkit.

### Note:

- MockSmartStore doesn't encrypt data and is not meant to be used in production applications.
- MockSmartStore currently supports the following forms of Smart SQL queries:

- `SELECT...WHERE...` For example:

```
SELECT {soupName:selectField} FROM {soupName} WHERE {soupName:whereField} IN
(values)
```

- `SELECT...WHERE...ORDER BY...` For example:

```
SELECT {soupName:_soup} FROM {soupName} WHERE {soupName:whereField} LIKE 'value'
ORDER BY LOWER({soupName:orderByField})
```

- `SELECT count(*) FROM {soupName}`

MockSmartStore doesn't directly support the simpler types of Smart SQL statements that are handled by the `build*QuerySpec()` functions. Instead, use the `querySpec` function that suits your purpose.

SEE ALSO:

[Retrieving Data from a Soup](#)

## Using SmartSync Data Framework to Access Salesforce Objects

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The SmartSync Data Framework library makes it easy for customers to synchronize Salesforce data on their mobile apps with Salesforce servers. In particular, SmartSync Data Framework enables customers whose devices have lost connectivity to continue working on Salesforce data. When connectivity is restored, SmartSync Data Framework synchronizes any changes made to local records in SmartStore with the corresponding records on the Salesforce server. SmartSync Data Framework predefines cache policies for fine-tuning interactions between cached data and server data in offline and online scenarios. SmartSync Data Framework convenience methods automate common network activities—fetching `sObject` metadata, fetching a list of most recently used objects, and building SOQL and SOSL queries.

## Using SmartSync Data Framework in Native Apps

The native SmartSync Data Framework library provides native iOS and Android APIs that simplify the development of offline-ready apps. A subset of this native functionality is also available to hybrid apps through a Cordova plug-in.

SmartSync Data Framework libraries offer parallel architecture and functionality for Android and iOS, expressed in each platform's native language. The shared functional concepts are straightforward:

- Query Salesforce object metadata by calling Salesforce REST APIs.
- Store the retrieved object data locally and securely for offline use.
- Sync data changes when the device goes from an offline to an online state.

With SmartSync Data Framework native libraries, you can:

- Get and post data by interacting with a server endpoint. SmartSync Data Framework helper APIs encode the most commonly used endpoints. These APIs help you fetch `sObject` metadata, retrieve the list of most recently used (MRU) objects, and build SOQL and SOSL queries. You can also use arbitrary endpoints that you specify in a custom class.
- Fetch Salesforce records and metadata and cache them on the device, using one of the pre-defined cache policies.
- Edit records offline and save them offline in SmartStore.
- Synchronize batches of records by pushing locally modified data to the Salesforce cloud.

## SmartSync Data Framework Components

The following components form the basis of SmartSync Data Framework architecture.

### Sync Manager

- **Android class:** `com.salesforce.androidsdk.smartsync.manager.SyncManager`
- **iOS class:** `SFSmartSyncSyncManager`

Provides APIs for synchronizing large batches of `sObjects` between the server and SmartStore. This class works independently of the metadata manager and is intended for the simplest and most common sync operations. Sync managers can “sync down”—download sets of `sObjects` from the server to SmartStore—and “sync up”—upload local `sObjects` to the server.

The sync manager works in tandem with the following utility classes:

### Sync State Classes

- **Android:** `com.salesforce.androidsdk.smartsync.util.SyncState`
- **iOS:** `SFSyncState`
  - Tracks the state of a sync operation. States include:
    - New—The sync operation has been initiated but has not yet entered a transaction with the server.
    - Running—The sync operation is negotiating a sync transaction with the server.
    - Done—The sync operation finished successfully.
    - Failed—The sync operation finished unsuccessfully.

### Sync Target Classes

- **Android:** `com.salesforce.androidsdk.smartsync.util.SyncTarget`
- **iOS:** `SFSyncTarget`
  - Specifies the sObjects to be downloaded during a “sync down” operation.

### Sync Options Classes

- **Android:** `com.salesforce.androidsdk.smartsync.util.SyncOptions`
- **iOS:** `SFSyncOptions`
  - Specifies configuration options for a “sync up” operation. Options include the list of field names to be synced.

### Metadata Manager

- **Android class:** `com.salesforce.androidsdk.smartsync.manager.MetadataManager`
- **iOS class:** `SFSmartSyncMetadataManager`

Performs data loading functions. This class helps you handle more full-featured queries and configurations than the sync manager protocols support. For example, metadata manager APIs can:

- Load SmartScope object types.
- Load MRU lists of sObjects. Results can be either global or limited to a specific sObject.
- Load the complete object definition of an sObject, using the `describe` API.
- Load the list of all sObjects available in an organization.
- Determine if an sObject is searchable, and, if so, load the search layout for the sObject type.
- Load the color resource for an sObject type.
- Mark an sObject as viewed on the server, thus moving it to the top of the MRU list for its sObject type.

To interact with the server, `MetadataManager` uses the standard Mobile SDK REST API classes:

- **Android:** `RestClient`, `RestRequest`
- **iOS:** `SFRestAPI`, `SFRestRequest`

It also uses the SmartSync Data Framework cache manager to read and write data to the cache.

### Cache Manager

- **Android class:** `com.salesforce.androidsdk.smartsync.manager.CacheManager`
- **iOS class:** `SFSmartSyncCacheManager`

Reads and writes objects, object types, and object layouts to the local cache on the device. It also provides a method for removing a specified cache type and cache key. The cache manager stores cached data in a SmartStore database backed by SQLCipher. Though the cache manager is not off-limits to apps, the metadata manager is its principle client and typically handles all interactions with it.

### SOQL Builder

- **Android class:** `com.salesforce.androidsdk.smartsync.util.SOQLBuilder`
- **iOS class:** `SFSmartSyncSoqlBuilder`

Utility class that makes it easy to build a SOQL query statement, by specifying the individual query clauses.

### SOSL Builder

- **Android class:** `com.salesforce.androidsdk.smartsync.util.SOSLBuilder`
- **iOS class:** `SFSmartSyncSoslBuilder`

Utility class that makes it easy to build a SOSL query statement, by specifying the individual query clauses.

### SmartSyncSDKManager (Android only)

For Android, SmartSync Data Framework apps use a different SDK manager object than basic apps. Your `App` class extends `SmartSyncSDKManager` instead of `SalesforceSDKManager`. If you create a SmartStore app with forcedroid version 3.0 or later, this substitution happens automatically. This change applies to both native and hybrid SmartSync Data Framework apps on Android.



**Note:** To support multi-user switching, SmartSync Data Framework creates unique instances of its components for each user account.

## Cache Policies

When you're updating your app data, you can specify a cache policy to tell SmartSync Data Framework how to handle the cache. You can choose to sync with server data, use the cache as a fallback when the server update fails, clear the cache, ignore the cache, and so forth. For Android, cache policies are defined in the `com.salesforce.androidsdk.smartsync.manager.CacheManager.CachePolicy` class. For iOS, they're part of the `SFDataCachePolicy` enumeration defined in `SFSmartSyncCacheManager.h`.

You specify a cache policy every time you call any metadata manager method that loads data. For example, here are the Android `MetadataManager` data loading methods:

```
public List<SalesforceObjectType>
 loadSmartScopeObjectTypes (CachePolicy cachePolicy,
 long refreshCacheIfOlderThan);

public List<SalesforceObject> loadMRUObjects (String objectTypeName,
 int limit, CachePolicy cachePolicy, long refreshCacheIfOlderThan,
 String networkFieldName);

public List<SalesforceObjectType> loadAllObjectTypes (
 CachePolicy cachePolicy, long refreshCacheIfOlderThan);

public SalesforceObjectType loadObjectType (
 String objectTypeName, CachePolicy cachePolicy,
 long refreshCacheIfOlderThan);

public List<SalesforceObjectType> loadObjectTypes (
```

```
List<String> objectTypeNames, CachePolicy cachePolicy,
long refreshCacheIfOlderThan);
```

You also specify cache policy to help the cache manager decide if it's time to reload the cache:

**Android:**

```
public boolean needToReloadCache(boolean cacheExists,
 CachePolicy cachePolicy, long lastCachedTime, long refreshIfOlderThan);
```

**iOS:**

```
- (BOOL)needToReloadCache:(BOOL)cacheExists
 cachePolicy:(SFDataCachePolicy)cachePolicy
 lastCachedTime:(NSDate *)cacheTime
 refreshIfOlderThan:(NSTimeInterval)refreshIfOlderThan;
```

Here's a list of cache policies.

**Table 9: Cache Policies**

| Cache Policy (iOS)                                                                                                 | Description                                                                                                                                          |
|--------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>iOS:</b><br>IgnoreCacheData<br><br><b>Android:</b><br>IGNORE_CACHE_DATA                                         | Ignores cached data. Always goes to the server for fresh data.                                                                                       |
| <b>iOS:</b><br>ReloadAndReturnCacheOnFailure<br><br><b>Android:</b><br>RELOAD_AND_RETURN_CACHE_ON_FAILURE          | Attempts to load data from the server, but falls back on cached data if the server call fails.                                                       |
| <b>iOS:</b><br>ReturnCacheDataDontReload<br><br><b>Android:</b><br>RETURN_CACHE_DATA_DONT_RELOAD                   | Returns data from the cache, and doesn't attempt to make a server call.                                                                              |
| <b>iOS:</b><br>ReloadAndReturnCacheData<br><br><b>Android:</b><br>RELOAD_AND_RETURN_CACHE_DATA                     | Reloads data from the server and updates the cache with the new data.                                                                                |
| <b>iOS:</b><br>ReloadIfExpiredAndReturnCacheData<br><br><b>Android:</b><br>RELOAD_IF_EXPIRED_AND_RETURN_CACHE_DATA | Reloads data from the server if cache data has become stale (that is, if the specified timeout has expired). Otherwise, returns data from the cache. |
| <b>iOS:</b><br>InvalidateCacheDontReload                                                                           | Clears the cache and does not reload data from the server.                                                                                           |

| Cache Policy (iOS)                                           | Description                                        |
|--------------------------------------------------------------|----------------------------------------------------|
| <b>Android:</b><br><code>INVALIDATE_CACHE_DONT_RELOAD</code> |                                                    |
| <b>iOS:</b><br><code>InvalidateCacheAndReload</code>         | Clears the cache and reloads data from the server. |
| <b>Android:</b><br><code>INVALIDATE_CACHE_AND_RELOAD</code>  |                                                    |

## Object Representation

When you use the metadata manager, SmartSync Data Framework model information arrives as a result of calling metadata manager load methods. The metadata manager loads the data from the current user's organization and presents it in one of three classes:

- [Object](#)
- [Object Type](#)
- [Object Type Layout](#)

### Object

- **Android class:** `com.salesforce.androidsdk.smartsync.model.SalesforceObject`
- **iOS class:** `SFObject`

These classes encapsulate the data that you retrieve from an `sObject` in Salesforce. The object class reads the data from a `JSONObject` in Android, or an `NSDictionary` object in iOS, that contains the results of your query. It then stores the object's ID, type, and name as properties. It also stores the `JSONObject` itself as raw data.

### Object Type

- **Android class** `com.salesforce.androidsdk.smartsync.model.SalesforceObjectType`
- **iOS class** `SFObjectType`

The object type class stores details of an `sObject`, including the prefix, name, label, plural label, and fields.

### Object Type Layout

- **Android class** `com.salesforce.androidsdk.smartsync.model.SalesforceObjectTypeLayout`
- **iOS class** `SFObjectTypeLayout`

The object type layout class retrieves the columnar search layout defined for the `sObject` in the organization, if one is defined. If no layout exists, you're free to choose the fields you want your app to display and the format in which to display them.

SEE ALSO:

[Cache Policies](#)


## Creating Native Apps with SmartSync Data Framework

In forceios and forcedroid version 5.0 and later, creating native SmartSync Data Framework apps literally requires no extra effort. Any native app you create automatically includes the SmartStore and SmartSync Data Framework libraries.

## Adding SmartSync Data Framework to Existing Android Apps

The following steps show you how to add SmartSync Data Framework to an existing Android project (hybrid or native) created with Mobile SDK 4.0 or later.

1. If your app is currently built on Mobile SDK 3.3 or earlier, upgrade your project to the latest SDK version as described in [Migrating from Previous Releases](#).
2. Add the SmartSync Data Framework library project to your project. SmartSync Data Framework uses SmartStore, so you also need to add that library if your project wasn't originally built with SmartStore.
  - a. In Android Studio, add the `libs/SmartSync` project to your module dependencies.
3. Throughout your project, change all code that uses the `SalesforceSDKManager` object to use `SmartSyncSDKManager` instead.

 **Note:** If you do a project-wide search and replace, be sure *not* to change the `KeyInterface` import, which should remain

```
import com.salesforce.androidsdk.app.SalesforceSDKManager.KeyInterface;
```

## Adding SmartSync Data Framework to Existing iOS Apps

You can easily upgrade existing iOS projects to support SmartSync Data Framework: just use forceios to create a new project, then add in your assets. However, if you'd like to know the steps for upgrading older SmartSync Data Framework apps to Mobile SDK 6.0 or later, you're in the right place.

In Mobile SDK 4.0, SmartSync Data Framework moved out of Mobile SDK core into its own library. You can add this new module to your project by updating your podspec.

SmartSync Data Framework relies on SmartStore, so CocoaPods automatically adds SmartStore to your project. In addition, native iOS projects in Mobile SDK 6.0 and later require a `SmartSyncSDKManager` object to initialize the app.

Instead of making the changes manually, we recommend that you create a new native project with forceios, then copy your assets into that project. The forceios native template uses the `SmartSyncSDKManager` class by default and gets the correct pods for you, plus many other updates. Since you're a hands-on developer, though, we'll state the details.

1. In your podspec, add SmartSync Data Framework as a subspec:

```
pod 'SalesforceMobileSDK-iOS', :subspecs => [
 'SmartSync'
]
end
```

2. In your `AppDelegate.m` file:

- a. Import the `SmartSyncSDKManager` header:

```
#import <SmartStore/SmartSyncSDKManager.h>
```

- b. In your `init` method, before the first use of `[SalesforceSDKManager sharedInstance]`, add the following call:

```
[SalesforceSDKManager sharedInstance setInstanceClass:[SmartSyncSDKManager class]];
```

This call is the only place where you explicitly reference the `SmartSyncSDKManager` class. No other code changes are required.

For a full example, see the [AppDelegate class](#) in the SmartSyncExplorer sample app.

## About Sync Targets

Sync targets configure data transfers between the Salesforce cloud and a local database on a mobile device. Mobile SDK 5.1 enhances the capabilities of targets to give developers more control over two-way data synchronization.

SmartSync Data Framework is all about syncing data. In essence, it

- Syncs data *down* from the server to a local database, and
- Syncs data *up* from the local database to the server.

Often, the data you're transferring doesn't cross break any rules, and the default sync targets work fine. For special cases, though, you can provide your own sync target to make sure that data transfers occur as expected. An example is when an object contains fields that are required but that apps can't update. If a sync up operation tries to upload both new and updated records with a single field list, the operation fails if it tries to update locked fields. Beginning in Mobile SDK 5.1, you have other options that can often spare you from implementing a custom target.

## Decentralizing Sync Manager Tasks (Or, Power to the Custom Targets!)


In the first SmartSync Data Framework release, the sync manager class internally handled all server and local database interactions. In addition, the sync manager was a "final" class that was off-limits for developer customization. Developers were unable to add their own nuances or extended functionality.

Later, an architectural refactoring delegated all server interactions from the sync manager class to sync down and sync up target classes. Thus began a transfer of power from the monolithic sync manager to the flexible sync targets. Unlike sync manager class, the second-generation target classes let developers subclass sync targets for their own purposes. By controlling interactions with servers, custom sync targets can talk to arbitrary server endpoints, or transform data before storing it.

Mobile SDK 5.1 enhances SmartSync Data Framework still further by moving local database interactions into targets. This enhancement offers several benefits.

- It decouples SmartSync Data Framework from SmartStore, giving developers the freedom to use other stores.
- It allows developers to use their own data layouts and capture local data changes however they like.
- It enables more complex objects, such as targets that can simultaneously handle multiple record types.

In short, SmartSync Data Framework now offers developers significant control over the entire round trip of data synchronization.

 **Note:** Beginning in Mobile SDK 5.1, additional "sync up" options can sometimes obviate the need for a custom target. See [Defining a Custom Sync Up Target](#).

SEE ALSO:

[Migrate iOS Apps from 5.0 to 5.1](#)

[Migrate Android Apps from 5.0 to 5.1](#)



## Syncing Data

In native SmartSync Data Framework apps, you can use the sync manager to sync data easily between the device and the Salesforce server. The sync manager provides methods for syncing “up”—from the device to the server—or “down”—from the server to the device.

All data requests in SmartSync Data Framework apps are asynchronous. Asynchronous means that the sync method that you call returns the server response in a callback method or update block that you define.

Each sync up or sync down method returns a sync state object. This object contains the following information:

- Sync operation ID. You can check the progress of the operation at any time by passing this ID to the sync manager’s `getSyncStatus` method.
- Your sync parameters (soup name, target for sync down operations, options for sync up operations).
- Type of operation (up or down).
- Progress percentage (integer, 0–100).
- Total number of records in the transaction.

## Using the Sync Manager

The sync manager object performs simple sync up and sync down operations. For sync down, it sends authenticated requests to the server on your behalf, and stores response data locally in SmartStore. For sync up, it collects the records you specify from SmartStore and merges them with corresponding server records according to your instructions. Sync managers know how to handle authentication for Salesforce users and community users. Sync managers can store records in any SmartStore instance—the default SmartStore, the global SmartStore, or a named instance.

Sync manager classes provide factory methods that return customized sync manager instances. To use the sync manager, you create an instance that matches the requirements of your sync operation. It is of utmost importance that you create the correct type of sync manager for every sync activity. If you don’t, your customers can encounter runtime authentication failures.

Once you’ve created an instance, you can use it to call typical sync manager functionality:

- Sync down
- Sync up
- Resync

Sync managers can perform three types of actions on SmartStore soup entries and Salesforce records:

- Create
- Update
- Delete

If you provide custom targets, sync managers can use them to synchronize data at arbitrary REST endpoints.

## SyncManager Instantiation (Android)

In Android, you use a different factory method for each of the following scenarios:

### For the current user:

```
public static synchronized SyncManager getInstance();
```

### For a specified user:

```
public static synchronized SyncManager
getInstance(UserAccount account);
```

**For a specified user in a specified community:**

```
public static synchronized SyncManager
getInstance(UserAccount account, String communityId);
```

**For a specified user in a specified community using the specified SmartStore database:**

```
public static synchronized SyncManager
getInstance(UserAccount account, String communityId, SmartStore smartStore);
```

**SFSmartSyncSyncManager Instantiation (iOS)**

In iOS, you use pairs of access and removal methods. You call the `sharedInstance:` class methods on the `SFSmartSyncSyncManager` class to access a preconfigured shared instance for each scenario. When you're finished using the shared instance for a particular use case, remove it with the corresponding `removeSharedInstance*:...`  method.

**For a specified user:**

```
+ (instancetype) sharedInstance: (SFUserAccount *) user;
+ (void) removeSharedInstance: (SFUserAccount *) user;
```

**For a specified user using the specified SmartStore database:**

```
+ (instancetype) sharedInstanceForUser: (SFUserAccount *) user
 storeName: (NSString *) storeName;

+ (void) removeSharedInstanceForUser: (SFUserAccount *) user
 storeName: (NSString *) storeName;
```

**For a specified SmartStore database:**

```
+ (instancetype) sharedInstanceForStore: (SFSmartStore *) store;
+ (void) removeSharedInstanceForStore: (SFSmartStore *) store;
```

**Syncing Down**

To download sObjects from the server to your local SmartSync Data Framework soup, use the “sync down” method:

- **Android SyncManager methods:**

```
public SyncState syncDown(SyncTarget target, String soupName,
 SyncUpdateCallback callback) throws JSONException;

public SyncState syncDown(SyncTarget target, SyncOptions options,
 String soupName, SyncUpdateCallback callback)
 throws JSONException;
```

- **iOS SFSmartSyncSyncManager methods:**

```
- (SFSyncState*)
 syncDownWithTarget: (SFSyncTarget*) target
 soupName: (NSString*) soupName
 updateBlock: (SFSyncSyncManagerUpdateBlock) updateBlock;

- (SFSyncState*)
```

```
syncDownWithTarget: (SFSSyncTarget*) target
 options: (SFSSyncOptions*) options
 soupName: (NSString*) soupName
 updateBlock: (SFSSyncSyncManagerUpdateBlock) updateBlock;
```


For “sync down” methods, you define a target that provides the list of `sObjects` to be downloaded. To provide an explicit list, use `JSONObject` on Android, or `NSDictionary` on iOS. However, you can also define the target with a query string. The sync target class provides factory methods for creating target objects from a SOQL, SOSL, or MRU query.

You also specify the name of the SmartStore soup that receives the downloaded data. This soup is required to have an indexed string field named `__local__`. Mobile SDK reports the progress of the sync operation through the callback method or update block that you provide.

## Merge Modes

The `options` parameter lets you control what happens to locally modified records. You can choose one of the following behaviors:

1. Overwrite modified local records and lose all local changes. Set the `options` parameter to the following value:
  - **Android:** `SyncOptions.optionsForSyncDown (MergeMode.OVERWRITE)`
  - **iOS:** `[SFSSyncOptions newSyncOptionsForSyncDown:SFSSyncStateMergeModeOverwrite]`
2. Preserve all local changes and locally modified records. Set the `options` parameter to the following value:
  - **Android:** `SyncOptions.optionsForSyncDown (MergeMode.LEAVE_IF_CHANGED)`
  - **iOS:** `[SFSSyncOptions newSyncOptionsForSyncDown:SFSSyncStateMergeModeLeaveIfChanged]`

 **Important:** If you use a version of `syncDown` that doesn’t take an `options` parameter, existing `sObjects` in the cache can be overwritten. To preserve local changes, always run sync up before running sync down.

### Example: Android:

The native SmartSyncExplorer sample app demonstrates how to use SmartSync Data Framework with Contact records. In Android, it defines a `ContactObject` class that represents a Salesforce Contact record as a Java object. To sync Contact data down to the SmartStore soup, the `syncDown()` method creates a sync target from a SOQL query that’s built with information from the `ContactObject` instance.

In the following snippet, note the use of `SOQLBuilder`. `SOQLBuilder` is a SmartSync Data Framework factory class that makes it easy to specify a SOQL query dynamically in a format that reads like an actual SOQL string. Each `SOQLBuilder` property setter returns a new `SOQLBuilder` object built from the calling object, which allows you to chain the method calls in a single logical statement. After you’ve specified all parts of the SOQL query, you call `build()` to create the final SOQL string.

If the sync down operation succeeds—that is, if `SyncState.isDone()` equals true—the received data goes into the specified soup. The callback method then only needs to fire an intent that reloads the data in the Contact list.

```
public synchronized void syncDown() {

 smartStore.registerSoup(ContactListLoader.CONTACT_SOUP, CONTACTS_INDEX_SPEC);

 final SyncUpdateCallback callback = new SyncUpdateCallback() {

 @Override

 public void onUpdate(SyncState sync) {
```

```

 if (Status.DONE.equals(sync.getStatus())) {
 fireLoadCompleteIntent();
 }
 }
};

try {
 if (syncId == -1) {
 final SyncOptions options =
 SyncOptions.optionsForSyncDown(SyncState.MergeMode.LEAVE_IF_CHANGED);

 final String soqlQuery =
 SOQLBuilder.getInstanceWithFields(
ContactObject.CONTACT_FIELDS_SYNC_DOWN).from(Constants.CONTACT).limit(ContactListLoader.LIMIT).build();

 final SyncDownTarget target = new SoqlSyncDownTarget(soqlQuery);

 final SyncState sync = syncMgr.syncDown(target, options,
 ContactListLoader.CONTACT_SOUP, callback);

 syncId = sync.getId();
 } else {
 syncMgr.reSync(syncId, callback);
 }
} catch (JSONException e) {
 Log.e(TAG, "JSONException occurred while parsing", e);
} catch (SmartSyncException e) {
 Log.e(TAG, "SmartSyncException occurred while attempting to sync down", e);
}
}

```

**iOS:**

The native SmartSyncExplorer sample app demonstrates how to use SmartSync Data Framework with Contact records. In iOS, this sample defines a `ContactSOBJECTData` class that represents a Salesforce Contact record as an Objective-C object. The sample also defines several classes that support the `ContactSOBJECTData` class:

- ContactSObjectDataSpec
- SObjectData
- SObjectDataSpec
- SObjectDataFieldSpec
- SObjectDataManager

To sync Contact data down to the SmartStore soup, the `refreshRemoteData` method of `SObjectDataManager` creates a `SFSyncDownTarget` object using a SOQL string. This query string is built with information from the Contact object. The `syncDownWithTarget:options:soupName:updateBlock:` method of `SFSmartSyncSyncManager` takes this target and the name of the soup that receives the returned data. In this example, the target specifies one option, `SFSyncStateMergeModeLeaveIfChanged`, to prevent SmartSync Data Framework from overwriting local changes. This method also requires an update block that is called when the sync operation has either succeeded or failed. Here, the update block saves the sync operation ID so that the method can call the `reSync:updateBlock:` method after the first sync down operation.

```
- (void)refreshRemoteData:(void (^)(void))completionBlock {
 if (![self.store soupExists:self.dataSpec.soupName]) {
 [self registerSoup];
 }

 __weak SObjectDataManager *weakSelf = self;
 SFSyncSyncManagerUpdateBlock updateBlock = ^(SFSyncState* sync) {
 __strong typeof(weakSelf) strongSelf = weakSelf;
 if ([sync isDone] || [sync hasFailed]) {
 strongSelf.syncDownId = sync.syncId;
 [strongSelf refreshLocalData:completionBlock];
 }
 };
 if (self.syncDownId == 0) {
 // First time.
 NSString *soqlQuery =
 [NSString stringWithFormat:@"SELECT %@ FROM %@ LIMIT %lu",
 [self.dataSpec.fieldNames componentsJoinedByString:@","],
 self.dataSpec.objectType,
 (unsigned long)kSyncLimit];
 SFSyncOptions *syncOptions =
 [SFSyncOptions
 newSyncOptionsForSyncDown:SFSyncStateMergeModeLeaveIfChanged];
 SFSyncDownTarget *syncTarget =
 [SFSqlSyncDownTarget newSyncTarget:soqlQuery];
 [self.syncMgr syncDownWithTarget:syncTarget
 options:syncOptions
 soupName:self.dataSpec.soupName
 updateBlock:updateBlock];
 } else {
 // Subsequent times.
 [self.syncMgr reSync:[NSNumber numberWithInt:self.syncDownId]
 updateBlock:updateBlock];
 }
}
```

If the sync down operation succeeds—that is, if the `isDone` method of `SFSyncState` returns `YES`—the specified soup receives the server data. The update block then passes control to the `refreshLocalData` method, which retrieves the data from the soup and updates the UI to reflect any changes.

```

- (void)refreshLocalData {
 if (![self.store soupExists:self.dataSpec.soupName]) {
 [self registerSoup];
 }

 SFQuerySpec *subjectsQuerySpec =
 [SFQuerySpec
 newAllQuerySpec:self.dataSpec.soupName
 withOrderPath:self.dataSpec.orderByFieldName
 withOrder:kSFSoupQuerySortOrderAscending
 withPageSize:kMaxQueryPageSize];
 NSError *queryError = nil;
 NSArray *queryResults =
 [self.store
 queryWithQuerySpec:subjectsQuerySpec
 pageIndex:0
 error:&queryError];

 [self log:SFLogLevelDebug
 msg:@"Got local query results. "
 "Populating data rows."];
 if (queryError) {
 [self log:SFLogLevelError
 format:@"Error retrieving '%@' data "
 "from SmartStore: %@",
 self.dataSpec.objectType,
 [queryError localizedDescription]];
 return;
 }

 self.fullDataRowList = [self populateDataRows:queryResults];
 [self log:SFLogLevelDebug
 format:@"Finished generating data rows. "
 "Number of rows: %d. Refreshing view.",
 [self.fullDataRowList count]];
 self.dataRows = [self.fullDataRowList copy];
 if (completionBlock) completionBlock();
}

```

## Incrementally Syncing Down

For certain target types, you can incrementally resync a previous sync down operation. Mobile SDK fetches only new or updated records if the sync down target supports resync. Otherwise, it reruns the entire sync operation.

Of the three built-in sync down targets (MRU, SOSL-based, and SOQL-based), only the SOQL-based sync down target supports resync. To support resync in custom sync targets, use the `maxTimeStamp` parameter passed during a fetch operation.

During sync down, Mobile SDK checks downloaded records for the modification date field specified by the target and determines the most recent timestamp. If you request a resync for that sync down, Mobile SDK passes the most recent timestamp, if available, to the sync down target. The sync down target then fetches only records created or updated since the given timestamp. The default modification date field is `lastModifiedDate`.

## Limitation

After an incremental sync, the following unused records remain in the local soup:

- Deleted records
- Records that no longer satisfy the sync down target

If you choose to remove these orphaned records, you can:

- Run a full sync down operation, or
- Compare the IDs of local records against the IDs returned by a full sync down operation.

## Invoking the Re-Sync Method

### Android:

On a `SyncManager` instance, call:

```
SyncState reSync(long syncId, SyncUpdateCallback callback);
```

### iOS:

On a `SFSmartSyncSyncManager` instance, call:

```
- (SFSyncState*) reSync:(NSNumber *)syncId
 updateBlock:(SFSyncSyncManagerUpdateBlock)updateBlock;
```

### Hybrid:

Call:

```
cordova.require("com.salesforce.plugin.SmartSync").reSync(syncId, successCB);
```

## Sample Apps

### Android

The `SmartSyncExplorer` sample app uses `reSync()` in the `ContactListLoader` class.

### iOS

The `SmartSyncExplorer` sample app uses `reSync()` in the `SObjectDataManager` class.

### Hybrid

The `SimpleSync` sample app uses `reSync()` in `SimpleSync.html's app.views.SearchPage` class.

## Syncing Up

### Performing "Sync Up" Operations

To apply local changes on the server, use one of the "sync up" methods:

- **Android `SyncManager` method:**

```
public SyncState syncUp(SyncUpTarget target, SyncOptions options, String soupName,
 SyncUpdateCallback callback) throws JSONException
```

- **iOS `SFSmartSyncSyncManager` method:**

```
- (SFSyncState*)
 syncUpWithOptions:(SFSyncOptions*)options
```

```
soupName: (NSString*) soupName
updateBlock: (SFSyncSyncManagerUpdateBlock) updateBlock;
```

These methods update the server with data from the given SmartStore soup. They look for created, updated, or deleted records in the soup, and then replicate those changes on the server. The `options` argument specifies a list of fields to be updated. In Mobile SDK5.1 and later, you can override this field list by initializing the sync manager object with separate field lists for create and update operations. See Handling Field Lists in Create and Update Operations.


Locally created objects must include an “attributes” field that contains a “type” field that specifies the sObject type. For example, for an account named Acme, use: `{Id:"local_x", Name: Acme, attributes: {type:"Account"}}`.

## Specifying Merge Modes

For sync up operations, you can specify a `mergeMode` option. You can choose one of the following behaviors:

1. Overwrite server records even if they've changed since they were synced down to that client. When you call the `syncUp` method:
  - **Android:** Set the `options` parameter to `SSyncOptions.optionsForSyncUp(fieldlist, SyncState.MergeMode.OVERWRITE)`
  - **iOS:** Set the `options` parameter to `[SFSyncOptions newSyncOptionsForSyncUp:fieldlist mergeMode:SFSyncStateMergeModeOverwrite]`
  - **Hybrid:** Set the `syncOptions` parameter to `{mergeMode:"OVERWRITE"}`
2. If any server record has changed since it was synced down to that client, leave it in its current state. The corresponding client record also remains in its current state. When you call the `syncUp()` method:
  - **Android:** Set the `options` parameter to `SyncOptions.optionsForSyncUp(fieldlist, SyncState.MergeMode.LEAVE_IF_CHANGED)`
  - **iOS:** Set the `options` parameter to `[SFSyncOptions newSyncOptionsForSyncUp:fieldlist mergeMode:SFSyncStateMergeModeLeaveIfChanged]`
  - **Hybrid:** Set the `syncOptions` parameter to `{mergeMode:"LEAVE_IF_CHANGED"}`

If your local record includes the target’s modification date field, Mobile SDK detects changes by comparing that field to the matching field in the server record. The default modification date field is `lastModifiedDate`. If your local records do not include the modification date field, the `LEAVE_IF_CHANGED` sync up operation reverts to an overwrite sync up.

 **Important:** The `LEAVE_IF_CHANGED` merge requires extra round trips to the server. More importantly, the status check and the record save operations happen in two successive calls. In rare cases, a record that is updated between these calls can be prematurely modified on the server.

 **Example: Android:**

When it’s time to sync up to the server, you call `syncUp()` with the same arguments as `syncDown()`: list of fields, name of source SmartStore soup, and an update callback. The only coding difference is that you format the list of affected fields as an instance of `SyncOptions` instead of `SyncTarget`. Here’s the way it’s handled in the SmartSyncExplorer sample:

```
public synchronized void syncUp() {

 final SyncUpTarget target = new SyncUpTarget();

 final SyncOptions options =
 SyncOptions.optionsForSyncUp(Arrays.asList(ContactObject.CONTACT_FIELDS_SYNC_UP),
```



```

 MergeMode.LEAVE_IF_CHANGED);

try {

 syncMgr.syncUp(target, options, ContactListLoader.CONTACT_SOUP,
 new SyncUpdateCallback() {

 @Override

 public void onUpdate(SyncState sync) {

 if (Status.DONE.equals(sync.getStatus())) {

 syncDown();

 }

 }

 });

} catch (JSONException e) {

 Log.e(TAG, "JSONException occurred while parsing", e);

} catch (SmartSyncException e) {

 Log.e(TAG, "SmartSyncException occurred while attempting to sync up", e);

}

}

```

In the internal `SyncUpdateCallback` implementation, this example takes the extra step of calling `syncDown()` when sync up is done. This step guarantees that the SmartStore soup remains up-to-date with any recent changes made to Contacts on the server.

#### iOS:

When it's time to sync up to the server, you send the `syncUp:withOptions:soupName:updateBlock:` message to `SFSmartSyncSyncManager` with the same arguments used for syncing down: list of fields, name of source SmartStore soup, and an update block. The only coding difference is that you format the list of affected fields as an instance of `SFSyncOptions` instead of `SFSyncTarget`. Here's how the SmartSyncExplorer sample sends the sync up message:

```

- (void)updateRemoteData:
 (SFSyncSyncManagerUpdateBlock) completionBlock {

 SFSyncOptions *syncOptions =
 [SFSyncOptions
 newSyncOptionsForSyncUp:self.dataSpec.fieldNames
 mergeMode:SFSyncStateMergeModeLeaveIfChanged];
 [self.syncMgr syncUpWithOptions:syncOptions
 soupName:self.dataSpec.soupName

```

```

 updateBlock:^(SFSyncState* sync) {
 if ([sync isDone] || [sync hasFailed]) {
 completionBlock(sync);
 }
 }
];
}

```

If the update block provided here determines that the sync operation has finished, it calls the completion block that's passed into `updateRemoteData`. A user initiates a syncing operation by tapping a button. Therefore, to see the definition of the completion block, look at the `syncUpDown` button handler in `ContactListViewController.m`. The handler calls `updateRemoteData` with the following block.

```

[self.dataMgr updateRemoteData:^(SFSyncState *syncProgressDetails)
{
 dispatch_async(dispatch_get_main_queue(), ^{
 __strong typeof(weakSelf) strongSelf = weakSelf;
 strongSelf.navigationItem.rightBarButtonItem.enabled = YES;

 // When the sync failed it means not everything could be synced up
 // it doesn't necessarily mean nothing could be synced up
 // Therefore we refresh regardless of success status
 [strongSelf.dataMgr refreshLocalData:completionBlock];
 [strongSelf.dataMgr refreshRemoteData:completionBlock];

 // We'll again call refreshLocalData when completing

 // Letting the user know whether the sync succeeded
 if ([syncProgressDetails isDone]) {
 [strongSelf showToast:@"Sync complete!"];
 } else if ([syncProgressDetails hasFailed]) {
 [strongSelf showToast:@"Sync failed."];
 }
 });
}];

```

If the sync up operation succeeded, this block first refreshes the display on the device, along with a “Sync complete!” confirmation toast. Regardless of the status of the sync operation, this method refreshes local and remote data. This step covers any partial successes as well as completions.

## The Refresh Sync Down Target

Many apps download records, cache all of them, and then let users edit them from the SmartStore cache when connectivity drops. Local “offline” work is quick and efficient—a great user experience—but, when connectivity resumes, it's important to refresh the cached records with server updates.

Unfortunately, in Mobile SDK 4.3 or earlier, refreshing records that didn't originate from a recent sync down operation isn't straightforward or efficient.

For a quicker, easier route, Mobile SDK 5.0 introduces the *refresh* sync down target. The refresh target provides a single call that doesn't require preparatory coding. You create an instance of the target with a soup name, an object type, and a list of fields. You then pass the target instance to a sync down method. The refresh target gathers IDs of the pertinent soup records, queries the server for the current field values, and then refreshes the soup.

## Refresh Target APIs

The refresh sync down target is available on iOS and Android for native, React native, and hybrid apps.

### Android

Class:

```
com.salesforce.androidsdk.smartsync.util.RefreshSyncDownTarget
```

Constructor:

```
public RefreshSyncDownTarget(List<String> fieldlist,
 String objectType, String soupName)
```

### iOS

Class:

```
SFRefreshSyncDownTarget
```

Factory method:

```
+ (SFRefreshSyncDownTarget*) newSyncTarget:(NSString*) soupName
 objectType:(NSString*) objectType fieldlist:(NSArray*) fieldlist
```

### JavaScript (Hybrid, React Native)

Function:

```
var target = {soupName:xxx, type:"refresh",
 objectType:yyy, fieldlist:["Id", ...]};
```

## Syncing Related Records

It's a common problem in syncing offline data: You can easily sync your explicit changes, but how do you update affected related records? You can do it manually with enough knowledge, determination, and perspicacity, but that's the old way. Starting with Mobile SDK 5.2, SmartSync Data Framework provides tools that let you sync parent records and their related records with a single call.

### Supported Relationship Types

Related record sync supports two types of one-to-many relationships: Lookup and Master-detail. Both types are defined in the child-to-parent, many-to-one direction. Each child knows its parent, but the parent doesn't know its children.

#### Lookup Relationships

A lookup relationship is a "loose" link between objects based on one or more fields. For lookup relationships:

- Child records do not require a parent field.
- Changes to one object do not affect the security, access, or deletion of a linked object.

Salesforce supports up to 25 lookup fields per object. Lookup relationships can be multiple layers deep.

#### Master-detail Relationships

A master-detail relationship is a parent-child link in which the parent object exerts some control over its children. In master-detail linkage:

- Child records require a parent field.
- The parent's access level determines the access level of its children.
- If a parent record is deleted, its children are also deleted.

Salesforce supports up to two master-detail fields per object, and up to three levels of master-detail relationships.

See [Object Relationships Overview](#) in Salesforce Help.



**Note:** SmartSync Data Framework does not support many-to-many relationships.

## Objects Used in Related Record Sync

Related record sync uses two special types of sync targets:

### Parent-children sync up target

- **Android:** `ParentChildrenSyncUpTarget`
- **iOS:** `SFParentChildrenSyncUpTarget`

Handles locally created or updated records and deleted records.

### Parent-children sync down target

- **Android:** `ParentChildrenSyncDownTarget`
- **iOS:** `SFParentChildrenSyncDownTarget`

Supports `resync` and `cleanResyncGhosts` methods.

These targets support *leave-if-changed* and *overwrite* merge modes. Each target provides a factory method (on iOS) or a constructor (on Android) that initializes an instance with the required information you provide. To perform the sync, you configure a new target class instance and pass it to the standard SmartSync Data Framework sync method that accepts a target object.

To initialize the targets, you also provide two helper objects that deliver necessary related record information:

### Parent information object

- **Android:** `ParentInfo`
- **iOS:** `SFParentInfo`

Includes:

- Object type
- Soup name
- ID field (Optional in all cases. Defaults to "Id". Set this value only if you are specifying a different field to identify the records.)
- Last Modified Date field (Optional in all cases. Defaults to "LastModifiedDate". Set this value only if you are specifying a different field for time stamps.)

### Child information object

- **Android:** `ChildrenInfo`
- **iOS:** `SFChildrenInfo`

Includes:

- Object type
- Soup name
- Parent ID field
- ID field (Optional in all cases. Defaults to "Id". Set this value only if you are specifying a different field to identify the records.)
- Last Modified Date field (Optional in all cases. Defaults to "LastModifiedDate". Set this value only if you are specifying a different field for time stamps.)

## Preparing Your SmartStore Data Model

To prepare for handling related objects offline, you first set up a SmartStore soup for each expected parent and child object type. For each soup, you add indexed ID fields that model the server-side relationships. Here's the list of required indexed fields:

### Soup for a parent object:

Field for server ID of record

### Soup for a child object:

Field for server ID of record

Field for server ID of parent record

All sync operations—up and down—begin with the parent soup and then continue to the child soups. Here's how this flow works:

- When you sync down related records, you are targeting parent records, and the sync downloads those records and all their children. For example, if you're syncing accounts with their contacts, you get the contacts linked to the accounts you've downloaded. You don't get contacts that aren't linked to those accounts.
- When you sync up related records, SmartSync Data Framework iterates over the soup of parent records and picks up related children records. Modified children records that are not related to a parent record are ignored during that sync up operation.

## Sync Up

To initialize the parent-child sync-up target, you provide parent information objects and child information objects. These objects fully describe the relationships between parent-child records, both on the server and in the local store. You also provide the list of fields to sync. Here's the full list of required information:

- Parent information object
- Child information object
- Relationship type (for example, master-detail or lookup)
- Fields to sync up in parent and children soups

The sync up operation iterates over the soup containing the parent records and uses the given information to pull related records from the children's soups. A record is considered dirty when the `__local__` field is set to true. A record tree—consisting of one parent and its children—is a candidate for sync up when any record in the tree is dirty. Whether the sync up actually occurs depends on how SmartSync Data Framework handles the merge mode.

### “Leave-if-changed” Merge Mode Handling

SmartSync Data Framework fetches Last Modified Date fields of the target parent and children server records. The sync up operation skips that record tree if

- the last modified date of any fetched server record is more recent than its corresponding local record
- or
- if any fetched server record has been deleted.

### Updates Applied after Sync Up

After the local changes have been synced to the server, SmartSync Data Framework cleans up related records.

- If sync up creates any parent or child record on the server, SmartSync Data Framework updates the server ID field of the corresponding local record. If the created record is a parent, the parent ID fields of its children are also updated in the local store.
- If any server records were deleted since the last sync down, deletes the corresponding local records.
- If sync up deletes a parent record and the relationship type is master-detail, SmartSync Data Framework deletes the record's children on the server and in the local store.

## Sync Down

To initialize the parent-children sync-down target, you provide parent information objects and children information objects. These objects fully describe the relationships between parent-child records, both on the server and in the local store. You also provide a list of fields to sync and some SOQL filters.

The new sync down target is actually a subclass of the SOQL sync down target. Instead of being given the SOQL query, however, the target generates it from the parent and children information objects, list of fields, and SOQL filters.

### Information Passed to Sync Down Targets

- Parent information object
- Child information object
- Relationship type (for example, master-detail or lookup)
- Fields to sync down in parent and children soups
- SOQL filter to apply in query on root records during sync down—for example, the condition of a WHERE clause

### Server Call

SmartSync Data Framework fetches the record trees, each consisting of one parent and its children, using SOQL. It then separates parents from their children and stores them in their respective soups.

### “Leave-if-changed” Merge Mode Handling

Local record trees that contain any dirty records—locally created, modified, or deleted records—are left unaltered. For example, if a parent record has one dirty child, SmartSync Data Framework doesn’t update the parent or the child. This rule applies even if the parent is clean locally but has been changed on the server.

### Handling Resync

During resync, SmartSync Data Framework adjusts the SOQL query to download only those record trees in which the parent changed since the last sync.

## Implementing Related Record Sync

Once you understand the principles and requirements involved, implementing it is straightforward. You can add related record sync to your code in a few steps. The following code snippets demonstrate the technique using Account (parent) and Contact (child) objects.

### Android

1. Create SmartStore soups that define the required indexed fields.

```
// Creating soup for accounts

final IndexSpec[] indexSpecs = {
 new IndexSpec(Constants.ID, SmartStore.Type.string),
 new IndexSpec(Constants.NAME, SmartStore.Type.string),
 new IndexSpec(Constants.DESCRPTION, SmartStore.Type.string),
 new IndexSpec(SyncTarget.LOCAL, SmartStore.Type.string)
};

smartStore.registerSoup("AccountSoup", indexSpecs);

// Creating soup for contacts

final IndexSpec[] contactsIndexSpecs = {
 new IndexSpec(Constants.ID, SmartStore.Type.string),
```

```

 new IndexSpec(Constants.LAST_NAME, SmartStore.Type.string),
 new IndexSpec(SyncTarget.LOCAL, SmartStore.Type.string),
 new IndexSpec(ACCOUNT_ID, SmartStore.Type.string)
};

smartStore.registerSoup(CONTACTS_SOUP, contactsIndexSpecs);

```

2. Create instance of a sync target object and its supporting informational objects.

```

// Creating object for parent info

ParentInfo parentInfo =
 new ParentInfo(Constants.ACCOUNT, "AccountSoup", Constants.ID,
 Constants.LAST_MODIFIED_DATE);

// Creating object for children info

ChildrenInfo childrenInfo = new ChildrenInfo(
 Constants.CONTACT, Constants.CONTACT + "s", "ContactSoup", ACCOUNT_ID,
 Constants.ID, Constants.LAST_MODIFIED_DATE);

// Creating sync up target

ParentChildrenSyncUpTarget syncUpTarget =
 new ParentChildrenSyncUpTarget(
 parentInfo,
 Arrays.asList(Constants.ID, Constants.NAME, Constants.DESCRPTION),
 Arrays.asList(Constants.NAME, Constants.DESCRPTION),
 childrenInfo,
 Arrays.asList(Constants.LAST_NAME, ACCOUNT_ID),
 Arrays.asList(Constants.LAST_NAME, ACCOUNT_ID),
 RelationshipType.MASTER_DETAIL); // account-contacts are master-detail

// Creating sync down target

ParentChildrenSyncDownTarget syncDownTarget =
 new ParentChildrenSyncDownTarget(
 parentInfo,
 Arrays.asList(Constants.ID, Constants.NAME, Constants.DESCRPTION),
 parentSqlFilter,
 childrenInfo,
 Arrays.asList(Constants.LAST_NAME, ACCOUNT_ID),
 RelationshipType.MASTER_DETAIL); // account-contacts are master-detail

```

3. Call the SmartSync Data Framework sync method that takes a sync target.

For sync up:

```

// Running sync up

syncManager.syncUp(syncUpTarget, options, "AccountSoup", new SyncUpdateCallback() {
 @Override
 public void onUpdate(SyncState sync) {
 // Handle updates
 }
});

```

```
 }
 });
```

For sync down:

```
//Running sync down target

syncManager.syncDown(syncDownTarget, options, "AccountSoup",
 new SyncUpdateCallback() {
 @Override
 public void onUpdate(SyncState sync) {
 // Handle updates
 }
 });
```

## iOS

1. Create SmartStore soups that define the required indexed fields.

```
// Creating soup for accounts

NSArray* indexSpecs = @[
 [[SFSoupIndex alloc] initWithPath:@"Id"
 indexType:kSoupIndexTypeString
 columnName:nil],
 [[SFSoupIndex alloc] initWithPath:@"Name"
 indexType:kSoupIndexTypeString
 columnName:nil],
 [[SFSoupIndex alloc] initWithPath:@"Description"
 indexType:kSoupIndexTypeFullText
 columnName:nil],
 [[SFSoupIndex alloc] initWithPath:kSyncTargetLocal
 indexType:kSoupIndexTypeString
 columnName:nil]
];

[store registerSoup:@"AccountSoup" withIndexSpecs:indexSpecs error:nil];

// Creating soup for contacts
indexSpecs = @[
 [[SFSoupIndex alloc] initWithPath:@"Id"
 indexType:kSoupIndexTypeString
 columnName:nil],
 [[SFSoupIndex alloc] initWithPath:@"LastName"
 indexType:kSoupIndexTypeString
 columnName:nil],
 [[SFSoupIndex alloc] initWithPath:@"AccountId"
 indexType:kSoupIndexTypeString
 columnName:nil],
 [[SFSoupIndex alloc] initWithPath:kSyncTargetLocal
 indexType:kSoupIndexTypeString
 columnName:nil]
];

[store registerSoup:@"ContactSoup" withIndexSpecs:indexSpecs error:nil];
```



2. Create instance of a sync target object and its supporting informational objects.

```
// Creating object for parent info

SFParentInfo* parentInfo =
 [SFParentInfo newWithSObjectType:@"Account"
 soupName:@"AccountSoup"
 idFieldName:@"Id"
 modificationDateFieldName:@"LastModifiedDate"];

// Creating object for children info

SFChildrenInfo* childrenInfo =
 [SFChildrenInfo newWithSObjectType:@"Contact"
 objectTypePlural:@"Contacts"
 soupName:@"ContactSoup"
 parentIdFieldName:@"AccountId"
 idFieldName:@"Id"
 modificationDateFieldName:@"LastModifiedDate"];

// Creating sync up target

SFParentChildrenSyncUpTarget *syncUpTarget =
 [SFParentChildrenSyncUpTarget newSyncTargetWithParentInfo:parentInfo
 parentCreateFieldlist:@[@"Id", @"Name", @"Description"]
 parentUpdateFieldlist:@[@"Name", @"Description"]
 childrenInfo:childrenInfo
 childrenCreateFieldlist:@[@"LastName", @"AccountId"]
 childrenUpdateFieldlist:@[@"LastName", @"AccountId"]
 relationshipType:SFParentChildrenRelationshipMasterDetail];
 // account-contacts are master-detail

// Creating sync down target

SFParentChildrenSyncDownTarget *syncDownTarget =
 [SFParentChildrenSyncDownTarget
 newSyncTargetWithParentInfo:parentInfo
 parentFieldlist:@[@"Id", @"Name", @"Description"]
 parentSoqlFilter:@"Name LIKE 'A%'"
 childrenInfo:childrenInfo
 childrenFieldlist:@[@"LastName", @"AccountId"]
 relationshipType:SFParentChildrenRelationshipMasterDetail];
 // account-contacts are master-detail
```

3. Call the SmartSync Data Framework sync method that takes a sync target.

For sync up:

```
// Running sync up

[syncManager syncUpWithTarget:syncUpTarget
 options:options
 soupName:@"AccountSoup"
 updateBlock:^(SFSyncState* sync) {
 // Handle updates
```

```
 }
];
}
```

For sync down:

```
//Running sync down target


[syncManager syncDownWithTarget:syncDownTarget
 options:options
 soupName:@"AccountSoup"
 updateBlock:^(SFSyncState* sync) {
 // Handle updates
}
];
```

## Handling “Ghost” Records After Sync Down Operations

If you’re finding that sync down operations sometimes leave unwanted records in your SmartStore soups, you can use the `cleanResyncGhosts` API to get rid of them.

In certain prescribed cases, SmartStore soups do not reflect the exact contents of the most recent sync down operation. For example, if a record is deleted on the Salesforce server, the next sync down operation doesn’t remove that record from SmartStore. Also, records that don’t satisfy the sync criteria are excluded from the sync down results but aren’t automatically removed from the soup. These records that unexpectedly remain in the SmartStore soup are known as *ghost records*.

In Mobile SDK 4.2, SmartSync Data Framework adds a `cleanResyncGhosts` method that identifies and removes ghost records. This method is available for Android native, iOS native, hybrid, and React Native platforms.

 **Warning:** Exercise restraint in using the `cleanResyncGhosts` method. Calls to this method can be expensive in both runtime performance and payload size. Use this method as a low-frequency cleanup operation, rather than as part of every sync down operation.

### Android Native

```
public void cleanResyncGhosts(long syncId)
```

### iOS Native

```
- (void)
 cleanResyncGhosts:(NSNumber*) syncId
 completionStatusBlock:(SFSyncSyncManagerCompletionStatusBlock) completionStatusBlock
```

### Hybrid

```
cleanResyncGhosts(isGlobalStore, syncId, successCB, errorCallback)
cleanResyncGhosts(storeConfig, syncId, successCB, errorCallback)
```

### React Native

```
smartsync.cleanResyncGhosts(isGlobalStore, syncId, successCB, errorCallback)
smartsync.cleanResyncGhosts(storeConfig, syncId, successCB, errorCallback)
```

## Using `cleanResyncGhosts` with Custom Sync Down Targets

If your app uses a custom sync down target, `cleanResyncGhosts` requires the custom target to implement the `getListOfRemoteIds` method. This method returns the list of Salesforce IDs that satisfy the sync down target’s criteria. For

`getListofRemoteIds` coding examples, see the SOQL, SOSL, or MRU sync down target in these SmartSync Data Framework library folders:

### iOS

<https://github.com/forcedotcom/SalesforceMobileSDK-iOS/tree/master/libs/SmartSync/SmartSync/Classes/Util>

### Android

<https://github.com/forcedotcom/SalesforceMobileSDK-Android/tree/master/libs/SmartSync/src/com/salesforce/androidsdk/smartsync/util>

## Using the Sync Manager with Global SmartStore

To use SmartSync Data Framework with a global SmartStore instance, call a static factory method on the sync manager object to get a compatible sync manager instance.

### Android:

| Static Method                                                                                       | Description                                                                                                                                                                                                                   |
|-----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <pre>SyncManager getInstance(UserAccount account, String communityId, SmartStore smartStore);</pre> | Returns a sync manager instance that talks to the server as the given community user and writes to or reads from the given SmartStore instance. Use this factory method for syncing data with the global SmartStore instance. |
| <pre>SyncManager getInstance(UserAccount account, String communityId);</pre>                        | Returns a sync manager instance that talks to the server as the given community user and writes to or reads from the user's default SmartStore instance.                                                                      |
| <pre>SyncManager getInstance(UserAccount account);</pre>                                            | Returns a sync manager instance that talks to the server as the given user and writes to or reads from the user's default SmartStore instance.                                                                                |
| <pre>SyncManager getInstance();</pre>                                                               | Returns a sync manager instance that talks to the server as the current user and writes to or reads from the current user's default SmartStore instance.                                                                      |

### iOS:

| Static Method                                                                                                          | Description                                                                                                                                                                                                           |
|------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <pre>+ (instancetype) sharedInstanceForUser:     (SFUserAccount *)user     storeName:     (NSString *)storeName;</pre> | Returns a sync manager instance that talks to the server as the given user and writes to or reads from the user's default SmartStore instance.                                                                        |
| <pre>+ (instancetype) sharedInstanceForStore:     (SFSmartStore *)store;</pre>                                         | Returns a sync manager instance that talks to the server as the current user and writes to or reads from the given SmartStore instance. Use this factory method for syncing data with the global SmartStore instance. |

| Static Method                                                                                        | Description                                                                                                                                                                        |
|------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <pre data-bbox="219 273 941 367">+ (instancetype)   sharedInstance:     (SFUserAccount *)user;</pre> | <p data-bbox="974 262 1445 357">Returns a sync manager instance that talks to the server as the given user and writes to or reads from the user's default SmartStore instance.</p> |

**Hybrid:**

In each of the following methods, the optional first argument tells the SmartSync Data Framework plug-in whether to use a global store. This argument accepts a Boolean value or a `StoreConfig` object. If you use a `StoreConfig` object, you can specify `storeName`, `isGlobalStore`, or both, depending on your context. See [Creating and Accessing User-based Stores](#).

- ```
syncDown(isGlobalStore, target, soupName, options, successCB, errorCallback);
syncDown(storeConfig, target, soupName, options, successCB, errorCallback);
```
- ```
reSync(isGlobalStore, syncId, successCB, errorCallback);
reSync(storeConfig, syncId, successCB, errorCallback);
```
- ```
syncUp(isGlobalStore, target, soupName, options, successCB, errorCallback);
syncUp(storeConfig, target, soupName, options, successCB, errorCallback);
```
- ```
getSyncStatus(isGlobalStore, syncId, successCB, errorCallback);
getSyncStatus(storeConfig, syncId, successCB, errorCallback);
```

## SEE ALSO:

- [Creating and Accessing User-based Stores](#)
- [Using Global SmartStore](#)

## Using Custom Sync Down Targets

During sync down operations, a sync down target controls the set of records to be downloaded and the request endpoint. You can use pre-formatted MRU, SOQL-based, and SOSL-based targets, or you can create custom targets. Custom targets can access arbitrary REST endpoints both inside and outside of Salesforce.

### Defining a Custom Sync Down Target

You define custom targets for sync down operations by subclassing your platform's abstract base class for sync down targets. To use custom targets in hybrid apps, implement a custom native target class for each platform you support. The base sync down target classes are:

- **Android:** `SyncDownTarget`
- **iOS:** `SFSyncDownTarget`

 **Note:** These classes sync the requested records but not their related records. To include related records, use the sync target classes described in [Syncing Related Records](#).

## Required Methods

Every custom target class must implement the following required methods.

### Start Fetch Method

Called by the sync manager to initiate the sync down operation. If `maxTimeStamp` is greater than 0, this operation becomes a "resync". It then returns only the records that have been created or updated since the specified time.

#### Android:

```
JSONArray startFetch(SyncManager syncManager, long maxTimeStamp);
```

#### iOS:

```
- (void) startFetch:(SFSmartSyncSyncManager*) syncManager
 maxTimeStamp:(long long)maxTimeStamp
 errorCallback:(SFSyncDownTargetFetchErrorBlock)
 errorCallback
 completeBlock:(SFSyncDownTargetFetchCompleteBlock)
 completeBlock;
```

### Continue Fetching Method

Called by the sync manager repeatedly until the method returns null. This process retrieves all records that require syncing.

#### Android:

```
JSONArray continueFetch(SyncManager syncManager);
```

#### iOS:

```
- (void)
 continueFetch:(SFSmartSyncSyncManager*) syncManager
 errorCallback:(SFSyncDownTargetFetchErrorBlock)
 errorCallback
 completeBlock:(SFSyncDownTargetFetchCompleteBlock)
 completeBlock;
```

### modificationDateFieldName Property (Optional)

Optionally, you can override the `modificationDateFieldName` property in your custom class. Mobile SDK uses the field with this name to compute the `maxTimeStamp` value that `startFetch` uses to rerun the sync down operation. This operation is also known as *resync*. The default field is `lastModifiedDate`.

#### Android:

```
String getModificationDateFieldName();
```

#### iOS:

```
modificationDateFieldName property
```

### idFieldName Property (Optional)

Optionally, you can override the `idFieldName` property in your custom class. Mobile SDK uses the field with this name to get the ID of the record. For example, during sync up, Mobile SDK obtains the ID that it passes to the `updateOnServer()` method from the field whose name matches `idFieldName` in the local record.

#### Android:

```
String getIdFieldName();
```

#### iOS:

```
idFieldName property
```

## Invoking the Sync Down Method with a Custom Target

### Android:

Pass an instance of your custom `SyncDownTarget` class to the `SyncManager` sync down method:

```
SyncState syncDown(SyncDownTarget target, SyncOptions options, String soupName,
SyncUpdateCallback callback);
```

### iOS:

Pass an instance of your custom `SFSyncDownTarget` class to the `SFSmartSyncSyncManager` sync down method:

```
- (SFSyncState*)
 syncDownWithTarget:(SFSyncDownTarget*) target
 soupName:(NSString*) soupName
 updateBlock:
 (SFSyncSyncManagerUpdateBlock) updateBlock;
```

### Hybrid:

1. Create a target object with the following property settings:

- Set `type` to "custom".
- Set at least one of the following properties:

#### Android (if supported):

Set `androidImpl` to the package-qualified name of your Android custom class.

#### iOS (if supported):

Set `iOSImpl` to the name of your iOS custom class.

The following example supports both Android and iOS:

```
var target =
{type:"custom",
 androidImpl:
 "com.salesforce.samples.notesync.ContentSoqlSyncDownTarget",
 iOSImpl:"SFContentSoqlSyncDownTarget",
 ...
};
```

2. Pass this target to the hybrid sync down method:

```
cordova.require("com.salesforce.plugin.SmartSync").syncDown(target, ...);
```

## Sample Apps

### Android

The NoteSync native Android sample app defines and uses the `com.salesforce.samples.notesync.ContentSoqlSyncDownTarget` sync down target.

### iOS

The NoteSync native iOS sample app defines and uses the `SFContentSoqlSyncDownTarget` sync down target.

## Using Custom Sync Up Targets

During sync up operations, a sync up target controls the set of records to be uploaded and the REST endpoint for updating records on the server. You can access arbitrary REST endpoints—both inside and outside of Salesforce—by creating custom sync up targets.

### Defining a Custom Sync Up Target

You define custom targets for sync up operations by subclassing your platform's abstract base class for sync up targets. To use custom targets in hybrid apps, you're required to implement a custom native target class for each platform you support. The base sync up target classes are:

- **Android:** `SyncUpTarget`
- **iOS:** `SFSyncUpTarget`

 **Note:** These classes sync the requested records but not their related records. To include related records, use the sync target classes described in [Syncing Related Records](#).

### Handling Field Lists in Create and Update Operations

A target's Create On Server and Update On Server methods operate only on the list of fields specified in their argument lists. However, a Salesforce object can require the target to create certain fields that can't be updated by apps. With these objects, a target that uses a single field list for both create and update operations can fail if it tries to update locked fields.

To specify distinct field lists for create and update operations, you can use an initializer method that supports `createFieldlist` and `updateFieldlist` parameters. This option can save you the effort of defining a custom target if you're doing so only to provide these field lists.

- **Android:** Use the following `SyncUpTarget` constructor:

```
public SyncUpTarget(List<String> createFieldlist, List<String> updateFieldlist)
```

If you provide the `createFieldlist` and `updateFieldlist` arguments, the target uses them where applicable. In those cases, the target ignores the field list defined in the `SyncOptions` object.

- **iOS:** Call the following `SFSyncUpTarget` `initWithCreateFieldlist:` method:

```
- (instancetype) initWithCreateFieldlist:(NSArray *) createFieldlist
 updateFieldlist:(NSArray *) updateFieldlist
```

If you provide the `createFieldlist` and `updateFieldlist` arguments, the target uses them where applicable. In those cases, the target ignores the field list defined in the `SFSyncOptions` object.

### Required Methods

Every custom target class must implement the following required methods.

#### Create On Server Method

Sync up a locally created record. Hybrid and React native apps can override the `fields` parameter by calling `syncUp` with the optional `createFieldList` parameter.

**Android:**

```
String createOnServer(SyncManager syncManager,
 String objectType, Map<String, Object> fields);
```

**iOS:**

```
- (void) createOnServer:(NSString*) objectType
 fields:(NSDictionary*) fields
 completionBlock:(SFSyncUpTargetCompleteBlock)
 completionBlock
 failBlock:(SFSyncUpTargetErrorBlock) failBlock;
```

**Update On Server Method**

Sync up a locally updated record. For the `objectId` parameter, SmartSync Data Framework uses the field specified in the `getIdFieldName()` method (Android) or the `idFieldName` property (iOS) of the custom target. Hybrid and React native apps can override the `fields` parameter by calling `syncUp` with the optional `updateFieldList` parameter.

**Android:**

```
updateOnServer(SyncManager syncManager, String objectType, String objectId,
 Map<String, Object> fields);
```

**iOS:**

```
- (void) updateOnServer:(NSString*) objectType
 objectId:(NSString*) objectId
 fields:(NSDictionary*) fields
 completionBlock:(SFSyncUpTargetCompleteBlock)
 completionBlock
 failBlock:(SFSyncUpTargetErrorBlock) failBlock;
```

**Delete On Server Method**

Sync up a locally deleted record. For the `objectId` parameter, SmartSync Data Framework uses the field specified in the `getIdFieldName()` method (Android) or the `idFieldName` property (iOS) of the custom target.

**Android:**

```
deleteOnServer(SyncManager syncManager, String objectType,
 String objectId);
```

**iOS:**

```
- (void) deleteOnServer:(NSString*) objectType
 objectId:(NSString*) objectId
 completionBlock:(SFSyncUpTargetCompleteBlock)
 completionBlock
 failBlock:(SFSyncUpTargetErrorBlock) failBlock;
```

**Optional Configuration Changes**

Optionally, you can override the following values in your custom class.

**getIdsOfRecordsToSyncUp**

List of record IDs returned for syncing up. By default, these methods return any record where `__local__` is true.

**Android:**

```
Set<String> getIdsOfRecordsToSyncUp(SyncManager syncManager,
 String soupName);
```



**iOS:**

```
- (NSArray*)
getIdsOfRecordsToSyncUp: (SFSmartSyncSyncManager*) syncManager
 soupName: (NSString*) soupName;
```

**Modification Date Field Name**

Field used during a LEAVE\_IF\_CHANGED sync up operation to determine whether a record was remotely modified. Default value is `lastModifiedDate`.

**Android:**

```
String getModificationDateFieldName();
```

**iOS:**

`modificationDateFieldName` property

**Last Modification Date**

The last modification date value returned for a record. By default, sync targets fetch the modification date field value for the record.

**Android:**

```
String fetchLastModifiedDate(SyncManager syncManager,
 String objectType, String objectId);
```

**iOS:**

```
- (void)
fetchRecordModificationDates: (NSDictionary *) record
 modificationResultBlock: (SFSyncUpRecordModificationResultBlock)
 modificationResultBlock
```

**ID Field Name**

Field used to get the ID of the record. For example, during sync up, Mobile SDK obtains the ID that it passes to the `updateOnServer()` method from the field whose name matches `idFieldName` in the local record.

**Android:**

```
String getIdFieldName();
```

**iOS:**

`idFieldName` property

## Invoking the Sync Up Method with a Custom Target

**Android:**

On a `SyncManager` instance, call:

```
SyncState syncUp(SyncUpTarget target,
 SyncOptions options, String soupName,
 SyncUpdateCallback callback);
```

**iOS:**

On a `SFSyncManager` instance, call:

```
- (SFSyncState*)
syncUpWithOptions: (SFSyncOptions*) options
```

```
soupName: (NSString*) soupName
updateBlock: (SFSyncSyncManagerUpdateBlock) updateBlock
```

**Hybrid:**

```
cordova.require("com.salesforce.plugin.smartsync").
 syncUp(isGlobalStore, target, soupName,
 options, successCB, errorCallback);
cordova.require("com.salesforce.plugin.smartsync").
 syncUp(storeConfig, target, soupName,
 options, successCB, errorCallback);
```

## Syncing Related Records

It's a common problem in syncing offline data: You can easily sync your explicit changes, but how do you update affected related records? You can do it manually with enough knowledge, determination, and perspicacity, but that's the old way. Starting with Mobile SDK 5.2, SmartSync Data Framework provides tools that let you sync parent records and their related records with a single call.

### Supported Relationship Types

Related record sync supports two types of one-to-many relationships: Lookup and Master-detail. Both types are defined in the child-to-parent, many-to-one direction. Each child knows its parent, but the parent doesn't know its children.

#### Lookup Relationships

A lookup relationship is a "loose" link between objects based on one or more fields. For lookup relationships:

- Child records do not require a parent field.
- Changes to one object do not affect the security, access, or deletion of a linked object.

Salesforce supports up to 25 lookup fields per object. Lookup relationships can be multiple layers deep.

#### Master-detail Relationships

A master-detail relationship is a parent-child link in which the parent object exerts some control over its children. In master-detail linkage:

- Child records require a parent field.
- The parent's access level determines the access level of its children.
- If a parent record is deleted, its children are also deleted.

Salesforce supports up to two master-detail fields per object, and up to three levels of master-detail relationships.

See [Object Relationships Overview](#) in Salesforce Help.



**Note:** SmartSync Data Framework does not support many-to-many relationships.

### Objects Used in Related Record Sync

Related record sync uses two special types of sync targets:

#### Parent-children sync up target

- **Android:** `ParentChildrenSyncUpTarget`
- **iOS:** `SFParentChildrenSyncUpTarget`

Handles locally created or updated records and deleted records.

**Parent-children sync down target**

- **Android:** `ParentChildrenSyncDownTarget`
- **iOS:** `SFParentChildrenSyncDownTarget`

Supports `resync` and `cleanResyncGhosts` methods.

These targets support *leave-if-changed* and *overwrite* merge modes. Each target provides a factory method (on iOS) or a constructor (on Android) that initializes an instance with the required information you provide. To perform the sync, you configure a new target class instance and pass it to the standard SmartSync Data Framework sync method that accepts a target object.

To initialize the targets, you also provide two helper objects that deliver necessary related record information:

**Parent information object**

- **Android:** `ParentInfo`
- **iOS:** `SFParentInfo`

Includes:

- Object type
- Soup name
- ID field (Optional in all cases. Defaults to "Id". Set this value only if you are specifying a different field to identify the records.)
- Last Modified Date field (Optional in all cases. Defaults to "LastModifiedDate". Set this value only if you are specifying a different field for time stamps.)

**Child information object**

- **Android:** `ChildrenInfo`
- **iOS:** `SFChildrenInfo`

Includes:

- Object type
- Soup name
- Parent ID field
- ID field (Optional in all cases. Defaults to "Id". Set this value only if you are specifying a different field to identify the records.)
- Last Modified Date field (Optional in all cases. Defaults to "LastModifiedDate". Set this value only if you are specifying a different field for time stamps.)

**Preparing Your SmartStore Data Model**

To prepare for handling related objects offline, you first set up a SmartStore soup for each expected parent and child object type. For each soup, you add indexed ID fields that model the server-side relationships. Here's the list of required indexed fields:

**Soup for a parent object:**

Field for server ID of record

**Soup for a child object:**

Field for server ID of record

Field for server ID of parent record

All sync operations—up and down—begin with the parent soup and then continue to the child soups. Here's how this flow works:

- When you sync down related records, you are targeting parent records, and the sync downloads those records and all their children. For example, if you're syncing accounts with their contacts, you get the contacts linked to the accounts you've downloaded. You don't get contacts that aren't linked to those accounts.

- When you sync up related records, SmartSync Data Framework iterates over the soup of parent records and picks up related children records. Modified children records that are not related to a parent record are ignored during that sync up operation.

## Sync Up

To initialize the parent-child sync-up target, you provide parent information objects and child information objects. These objects fully describe the relationships between parent-child records, both on the server and in the local store. You also provide the list of fields to sync. Here's the full list of required information:

- Parent information object
- Child information object
- Relationship type (for example, master-detail or lookup)
- Fields to sync up in parent and children soups

The sync up operation iterates over the soup containing the parent records and uses the given information to pull related records from the children's soups. A record is considered dirty when the `__local__` field is set to true. A record tree—consisting of one parent and its children—is a candidate for sync up when any record in the tree is dirty. Whether the sync up actually occurs depends on how SmartSync Data Framework handles the merge mode.

### “Leave-if-changed” Merge Mode Handling

SmartSync Data Framework fetches Last Modified Date fields of the target parent and children server records. The sync up operation skips that record tree if

- the last modified date of any fetched server record is more recent than its corresponding local record
- or
- if any fetched server record has been deleted.

### Updates Applied after Sync Up

After the local changes have been synced to the server, SmartSync Data Framework cleans up related records.

- If sync up creates any parent or child record on the server, SmartSync Data Framework updates the server ID field of the corresponding local record. If the created record is a parent, the parent ID fields of its children are also updated in the local store.
- If any server records were deleted since the last sync down, deletes the corresponding local records.
- If sync up deletes a parent record and the relationship type is master-detail, SmartSync Data Framework deletes the record's children on the server and in the local store.

## Sync Down

To initialize the parent-children sync-down target, you provide parent information objects and children information objects. These objects fully describe the relationships between parent-child records, both on the server and in the local store. You also provide a list of fields to sync and some SOQL filters.

The new sync down target is actually a subclass of the SOQL sync down target. Instead of being given the SOQL query, however, the target generates it from the parent and children information objects, list of fields, and SOQL filters.

### Information Passed to Sync Down Targets

- Parent information object
- Child information object
- Relationship type (for example, master-detail or lookup)
- Fields to sync down in parent and children soups
- SOQL filter to apply in query on root records during sync down—for example, the condition of a WHERE clause

## Server Call

SmartSync Data Framework fetches the record trees, each consisting of one parent and its children, using SOQL. It then separates parents from their children and stores them in their respective soups.

### “Leave-if-changed” Merge Mode Handling

Local record trees that contain any dirty records—locally created, modified, or deleted records—are left unaltered. For example, if a parent record has one dirty child, SmartSync Data Framework doesn’t update the parent or the child. This rule applies even if the parent is clean locally but has been changed on the server.

### Handling Resync

During resync, SmartSync Data Framework adjusts the SOQL query to download only those record trees in which the parent changed since the last sync.

## Implementing Related Record Sync

Once you understand the principles and requirements involved, implementing it is straightforward. You can add related record sync to your code in a few steps. The following code snippets demonstrate the technique using Account (parent) and Contact (child) objects.

### Android

1. Create SmartStore soups that define the required indexed fields.

```
// Creating soup for accounts

final IndexSpec[] indexSpecs = {
 new IndexSpec(Constants.ID, SmartStore.Type.string),
 new IndexSpec(Constants.NAME, SmartStore.Type.string),
 new IndexSpec(Constants.DESCRPTION, SmartStore.Type.string),
 new IndexSpec(SyncTarget.LOCAL, SmartStore.Type.string)
};

smartStore.registerSoup("AccountSoup", indexSpecs);

// Creating soup for contacts

final IndexSpec[] contactsIndexSpecs = {
 new IndexSpec(Constants.ID, SmartStore.Type.string),
 new IndexSpec(Constants.LAST_NAME, SmartStore.Type.string),
 new IndexSpec(SyncTarget.LOCAL, SmartStore.Type.string),
 new IndexSpec(ACCOUNT_ID, SmartStore.Type.string)
};

smartStore.registerSoup(CONTACTS_SOUP, contactsIndexSpecs);
```

2. Create instance of a sync target object and its supporting informational objects.

```
// Creating object for parent info

ParentInfo parentInfo =
 new ParentInfo(Constants.ACCOUNT, "AccountSoup", Constants.ID,
 Constants.LAST_MODIFIED_DATE);

// Creating object for children info
```

```

ChildrenInfo childrenInfo = new ChildrenInfo(
 Constants.CONTACT, Constants.CONTACT + "s", "ContactSoup", ACCOUNT_ID,
 Constants.ID, Constants.LAST_MODIFIED_DATE);

// Creating sync up target

ParentChildrenSyncUpTarget syncUpTarget =
 new ParentChildrenSyncUpTarget(
 parentInfo,
 Arrays.asList(Constants.ID, Constants.NAME, Constants.DESCRPTION),
 Arrays.asList(Constants.NAME, Constants.DESCRPTION),
 childrenInfo,
 Arrays.asList(Constants.LAST_NAME, ACCOUNT_ID),
 Arrays.asList(Constants.LAST_NAME, ACCOUNT_ID),
 RelationshipType.MASTER_DETAIL); // account-contacts are master-detail

// Creating sync down target

ParentChildrenSyncDownTarget syncDownTarget =
 new ParentChildrenSyncDownTarget(
 parentInfo,
 Arrays.asList(Constants.ID, Constants.NAME, Constants.DESCRPTION),
 parentSqlFilter,
 childrenInfo,
 Arrays.asList(Constants.LAST_NAME, ACCOUNT_ID),
 RelationshipType.MASTER_DETAIL); // account-contacts are master-detail

```

3. Call the SmartSync Data Framework sync method that takes a sync target.

For sync up:

```

// Running sync up

syncManager.syncUp(syncUpTarget, options, "AccountSoup", new SyncUpdateCallback() {
 @Override
 public void onUpdate(SyncState sync) {
 // Handle updates
 }
});

```

For sync down:

```

//Running sync down target

syncManager.syncDown(syncDownTarget, options, "AccountSoup",
 new SyncUpdateCallback() {
 @Override
 public void onUpdate(SyncState sync) {
 // Handle updates
 }
 });

```

iOS

1. Create SmartStore soups that define the required indexed fields.

```
// Creating soup for accounts
NSArray* indexSpecs = @[
 [[SFSoupIndex alloc] initWithPath:@"Id"
 indexType:kSoupIndexTypeString
 columnName:nil],
 [[SFSoupIndex alloc] initWithPath:@"Name"
 indexType:kSoupIndexTypeString
 columnName:nil],
 [[SFSoupIndex alloc] initWithPath:@"Description"
 indexType:kSoupIndexTypeFullText
 columnName:nil],
 [[SFSoupIndex alloc] initWithPath:kSyncTargetLocal
 indexType:kSoupIndexTypeString
 columnName:nil]
];

[store registerSoup:@"AccountSoup" withIndexSpecs:indexSpecs error:nil];

// Creating soup for contacts
indexSpecs = @[
 [[SFSoupIndex alloc] initWithPath:@"Id"
 indexType:kSoupIndexTypeString
 columnName:nil],
 [[SFSoupIndex alloc] initWithPath:@"LastName"
 indexType:kSoupIndexTypeString
 columnName:nil],
 [[SFSoupIndex alloc] initWithPath:@"AccountId"
 indexType:kSoupIndexTypeString
 columnName:nil],
 [[SFSoupIndex alloc] initWithPath:kSyncTargetLocal
 indexType:kSoupIndexTypeString
 columnName:nil]
];

[store registerSoup:@"ContactSoup" withIndexSpecs:indexSpecs error:nil];
```

2. Create instance of a sync target object and its supporting informational objects.

```
// Creating object for parent info
SFParentInfo* parentInfo =
 [SFParentInfo newWithSOBJECTType:@"Account"
 soupName:@"AccountSoup"
 idFieldName:@"Id"
 modificationDateFieldName:@"LastModifiedDate"];

// Creating object for children info
SFChildrenInfo* childrenInfo =
 [SFChildrenInfo newWithSOBJECTType:@"Contact"
 subjectTypePlural:@"Contacts"
 soupName:@"ContactSoup"];
```

```

 parentIdFieldName:@"AccountId"
 idFieldName:@"Id"
 modificationDateFieldName:@"LastModifiedDate"];

// Creating sync up target

SFParentChildrenSyncUpTarget *syncUpTarget =
 [SFParentChildrenSyncUpTarget newSyncTargetWithParentInfo:parentInfo
 parentCreateFieldlist:@[@"Id", @"Name", @"Description"]
 parentUpdateFieldlist:@[@"Name", @"Description"]
 childrenInfo:childrenInfo
 childrenCreateFieldlist:@[@"LastName", @"AccountId"]
 childrenUpdateFieldlist:@[@"LastName", @"AccountId"]
 relationshipType:SFParentChildrenRelationshipMasterDetail];
// account-contacts are master-detail

// Creating sync down target

SFParentChildrenSyncDownTarget *syncDownTarget =
 [SFParentChildrenSyncDownTarget
 newSyncTargetWithParentInfo:parentInfo
 parentFieldlist:@[@"Id", @"Name", @"Description"]
 parentSqlFilter:@"Name LIKE 'A%'"
 childrenInfo:childrenInfo
 childrenFieldlist:@[@"LastName", @"AccountId"]
 relationshipType:SFParentChildrenRelationshipMasterDetail];
// account-contacts are master-detail

```

3. Call the SmartSync Data Framework sync method that takes a sync target.

For sync up:

```

// Running sync up

[syncManager syncUpWithTarget:syncUpTarget
 options:options
 soupName:@"AccountSoup"
 updateBlock:^(SFSyncState* sync) {
 // Handle updates
}
];

```

For sync down:

```

//Running sync down target

[syncManager syncDownWithTarget:syncDownTarget
 options:options
 soupName:@"AccountSoup"
 updateBlock:^(SFSyncState* sync) {
 // Handle updates
}
];

```



## Storing and Retrieving Cached Data

The cache manager provides methods for writing and reading sObject metadata to the SmartSync Data Framework cache. Each method requires you to provide a key string that identifies the data in the cache. You can use any unique string that helps your app locate the correct cached data.

You also specify the type of cached data. Cache manager methods read and write each of the three categories of sObject data: metadata, MRU (most recently used) list, and layout. Since only your app uses the type identifiers you provide, you can use any unique strings that clearly distinguish these data types.

### Cache Manager Classes

- **Android:** `com.salesforce.androidsdk.smartsync.manager.CacheManager`
- **iOS:** `SFSmartSyncCacheManager`

### Read and Write Methods

Here are the `CacheManager` methods for reading and writing sObject metadata, MRU lists, and sObject layouts.

- **Android:**

#### sObjects Metadata

```
public List<SalesforceObject> readObjects(String cacheType,
 String cacheKey);
public void writeObjects(List<SalesforceObject> objects,
 String cacheKey, String cacheType);
```

#### MRU List

```
public List<SalesforceObjectType>
readObjectTypes(String cacheType, String cacheKey);

public void
writeObjectTypes(List<SalesforceObjectType> objects,
 String cacheKey, String cacheType);
```

#### sObject Layouts

```
public List<SalesforceObjectTypeLayout>
readObjectLayouts(String cacheType, String cacheKey);

public void
writeObjectLayouts(List<SalesforceObjectTypeLayout> objects,
 String cacheKey, String cacheType);
```

- **iOS:**

#### Read Method

```
- (NSArray *)
readDataWithCacheType:(NSString *)cacheType
 cacheKey:(NSString *)cacheKey
 cachePolicy:(SFDataCachePolicy)cachePolicy
 objectClass:(Class)objectClass
 cachedTime:(out NSDate **)lastCachedTime;
```

**Write Method**

```
- (void)writeDataToCache:(id) data
 cacheType:(NSString *) cacheType
 cacheKey:(NSString *) cacheKey;
```

**Clearing the Cache**

When your app is ready to clear the cache, use the following cache manager methods:

- **Android:**

```
public void removeCache(String cacheType, String cacheKey);
```

- **iOS:**

```
- (void)removeCache:(NSString *) cacheType
 cacheKey:(NSString *) cacheKey;
```

These methods let you clear a selected portion of the cache. To clear the entire cache, call the method for each cache key and data type you've stored.

**Using SmartSync Data Framework in Hybrid and React Native Apps**

SmartSync Data Framework for JavaScript is a Mobile SDK library that represents Salesforce objects as JavaScript objects. To use SmartSync Data Framework in JavaScript, you create models of Salesforce objects and manipulate the underlying records just by changing the model data. If you perform a SOQL or SOSL query, you receive the resulting records in a model collection rather than as a JSON string.

In hybrid apps, Mobile SDK provides two options for using SmartSync Data Framework.

- `com.salesforce.plugin.smartsync`: The SmartSync Data Framework plug-in offers basic “sync up” and “sync down” functionality. This plug-in exposes part of the native SmartSync Data Framework library. For simple syncing tasks, you can use the plug-in to sync records rapidly in a native thread, rather than in the web view.
- `smartsync.js`: The SmartSync Data Framework JavaScript library provides a `Force.SObject` data framework for more complex syncing operations. This library is based on `backbone.js`, an open-source JavaScript framework that defines an extensible data modeling mechanism. To understand this technology, browse the examples and documentation at [backbonejs.org](http://backbonejs.org).

A set of sample hybrid applications demonstrate how to use SmartSync Data Framework. Sample apps in the `hybrid/SampleApps/AccountEditor/assets/www` folder demonstrate how to use the `Force.SObject` library in `smartsync.js`:

- Account Editor (`AccountEditor.html`)
- User Search (`UserSearch.html`)
- User and Group Search (`UserAndGroupSearch.html`)

The sample app in the `hybrid/SampleApps/SimpleSync` folder demonstrates how to use the SmartSync Data Framework plug-in.

**Should I Use Smartsync.js or the SmartSync Data Framework Plugin?**

`smartsync.js`—the JavaScript version of SmartSync Data Framework—and native SmartSync Data Framework—available to hybrid apps through a Cordova plug-in—share a name, but they offer different advantages.


`smartsync.js` is built on `backbone.js` and gives you easy-to-use model objects to represent single records or collections of records. It also provides convenient `fetch`, `save`, and `delete` methods. However, it doesn't give you true sync down and sync up functionality. Fetching records with an `SObjectCollection` is similar to the plug-in's `syncDown` method, but it deposits all the retrieved objects in memory. For that reason, it's not the best choice for moving large data sets. Furthermore, you're required to implement the sync up functionality yourself. The `AccountEditor` sample app demonstrates a typical JavaScript `syncUp()` implementation.

Native SmartSync Data Framework doesn't return model objects, but it provides robust `syncUp` and `syncDown` methods for moving large data sets to and from the server.

You can also use the two libraries together. For example, you can set up a `Force.StoreCache` with `smartsync.js`, sync data into it using the SmartSync Data Framework plug-in, and then call `fetch` or `save` using `smartsync.js`. You can then sync up from the same cache using the SmartSync Data Framework plug-in, and it all works.

Both libraries provide the means to define your own custom endpoints, so which do you choose? The following guidelines can help you decide:

- Use custom endpoints from `smartsync.js` if you want to talk to the server directly for saving or fetching data with JavaScript.
- If you talk only to SmartStore and get data into SmartStore using the SmartSync Data Framework plug-in and then you don't need the custom endpoints in `smartsync.js`. However, you must define native custom targets.

 **Note:** `smartsync.js` uses promises internally. If you're developing for Android 19 and using Mobile SDK promise-based APIs, include this file: <https://www.promisejs.org/polyfills/promise-7.0.4.min.js>.

## About Backbone Technology

The SmartSync Data Framework library, `smartsync.js`, provides extensions to the open-source Backbone JavaScript library. The Backbone library defines key building blocks for structuring your web application:

- Models with key-value binding and custom events, for modeling your information
- Collections with a rich API of enumerable functions, for containing your data sets
- Views with declarative event handling, for displaying information in your models
- A router for controlling navigation between views

Salesforce SmartSync Data Framework extends the `Model` and `Collection` core Backbone objects to connect them to the Salesforce REST API. SmartSync Data Framework also provides optional offline support through SmartStore, the secure storage component of the Mobile SDK.

To learn more about Backbone, see <http://backbonejs.org/> and <http://backbonetutorials.com/>. You can also search online for "backbone javascript" to find a wealth of tutorials and videos.

## Models and Model Collections

Two types of objects make up the SmartSync Data Framework:

- Models
- Model collections

Definitions for these objects extend classes defined in `backbone.js`, a popular third-party JavaScript framework. For background information, see <http://backbonetutorials.com>.

### Models

Models on the client represent server records. In SmartSync Data Framework, model objects are instances of `Force.SObject`, a subclass of the `Backbone.Model` class. `SObject` extends `Model` to work with Salesforce APIs and, optionally, with SmartStore.

You can perform the following CRUD operations on `SObject` model objects:

- Create
- Destroy
- Fetch
- Save
- Get/set attributes

In addition, model objects are observable: Views and controllers can receive notifications when the objects change.

## Properties

`Force.SObject` adds the following properties to `Backbone.Model`:

### **subjectType**

Required. The name of the Salesforce object that this model represents. This value can refer to either a standard object or a custom object.

### **fieldlist**

Required. Names of fields to fetch, save, or destroy.

### **cacheMode**

[Offline behavior.](#)

### **mergeMode**

[Conflict handling behavior.](#)

### **cache**

For updatable offline storage of records. The SmartSync Data Framework comes bundled with `Force.StoreCache`, a cache implementation that is backed by `SmartStore`.

### **cacheForOriginals**

Contains original copies of records fetched from server to support conflict detection.

## Examples

You can assign values for model properties in several ways:

- As properties on a `Force.SObject` instance.
- As methods on a `Force.SObject` sub-class. These methods take a parameter that specifies the desired CRUD action ("create", "read", "update", or "delete").
- In the options parameter of the `fetch()`, `save()`, or `destroy()` function call.

For example, these code snippets are equivalent.

```
// As properties on a Force.SObject instance
acc = new Force.SObject({Id:"<some_id>"});
acc.subjectType = "account";
acc.fieldlist = ["Id", "Name"];
acc.fetch();
```

```
// As methods on a Force.SObject sub-class
Account = Force.SObject.extend({
 subjectType: "account",
 fieldlist: function(method) { return ["Id", "Name"]; }
});
```

```
Acc = new Account({Id:"<some_id>"});
acc.fetch();
```

```
// In the options parameter of fetch()
acc = new Force.SObject({Id:"<some_id>"});
acc.subjectType = "account";
acc.fetch({fieldlist:["Id", "Name"]});
```

## Model Collections

Model collections in the SmartSync Data Framework are containers for query results. Query results stored in a model collection can come from the server via SOQL, SOSL, or MRU queries. Optionally, they can also come from the cache via SmartSQL (if the cache is SmartStore), or another query mechanism if you use an alternate cache.

Model collection objects are instances of `Force.SObjectCollection`, a subclass of the `Backbone.Collection` class. `SObjectCollection` extends `Collection` to work with Salesforce APIs and, optionally, with SmartStore.

## Properties

`Force.SObjectCollection` adds the following properties to `Backbone.Collection`:

### **config**

Required. Defines the records the collection can hold (using SOQL, SOSL, MRU or SmartSQL).

### **cache**

For updatable offline storage of records. The SmartSync Data Framework comes bundled with `Force.StoreCache`, a cache implementation that's backed by SmartStore.

### **cacheForOriginals**

Contains original copies of records fetched from server to support conflict detection.

## Examples

You can assign values for model collection properties in several ways:

- As properties on a `Force.SObject` instance
- As methods on a `Force.SObject` sub-class
- In the options parameter of the `fetch()`, `save()`, or `destroy()` function call

For example, these code snippets are equivalent.

```
// As properties on a Force.SObject instance
list = new Force.SObjectCollection({config:<valid_config>});
list.fetch();
```

```
// As methods on a Force.SObject sub-class
MyCollection = Force.SObjectCollection.extend({
 config: function() { return <valid_config>; }
});
list = new MyCollection();
list.fetch();
```

```
// In the options parameter of fetch()
list = new Force.SObjectCollection();
list.fetch({config:<valid_config>});
```

## Using the SmartSync Data Framework Plugin

Beginning with Mobile SDK 3.0, the SmartSync Data Framework plug-in provides JavaScript access to the native SmartSync Data Framework library's "sync up" and "sync down" functionality. As a result, performance-intensive operations—network negotiations, parsing, SmartStore management—run on native threads that do not affect web view operations.

Adding the SmartSync Data Framework plug-in to your hybrid project is a function of the Mobile SDK npm scripts:

- For forceios version 3.0 or later, the plug-in is automatically included.
- For forcedroid version 3.0 or later, answer "yes" when asked if you want to use SmartStore.

If you're adding the SmartSync Data Framework plug-in to an existing hybrid app, it's best to re-create the app using the latest version of forcedroid or forceios. When the new app is ready, copy your custom HTML, CSS, and JavaScript files from your old project into the new project.

### SmartSync Data Framework Plugin Methods

The SmartSync Data Framework plug-in exposes two methods: `syncDown()` and `syncUp()`. When you use these methods, several important guidelines can make your life simpler:

- To create, update, or delete records locally for syncing with the plug-in, use `Force.SObject` from `smartsync.js`. SmartSync Data Framework expects some special fields on soup records that `smartsync.js` creates for you.
- Similarly, to create the soup that you'll use in your sync operations, use `Force.StoreCache` from `smartsync.js`.
- If you've changed objects in the soup, always call `syncUp()` before calling `syncDown()`.

#### `syncDown()` Method

Downloads the `sObjects` specified by `target` into the SmartStore soup specified by `soupName`. If `sObjects` in the soup have the same ID as objects specified in the target, SmartSync Data Framework overwrites the duplicate objects in the soup.

SmartSync Data Framework also supports a refresh sync down target, which simplifies the process of refreshing cached records. See [The Refresh Sync Down Target](#).

#### Syntax

```
cordova.require("com.salesforce.plugin.smartsync").syncDown(
 [isGlobalStore,]target, soupName, options, callback);
cordova.require("com.salesforce.plugin.smartsync").syncDown(
 [storeConfig,]target, soupName, options, callback);
```

#### Parameters

##### **isGlobalStore**

(Optional) Boolean that indicates whether this operation occurs in a global or user-based SmartStore database. Defaults to `false`.

##### **storeConfig**

(Optional) `StoreConfig` object that specifies a store name and whether the store is global or user-based.

##### **target**

Indicates which `sObjects` to download to the soup. Can be any of the following strings:

- ```
{type:"soql", query:"<soql query>"}
```

Downloads the sObjects returned by the given SOQL query.
- ```
{type:"sosl", query:"<sosl query>"}
```

Downloads the sObjects returned by the given SOSL query.
- ```
{type:"mru", objectType:"<object type>", fieldlist:"<fields to fetch>"}
```

Downloads the specified fields of the most recently used sObjects of the specified sObject type.
- ```
{type:"custom", androidImpl:"<name of native Android target class (if supported)>", iosImpl:"<name of native iOS target class (if supported)>"}
```

Downloads the records specified by the given custom targets. If you use custom targets, provide either `androidImpl` or `iosImpl`, or, preferably, both. See [Using Custom Sync Down Targets](#).

**soupName**

Name of soup that receives the downloaded sObjects.

**options**

Use one of the following values:

- To overwrite local records that have been modified, pass `{mergeMode:Force.MERGE_MODE_DOWNLOAD.OVERWRITE}`.
- To preserve local records that have been modified, pass `{mergeMode:Force.MERGE_MODE_DOWNLOAD.LEAVE_IF_CHANGED}`. With this value, locally modified records are not overwritten.

**callback**

Function called once the sync has started. This function is called multiple times during a sync operation:

- When the sync operation begins
- When the internal REST request has completed
- After each page of results is downloaded, until 100% of results have been received

Status updates on the sync operation arrive via browser events. To listen for these updates, use the following code:

```
document.addEventListener("sync",
 function(event) {
 // event.detail contains the status of the sync operation
 }
);
```

The `event.detail` member contains a map with the following fields:

- `syncId`: ID for this sync operation
- `type`: "syncDown"
- `target`: Targets you provided
- `soupName`: Soup name you provided
- `options`: "{}"
- `status`: Sync status, which can be "NEW", "RUNNING", "DONE" or "FAILED"
- `progress`: Percent of total records downloaded so far (integer, 0–100)
- `totalSize`: Number of records downloaded so far

## syncUp() Method

Uploads created, deleted, or updated records in the SmartStore soup specified by `soupName`, and then updates, creates, or deletes the corresponding records on the Salesforce server. Updates are reported through browser events.

### Syntax

```
cordova.require("com.salesforce.plugin.smartsync").syncUp(isGlobalStore, target, soupName,
 options, callback);
cordova.require("com.salesforce.plugin.smartsync").syncUp(storeConfig, target, soupName,
 options, callback);
```

### Parameters

#### **isGlobalStore**

(Optional) Boolean that indicates whether this operation occurs in a global or user-based SmartStore database. Defaults to `false`.

#### **storeConfig**

(Optional) `StoreConfig` object that specifies a store name and whether the store is global or user-based.

#### **target**

JSON object that contains at least the name of one native custom target class, if you define custom targets.

A Salesforce object can require certain fields that can't be updated by apps. With these objects, a target that uses a single field list for both create and update operations can fail if it tries to update locked fields. Past versions of SmartSync Data Framework required the developer to create a custom native target to differentiate between create and update field lists.

As of Mobile SDK 5.1, you no longer have to define custom native targets for these scenarios. Instead, to specify distinct field lists for create and update operations, add the following JSON object to the `target` object:

```
{createFieldlist: [<array_of_fields_to_create>], updateFieldlist:
 [<another_array_of_fields_to_update>]}
```

If you provide `createFieldlist` and `updateFieldlist` arguments, the native custom target uses them where applicable. In those cases, the target ignores the field list defined in its "sync options" settings.

See the `syncDown()` method description for more information on `target` metadata.

#### **soupName**

Name of soup from which to upload sObjects.

#### **options**

A map with the following keys:

- `fieldlist`: List of fields sent to the server.
- `mergeMode`:
  - To overwrite remote records that have been modified, pass "OVERWRITE".
  - To preserve remote records that have been modified, pass "LEAVE\_IF\_CHANGED". With this value, modified records on the server are not overwritten.
  - Defaults to "OVERWRITE" if not specified.

#### **callback**

Function called multiple times after the sync has started. During the sync operation, this function is called for these events:

1. When the sync operation begins
2. When the internal REST request has completed
3. After each page of results is uploaded, until 100% of results have been received



Status updates on the sync operation arrive via browser events. To listen for these updates, use the following code:

```
document.addEventListener("sync",
 function(event) {
 // event.detail contains the status of the sync operation
 }
);
```

The `event.detail` member contains a map with the following fields:

- `syncId`: ID for this sync operation
- `type`: "syncUp"
- `target`: "{}" or a map or dictionary containing the class names of Android and iOS custom target classes you've implemented
- `soupName`: Soup name you provided
- `options`:
  - `fieldlist`: List of fields sent to the server
  - `mergeMode`: "OVERWRITE" or "LEAVE\_IF\_CHANGED"
- `status`: Sync status, which can be "NEW", "RUNNING", "DONE" or "FAILED"
- `progress`: Percent of total records downloaded so far (integer, 0–100)
- `totalSize`: Number of records downloaded so far

SEE ALSO:

[Creating and Accessing User-based Stores](#)

## Using SmartSync Data Framework in JavaScript

To use SmartSync Data Framework in a hybrid app, import these files with `<script>` tags:

- `jquery-x.x.x.min.js` (use the version in the `dependencies/jquery/` directory of the [SalesforceMobileSDK-Shared](#) repository)
- `underscore-x.x.x.min.js` (use the version in the `dependencies/underscore/` directory of the [SalesforceMobileSDK-Shared](#) repository)
- `backbone-x.x.x.min.js` (use the version in the `dependencies/backbone/` directory of the [SalesforceMobileSDK-Shared](#) repository)
- `cordova.js`
- `force.js`
- `smartsync.js`

## Implementing a Model Object

To begin using SmartSync Data Framework objects, define a model object to represent each `SObject` that you want to manipulate. The `SObjects` can be standard Salesforce objects or custom objects. For example, this code creates a model of the Account object that sets the two required properties—`subjectType` and `fieldlist`—and defines a `cacheMode()` function.

```
app.models.Account = Force.SObject.extend({
 subjectType: "Account",
 fieldlist: ["Id", "Name", "Industry", "Phone"],
```

```

cacheMode: function(method) {
 if (app.offlineTracker.get("offlineStatus") == "offline") {
 return "cache-only";
 }
 else {
 return (method == "read" ?
 "cache-first" : "server-first");
 }
}
});

```

Notice that the `app.models.Account` model object extends `Force.SObject`, which is defined in `smartsync.js`. Also, the `cacheMode()` function queries a local `offlineTracker` object for the device's offline status. You can use the Cordova library to determine offline status at any particular moment.

SmartSync Data Framework can perform a fetch or a save operation on the model. It uses the app's `cacheMode` value to determine whether to perform an operation on the server or in the cache. Your `cacheMode` member can either be a simple string property or a function returning a string.

## Implementing a Model Collection

The model collection for this sample app extends `Force.SObjectCollection`.

```

// The AccountCollection Model
app.models.AccountCollection = Force.SObjectCollection.extend({
 model: app.models.Account,
 fieldlist: ["Id", "Name", "Industry", "Phone"],
 setCriteria: function(key) {
 this.key = key;
 },
 config: function() {
 // Offline: do a cache query
 if (app.offlineTracker.get("offlineStatus") == "offline") {
 return {type:"cache", cacheQuery:{queryType:"like",
 indexPath:"Name", likeKey: this.key+"%",
 order:"ascending"}};
 }
 // Online
 else {
 // First time: do a MRU query
 if (this.key == null) {
 return {type:"mru", objectType:"Account",
 fieldlist: this.fieldlist};
 }
 // Other times: do a SOQL query
 else {
 var soql = "SELECT " + this.fieldlist.join(",")
 + " FROM Account"
 + " WHERE Name like '" + this.key + "%'";
 return {type:"soql", query:soql};
 }
 }
 }
});

```

This model collection uses an optional key that is the name of the account to be fetched from the collection. It also defines a `config()` function that determines what information is fetched. If the device is offline, the `config()` function builds a cache query statement. Otherwise, if no key is specified, it queries the most recently used record ("mru"). If the key is specified and the device is online, it builds a standard SOQL query that pulls records for which the name matches the key. The fetch operation on the `Force.SObjectCollection` prototype transparently uses the returned configuration to automatically fill the model collection with query records.

See [querySpec](#) for information on formatting a cache query.

 **Note:** These code examples are part of the Account Editor sample app. See [Account Editor Sample](#) for a sample description.

## Offline Caching

To provide offline support, your app must be able to cache its models and collections. SmartSync Data Framework provides a configurable mechanism that gives you full control over caching operations.

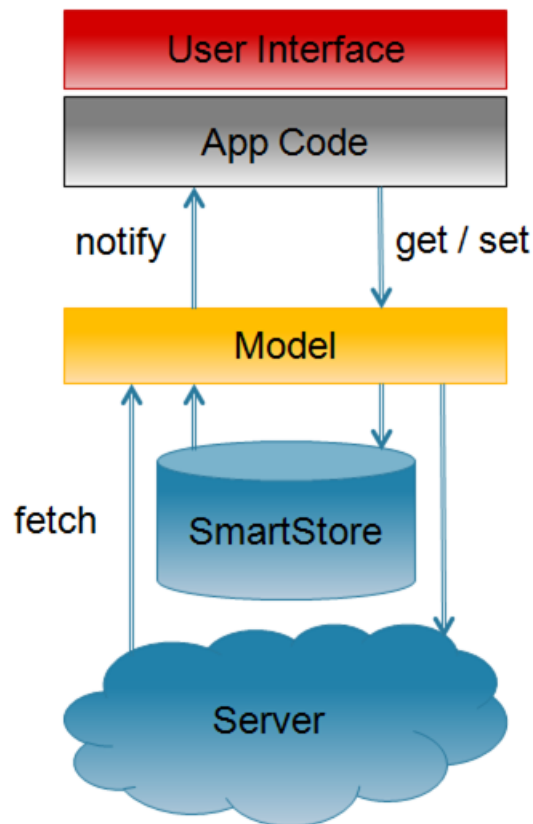
### Default Cache and Custom Cache Implementations

For its default cache, the SmartSync Data Framework library defines `StoreCache`, a cache implementation that uses `SmartStore`. Both `StoreCache` and `SmartStore` are optional components for SmartSync Data Framework apps. If your application runs in a browser instead of the Mobile SDK container, or if you don't want to use `SmartStore`, you must provide an alternate cache implementation. SmartSync Data Framework requires cache objects to support these operations:

- retrieve
- save
- save all
- remove
- find

### SmartSync Data Framework Caching Workflow

The SmartSync Data Framework model performs all interactions with the cache and the Salesforce server on behalf of your app. Your app gets and sets attributes on model objects. During save operations, the model uses these attribute settings to determine whether to write changes to the cache or server, and how to merge new data with existing data. If anything changes in the underlying data or in the model itself, the model sends event notifications. Similarly, if you request a fetch, the model fetches the data and presents it to your app in a model collection.



SmartSync Data Framework updates data in the cache transparently during CRUD operations. You can control the transparency level through optional flags. Cached objects maintain "dirty" attributes that indicate whether they've been created, updated, or deleted locally.

## Cache Modes

When you use a cache, you can specify a mode for each CRUD operation. Supported modes are:

| Mode                        | Constant                                   | Description                                                                                                                                              |
|-----------------------------|--------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| "cache-only"                | <code>Force.CACHE_MODE.CACHE_ONLY</code>   | Read from, or write to, the cache. Do not perform the operation on the server.                                                                           |
| "server-only"               | <code>Force.CACHE_MODE.SERVER_ONLY</code>  | Read from, or write to, the server. Do not perform the operation on the cache.                                                                           |
| "cache-first"               | <code>Force.CACHE_MODE.CACHE_FIRST</code>  | For FETCH operations only. Fetch the record from the cache. If the cache doesn't contain the record, fetch it from the server and then update the cache. |
| "server-first"<br>(default) | <code>Force.CACHE_MODE.SERVER_FIRST</code> | Perform the operation on the server, then update the cache.                                                                                              |

To query the cache directly, use a cache query. SmartStore provides query APIs as well as its own query language, Smart SQL. See [Retrieving Data from a Soup](#).

## Implementing Offline Caching

To support offline caching, SmartSync Data Framework requires you to supply your own implementations of a few tasks:

- Tracking offline status and specifying the appropriate cache control flag for CRUD operations, as shown in the [app.models.Account](#) example.
- Collecting records that were edited locally and saving their changes to the server when the device is back online. The following example uses a SmartStore cache query to retrieve locally changed records, then calls the `SyncPage` function to render the results in HTML.

```
sync: function() {
 var that = this;
 var localAccounts = new app.models.AccountCollection();
 localAccounts.fetch({
 config: {type:"cache", cacheQuery: {queryType:"exact",
 indexPath:"__local__", matchKey:true}},
 success: function(data) {
 that.slidePage(new app.views.SyncPage({model: data}).render());
 }
 });
}

app.views.SyncPage = Backbone.View.extend({

 template: _.template($("#sync-page").html()),

 render: function(eventName) {
 $(this.el).html(this.template(_.extend(
 {countLocallyModified: this.model.length},
 this.model.toJSON())));
 this.listView = new app.views.AccountListView(
 {el: $("ul", this.el), model: this.model});
 this.listView.render();
 return this;
 },
 ...
});
```

## Using StoreCache For Offline Caching

The `smartsync.js` library implements a cache named `StoreCache` that stores its data in SmartStore. Although SmartSync Data Framework uses `StoreCache` as its default cache, `StoreCache` is a stand-alone component. Even if you don't use SmartSync Data Framework, you can still leverage `StoreCache` for SmartStore operations.

- 📌 **Note:** Although `StoreCache` is intended for use with SmartSync Data Framework, you can use any cache mechanism with SmartSync Data Framework that meets the requirements described in [Offline Caching](#).

## Construction and Initialization

StoreCache objects work internally with SmartStore soups. To create a StoreCache object backed by the soup `soupName`, use the following constructor:

```
new Force.StoreCache(soupName [, additionalIndexSpecs, keyField])
```

### soupName

Required. The name of the underlying SmartStore soup.

### additionalIndexSpecs

Fields to include in the cache index in addition to default index fields. See [Registering a Soup](#) for formatting instructions.

### keyField

Name of field containing the record ID. If not specified, StoreCache expects to find the ID in a field named "id."

Soup items in a StoreCache object include four additional boolean fields for tracking offline edits:

- `__locally_created__`
- `__locally_updated__`
- `__locally_deleted__`
- `__local__` (set to true if any of the previous three are true)

These fields are for internal use but can also be used by apps. If your app uses the SmartSync Data Framework plugin to sync up to the server, you're probably required to create these fields in the source soup. See [Preparing Soups for SmartSync Data Framework](#) for instructions.

StoreCache indexes each soup on the `__local__` field and its ID field. You can use the `additionalIndexSpecs` parameter to specify additional fields to include in the index.

To register the underlying soup, call `init()` on the StoreCache object. This function returns a jQuery promise that resolves once soup registration is complete.

## StoreCache Methods

### init()

Registers the underlying SmartStore soup. Returns a jQuery promise that resolves when soup registration is complete.

### retrieve(key [, fieldlist])

Returns a jQuery promise that resolves to the record with `key` in the `keyField` returned by the SmartStore. The promise resolves to null when no record is found or when the found record does not include all the fields in the `fieldlist` parameter.

#### key

The key value of the record to be retrieved.

#### fieldlist

(Optional) A JavaScript array of required fields. For example:

```
["field1", "field2", "field3"]
```

### save(record [, noMerge])

Returns a jQuery promise that resolves to the saved record once the SmartStore upsert completes. If `noMerge` is not specified or is false, the passed record is merged with the server record with the same key, if one exists.

**record**

The record to be saved, formatted as:

```
{<field_name1>:"<field_value1>"[,<field_name2>:"<field_value2>",...]}
```

For example:

```
{Id:"007", Name:"JamesBond", Mission:"TopSecret"}
```

**noMerge**

(Optional) Boolean value indicating whether the passed record is to be merged with the matching server record. Defaults to false.

**saveAll(records [, noMerge])**

Identical to `save()`, except that `records` is an array of records to be saved. Returns a jQuery promise that resolves to the saved records.

**records**

An array of records. Each item in the array is formatted as demonstrated for the `save()` function.

**noMerge**

(Optional) Boolean value indicating whether the passed record is to be merged with the matching server record. Defaults to false.

**remove(key)**

Returns a jQuery promise that resolves when the record with the given key has been removed from the SmartStore.

**key**

Key value of the record to be removed.

**find(querySpec)**

Returns a jQuery promise that resolves once the query has been run against the SmartStore. The resolved value is an object with the following fields:

| Field                    | Description                                                 |
|--------------------------|-------------------------------------------------------------|
| <code>records</code>     | All fetched records                                         |
| <code>hasMore</code>     | Function to check if more records can be retrieved          |
| <code>getMore</code>     | Function to fetch more records                              |
| <code>closeCursor</code> | Function to close the open cursor and disable further fetch |

**querySpec**

A specification based on SmartStore query function calls, formatted as:

```
{queryType: "like" | "exact" | "range" | "smart"[, query_type_params]}
```

where `query_type_params` match the format of the related SmartStore query function call. See [Retrieving Data from a Soup](#).

Here are some examples:

```
{queryType:"exact", indexPath:"<indexed_field_to_match_on>", matchKey:<value_to_match>,
 order:"ascending"|"descending", pageSize:<entries_per_page>}

{queryType:"range", indexPath:"<indexed_field_to_match_on>", beginKey:<start_of_Range>,
 endKey:<end_of_range>, order:"ascending"|"descending", pageSize:<entries_per_page>}

{queryType:"like", indexPath:"<indexed_field_to_match_on>", likeKey:"<value_to_match>",
 order:"ascending"|"descending", pageSize:<entries_per_page>}

{queryType:"smart", smartSql:"<smart_sql_query>", order:"ascending"|"descending",
 pageSize:<entries_per_page>}
```

## Examples

The following example shows how to create, initialize, and use a StoreCache object.

```
var cache = new Force.StoreCache("agents", [{path:"Mission", type:"string"}]);
// initialization of the cache / underlying soup
cache.init()
.then(function() {
 // saving a record to the cache
 return cache.save({Id:"007", Name:"JamesBond", Mission:"TopSecret"});
})
.then(function(savedRecord) {
 // retrieving a record from the cache
 return cache.retrieve("007");
})
.then(function(retrievedRecord) {
 // searching for records in the cache
 return cache.find({queryType:"like", indexPath:"Mission", likeKey:"Top%",
order:"ascending", pageSize:1});
})
.then(function(result) {
 // removing a record from the cache
 return cache.remove("007");
});
```

The next example shows how to use the `saveAll()` function and the results of the `find()` function.

```
// initialization
var cache = new Force.StoreCache("agents", [{path:"Name", type:"string"}, {path:"Mission",
 type:"string"}]);
cache.init()
.then(function() {
 // saving some records
 return cache.saveAll([{Id:"007", Name:"JamesBond"},{Id:"008", Name:"Agent008"},
{Id:"009", Name:"JamesOther"}]);
})
.then(function() {
 // doing an exact query
 return cache.find({queryType:"exact", indexPath:"Name", matchKey:"Agent008",
order:"ascending", pageSize:1});
```



```

})
.then(function(result) {
 alert("Agent mission is:" + result.records[0]["Mission"]);
});

```

## Conflict Detection

Model objects support optional conflict detection to prevent unwanted data loss when the object is saved to the server. You can use conflict detection with any save operation, regardless of whether the device is returning from an offline state.

To support conflict detection, you specify a secondary cache to contain the original values fetched from the server. SmartSync Data Framework keeps this cache for later reference. When you save or delete, you specify a *merge mode*. The following table summarizes the supported modes. To understand the mode descriptions, consider "theirs" to be the current server record, "yours" the current local record, and "base" the record that was originally fetched from the server.

| Mode Constant                                        | Description                                                                                                               |
|------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| <code>Force.MERGE_MODE.OVERWRITE</code>              | Write "yours" to the server, without comparing to "theirs" or "base". (This is the same as not using conflict detection.) |
| <code>Force.MERGE_MODE.MERGE_ACCEPT_YOURS</code>     | Merge "theirs" and "yours". If the same field is changed both locally and remotely, the local value is kept.              |
| <code>Force.MERGE_MODE.MERGE_FAIL_IF_CONFLICT</code> | Merge "theirs" and "yours". If the same field is changed both locally and remotely, the operation fails.                  |
| <code>Force.MERGE_MODE.MERGE_FAIL_IF_CHANGED</code>  | Merge "theirs" and "yours". If any field is changed remotely, the operation fails.                                        |

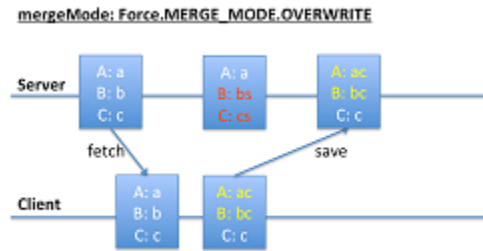
If a save or delete operation fails, you receive a report object with the following fields:

| Field Name                      | Contains                                                               |
|---------------------------------|------------------------------------------------------------------------|
| <code>base</code>               | Originally fetched attributes                                          |
| <code>theirs</code>             | Latest server attributes                                               |
| <code>yours</code>              | Locally modified attributes                                            |
| <code>remoteChanges</code>      | List of fields changed between base and theirs                         |
| <code>localChanges</code>       | List of fields changed between base and yours                          |
| <code>conflictingChanges</code> | List of fields changed both in theirs and yours, with different values |

Diagrams can help clarify how merge modes operate.

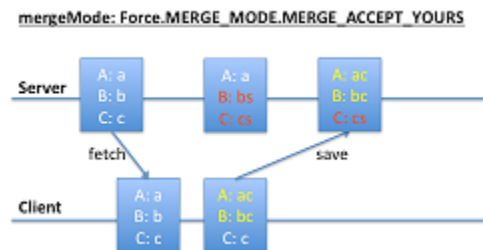
### MERGE\_MODE.OVERWRITE

In the `MERGE_MODE.OVERWRITE` diagram, the client changes A and B, and the server changes B and C. Changes to B conflict, whereas changes to A and C do not. However, the save operation blindly writes all the client's values to the server, overwriting any changes on the server.



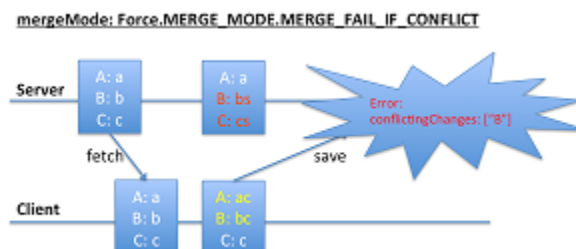
### MERGE\_MODE.ACCEPT\_YOURS

In the `MERGE_MODE.ACCEPT_YOURS` diagram, the client changes A and B, and the server changes B and C. Client changes (A and B) overwrites corresponding fields on the server, regardless of whether conflicts exist. However, fields that the client leaves unchanged (C) do not overwrite corresponding server values.



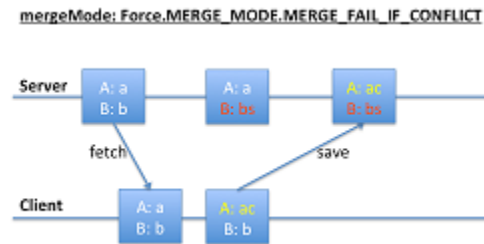
### MERGE\_FAIL\_IF\_CONFLICT (Fails)

In the first `MERGE_FAIL_IF_CONFLICT` diagram, both the client and the server change B. These conflicting changes cause the save operation to fail.



## MERGE\_FAIL\_IF\_CONFLICT (Succeeds)

In the second `MERGE_MODE.MERGE_FAIL_IF_CONFLICT` diagram, the client changed A, and the server changed B. These changes don't conflict, so the save operation succeeds.



## Mini-Tutorial: Conflict Detection

The following mini-tutorial demonstrates how merge modes affect save operations under various circumstances. It takes the form of an extended example within an HTML context.

1. Set up the necessary caches:

```
var cache = new Force.StoreCache(soupName);
var cacheForOriginals =
 new Force.StoreCache(soupNameForOriginals);
var Account = Force.SObject.extend({
 objectType:"Account",
 fieldlist:["Id", "Name", "Industry"],
 cache:cache,
 cacheForOriginals:cacheForOriginals});
```

2. Get an existing account:

```
var account = new Account({Id:<some actual account id>});
account.fetch();
```

3. Let's assume that the account has Name:"Acme" and Industry:"Software". Change the name to "Acme2."

```
Account.set("Name", "Acme2");
```

4. Save to the server without specifying a merge mode, so that the default "overwrite" merge mode is used:

```
account.save(null);
```

The account's Name is now "Acme2" and its Industry is "Software" Let's assume that Industry changes on the server to "Electronics."

5. Change the account Name again:

```
Account.set("Name", "Acme3");
```

You now have a change in the cache (Name) and a change on the server (Industry).

6. Save again, using "merge-fail-if-changed" merge mode.

```
account.save(null,
 {mergeMode: "merge-fail-if-changed", error: function(err) {
 // err will be a map of the form:
 // {base:..., theirs:..., yours:...,
```

```

 // remoteChanges:["Industry"], localChanges:["Name"],
 // conflictingChanges:[]
 });

```

The error callback is called because the server record has changed.

7. Save again, using "merge-fail-if-conflict" merge mode. This merge succeeds because no conflict exists between the change on the server and the change on the client.

```
account.save(null, {mergeMode: "merge-fail-if-conflict"});
```

The account's Name is now "Acme3" (yours) and its Industry is "Electronics" (theirs). Let's assume that, meanwhile, Name on the server changes to "NewAcme" and Industry changes to "Services."

8. Change the account Name again:

```
Account.set("Name", "Acme4");
```

9. Save again, using "merge-fail-if-changed" merge mode. The error callback is called because the server record has changed.

```

account.save(null, {mergeMode: "merge-fail-if-changed", error: function(err) {
 // err will be a map of the form:
 // {base:..., theirs:..., yours:...,
 // remoteChanges:["Name", "Industry"],
 // localChanges:["Name"], conflictingChanges:["Name"]}
});

```

10. Save again, using "merge-fail-if-conflict" merge mode:

```

account.save(null, {mergeMode: "merge-fail-if-changed", error: function(err) {
 // err will be a map of the form:
 // {base:..., theirs:..., yours:...,
 // remoteChanges:["Name", "Industry"],
 // localChanges:["Name"], conflictingChanges:["Name"]}
});

```

The error callback is called because both the server and the cache change the Name field, resulting in a conflict:

11. Save again, using "merge-accept-yours" merge mode. This merge succeeds because your merge mode tells the `save()` function which Name value to accept. Also, since you haven't changed Industry, that field doesn't conflict.

```
account.save(null, {mergeMode: "merge-accept-yours"});
```

Name is "Acme4" (yours) and Industry is "Services" (theirs), both in the cache and on the server.

## Accessing Custom API Endpoints

In Mobile SDK 2.1, SmartSync expands its scope to let you work with any REST API. Previously, you could only perform basic operations on sObjects with the Lightning Platform API. Now you can use SmartSync with Apex REST objects, Chatter Files, and any other Salesforce REST API. You can also call non-Salesforce REST APIs.

### Force.RemoteObject Class

To support arbitrary REST calls, SmartSync Data Framework introduces the `Force.RemoteObject` abstract class. `Force.RemoteObject` serves as a layer of abstraction between `Force.SObject` and `Backbone.Model`. Instead of directly subclassing `Backbone.Model`, `Force.SObject` now subclasses `Force.RemoteObject`, which in turn subclasses

`Backbone.Model.Force.RemoteObject` does everything `Force.SObject` formerly did except communicate with the server.

### Calling Custom Endpoints with `syncRemoteObjectWithServer()`

The `RemoteObject.syncRemoteObjectWithServer()` prototype method handles server interactions. `Force.SObject` implements `syncRemoteObjectWithServer()` to use the Lightning Platform REST API. If you want to use other server endpoints, create a subclass of `Force.RemoteObject` and implement `syncRemoteObjectWithServer()`. This method is called when you call `fetch()` on an object of your subclass, if the object is currently configured to fetch from the server.

#### Example: Example

The FileExplorer sample application is a SmartSync Data Framework app that shows how to use `Force.RemoteObject`. `HybridFileExplorer` calls the Chatter REST API to manipulate files. It defines an `app.models.File` object that extends `Force.RemoteObject`. In its implementation of `syncRemoteObjectWithServer()`, `app.models.File` calls `Force.forceJsClient.fileDetails()`, which wraps the `/chatter/files/fileId` REST API.

```
app.models.File = Force.RemoteObject.extend({
 syncRemoteObjectWithServer: function(method, id) {
 if (method !== "read")
 throw "Method not supported " + method;
 return Force.forceJsClient.fileDetails(id, null);
 }
});
```

### Force.RemoteObjectCollection Class

To support collections of fetched objects, SmartSync Data Framework introduces the `Force.RemoteObjectCollection` abstract class. This class serves as a layer of abstraction between `Force.SObjectCollection` and `Backbone.Collection`. Instead of directly subclassing `Backbone.Collection`, `Force.SObjectCollection` now subclasses `Force.RemoteObjectCollection`, which in turn subclasses `Backbone.Collection`. `Force.RemoteObjectCollection` does everything `Force.SObjectCollection` formerly did except communicate with the server.

### Implementing Custom Endpoints with `fetchRemoteObjectFromServer()`

The `RemoteObject.fetchRemoteObjectFromServer()` prototype method handles server interactions. This method uses the REST API to run SOQL/SOSL and MRU queries. If you want to use arbitrary server endpoints, create a subclass of `Force.RemoteObjectCollection` and implement `fetchRemoteObjectFromServer()`. This method is called when you call `fetch()` on an object of your subclass, if the object is currently configured to fetch from the server.

When the `app.models.FileCollection.fetchRemoteObjectsFromServer()` function returns, it promises an object containing valuable information and useful functions that use metadata from the response. This object includes:

- `totalSize`: The number of files in the returned collection
- `records`: The collection of returned files
- `hasMore`: A function that returns a boolean value that indicates whether you can retrieve another page of results
- `getMore`: A function that retrieves the next page of results (if `hasMore()` returns true)
- `closeCursor`: A function that indicates that you're finished iterating through the collection

These functions leverage information contained in the server response, including `Files.length` and `nextPageUrl`.

 **Example: Example**

The HybridFileExplorer sample application also demonstrates how to use `Force.RemoteObjectCollection`. This example calls the Chatter REST API to iterate over a list of files. It supports three REST operations: `ownedFilesList`, `filesInUsersGroups`, and `filesSharedWithUser`.

You can write functions such as `hasMore()` and `getMore()`, shown in this example, to navigate through pages of results. However, since apps don't call `fetchRemoteObjectsFromServer()` directly, you capture the returned promise object when you call `fetch()` on your collection object.

```
app.models.FileCollection = Force.RemoteObjectCollection.extend({
 model: app.models.File,

 setCriteria: function(key) {
 this.config = {type:key};
 },

 fetchRemoteObjectsFromServer: function(config) {
 var fetchPromise;
 switch(config.type) {
 case "ownedFilesList": fetchPromise =
 Force.forceJsClient.ownedFilesList("me", 0);
 break;
 case "filesInUsersGroups": fetchPromise =
 Force.forceJsClient.
 filesInUsersGroups("me", 0);
 break;
 case "filesSharedWithUser": fetchPromise =
 Force.forceJsClient.
 filesSharedWithUser("me", 0);
 break;
 }
 };

 return fetchPromise
 .then(function(resp) {
 var nextPageUrl = resp.nextPageUrl;
 return {
 totalSize: resp.files.length,
 records: resp.files,
 hasMore: function() {
 return nextPageUrl != null; },
 getMore: function() {
 var that = this;
 if (!nextPageUrl)
 return null;
 return
 forceJsClient.queryMore(nextPageUrl)
 .then(function(resp) {
 nextPageUrl = resp.nextPageUrl;
 that.records.
 pushObjects(resp.files);
 return resp.files;
 });
 },
 closeCursor: function() {
```

```

 return $.when(function() {
 nextPageUrl = null;
 });
 });
}
});

```

## Using Apex REST Resources

To support Apex REST resources, Mobile SDK provides two classes: `Force.ApexRestObject` and `Force.ApexRestObjectCollection`. These classes subclass `Force.RemoteObject` and `Force.RemoteObjectCollection`, respectively, and can talk to a REST API that you have created using Apex REST.

### Force.ApexRestObject

`Force.ApexRestObject` is similar to `Force.SObject`. Instead of an `subjectType`, `Force.ApexRestObject` requires the Apex REST resource path relative to `services/apexrest`. For example, if your full resource path is `services/apexrest/simpleAccount/*`, you specify only `/simpleAccount/*`. `Force.ApexRestObject` also expects you to specify the name of your ID field if it's different from "Id".

#### Example: Example

Let's assume you've created an Apex REST resource called "simple account," which is just an account with two fields: `accountId` and `accountName`.

```

@RestResource(urlMapping='/simpleAccount/*')
global with sharing class SimpleAccountResource {
 static String getIdFromURI() {
 RestRequest req = RestContext.request;
 return req.requestURI.substring(req.requestURI.lastIndexOf('/')+1);
 }

 @HttpGet global static Map<String, String> doGet() {
 String id = getIdFromURI();
 Account acc = [select Id, Name from Account
 where Id = :id];
 return new Map<String, String>{
 'accountId'=>acc.Id, 'accountName'=>acc.Name};
 }

 @HttpPost global static Map<String, String>
 doPost(String accountName) {
 Account acc = new Account(Name=accountName);
 insert acc;
 return new Map<String, String>{
 'accountId'=>acc.Id, 'accountName'=>acc.Name};
 }

 @HttpPatch global static Map<String, String>
 doPatch(String accountName) {
 String id = getIdFromURI();
 }
}

```

```

 Account acc = [select Id from Account
 where Id = :id];
 acc.Name = accountName;
 update acc;
 return new Map<String, String>{
 'accountId'=>acc.Id, 'accountName'=>acc.Name;
 }
 }

 @HttpDelete global static void doDelete() {
 String id = getIdFromURI();
 Account acc = [select Id from Account where Id = :id];
 delete acc;
 RestContext.response.statusCode = 204;
 }
}

```

With SmartSync Data Framework, you do the following to create a "simple account".

```

var SimpleAccount = Force.ApexRestObject.extend(
 {apexRestPath:"/simpleAccount",
 idAttribute:"accountId",
 fieldlist:["accountId", "accountName"]});
var acc = new SimpleAccount({accountName:"MyFirstAccount"});
acc.save();

```

You can update that "simple account".

```

acc.set("accountName", "MyFirstAccountUpdated");
acc.save(null, {fieldlist:["accountName"]});
// our apex patch endpoint only expects accountName

```

You can fetch another "simple account".

```

var acc2 = new SimpleAccount({accountId:"&valid id&"});
acc2.fetch();


```

You can delete a "simple account".

```

acc.destroy();

```

 **Note:** In SmartSync Data Framework calls such as `fetch()`, `save()`, and `destroy()`, you typically pass an options parameter that defines success and error callback functions. For example:

```

acc.destroy({success:function(){alert("delete succeeded");}});

```

### Force.ApexRestObjectCollection

`Force.ApexRestObjectCollection` is similar to `Force.SObjectCollection`. The config you specify for fetching doesn't support SOQL, SOSL, or MRU. Instead, it expects the Apex REST resource path, relative to `services/apexrest`. For example, if your full resource path is `services/apexrest/simpleAccount/*`, you specify only `/simpleAccount/*`.



You can also pass parameters for the query string if your endpoint supports them. The Apex REST endpoint is expected to return a response in this format:

```
{
 totalSize: <number of records returned>
 records: <all fetched records>
 nextRecordsUrl: <url to get next records or null>
}
```

### Example: Example

Let's assume you've created an Apex REST resource called "simple accounts". It returns "simple accounts" that match a given name.

```
@RestResource(urlMapping='/simpleAccounts/*')
global with sharing class SimpleAccountsResource {
 @HttpGet global static SimpleAccountsList doGet() {
 String namePattern =
 RestContext.request.params.get('namePattern');
 List<SimpleAccount> records = new List<SimpleAccount>();
 for (SObject sobj : Database.query(
 'select Id, Name from Account
 where Name like \'' + namePattern + '\')) {
 Account acc = (Account) sobj;
 records.add(new
 SimpleAccount(acc.Id, acc.Name));
 }
 return new SimpleAccountsList(records.size(), records);
 }
}

global class SimpleAccountsList {
 global Integer totalSize;
 global List<SimpleAccount> records;

 global SimpleAccountsList(Integer totalSize,
 List<SimpleAccount> records) {
 this.totalSize = totalSize;
 this.records = records;
 }
}

global class SimpleAccount {
 global String accountId;
 global String accountName;

 global SimpleAccount(String accountId, String accountName)
 {
 this.accountId = accountId;
 this.accountName = accountName;
 }
}
}
```


With SmartSync Data Framework, you do the following to fetch a list of "simple account" records.

```
var SimpleAccountCollection =
 Force.ApexRestObjectCollection.extend(
 {model: SimpleAccount,
```

```

 config:{
 apexRestPath:"/simpleAccounts",
 params:{namePattern:"My%"}
 }
 };
var accs = new SimpleAccountCollection();
accs.fetch();

```

 **Note:** In SmartSync Data Framework calls such as `fetch()`, you typically pass an options parameter that defines success and error callback functions. For example:

```

acc.fetch({success:function(){alert("fetched " +
 accs.models.length + " simple accounts");}}});

```

## Tutorial: Creating a Hybrid SmartSync Data Framework Application

This tutorial demonstrates how to create a local hybrid app that uses the SmartSync Data Framework. It recreates the UserSearch sample application that ships with Mobile SDK. UserSearch lets you search for User records in a Salesforce organization and see basic details about them.

This sample uses the following web technologies:

- Backbone.js
- Ratchet
- HTML5
- JavaScript

### Create a Template Project

First, make sure you've installed Salesforce Mobile SDK using the NPM installer. For iOS instructions, see [iOS Preparation](#). For Android instructions, see [Android Preparation](#).

Also, download the `ratchet.css` file from <http://goratchet.com/>.

Once you've installed Mobile SDK, create a local hybrid project for your platform.

1. At a Terminal window or Windows command prompt, run the `forcehybrid create` command using the following values:

| Prompt (or Parameter)                         | Value                                                                                           |
|-----------------------------------------------|-------------------------------------------------------------------------------------------------|
| Platform ( <code>--platform</code> )          | <i>ios, android, or ios, android</i>                                                            |
| Application type ( <code>--apptype</code> )   | <i>hybrid_local</i>                                                                             |
| Application name ( <code>--appname</code> )   | <i>UserSearch</i>                                                                               |
| Package name ( <code>--packagename</code> )   | <i>com.acme.usersearch</i>                                                                      |
| Organization ( <code>--organization</code> )  | <i>"Acme Widgets, Inc."</i>                                                                     |
| Output directory ( <code>--outputdir</code> ) | Leave blank for current directory, or enter a name to create a new subdirectory for the project |

Here's a command line example:

```
forcehybrid create --platform=ios,android --apptype=hybrid_local
 --appname=UserSearch --packagename=com.acme.usersearch
 --organization="Acme Widgets, Inc." --outputdir=""
```

2. Copy all files—actual and symbolic—from the `samples/usersearch` directory of the <https://github.com/forcedotcom/SalesforceMobileSDK-Shared/> repository into the `www/` folder, as follows:

- In a Mac OS X terminal window, change to your project's root directory—`./UserSearch/`—and type this command:

```
cp -RL <insert local path to SalesforceMobileSDK-Shared>/samples/UserSearch/* www/
```

- In Windows, make sure that every file referenced in the `<shared_repo>\samples\usersearch` folder also appears in your `<project_name>\www` folder. Resolve the symbolic links explicitly, as shown in the following script:

```
cd <your project's root directory>
set SHARED_REPO=<insert local path to SalesforceMobileSDK-Shared>
copy %SHARED_REPO%\samples\usersearch\UserSearch.html www
copy %SHARED_REPO%\samples\usersearch\bootconfig.json www
copy %SHARED_REPO%\dependencies\ratchet\ratchet.css www
copy %SHARED_REPO%\samples\common\styles.css www
copy %SHARED_REPO%\test\MockCordova.js www
copy %SHARED_REPO%\samples\common\auth.js www
copy %SHARED_REPO%\dependencies\backbone\backbone-min.js www
copy %SHARED_REPO%\libs\cordova.force.js www
copy %SHARED_REPO%\dependencies\fastclick\fastclick.js www
copy %SHARED_REPO%\libs\force.js www
copy %SHARED_REPO%\libs\force+promise.js www
copy %SHARED_REPO%\dependencies\jquery\jquery.min.js www
copy %SHARED_REPO%\libs\smartsync.js www
copy %SHARED_REPO%\samples\common\stackrouter.js www
copy %SHARED_REPO%\dependencies\underscore\underscore-min.js www
```

3. Run the following command:

```
cordova prepare
```

4. Open the `platforms/android/` project folder in Android Studio (for Android) or Xcode (for iOS) by following the onscreen instructions printed by forcehybrid.
5. From the `www` folder, open `UserSearch.html` in your code editor and delete all its contents.

## Edit the Application HTML File

To create your app's basic structure, define an empty HTML page that contains references, links, and code infrastructure.

1. From the `www` folder, open `UserSearch.html` in your code editor and delete all its contents.
2. Delete the contents and add the following basic structure:

```
<!DOCTYPE html>
<html>
 <head>
 </head>
 <body>
```

```

</body>
</html>

```

3. In the <head> element:

a. Specify that the page title is “Users”.

```
<title>Users</title>
```

b. Turn off scaling to make the page look like an app rather than a web page.

```
<meta name="viewport" content="width=device-width, initial-scale=1.0,
 maximum-scale=1.0, user-scalable=no;" />
```

c. Provide a mobile “look” by adding links to the styles.css and ratchet.css files.

```
<link rel="stylesheet" href="css/styles.css"/>
<link rel="stylesheet" href="css/ratchet.css"/>
```

4. Now let’s start adding content to the body. In the <body> block, add an empty div tag, with ID set to “content”, to contain the app’s generated UI.

```
<body>
<div id="content"></div>
```

5. Include the necessary JavaScript files.

```
<script src="js/jquery.min.js"></script>
<script src="js/underscore-min.js"></script>
<script src="js/backbone-min.js"></script>
<script src="cordova.js"></script>
<script src="js/force.js"></script>
<script src="js/force+promise.js"></script>
<script src="js/smartsync.js"></script>
<script src="js/fastclick.js"></script>
<script src="js/stackrouter.js"></script>
<script src="js/auth.js"></script>
```



**Example:** Here’s the complete application to this point.

```
<!DOCTYPE html>
<html>
 <head>
 <title>Users</title>
 <meta name="viewport" content="width=device-width,
 initial-scale=1.0, maximum-scale=1.0;
 user-scalable=no" />
 <link rel="stylesheet" href="css/styles.css"/>
 <link rel="stylesheet" href="css/ratchet.css"/>
 </head>
 <body>
 <div id="content"></div>
 <script src="js/jquery.min.js"></script>
 <script src="js/underscore-min.js"></script>
 <script src="js/backbone-min.js"></script>
```

```

 <script src="cordova.js"></script>
 <script src="js/force.js"></script>
 <script src="js/force+promise.js"></script>
 <script src="js/smartsync.js"></script>
 <script src="js/fastclick.js"></script>
 <script src="js/stackrouter.js"></script>
 <script src="js/auth.js"></script>
 </body>
</html>

```

## Create a SmartSync Data Framework Model and a Collection

Now that we've configured the HTML infrastructure, let's get started using SmartSync Data Framework by extending two of its primary objects:

- `Force.SObject`
- `Force.SObjectCollection`

These objects extend `Backbone.Model`, so they support the `Backbone.Model.extend()` function. To extend an object using this function, pass it a JavaScript object containing your custom properties and functions.

1. In the `<body>` tag, create a `<script>` object.
2. In the `<script>` tag, create a model object for the Salesforce user `sObject`. Extend `Force.SObject`, and specify the `sObject` type and the fields we are targeting.

```

app.models.User = Force.SObject.extend({
 objectType: "User",
 fieldlist: ["Id", "FirstName", "LastName",
 "SmallPhotoUrl", "Title", "Email",
 "MobilePhone", "City"]
});

```

3. Immediately after setting the `User` object, create a `UserCollection` object to hold user search results. Extend `Force.SObjectCollection`, and specify your new model (`app.models.User`) as the model for items in the collection.

```

app.models.UserCollection = Force.SObjectCollection.extend({
 model: app.models.User,
 fieldlist: ["Id", "FirstName", "LastName",
 "SmallPhotoUrl", "Title"],
});

```

4. In this collection, implement a function named `setCriteria` that takes a search key and builds a SOQL query using it. You also need a getter to return the key at a later point.

```

<script>
 // The Models
 // =====
 // The User Model
 app.models.User = Force.SObject.extend({
 objectType: "User",
 fieldlist: ["Id", "FirstName",
 "LastName", "SmallPhotoUrl",
 "Title", "Email",

```

```


 "MobilePhone","City"]
 });

 // The UserCollection Model
 app.models.UserCollection = Force.SObjectCollection.extend({
 model: app.models.User
 fieldlist: ["Id", "FirstName", "LastName",
 "SmallPhotoUrl", "Title"],

 getCriteria: function() {
 return this.key;
 },

 setCriteria: function(key) {
 this.key = key;
 this.config = {type:"soql", query:"SELECT "
 + this.fieldlist.join(",")
 + " FROM User"
 + " WHERE Name like '" + key + "%'"
 + " ORDER BY Name "
 + " LIMIT 25 "
 };
 }
 });
</script>

```

 **Example:** Here's the complete model code.

```

<script>
 // The Models

 // The User Model
 app.models.User = Force.SObject.extend({
 objectType: "User",
 fieldlist: ["Id", "FirstName", "LastName",
 "SmallPhotoUrl", "Title", "Email",
 "MobilePhone","City"]
 });

 // The UserCollection Model
 app.models.UserCollection = Force.SObjectCollection.extend({
 model: app.models.User
 fieldlist: ["Id", "FirstName", "LastName",
 "SmallPhotoUrl", "Title"],

 getCriteria: function() {
 return this.key;
 },

 setCriteria: function(key) {
 this.key = key;
 this.config = {
 type:"soql",
 query:"SELECT " + this.fieldlist.join(",")
 };
 }
 });
</script>

```

```

 + " FROM User"
 + " WHERE Name like '" + key + "%'"
 + " ORDER BY Name "
 + " LIMIT 25 "
 };
 }
 });
</script>

```

## Create View Templates

Templates let you describe an HTML layout within a container HTML page. To define an inline template in your HTML page, you use a `<script>` tag of type "text/template". JavaScript code can apply your template to the page design when it instantiates a new HTML page at runtime.

The `search-page` template is simple. It includes a header, a search field, and a list to hold the search results. At runtime, the search page instantiates the `user-list-item` template to render the results list. When a customer clicks a list item, the list instantiates the `user-page` template to show user details.

1. Add a template script block with an ID set to "search-page". Place the block within the `<body>` block after the "content" `<div>` tag.

```

<script id="search-page" type="text/template">
</script>

```

2. In the new `<script>` block, define the search page HTML template using Ratchet styles.

```

<script id="search-page" type="text/template">
 <header class="bar-title">
 <h1 class="title">Users</h1>
 </header>

 <div class="bar-standard bar-header-secondary">
 <input type="search" class="search-key"
 placeholder="Search"/>
 </div>

 <div class="content">
 <ul class="list">
 </div>
</script>

```

3. Add a second script block for a user list template.

```

<script id="user-list-item" type="text/template">
</script>

```

4. Define the user list template. Notice that this template contains references to the `SmallPhotoUrl`, `FirstName`, `LastName`, and `Title` fields from the Salesforce user record. References that use the `<%= varname %>` format are called "free variables" in Ratchet apps.

```

<script id="user-list-item" type="text/template">
 <a href="#users/<%= Id %>" class="pad-right">


```

```

 <div class="details-short">
 <%= FirstName %> <%= LastName %>

 Title<%= Title %>
 </div>

</script>

```

5. Add a third script block for a user details template.

```

<script id="user-page" type="text/template">
</script>

```

6. Add the template body. Notice that this template contains references to the `SmallPhotoUrl`, `FirstName`, `LastName`, and `Title` fields from the Salesforce user record. References that use the `<%= varname %>` format in Ratchet apps are called "free variables".

```

<script id="user-page" type="text/template">
 <header class="bar-title">
 Back
 <h1 class="title">User</h1>
 </header>

 <footer class="bar-footer">

 </footer>

 <div class="content">
 <div class="content-padded">

 <div class="details">
 <%= FirstName %> <%= LastName %>

 <%= Id %>

 <% if (Title) { %><%= Title %>
<% } %>
 <% if (City) { %><%= City %>
<% } %>
 <% if (MobilePhone) { %> <a
 href="tel:<%= MobilePhone %>"
 <%= MobilePhone %>
<% } %>
 <% if (Email) { %><a
 href="mailto:<%= Email %>"
 <%= Email %><% } %>
 </div>
 </div>
 </div>
</script>

```

## Add the Search View

To create the view for a screen, you extend `Backbone.View`. Let's start by defining the search view. In this extension, you load the template, define subviews and event handlers, and implement the functionality for rendering the views and performing a SOQL search query.



1. In the `<script>` block where you defined the `User` and `UserCollection` models, create a `Backbone.View` extension named `SearchPage` in the `app.views` array.

```
app.views.SearchPage = Backbone.View.extend({
});
```

For the remainder of this procedure, add all code to the `extend({})` block. Each step adds another item to the implementation list and therefore ends with a comma, until the last item.

2. Load the search-page template by calling the `_.template()` function. Pass it the raw HTML content of the `search-page` script tag.

```
template: _.template($("#search-page").html()),
```

3. Add a `keyup` event. You define the `search` handler function a little later.

```
events: {
 "keyup .search-key": "search"
},
```

4. Instantiate a subview named `UserListView` that contains the list of search results. (You define `app.views.UserListView` later.)


```
initialize: function() {
 this.listView = new app.views.UserListView({model: this.model});
},
```

5. Create a `render()` function for the search page view. Rendering the view consists of loading the template as the app's HTML content. Restore any criteria previously typed in the search field and render the subview inside the `<ul>` element.

```
render: function(eventName) {
 $(this.el).html(this.template());
 $(".search-key", this.el).val(this.model.getCriteria());
 this.listView.setElement($("#ul", this.el)).render();
 return this;
},
```

6. Implement the `search` function. This function is the `keyup` event handler that performs a search when the customer types a character in the search field.

```
search: function(event) {
 this.model.setCriteria($(".search-key", this.el).val());
 this.model.fetch();
}
```

-  **Example:** Here's the complete extension.

```
app.views.SearchPage = Backbone.View.extend({
 template: _.template($("#search-page").html()),
 events: {
 "keyup .search-key": "search"
 },
 initialize: function() {
```

```

 this.listView = new app.views.UserListView({model: this.model});
 },
 render: function(eventName) {
 $(this.el).html(this.template());
 $(".search-key", this.el).val(this.model.getCriteria());
 this.listView.setElement($(".ul", this.el)).render();
 return this;
 },
 search: function(event) {
 this.model.setCriteria($(".search-key", this.el).val());
 this.model.fetch();
 }
});

```

## Add the Search Result List View

The view for the search result list doesn't need a template. It is simply a container for list item views. It tracks these views in the `listItemViews` member. If the underlying collection changes, it re-renders itself.

1. In the `<script>` block that contains the `SearchPage` view, extend `Backbone.View` to show a list of search view results. Add an array for list item views and an `initialize()` function.

```

app.views.UserListView = Backbone.View.extend({
 listItemViews: [],
 initialize: function() {
 this.model.bind("reset", this.render, this);
 },

```

For the remainder of this procedure, add all code to the `extend({})` block.

2. Create the `render()` function. This function cleans up any existing list item views by calling `close()` on each one.

```

 render: function(eventName) {
 _.each(this.listItemViews,
 function(itemView) { itemView.close(); });

```

3. Still in the `render()` function, create a set of list item views for the records in the underlying collection. Each of these views is just an entry in the list. You define `app.views.UserListItemView` later.

```

 this.listItemViews = _.map(this.model.models, function(model) { return new
 app.views.UserListItemView({model: model}); });


```

4. Still in the `render()` function, append each list item view to the root DOM element and then return the rendered `UserListView` object.

```

 $(this.el).append(_.map(this.listItemViews, function(itemView) {
 return itemView.render().el; }));
 return this;
}

```

 **Example:** Here's the complete extension:

```
app.views.UserListView = Backbone.View.extend({
 listItemViews: [],

 initialize: function() {
 this.model.bind("reset", this.render, this);
 },
 render: function(eventName) {
 _.each(this.listItemViews, function(itemView) {
 itemView.close(); });
 this.listItemViews = _.map(this.model.models,
 function(model) {
 return new app.views.UserListItemView(
 {model: model}); });
 $(this.el).append(_.map(this.listItemViews,
 function(itemView) {
 return itemView.render().el;
 }));
 return this;
 }
});
```

## Add the Search Result List Item View

To define the search result list item view, you design and implement the view of a single row in a list. Each list item displays the following user fields:

- SmallPhotoUrl
- FirstName
- LastName
- Title

1. Immediately after the `UserListView` view definition, create the view for the search result list item. Once again, extend `Backbone.View` and indicate that this view is a list item by defining the `tagName` member. For the remainder of this procedure, add all code in the `extend({})` block.

```
app.views.UserListItemView = Backbone.View.extend({
});
```

2. Add an `<li>` tag.

```
app.views.UserListItemView = Backbone.View.extend({
 tagName: "li",
});
```

3. Load the template by calling `_.template()` with the raw content of the `user-list-item` script.

```
template: _.template($("#user-list-item").html()),
```


4. Add a `render()` function. The `template()` function, from `underscore.js`, takes JSON data and returns HTML crafted from the associated template. In this case, the function extracts the customer's data from JSON and returns HTML that conforms to

the `user-list-item` template. During the conversion to HTML, the `template()` function replaces free variables in the template with corresponding properties from the JSON data.

```
render: function(eventName) {
 $(this.el).html(this.template(this.model.toJSON()));
 return this;
},
```

5. Add a `close()` method to be called from the list view that does necessary cleanup and stops memory leaks.

```
close: function() {
 this.remove();
 this.off();
}
```

 **Example:** Here's the complete extension.

```
app.views.UserListItemView = Backbone.View.extend({
 tagName: "li",
 template: _.template($("#user-list-item").html()),
 render: function(eventName) {
 $(this.el).html(this.template(this.model.toJSON()));
 return this;
 },
 close: function() {
 this.remove();
 this.off();
 }
});
```

## Add the User View

Finally, you add a simple page view that displays a selected customer's details. This view is the second page in this app. The customer navigates to it by tapping an item in the Users list view. The `user-page` template defines a **Back** button that returns the customer to the search list.

1. Immediately after the `UserListItemView` view definition, create the view for a customer's details. Extend `Backbone.View` again. For the remainder of this procedure, add all code in the `extend({})` block.

```
app.views.UserPage = Backbone.View.extend({
});
```

2. Specify the template to be instantiated.

```
app.views.UserPage = Backbone.View.extend({
 template: _.template($("#user-page").html()),
});
```


3. Implement a `render()` function. This function re-reads the model and converts it first to JSON and then to HTML.

```
app.views.UserPage = Backbone.View.extend({
 template: _.template($("#user-page").html()),
```

```

 render: function(eventName) {
 $(this.el).html(this.template(this.model.toJSON()));
 return this;
 }
 });

```

 **Example:** Here's the complete extension.

```

app.views.UserPage = Backbone.View.extend({
 template: _.template($("#user-page").html()),
 render: function(eventName) {
 $(this.el).html(this.template(this.model.toJSON()));
 return this;
 }
});

```

## Define a Router

A Backbone router defines navigation paths among views. To learn more about routers, see [What is a router?](#)

1. In the final `<script>` block, define the application router by extending `Backbone.StackRouter`.

```

app.Router = Backbone.StackRouter.extend({
});

```

For the remainder of this procedure, add all code in the `extend({})` block.

2. Because the app supports a search list page and a user page, add a route for each page inside a `routes` object. Also add a route for the main container page (`""`).

```

routes: {
 "": "list",
 "list": "list",
 "users/:id": "viewUser"
},

```

3. Define an `initialize()` function that creates the search results collection and the search page and user page views.

```

initialize: function() {
 Backbone.Router.prototype.initialize.call(this);

 // Collection behind search screen
 app.searchResults = new app.models.UserCollection();

 app.searchPage = new app.views.SearchPage(
 {model: app.searchResults});
 app.userPage = new app.views.UserPage();
},

```

4. Define the `list()` function for handling the only item in this route. Call `slidePage()` to show the search results page right away—when data arrives, the list redraws itself.

```
list: function() {
 app.searchResults.fetch();
 this.slidePage(app.searchPage);
},
```

5. Define a `viewUser()` function that fetches and displays details for a specific user.

```
viewUser: function(id) {
 var that = this;
 var user = new app.models.User({Id: id});
 user.fetch({
 success: function() {
 app.userPage.model = user;
 that.slidePage(app.userPage);
 }
 });
}
```

6. After saving the file, run the `cordova prepare` command.
7. Run the application.



**Example:** You've finished! Here's the entire application:

```
<!DOCTYPE html>
<html>
<head>
<title>Users</title>
<meta name="viewport" content="width=device-width, initial-scale=1.0, maximum-scale=1.0,
 user-scalable=no;" />
<link rel="stylesheet" href="css/styles.css"/>
<link rel="stylesheet" href="css/ratchet.css"/>
</head>

<body>

<div id="content"></div>
<script src="js/jquery.min.js"></script>
<script src="js/underscore-min.js"></script>
<script src="js/backbone-min.js"></script>

<!-- Local Testing -->
<script src="js/MockCordova.js"></script>
<script src="js/cordova.force.js"></script>
<script src="js/MockSmartStore.js"></script>
<!-- End Local Testing -->

<!-- Container -->
<script src="cordova.js"></script>
<!-- End Container -->

<script src="js/force.js"></script>
<script src="js/force+promise.js"></script>
```

```

<script src="js/smartsync.js"></script>
<script src="js/fastclick.js"></script>
<script src="js/stackrouter.js"></script>
<script src="js/auth.js"></script>

<!-- ----Search page template ---- -->
<script id="search-page" type="text/template">
 <header class="bar-title">
 <h1 class="title">Users</h1>
 </header>

 <div class="bar-standard bar-header-secondary">
 <input type="search"
 class="search-key"
 placeholder="Search"/>
 </div>

 <div class="content">
 <ul class="list">
 </div>
</script>

<!-- ---- User list item template ---- -->
<script id="user-list-item" type="text/template">

 <a href="#users/<%= Id %>" class="pad-right">

 <div class="details-short">
 <%= FirstName %> <%= LastName %>

 Title<%= Title %>
 </div>

</script>

<!-- ---- User page template ---- -->
<script id="user-page" type="text/template">
 <header class="bar-title">
 Back
 <h1 class="title">User</h1>
 </header>

 <footer class="bar-footer">

 </footer>

 <div class="content">
 <div class="content-padded">

 <div class="details">
 <%= FirstName %> <%= LastName %>

 <%= Id %>

 <% if (Title) { %><%= Title %>
<% } %>
 </div>
 </div>
 </div>

```

```

 <% if (City) { %><%= City %>
<% } %>
 <% if (MobilePhone) { %>
 <a href="tel:<%= MobilePhone %>">
 <%= MobilePhone %>
<% } %>
 <% if (Email) { %>
 <a href="mailto:<%= Email %>">
 <%= Email %><% } %>
 </div>
</div>
</div>
</script>

<script>
// ---- The Models ---- //
// The User Model
app.models.User = Force.SObject.extend({
 objectType: "User",
 fieldlist: ["Id", "FirstName", "LastName", "SmallPhotoUrl",
 "Title", "Email", "MobilePhone", "City"]
});

// The UserCollection Model
app.models.UserCollection = Force.SObjectCollection.extend({
 model: app.models.User,
 fieldlist: ["Id", "FirstName", "LastName", "SmallPhotoUrl",
 "Title"],

 getCriteria: function() {
 return this.key;
 },

 setCriteria: function(key) {
 this.key = key;
 this.config = {type:"soql",
 query:"SELECT "
 + this.fieldlist.join(",")
 + " FROM User"
 + " WHERE Name like '" + key + "%'"
 + " ORDER BY Name "
 + " LIMIT 25 "
 };
 }
});

// ----- The Views -----
// ----- //

app.views.SearchPage = Backbone.View.extend({
 template: _.template($("#search-page").html()),
 events: {
 "keyup .search-key": "search"
 }
});

```



```

 },

 initialize: function() {
 this.listView =
 new app.views.UserListView(
 {model: this.model});
 },

 render: function(eventName) {
 $(this.el).html(this.template());
 $(".search-key", this.el).val(this.model.getCriteria());
 this.listView.setElement($("#ul", this.el)).render();
 return this;
 },

 search: function(event) {
 this.model.setCriteria($(".search-key", this.el).val());
 this.model.fetch();
 }
 });

 app.views.UserListView = Backbone.View.extend({

 listItemViews: [],

 initialize: function() {
 this.model.bind("reset", this.render, this);
 },

 render: function(eventName) {
 _.each(this.listItemViews,
 function(itemView) {itemView.close(); });
 this.listItemViews =
 _.map(this.model.models, function(model) {
 return new app.views.UserListItemView(
 {model: model}); });
 $(this.el).append(_.map(this.listItemViews,
 function(itemView) {
 return itemView.render().el; }));
 return this;
 }
 });

 app.views.UserListItemView = Backbone.View.extend({

 tagName: "li",
 template: _.template($("#user-list-item").html()),

 render: function(eventName) {
 $(this.el).html(this.template(this.model.toJSON()));
 return this;
 },

 close: function() {

```

```

 this.remove();
 this.off();
 }
});

app.views.UserPage = Backbone.View.extend({

 template: _.template($("#user-page").html()),

 render: function(eventName) {
 $(this.el).html(this.template(this.model.toJSON()));
 return this;
 }

});

// ----- The Application Router
// -----

app.Router = Backbone.StackRouter.extend({

 routes: {
 "": "list",
 "list": "list",
 "users/:id": "viewUser"
 },

 initialize: function() {
 Backbone.Router.prototype.initialize.call(this);

 // Collection behind search screen
 app.searchResults = new app.models.UserCollection();

 // We keep a single instance of SearchPage and UserPage
 app.searchPage = new app.views.SearchPage(
 {model: app.searchResults});
 app.userPage = new app.views.UserPage();
 },

 list: function() {
 app.searchResults.fetch();
 // Show page right away
 // List will redraw when data comes in
 this.slidePage(app.searchPage);
 },

 viewUser: function(id) {
 var that = this;
 var user = new app.models.User({Id: id});
 user.fetch({
 success: function() {
 app.userPage.model = user;
 that.slidePage(app.userPage);
 }
 });
 }
});

```

```
 }
 });
}
});
</script>
</body>
</html>
```

## SmartSync Data Framework Sample Apps

Salesforce Mobile SDK provides sample apps that demonstrate how to use SmartSync Data Framework in hybrid apps. Account Editor is the most full-featured of these samples. You can switch to one of the simpler samples by changing the `startPage` property in the `bootconfig.json` file.

### Running the Samples in iOS

In your Salesforce Mobile SDK for iOS installation directory, double-click the `SalesforceMobileSDK.xcworkspace` to open it in Xcode. In Xcode Project Navigator, select the `Hybrid SDK/AccountEditor` project and click **Run**.

### Running the Samples in Android

To run the sample in Android Studio, you first add references to basic libraries from your clone of the `SalesforceMobileSDK-Android` repository. Add the following dependencies to your sample module, setting **Scope** to “Compile” for each one:

- `libs/SalesforceSDK`
- `libs/SmartStore`
- `hybrid/SampleApps/AccountEditor`

After Android Studio finishes building, click **Run** '`<sample_name>`' in the toolbar or menu.

### Account Editor Sample

Account Editor is the most complex SmartSync Data Framework-based sample application in Mobile SDK 2.0. It allows you to create/edit/update/delete accounts online and offline, and also demonstrates conflict detection.

To run the sample:

1. If you've made changes to `external/shared/sampleApps/smartsync/bootconfig.json`, revert it to its original content.
2. Launch Account Editor.

This application contains three screens:

- Accounts search
- Accounts detail
- Sync

When the application first starts, you see the Accounts search screen listing the most recently used accounts. In this screen, you can:

- Type a search string to find accounts whose names contain the given string.
- Tap an account to launch the account detail screen.
- Tap **Create** to launch an empty account detail screen.

- Tap **Online** to go offline. If you are already offline, you can tap the **Offline** button to go back online. (You can also go offline by putting the device in airplane mode.)

To launch the Account Detail screen, tap an account record in the Accounts search screen. The detail screen shows you the fields in the selected account. In this screen, you can:

- Tap a field to change its value.
- Tap **Save** to update or create the account. If validation errors occur, the fields with problems are highlighted.

If you're online while saving and the server's record changed since the last fetch, you receive warnings for the fields that changed remotely.

Two additional buttons, **Merge** and **Overwrite**, let you control how the app saves your changes. If you tap **Overwrite**, the app saves to the server all values currently displayed on your screen. If you tap **Merge**, the app saves to the server only the fields you changed, while keeping changes on the server in fields you did not change.

- Tap **Delete** to delete the account.
- Tap **Online** to go offline, or tap **Offline** to go online.

To see the Sync screen, tap **Online** to go offline, then create, update, or delete an account. When you tap **Offline** again to go back online, the Sync screen shows all accounts that you modified on the device.

Tap **Process *n* records** to try to save your local changes to the server. If any account fails to save, it remains in the list with a notation that it failed to sync. You can tap any account in the list to edit it further or, in the case of a locally deleted record, to undelete it.

## Looking Under the Hood

To view the source code for this sample, open `AccountEditor.html` in an HTML or text editor.

Here are the key sections of the file:

- Script includes
- Templates
- Models
- Views
- Router

## Script Includes

This sample includes the standard list of libraries for SmartSync Data Framework applications.

- jQuery—See <http://jquery.com/>.
- Underscore—Utility-belt library for JavaScript, required by backbone. See <http://underscorejs.org/>.
- Backbone—Gives structure to web applications. Used by SmartSync Data Framework. See <http://backbonejs.org/>.
- `cordova.js`—Required for hybrid applications using the Salesforce Mobile SDK.
- `force.js`—Lightning Platform JavaScript library for making REST API calls. Required by SmartSync Data Framework.
- `smartsync.js`—The Mobile SDK SmartSync Data Framework.
- `fastclick.js`—Library used to eliminate the 300 ms delay between physical tap and firing of a click event. See <https://github.com/ftlabs/fastclick>.
- `stackrouter.js` and `auth.js`—Helper JavaScript libraries used by all three sample applications.

## Templates

Templates for this application include:

- search-page
- sync-page
- account-list-item
- edit-account-page (for the Account detail page)

## Models

This sample defines three models: `AccountCollection`, `Account` and `OfflineTracker`.

`AccountCollection` is a subclass of SmartSync Data Framework's `Force.SObjectCollection` class, which is a subclass of the Backbone framework's `Collection` class.

The `AccountCollection.config()` method returns an appropriate query to the collection. The query mode can be:

- Most recently used (MRU) if you are online and haven't provided query criteria
- SOQL if you are online and have provided query criteria
- SmartSQL when you are offline

When the app calls `fetch()` on the collection, the `fetch()` function executes the query returned by `config()`. It then uses the results of this query to populate `AccountCollection` with `Account` objects from either the offline cache or the server.

`AccountCollection` uses the two global caches set up by the AccountEditor application: `app.cache` for offline storage, and `app.cacheForOriginals` for conflict detection. The code shows that the `AccountCollection` model:

- Contains objects of the `app.models.Account` model (`model` field)
- Specifies a list of fields to be queried (`fieldlist` field)
- Uses the sample app's global offline cache (`cache` field)
- Uses the sample app's global conflict detection cache (`cacheForOriginals` field)
- Defines a `config()` function to handle online as well as offline queries

Here's the code (shortened for readability):

```
app.models.AccountCollection = Force.SObjectCollection.extend({
 model: app.models.Account,
 fieldlist: ["Id", "Name", "Industry", "Phone", "Owner.Name",
 "LastModifiedBy.Name", "LastModifiedDate"],
 cache: function() { return app.cache},
 cacheForOriginals: function() {
 return app.cacheForOriginals;},

 config: function() {
 // Offline: do a cache query
 if (!app.offlineTracker.get("isOnline")) {
 // ...
 }
 // Online
 else {
 // ...
 }
 }
});
```

`Account` is a subclass of SmartSync Data Framework's `Force.SObject` class, which is a subclass of the Backbone framework's `Model` class. Code for the `Account` model shows that it:

- Uses a `subjectType` field to indicate which type of `sObject` it represents (`Account`, in this case).
- Defines `fieldList` as a method rather than a field, because the fields that it retrieves from the server are not the same as the ones it sends to the server.
- Uses the sample app's global offline cache (`cache` field).
- Uses the sample app's global conflict detection cache (`cacheForOriginals` field).
- Supports a `cacheMode()` method that returns a value indicating how to handle caching based on the current offline status.

Here's the code:

```
app.models.Account = Force.SObject.extend({
 subjectType: "Account",
 fieldList: function(method) {
 return method == "read"
 ? ["Id", "Name", "Industry", "Phone", "Owner.Name",
 "LastModifiedBy.Name", "LastModifiedDate"]
 : ["Id", "Name", "Industry", "Phone"];
 },
 cache: function() { return app.cache;},
 cacheForOriginals: function() { return app.cacheForOriginals;},
 cacheMode: function(method) {
 if (!app.offlineTracker.get("isOnline")) {
 return Force.CACHE_MODE.CACHE_ONLY;
 }
 // Online
 else {
 return (method == "read" ?
 Force.CACHE_MODE.CACHE_FIRST :
 Force.CACHE_MODE.SERVER_FIRST);
 }
 }
});
```

`OfflineTracker` is a subclass of Backbone's `Model` class. This class tracks the offline status of the application by observing the browser's offline status. It automatically switches the app to offline when it detects that the browser is offline. However, it goes online only when the user requests it.

Here's the code:

```
app.models.OfflineTracker = Backbone.Model.extend({
 initialize: function() {
 var that = this;
 this.set("isOnline", navigator.onLine);
 document.addEventListener("offline", function() {
 console.log("Received OFFLINE event");
 that.set("isOnline", false);
 }, false);
 document.addEventListener("online", function() {
 console.log("Received ONLINE event");
 // User decides when to go back online
 }, false);
 }
});
```

## Views

This sample defines five views:

- SearchPage
- AccountListView
- AccountListItemView
- EditAccountView
- SyncPage

A view typically provides a template field to specify its design template, an `initialize()` function, and a `render()` function.

Each view can also define an `events` field. This field contains an array whose key/value entries specify the event type and the event handler function name. Entries use the following format:

```
"<event-type>[<control>]": "<event-handler-function-name>"
```

For example:

```
events: {
 "click .button-prev": "goBack",
 "change": "change",
 "click .save": "save",
 "click .merge": "saveMerge",
 "click .overwrite": "saveOverwrite",
 "click .toggleDelete": "toggleDelete"
},
```

### SearchPage

View for the entire search screen. It expects an `AccountCollection` as its model. It watches the search input field for changes (the `keyup` event) and updates the model accordingly in the `search()` function.

```
events: {
 "keyup .search-key": "search"
},
search: function(event) {
 this.model.setCriteria($(".search-key", this.el).val());
 this.model.fetch();
}
```

### AccountListView

View for the list portion of the search screen. It expects an `AccountCollection` as its model and creates `AccountListItemView` object for each account in the `AccountCollection` object.

### AccountListItemView

View for an item within the list.

### EditAccountPage

View for account detail page. This view monitors several events:

Event Type	Target Control	Handler function name
click	button-prev	goBack
change	Not set (can be any edit control)	change
click	save	save

Event Type	Target Control	Handler function name
click	merge	saveMerge
click	overwrite	saveOverwrite
click	toggleDelete	toggleDelete

A couple of event handler functions deserve special attention. The `change()` function shows how the view uses the event target to send user edits back to the model:

```
change: function(evt) {
 // apply change to model
 var target = event.target;
 this.model.set(target.name, target.value);
 $("#account" + target.name + "Error", this.el).hide();
}
```

The `toggleDelete()` function handles a toggle that lets the user delete or undelete an account. If the user clicks to undelete, the code sets an internal `__locally_deleted__` flag to false to indicate that the record is no longer deleted in the cache. Else, it attempts to delete the record on the server by destroying the local model.

```
toggleDelete: function() {
 if (this.model.get("__locally_deleted__")) {
 this.model.set("__locally_deleted__", false);
 this.model.save(null, this.getSaveOptions(
 null, Force.CACHE_MODE.CACHE_ONLY));
 }
 else {
 this.model.destroy({
 success: function(data) {
 app.router.navigate("#", {trigger:true});
 },
 error: function(data, err, options) {
 var error = new Force.Error(err);
 alert("Failed to delete account:
 " + (error.type === "RestError" ?
 error.details[0].message :
 "Remote change detected - delete aborted"));
 }
 });
 }
}
```

### SyncPage

View for the sync page. This view monitors several events:

Event Type	Control	Handler function name
click	button-prev	goBack
click	sync	sync



To see how the screen is rendered, look at the render method:

```
render: function(eventName) {

 $(this.el).html(this.template(_.extend(
 {countLocallyModified: this.model.length},
 this.model.toJSON())));

 this.listView.setElement($("#ul", this.el)).render();

 return this;

},
```

Let's take a look at what happens when the user taps **Process** (the sync control).

The `sync()` function looks at the first locally modified Account in the view's collection and tries to save it to the server. If the save succeeds and there are no more locally modified records, the app navigates back to the search screen. Otherwise, the app marks the account as having failed locally and then calls `sync()` again.

```
sync: function(event) {
 var that = this;
 if (this.model.length == 0 ||
 this.model.at(0).get("__sync_failed__")) {
 // We push sync failures back to the end of the list.
 // If we encounter one, it means we are done.
 return;
 }
 else {
 var record = this.model.shift();

 var options = {
 mergeMode: Force.MERGE_MODE.MERGE_FAIL_IF_CHANGED,
 success: function() {
 if (that.model.length == 0) {
 app.router.navigate("#", {trigger:true});
 }
 else {
 that.sync();
 }
 },
 error: function() {
 record = record.set("__sync_failed__", true);
 that.model.push(record);
 that.sync();
 }
 };
 return record.get("__locally_deleted__")
 ? record.destroy(options) :
 record.save(null, options);
 }
};
```

## Router

When the router is initialized, it sets up the two global caches used throughout the sample.

```
setupCaches: function() {
 // Cache for offline support
 app.cache = new Force.StoreCache("accounts",
 [{path:"Name", type:"string"}]);

 // Cache for conflict detection
 app.cacheForOriginals = new Force.StoreCache("original-accounts");

 return $.when(app.cache.init(), app.cacheForOriginals.init());
},
```

Once the global caches are set up, it also sets up two `AccountCollection` objects: One for the search screen, and one for the sync screen.

```
// Collection behind search screen
app.searchResults = new app.models.AccountCollection();

// Collection behind sync screen
app.localAccounts = new app.models.AccountCollection();
app.localAccounts.config = {
 type:"cache",
 cacheQuery: {
 queryType:"exact",
 indexPath:"__local__",
 matchKey:true,
 order:"ascending",
 pageSize:25}};
```

Finally, it creates the view objects for the Search, Sync, and EditAccount screens.

```
// We keep a single instance of SearchPage / SyncPage and EditAccountPage
app.searchPage = new app.views.SearchPage({model: app.searchResults});
app.syncPage = new app.views.SyncPage({model: app.localAccounts});
app.editPage = new app.views.EditAccountPage();
```

The router has a `routes` field that maps actions to methods on the router class.

```
routes: {
 "": "list",
 "list": "list",
 "add": "addAccount",
 "edit/accounts/:id": "editAccount",
 "sync": "sync"
},
```

The `list` action fills the search result collections by calling `fetch()` and brings the search page into view.

```
list: function() {
 app.searchResults.fetch();
 // Show page right away - list will redraw when data comes in
 this.slidePage(app.searchPage);
},
```

The `addAccount` action creates an empty account object and bring the edit page for that account into view.

```
addAccount: function() {
 app.editPage.model = new app.models.Account({Id: null});
 this.slidePage(app.editPage);
},
```

The `editAccount` action fetches the specified Account object and brings the account detail page into view.

```
editAccount: function(id) {
 var that = this;
 var account = new app.models.Account({Id: id});
 account.fetch({
 success: function(data) {
 app.editPage.model = account;
 that.slidePage(app.editPage);
 },
 error: function() {
 alert("Failed to get record for edit");
 }
 });
}
```

The `sync` action computes the `localAccounts` collection by calling `fetch` and brings the sync page into view.

```
sync: function() {
 app.localAccounts.fetch();
 // Show page right away - list will redraw when data comes in
 this.slidePage(app.syncPage);
}
```

## Defining Sync Names and Sync Configuration Files

Beginning in Mobile SDK 6.0, you can define sync configuration files and assign names to sync configurations. You can use sync names to run, edit, or delete a saved sync operation.

You can define “sync down” and “sync up” operations through configuration files rather than code. To keep the mechanism simple, Mobile SDK enforces the following file naming conventions:

- To define sync operations for the default global store, provide a file named `globalsyncs.json`.
- To define sync operations for the default user store, provide a file named `usersyncs.json`.

Hybrid apps load sync configuration files automatically, while other apps load them with a single line of code. To see examples, study the `SmartSyncExplorer` and `SmartSyncExplorerHybrid` sample apps. These apps use configuration files to set up their sync operations.

### Note:

- The JSON used to define sync operations is the same for all app types and platforms.
- Configuration file locations required by Mobile SDK vary according to app type and platform.
- If the name that a configuration file assigns to a sync operation already exists, Mobile SDK ignores the configuration file.

## Configuration File Format

The following example demonstrates the configuration file format.

```
{
 "syncs": [
 {
 "syncName": "sync1",
 "syncType": "syncDown",
 "soupName": "accounts",
 "target": {"type":"soql", "query":"SELECT Id, Name, LastModifiedDate FROM
Account"},
 "options": {"mergeMode":"OVERWRITE"}
 },
 {
 "syncName": "sync2",
 "syncType": "syncUp",
 "soupName": "accounts",
 "target": {"createFieldlist":["Name"]},
 "options": {"fieldlist":["Id", "Name", "LastModifiedDate"]},
 "mergeMode":"LEAVE_IF_CHANGED"
 }
]
}
```

## Expected Locations of Configuration Files

### iOS

- Native applications: / in the Resources bundle
- Hybrid applications: /www in the Resources bundle

### Android

- Native applications: /res/raw
- Hybrid applications: /assets/www

## Configuration File Example

SmartSyncExplorer sample apps—SmartSyncExplorer for iOS and Android, SmartSyncExplorerHybrid for iOS and Android—use a configuration file named `userconfig.json`:

```
{ "syncs":
 [
 {
 "syncName": "syncDownContacts",
 "syncType": "syncDown",
 "soupName": "contacts",
 "target": {"type":"soql",
 "query":"SELECT FirstName,
 LastName,
 Title,
 MobilePhone,
 Email,
```

```

 Department,
 HomePhone
 FROM Contact
 LIMIT 10000"},
 "options": {"mergeMode": "OVERWRITE"}
},
{
 "syncName": "syncUpContacts",
 "syncType": "syncUp",
 "soupName": "contacts",
 "target": {"createFieldlist": ["FirstName",
 "LastName",
 "Title",
 "MobilePhone",
 "Email",
 "Department",
 "HomePhone"]},
 "options": {"fieldlist": ["Id",
 "FirstName",
 "LastName",
 "Title",
 "MobilePhone",
 "Email",
 "Department",
 "HomePhone"],
 "mergeMode": "LEAVE_IF_CHANGED"}
}
]
}

```

## Loading Sync Definitions from Configuration Files (iOS Native Apps)

Loading methods are defined on the `SmartSyncSDKManager` class.

### User store

```
[[SmartSyncSDKManager sharedManager] setupUserSyncsFromDefaultConfig];
```

### Global store

```
[[SmartSyncSDKManager sharedManager] setupGlobalSyncsFromDefaultConfig];
```

Here's an example. This excerpt is from `SObjectDataManager.m` in the iOS `SmartSyncExplorer` native sample app.

```

- (id)initWithDataSpec:(SObjectDataSpec *)dataSpec {
 self = [super init];
 if (self) {
 (...)
 [[SmartSyncSDKManager sharedManager] setupUserSyncsFromDefaultConfig];
 (...)
 }
 return self;
}

```

## Loading Sync Definitions from Configuration Files (Android Native Apps)

Loading methods are defined on the `SmartSyncSDKManager`.

**User store**

```
SmartSyncSDKManager.getInstance().setupUserSyncsFromDefaultConfig();
```

**Global store**

```
SmartSyncSDKManager.getInstance().setupGlobalSyncsFromDefaultConfig();
```

Here's an example. This excerpt is from `ContactListLoader.java` in the Android SmartSyncExplorer native sample app:

```
public ContactListLoader(Context context, UserAccount account) {
 super(context);
 (...)
 SmartSyncSDKManager.getInstance().setupUserSyncsFromDefaultConfig();
 (...)
}
```

## Using Sync Names

Mobile SDK provides a collection of APIs for using and managing named sync operations. You can programmatically create and delete named syncs at runtime, run or rerun them by name, and manage named syncs in memory.

### Name-Based APIs (iOS)

Most of these methods are new. Updated methods use the same parameters as their existing analogs for `target`, `options`, and `updateBlock`.

**Get sync status by name**

```
- (nullable
 SFSyncState*)getSyncStatusByName:(NSString*) syncName;
```

**Check for an existing sync by name**

```
- (BOOL)hasSyncWithName:(NSString*) syncName;
```

**Delete a sync configuration by name**

```
- (void)deleteSyncByName:(NSString*) syncName;
```

**Create a named sync configuration**

```
- (SFSyncState *)createSyncDown:(SFSyncDownTarget *)target
 options:(SFSyncOptions *)options
 soupName:(NSString *) soupName
 syncName:(NSString *) syncName;
```

```
- (SFSyncState *)createSyncUp:(SFSyncUpTarget *)target
 options:(SFSyncOptions *)options
 soupName:(NSString *) soupName
 syncName:(NSString *) syncName;
```

 **Note:** These operations fail if the requested sync name already exists.

**Create and run a named sync configuration**

These operations both create a sync configuration with the given name and then run it in the same call.

```
- (SFSyncState*) syncDownWithTarget: (SFSyncDownTarget*) target
 options: (SFSyncOptions*) options
 soupName: (NSString*) soupName
 syncName: (NSString* __nullable) syncName
 updateBlock: (SFSyncSyncManagerUpdateBlock) updateBlock;
```

```
- (SFSyncState*) syncUpWithTarget: (SFSyncUpTarget*) target
 options: (SFSyncOptions*) options
 soupName: (NSString*) soupName
 syncName: (NSString*) syncName
 updateBlock: (SFSyncSyncManagerUpdateBlock) updateBlock;
```

 **Note:** These operations fail if the requested sync name already exists.

**Rerun a named sync configuration**

```
- (nullable SFSyncState*) reSyncByName: (NSString*) syncName
 updateBlock: (SFSyncSyncManagerUpdateBlock) updateBlock;
```

**Name-Based APIs (Android)**

Most of these methods are new. Overridden methods use the same parameters as their existing analogs for `target`, `options`, and `callback`.

**Get sync status by name**

```
public SyncState getSyncStatus(String name);
```

**Check for an existing sync by name**

```
public boolean hasSyncWithName(String name);
```

**Delete a sync configuration by name**

```
public void deleteSync(String name);
```

**Create a named sync configuration**

```
public SyncState createSyncDown(SyncDownTarget target, SyncOptions options,
 String soupName, String syncName);
```


```
public SyncState createSyncUp(SyncUpTarget target, SyncOptions options,
 String soupName, String syncName);
```

 **Note:** These operations fail if the requested sync name already exists.

**Create and run a named sync configuration**

```
public SyncState syncDown(SyncDownTarget target, SyncOptions options,
 String soupName, String syncName, SyncUpdateCallback callback);
```

```
public SyncState syncUp(SyncUpTarget target, SyncOptions options,
 String soupName, String syncName, SyncUpdateCallback callback);
```

 **Note:** These operations both create and run a sync configuration with the given name. They fail if the requested sync name already exists.

### Rerun a named sync configuration

```
public SyncState reSync(String syncName, SyncUpdateCallback callback);
```

## Name-Based APIs (Hybrid)

Most of these methods are existing legacy APIs. Wherever a sync ID is accepted, you can pass the sync name instead.

### Get sync status by name

You can use this function to determine if a sync configuration exists. It returns null if the sync configuration doesn't exist.

```
getSyncStatus(storeConfig, syncIdOrName, successCB, errorCallback)
```

### Delete a sync configuration by name

```
deleteSync(storeConfig, syncIdOrName, successCB, errorCallback)
```

### Create and run a named sync configuration

The legacy `syncDown()` function now includes a `syncName` parameter. If the name is provided, Mobile SDK creates a configuration with the given name. This function fails if the requested sync name already exists.

```
syncDown(storeConfig, target, soupName, options, syncName, successCB, errorCallback)
```

```
syncUp(storeConfig, target, soupName, options, syncName, successCB, errorCallback)
```

### Run (or re-run) any sync by name

This existing method now has an overload that accepts either a sync ID or name.

```
reSync(storeConfig, syncIdOrName, successCB, errorCallback)
```

## Name-Based APIs (React Native)

Most of these methods are existing legacy APIs. Wherever a sync ID is accepted, you can pass the sync name instead.

### Get sync status by name

This existing method now has an overload that accepts either a sync ID or a sync name.

```
getSyncStatus(storeConfig, syncIdOrName, successCB, errorCallback)
```

### Delete by name

This method, new in Mobile SDK 6.0, accepts either a sync ID or a sync name.

```
deleteSync(storeConfig, syncIdOrName, successCB, errorCallback)
```

### Create and run a sync with a name - new optional parameter syncName

This existing method now has an optional parameter that accepts a sync name.

```
syncDown(storeConfig, target, soupName, options, syncName, successCB, errorCallback)
syncUp(storeConfig, target, soupName, options, syncName, successCB, errorCallback)
```

### Run (or re-run) any sync by name - overloaded to accept id or name

This existing method now has an overload that accepts either a sync ID or a sync name.

```
reSync(storeConfig, syncIdOrName, successCB, errorCallback)
```



### Example: Invoking the Resync Method in Native Android Apps

Excerpt from `ContactListLoader.java` from Android `SmartSyncExplorer` native sample app:

```
public synchronized void syncUp() {
 try {
 syncMgr.reSync(SYNC_UP_NAME /* see usersyncs.json */, new SyncUpdateCallback()
 {
 @Override
 public void onUpdate(SyncState sync) {
 if (Status.DONE.equals(sync.getStatus())) {
 syncDown();
 }
 }
 });
 } catch (JSONException e) {
 Log.e(TAG, "JSONException occurred while parsing", e);
 } catch (SmartSyncException e) {
 Log.e(TAG, "SmartSyncException occurred while attempting to sync up", e);
 }
}
```

```
public synchronized void syncDown() {
 try {
 syncMgr.reSync(SYNC_DOWN_NAME /* see usersyncs.json */, new SyncUpdateCallback()
 {
 @Override
 public void onUpdate(SyncState sync) {
 if (Status.DONE.equals(sync.getStatus())) {
 fireLoadCompleteIntent();
 }
 }
 });
 } catch (JSONException e) {
 Log.e(TAG, "JSONException occurred while parsing", e);
 } catch (SmartSyncException e) {
 Log.e(TAG, "SmartSyncException occurred while attempting to sync down", e);
 }
}
```

### Example: Invoking the Resync Method in Native iOS Apps

Excerpt from `SObjectDataManager.m` from iOS `SmartSyncExplorer` native sample app:

```
- (void)refreshRemoteData:(void (^)(void))completionBlock {
 __weak SObjectDataManager *weakSelf = self;
 // See usersyncs.json
 [self.syncMgr reSyncByName:kSyncDownName updateBlock:^(SFSyncState *sync) {
 __strong typeof(weakSelf) strongSelf = weakSelf;
 if ([sync isDone] || [sync hasFailed]) {
 [strongSelf refreshLocalData:completionBlock];
 }
 }
}
```

```

 }];
}

```

```

- (void)updateRemoteData:(SFSyncSyncManagerUpdateBlock) completionBlock {
 // See usersyncs.json
 [self.syncMgr reSyncByName:kSyncUpName updateBlock:^(SFSyncState* sync) {
 if ([sync isDone] || [sync hasFailed]) {
 completionBlock(sync);
 }
 }];
}

```

### Example: Invoking the Resync Method in Hybrid Apps

Excerpt from SmartSyncExplorer.html from SmartSyncExplorerHybrid sample app:

```

syncDown: function() {
 cordova.require("com.salesforce.plugin.smartsync").reSync("syncDownContacts" /*
see usersyncs.json */,
 this.handleSyncUpdate.bind(this));
},
syncUp: function() {
 cordova.require("com.salesforce.plugin.smartsync").reSync("syncUpContacts" /* see
usersyncs.json */,
 this.handleSyncUpdate.bind(this));},

```

### Example: Invoking the Resync Method in Hybrid Apps

Excerpt from SmartSyncExplorer.html from SmartSyncExplorerHybrid sample app:

```

syncDown: function() {
 cordova.require("com.salesforce.plugin.smartsync").reSync("syncDownContacts" /*
see usersyncs.json */,
 this.handleSyncUpdate.bind(this));
},
syncUp: function() {
 cordova.require("com.salesforce.plugin.smartsync").reSync("syncUpContacts" /* see
usersyncs.json */,
 this.handleSyncUpdate.bind(this));},

```

# CHAPTER 12 Files and Networking

## In this chapter ...

- [Architecture](#)
- [Downloading Files and Managing Sharing](#)
- [Uploading Files](#)
- [Encryption and Caching](#)
- [Using Files in Android Apps](#)
- [Using Files in iOS Native Apps](#)
- [Using Files in Hybrid Apps](#)


Mobile SDK provides an API for files management that implements two levels of technology. For files management, Mobile SDK provides convenience methods that process file requests through the Chatter REST API. Under the REST API level, networking classes give apps control over pending REST requests. Together, these two sides of the same coin give the SDK a robust content management feature as well as enhanced networking performance.

## Architecture

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Beginning with Mobile SDK 4.2, the Android REST request system uses OkHttp (v3.2.0), an open-source external library from Square Open Source, as its underlying architecture. This library replaces the Google Volley library from past releases. As a result, Mobile SDK no longer defines the `WrappedRestRequest` class. For more information, see [square.github.io/okhttp/](https://square.github.io/okhttp/).

In iOS, file management and networking rely on the `SalesforceNetwork` library. All REST API calls—for files and any other REST requests—go through this library.

 **Note:** If you directly accessed a third-party networking library in older versions of your app, update that code to use the `SalesforceNetwork` library.

Hybrid JavaScript functions use the the Mobile SDK architecture for the device operating system (Android, iOS, or Windows) to implement file operations. These functions are defined in `force.js`.

## Downloading Files and Managing Sharing

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Salesforce Mobile SDK provides convenience methods that build specialized REST requests for file download and sharing operations. You can use these requests to:

- Access the byte stream of a file.
- Download a page of a file.
- Preview a page of a file.
- Retrieve details of File records.
- Access file sharing information.
- Add and remove file shares.

## Pages in Requests

The term “page” in REST requests can refer to either a specific item or a group of items in the result set, depending on the context. When you preview a page of a specific file, for example, the request retrieves the specified page from the rendered pages. For most other requests, a page refers to a section of the list of results. The maximum number of records or topics in a page defaults to 25.

The response includes a `NextPageUrl` field. If this value is defined, there is another page of results. If you want your app to scroll through pages of results, you can use this field to avoid sending unnecessary requests. You can also detect when you’re at the end of the list by simply checking the response status. If nothing or an error is returned, there’s nothing more to display and no need to issue another request.

## Uploading Files

---

Native mobile platforms support a method for uploading a file. You provide a path to the local file to be uploaded, the name or title of the file, and a description. If you know the MIME type, you can specify that as well. The upload method returns a platform-specific request object that can upload the file to the server. When you send this request to the server, the server creates a file with version set to 1.

Use the following methods for the given app type:

App Type	Upload Method	Signature
Android native	<code>FileRequests.uploadFile()</code>	<pre>public static RestRequest uploadFile( File theFile, String name, String description, String mimeType) throws UnsupportedOperationException</pre>
iOS native	<pre>- requestForUploadFile: name:description:mimeType:</pre>	<pre>- (SFRestRequest *) requestForUploadFile:(NSData *)data name:(NSString *)name description:(NSString *)description mimeType:(NSString *)mimeType</pre>
Hybrid (Android and iOS)	N/A	N/A

## Encryption and Caching

Mobile SDK gives you access to the file's unencrypted byte stream but doesn't implement file caching or storage. You're free to devise your own solution if your app needs to store files on the device.

## Using Files in Android Apps

The `FileRequests` class provides static methods for creating `RestRequest` objects that perform file operations. Each method returns the new `RestRequest` object. Applications then call the `ownedFilesList()` method to retrieve a `RestRequest` object. It passes this object as a parameter to a function that uses the `RestRequest` object to send requests to the server:

```
performRequest(FileRequests.ownedFilesList(null, null));
```

This example passes null to the first parameter (`userId`). This value tells the `ownedFilesList()` method to use the ID of the context, or logged-in, user. The second null, for the `pageNum` parameter, tells the method to fetch the first page of results.


For native Android apps, file management classes and methods live in the `com.salesforce.androidsdk.rest.files` package.

SEE ALSO:

[FileRequests Methods \(Android\)](#)

## Managing the Request Queue

The `RestClient` class internally uses an instance of the `OkHttpClient` class to manage REST API requests. You can access underlying `OkHttp` objects directly to cancel pending requests. To manage a specific request, you can use the `OkHttp Call` object returned by the `RestClient.sendAsync()` Mobile SDK method.

 **Example:** The following examples show how to perform some common network operations with `OkHttpClient`.

### Common Imports

```
import okhttp3.Headers;
import okhttp3.HttpUrl;
import okhttp3.OkHttpClient;
import okhttp3.Call;
import okhttp3.Dispatcher;
import okhttp3.Request;
import okhttp3.RequestBody;
import okhttp3.Response;
```

### Obtain the Current OkHttpClient Handle

To get the handle of the `OkHttpClient` that the current `RestClient` instance is using:

```
OkHttpClient okClient = restClient.getOkHttpClient();
```

### Obtain the OkHttpClient Dispatcher

```
Dispatcher dispatcher = restClient.getOkHttpClient().dispatcher();
```

### Cancel All Pending Calls

```
Dispatcher dispatcher = restClient.getOkHttpClient().dispatcher();
dispatcher.cancelAll();
```

### Store the OkHttpClient Handle to a REST Request

```
Call call = restClient.sendAsync(restRequest, callback);
```

### Cancel a Specific REST Request Using a Stored Handle

```
Call call = restClient.sendAsync(restRequest, callback);
...
call.cancel();
```

For more information, see [square.github.io/okhttp/](https://square.github.io/okhttp/).

SEE ALSO:

[OkHttp: The Underlying Network Library](#)

## Using Files in iOS Native Apps

---

To handle files in native iOS apps, use convenience methods defined in the `SFRestAPI (Files)` category. These methods parallel the files API for Android native and hybrid apps. They send requests to the same list of REST APIs, but use different underpinnings.

## REST Responses and Multithreading

The `SalesforceNetwork` library always dispatches REST responses to the thread where your `SFRestDelegate` currently runs. This design accommodates your app no matter how your delegate intends to handle the server response. When you receive the response, you can do whatever you like with the returned data. For example, you can cache it, store it in a database, or immediately blast it to UI controls. If you send the response directly to the UI, however, remember that your delegate must dispatch its messages to the main thread.

SEE ALSO:

[SFRestAPI \(Files\) Category—Request Methods \(iOS\)](#)

## Managing Requests

The `SalesforceNetwork` library for iOS defines two primary objects, `SFNetworkEngine` and `SFNetworkOperation`. `SFRestRequest` internally uses a `SFNetworkOperation` object to make each server call.

If you'd like to access the `SFNetworkOperation` object for any request, you have two options.

- The following methods return `SFNetworkOperation*`:
  - `[SFRestRequest send:]`
  - `[SFRestAPI send:delegate:]`
- `SFRestRequest` objects include a `networkOperation` object of type `SFNetworkOperation*`.

To cancel pending REST requests, you also have two options.

- `SFRestRequest` provides a new method that cancels the request:

```
- (void) cancel;
```

- And `SFRestAPI` has a method that cancels all requests currently running:

```
- (void) cancelAllRequests;
```

### Example: Examples of Canceling Requests

To cancel all requests:

```
[[SFRestAPI sharedInstance] cancelAllRequests];
```

To cancel a single request:


```
SFRestRequest *request = [[SFRestAPI sharedInstance] requestForOwnedFilesList:nil
page:0];
[[SFRestAPI sharedInstance] send:request delegate:self];
...
// User taps Cancel Request button while waiting for the response
-(void) cancelRequest:(SFRestRequest *) request {
 [request cancel];
}
```

## Using Files in Hybrid Apps

---

Hybrid file request wrappers reside in the `force.js` JavaScript library. When using the hybrid functions, you pass in a callback function that receives and handles the server response. You also pass in a function to handle errors.

To simplify the code, you can leverage the `smartsync.js` and `force.js` libraries to build your HTML app. The [FileExplorer](#) sample app in the [github.com/forcedotcom/SalesforceMobileSDK-Shared](https://github.com/forcedotcom/SalesforceMobileSDK-Shared) repo demonstrates this.

 **Note:** Mobile SDK does not support file uploads in hybrid apps.

SEE ALSO:

[Files Methods For Hybrid Apps](#)



# CHAPTER 13 Push Notifications and Mobile SDK

## In this chapter ...

- [About Push Notifications](#)
- [Using Push Notifications in Hybrid Apps](#)
- [Using Push Notifications in Android](#)
- [Using Push Notifications in iOS](#)

Push notifications from Salesforce help your mobile users stay on top of important developments in their organizations. The Salesforce Mobile Push Notification Service, which becomes generally available in Summer '14, lets you configure and test mobile push notifications before you implement any code. To receive mobile notifications in a production environment, your Mobile SDK app implements the mobile OS provider's registration protocol and then handles the incoming notifications. Mobile SDK minimizes your coding effort by implementing most of the registration tasks internally.

## About Push Notifications

---

With the Salesforce Mobile Push Notification Service, you can develop and test push notifications in Salesforce Mobile SDK apps. Mobile SDK provides APIs that you can implement to register devices with the push notification service. However, receiving and handling the notifications remain the responsibility of the developer.

Push notification setup occurs on several levels:

- Configuring push services from the device technology provider (Apple for iOS, Google for Android)
- Configuring your Salesforce connected app definition to enable push notifications
- Implementing Apex triggers

OR

Calling the push notification resource of the Chatter REST API

- Modifying code in your Mobile SDK app
- Registering the mobile device at runtime

You're responsible for Apple or Google service configuration, connected app configuration, Apex or Chatter REST API coding, and minor changes to your Mobile SDK app. Salesforce Mobile SDK handles runtime registration transparently.

For a full description of how to set up mobile push notifications for your organization, see the [Salesforce Mobile Push Notifications Implementation Guide](#).

## Using Push Notifications in Hybrid Apps

---

To use push notifications in a hybrid app, first be sure to

- Register for push notifications with the OS provider.
- Configure your connected app to support push notifications for your target device platform.

Salesforce Mobile SDK lets your hybrid app register itself to receive notifications, and then you define the behavior that handles incoming notifications.

SEE ALSO:

[Using Push Notifications in Android](#)

[Using Push Notifications in iOS](#)

## Code Modifications (Hybrid)

1. (Android only) If your target platform is Android:

- a. Add an entry for `androidPushNotificationClientId`. In `assets/www/bootconfig.json`:

```
"androidPushNotificationClientId": "33333344444"
```

This value is the project number of the Google project that is authorized to send push notifications to an Android device.

2. In your callback for `cordova.require("com.salesforce.plugin.oauth").getAuthCredentials()`, add the following code:

```
cordova.require("com.salesforce.util.push").registerPushNotificationHandler(
 function(message) {
 // add code to handle notifications
 },
 function(error) {
 // add code to handle errors
 }
);
```

 **Example:** This code demonstrates how you might handle messages. The server delivers the payload in `message["payload"]`.

```
function(message) {
 var payload = message["payload"];
 if (message["foreground"]) {
 // Notification is received while the app is in
 // the foreground
 // Do something appropriate with payload
 }
 if (!message["foreground"]) {
 // Notification was received while the app was in
 // the background, and the notification was clicked,
 // bringing the app to the foreground
 // Do something appropriate with payload
 }
}
```

## Using Push Notifications in Android

---


Salesforce sends push notifications to Android apps through the Google Cloud Messaging for Android (GCM) framework. See <http://developer.android.com/google/gcm/index.html> for an overview of this framework.

When developing an Android app that supports push notifications, remember these key points:

- You must be a member of the Android Developer Program.
- You can test GCM push services only on an Android device with either the Android Market app or Google Play Services installed. Push notifications don't work on an Android emulator.
- You can also use the Send Test Notification link in your connected app detail view to perform a "dry run" test of your GCM setup without pinging any device.

To begin, create a Google API project for your app. Your project must have the GCM for Android feature enabled. See <http://developer.android.com/google/gcm/gs.html> for instructions on setting up your project.

The setup process for your Google API project creates a key for your app. Once you've finished the project configuration, you'll need to add the GCM key to your connected app settings.

 **Note:** Push notification registration occurs at the end of the OAuth login flow. Therefore, an app does not receive push notifications unless and until the user logs into a Salesforce organization.

## Configure a Connected App For GCM (Android)

To configure your Salesforce connected app to support push notifications:

1. In your Salesforce organization, from Setup, enter *Apps* in the *Quick Find* box, then select **Apps**.
2. In Connected Apps, click **Edit** next to an existing connected app, or **New** to create a new connected app. If you're creating a new connected app, see [Create a Connected App](#).
3. Under Mobile App Settings, select **Push Messaging Enabled**.
4. For Supported Push Platform, select **Android GCM**.
5. For Key for Server Applications (API Key), enter the key you obtained during the developer registration with Google.

6. Click **Save**.



**Note:** After saving a new connected app, you'll get a consumer key. Mobile apps use this key as their connection token.

## Code Modifications (Android)

To configure your Mobile SDK app to support push notifications:

1. Add an entry for `androidPushNotificationClientId`.
  - In `res/values/bootconfig.xml` (for native apps):

```
<string name="androidPushNotificationClientId">33333344444</string>
```

- In `assets/www/bootconfig.json` (for hybrid apps):

```
"androidPushNotificationClientId": "33333344444"
```

This value is the project number of the Google project that is authorized to send push notifications to an Android device.

Behind the scenes, Mobile SDK automatically reads this value and uses it to register the device against the Salesforce connected app. This validation allows Salesforce to send notifications to the connected app. At logout, Mobile SDK also automatically unregisters the device for push notifications.

2. Create a class in your app that implements `PushNotificationInterface`. `PushNotificationInterface` is a Mobile SDK Android interface for handling push notifications. `PushNotificationInterface` has a single method, `onPushMessageReceived(Bundle message)`:

```
public interface PushNotificationInterface {
 public void onPushMessageReceived(Bundle message);
}
```

In this method you implement your custom functionality for displaying, or otherwise disposing of, push notifications.

3. In the `onCreate()` method of your `Application` subclass, call the `SalesforceSDKManager.setPushNotificationReceiver()` method, passing in your implementation of

PushNotificationInterface. Call this method immediately after the SalesforceSDKManager.initNative() call. For example:

```
@Override
public void onCreate() {
 super.onCreate();
 SalesforceSDKManager.initNative(getApplicationContext(),
 new KeyImpl(), MainActivity.class);
 SalesforceSDKManager.getInstance().
 setPushNotificationReceiver(myPushNotificationInterface);
}
```

## Using Push Notifications in iOS

When developing an iOS app that supports push notifications, remember these key points:

- You must be a member of the iOS Developer Program.
- You can test Apple push services only on an iOS physical device. Push notifications don't work in the iOS simulator.
- There are no guarantees that all push notifications will reach the target device, even if the notification is accepted by Apple.
- Apple Push Notification Services setup requires the use of the OpenSSL command line utility provided in Mac OS X.

Before you can complete registration on the Salesforce side, you need to register with Apple Push Notification Services. The following instructions provide a general outline for what's required. See <http://www.raywenderlich.com/32960/> for complete instructions.

## Configuration for Apple Push Notification Services

Registering with Apple Push Notification Services (APNS) requires the following items.

### Certificate Signing Request (CSR) File

Generate this request using the Keychain Access feature in Mac OS X. You'll also use OpenSSL to export the CSR private key to a file for later use.

### App ID from iOS Developer Program

In the iOS Developer Member Center, create an ID for your app, then use the CSR file to generate a certificate. Next, use OpenSSL to combine this certificate with the private key file to create a .p12 file. You'll need this file later to configure your connected app.

### iOS Provisioning Profile

From the iOS Developer Member Center, create a new provisioning profile using your iOS app ID and developer certificate. You then select the devices to include in the profile and download to create the provisioning profile. You can then add the profile to Xcode. Install the profile on your test device using Xcode's Organizer.

When you've completed the configuration, sign and build your app in Xcode. Check the build logs to verify that the app is using the correct provisioning profile. To view the content of your provisioning profile, run the following command at the Terminal window:

```
security cms -D -i <your profile>.mobileprovision
```

## Configure a Connected App for APNS (iOS)

To configure your Salesforce connected app to support push notifications with Apple Push Notification Services (APNS):

1. In your Salesforce organization, from Setup, enter **Apps** in the **Quick Find** box, then select **Apps**.
2. In Connected Apps, either click **Edit** next to an existing connected app, or **New** to create a new connected app. If you're creating a new connected app, see [Create a Connected App](#).

- Under Mobile App Settings, select **Push Messaging Enabled**.
- For Supported Push Platform, select **Apple**.  
The page expands to show additional settings.

The screenshot shows the 'Mobile App Settings' interface. The 'Push Messaging Enabled' checkbox is checked. The 'Supported Push Platform' dropdown is set to 'Apple'. Below it, the 'Apple Environment' dropdown is set to 'Sandbox'. The 'Certificate' field shows 'Choose File' and 'No file chosen'. The 'Certificate Password' field contains 'test1234'. A note indicates 'Current certificate expires on 10/16/2014'.

- Select the Apple Environment that corresponds to your APNS certificate.
- Add your .p12 file and its password under **Mobile App Settings > Certificate** and **Mobile App Settings > Certificate Password**.

This screenshot is identical to the previous one, but the 'Certificate' field, which contains 'Choose File' and 'No file chosen', is circled in red to highlight the area where a certificate file should be selected.

 **Note:** You obtain the values for Apple Environment, Certificate, and Certificate Password when you configure your app with APNS.

- Click **Save**.

## Code Modifications (iOS)

Salesforce Mobile SDK for iOS provides the `SFPushNotificationManager` class to handle push registration. To use it, import `<SalesforceSDKCore/SFPushNotificationManager>`. The `SFPushNotificationManager` class is available as a runtime singleton:

```
[SFPushNotificationManager sharedInstance]
```

This class implements four registration methods:

```
- (void) registerForRemoteNotifications;
- (void) didRegisterForRemoteNotificationsWithDeviceToken:
 (NSData*) deviceTokenData;
- (BOOL) registerForSalesforceNotifications; // for internal use
- (BOOL) unregisterSalesforceNotifications; // for internal use
```

MobileSDK calls `registerForSalesforceNotifications` after login and `unregisterSalesforceNotifications` at logout. You call the other two methods from your `AppDelegate` class.

### Example: **SFPushNotificationManager Example**

To configure your `AppDelegate` class to support push notifications:

1. Register with Apple for push notifications by calling `registerForRemoteNotifications`. Call this method in the `application:didFinishLaunchingWithOptions:` method.

```
- (BOOL)application:(UIApplication *)application
 didFinishLaunchingWithOptions:(NSDictionary *)launchOptions
{
 self.window =
 [[UIWindow alloc] initWithFrame:
 [UIScreen mainScreen].bounds];
 [self initializeAppViewState];

 //
 // Register with APNS for push notifications. Note that,
 // to receive push notifications from Salesforce,
 // you also need to register for Salesforce notifications
 // in the application:
 // didRegisterForRemoteNotificationsWithDeviceToken:
 // method (as demonstrated below.)
 //
 [[SFPushNotificationManager sharedInstance]
 registerForRemoteNotifications];

 [[SFAuthenticationManager sharedManager]
 loginWithCompletion:self.initialLoginSuccessBlock
 failure:self.initialLoginFailureBlock]
 credentials:(SFOAuthCredentials *)credentials;
 return YES;
}
```

If registration succeeds, Apple passes a device token to the `application:didRegisterForRemoteNotificationsWithDeviceToken:` method of your `AppDelegate` class.

2. Forward the device token from Apple to `SFPushNotificationManager` by calling `didRegisterForRemoteNotificationsWithDeviceToken` on the `SFPushNotificationManager` shared instance.

```
- (void)application:(UIApplication*)application
 didRegisterForRemoteNotificationsWithDeviceToken:
 (NSData*)deviceToken
{
 //
 // Register your device token
 // with the push notification manager
 //
 [[SFPushNotificationManager sharedInstance]
 didRegisterForRemoteNotificationsWithDeviceToken:
 deviceToken];
}
```

```
}
```

3. Register to receive Salesforce notifications through the connected app by calling `registerForSalesforceNotifications`. Call this method only if the access token for the current session is valid.

```
- (void)application:(UIApplication*) application
 didRegisterForRemoteNotificationsWithDeviceToken:
 (NSData*) deviceToken
{
 //
 // Register your device token with the
 // push notification manager
 //
 [[SFPushNotificationManager sharedInstance]
 didRegisterForRemoteNotificationsWithDeviceToken:deviceToken];

 if ([SFAccountManager sharedInstance].
 credentials.accessToken != nil) {
 [[SFPushNotificationManager sharedInstance]
 registerForSalesforceNotifications];
 }
}
```

4. To log an error if registration with Apple should fail, add the following method.

```
- (void)application:(UIApplication*) application
 didFailToRegisterForRemoteNotificationsWithError:(NSError*) error
{
 NSLog(@"Failed to get token, error: %@", error);
}
```



# CHAPTER 14 Authentication, Security, and Identity in Mobile Apps

## In this chapter ...

- [OAuth Terminology](#)
- [OAuth 2.0 Authentication Flow](#)
- [Connected Apps](#)
- [Portal Authentication Using OAuth 2.0 and Salesforce Sites](#)
- [Using MDM with Salesforce Mobile SDK Apps](#)
- [Using Advanced Authentication in iOS Apps](#)
- [Enabling Browser-Based Authentication in Android Apps](#)

Secure authentication is essential for enterprise applications running on mobile devices. OAuth 2.0, the industry-standard protocol, enables secure authorization for access to a customer's data, without handing out the username and password. It is often described as the valet key of software access. A valet key restricts access to certain features of your car. For example, a parking attendant can't open the trunk or glove compartment using a valet key.

Mobile app developers can quickly and easily embed the Salesforce OAuth 2.0 implementation. The implementation uses an HTML view to collect the username and password, which are then sent to the server. The server returns a session token and a persistent refresh token that are stored on the device for future interactions.

A Salesforce *connected app* is the primary means by which a mobile app connects to Salesforce. A connected app gives both the developer and the administrator control over how the app connects and who has access. For example, a connected app can restrict access to a set of customers, set or relax an IP range, and so on.

## OAuth Terminology

---

### Access Token

A value used by the consumer to gain access to protected resources on behalf of the user, instead of using the user's Salesforce credentials. The access token is a session ID, and can be used directly.

### Authorization Code

A short-lived token that represents the access granted by the end user. The authorization code is used to obtain an access token and a refresh token.

### Connected App

An application external to Salesforce that uses the OAuth protocol to verify both the Salesforce user and the external application.

### Consumer Key

A value used by the consumer—in this case, the Mobile SDK app—to identify itself to Salesforce. Referred to as `client_id`.

### Consumer Secret

A secret that the consumer uses to verify ownership of the consumer key. To heighten security, Mobile SDK apps do not use the consumer secret.

### Refresh Token

A token used by the consumer to obtain a new access token, without having the end user approve the access again.

### Remote Access Application (DEPRECATED)

A *remote access application* is an application external to Salesforce that uses the OAuth protocol to verify both the Salesforce user and the external application. A remote access application is implemented as a connected app. Remote access applications have been deprecated in favor of connected apps.

## OAuth 2.0 Authentication Flow

---

The authentication flow depends on the state of authentication on the device. The following steps assume that Salesforce authentication occurs at app startup.

### First Time Authorization Flow

1. The customer opens a Mobile SDK app.
2. An authentication prompt appears.
3. The customer enters a username and password.
4. The app sends the customer's credentials to Salesforce and, in return, receives a session ID as confirmation of successful authentication.
5. The customer approves the app's request to grant access to the app.
6. The app starts.

### Ongoing Authorization

1. The customer opens a mobile app.
2. If the session ID is active, the app starts immediately. If the session ID is stale, the app uses the refresh token from its initial authorization to get an updated session ID.
3. The app starts.

## PIN Authentication (Optional)

PIN protection is a function of the mobile policy and is used only when it's enabled in the Salesforce connected app definition. It can be shown whether you are online or offline, if enough time has elapsed since you last used the application. See [About PIN Security](#).

1. The customer opens a mobile app after not using it for some time.
2. If the elapsed time exceeds the configured PIN timeout value, a passcode entry screen appears. The customer enters the PIN.
3. The app re-uses the existing session ID.
4. The app starts.

## OAuth 2.0 User-Agent Flow

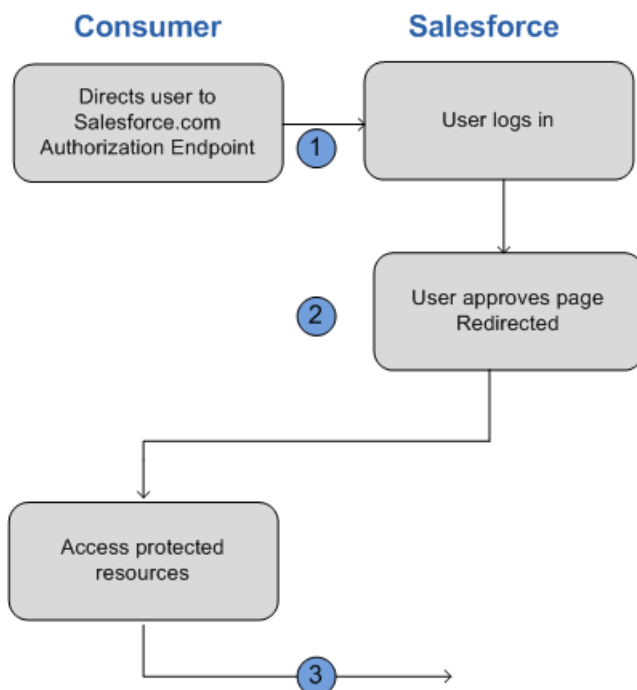
The user-agent authentication flow is used by client applications residing on the user's mobile device. The authentication is based on the user-agent's same-origin policy.

In the user-agent flow, the client app receives the access token as an HTTP redirection. The client app requests the authorization server to redirect the user-agent to another web server or to an accessible local resource. The server can extract the access token from the response and pass it to the client app. For security, the token response is provided as a hash (#) fragment on the URL. It prevents the token from being passed to the server or to any other servers in referral headers.

The user-agent authentication flow doesn't use the client secret because the client executables reside on the user's device, which makes the client secret accessible and exploitable.

 **Warning:** Because the access token is encoded into the redirection URI, it might be exposed to the user and other apps residing on the device.

If you're using JavaScript to authenticate, call `window.location.replace()` ; to remove the callback from the browser's history.



1. The client app directs the user to Salesforce to authenticate and authorize the app.

2. The user approves access for this authentication flow.
3. The app receives the callback from Salesforce.


After obtaining an access token, the consumer can use the access token to access data on the end-user's behalf and receive a refresh token. Refresh tokens let the consumer get a new access token if the access token becomes invalid for any reason.

## OAuth 2.0 Refresh Token Flow

After the consumer has been authorized for access, it can use a refresh token to get a new access token (session ID). This process happens only after the consumer has received a refresh token using either the web server or user-agent flow. It's up to the consumer to determine when an access token is no longer valid and when to apply for a new one. Bearer flows can be used only after the consumer has received a refresh token.

Using the refresh token authentication flow involves the following steps.

1. The consumer uses the existing refresh token to [request a new access token](#).
2. After the request is verified, Salesforce [sends a response](#) to the client.

 **Note:** Mobile SDK apps can use the SmartStore feature to store data locally for offline use. SmartStore data is inherently volatile. Its lifespan is tied to the authenticated user as well as to OAuth token states. When the user logs out of the app, SmartStore deletes all soup data associated with that user. Similarly, when the OAuth refresh token is revoked or expires, the user's app state is reset, and all data in SmartStore is purged. Carefully consider the volatility of SmartStore data when designing your app. This warning is especially important if your org sets a short lifetime for the refresh token.

## Scope Parameter Values

OAuth requires scope configuration both on server and on client. The agreement between the two sides defines the scope contract.

- **Server side**—Define scope permissions in a connected app on the Salesforce server. These settings determine which scopes client apps, such as Mobile SDK apps, can request. At a minimum, configure your connected app OAuth settings to match what's specified in your code. For hybrid apps and iOS native apps, `refresh_token`, `web`, and `api` are usually sufficient. For Android native apps, `refresh_token` and `api` are usually sufficient.
- **Client side**—Define scope requests in your Mobile SDK app. Client scope requests must be a subset of the connected app's scope permissions.

## Server Side Configuration

Scope parameter values.

Value	Description
<code>api</code>	Allows access to the current, logged-in user's account using APIs, such as REST API and Bulk API. This value also includes <code>chatter_api</code> , which allows access to Chatter REST API resources.
<code>chatter_api</code>	Allows access to Chatter REST API resources only.
<code>custom_permissions</code>	Allows access to the custom permissions in an organization associated with the connected app, and shows whether the current user has each permission enabled.
<code>full</code>	Allows access to all data accessible by the logged-in user, and encompasses all other scopes. <code>full</code> does not return a refresh token. You must explicitly request the <code>refresh_token</code> scope to get a refresh token.

Value	Description
<code>id</code>	Allows access to the identity URL service. You can request <code>profile</code> , <code>email</code> , <code>address</code> , or <code>phone</code> , individually to get the same result as using <code>id</code> ; they are all synonymous.
<code>openid</code>	Allows access to the current, logged in user's unique identifier for OpenID Connect apps.  The <code>openid</code> scope can be used in the OAuth 2.0 user-agent flow and the OAuth 2.0 Web server authentication flow to get back a signed ID token conforming to the <a href="#">OpenID Connect specifications</a> in addition to the access token.
<code>refresh_token</code>	Allows a refresh token to be returned if you are eligible to receive one. This lets the app interact with the user's data while the user is offline, and is synonymous with requesting <code>offline_access</code> .
<code>visualforce</code>	Allows access to Visualforce pages.
<code>web</code>	Allows the ability to use the <code>access_token</code> on the Web. This also includes <code>visualforce</code> , allowing access to Visualforce pages.



**Note:** For Mobile SDK apps, you're always required to select `refresh_token` in server-side Connected App settings. Even if you select the `full` scope, you still must explicitly select `refresh_token`.

## Client Side Configuration

The following rules govern scope configuration for Mobile SDK apps.

Scope	Mobile SDK App Configuration
<code>refresh_token</code>	Implicitly requested by Mobile SDK for your app; no need to include in your request.
<code>api</code>	Include in your request if you're making any Salesforce REST API calls (applies to most apps).
<code>web</code>	Include in your request if your app accesses pages defined in a Salesforce org (for hybrid apps, as well as native apps that load Salesforce-based Web pages.)
<code>full</code>	Include if you wish to request all permissions. (Mobile SDK implicitly requests <code>refresh_token</code> for you.)
<code>chatter_api</code>	Include in your request if your app calls Chatter REST APIs.
<code>id</code>	(Not needed)
<code>visualforce</code>	Use <code>web</code> instead.


## Using Identity URLs

If an authorization request is successful, the HTTP response contains the identity URL along with the access token. The URL is returned in the `id` scope parameter. For example,

```
https://login.salesforce.com/id/00Dx0000000BV7z/005x00000012Q9P.
```

The identity URL is also a RESTful API that you use to query for additional information about users, such as their username, email address, and org ID. It also returns endpoints that the client can talk to, such as photos for profiles and accessible API endpoints.

The format of the URL is `https://login.salesforce.com/id/orgID/userID`, where `orgID` is the ID of the Salesforce org that the user belongs to, and `userID` is the Salesforce user ID.

 **Note:** For a [sandbox](#), `login.salesforce.com` is replaced with `test.salesforce.com`.

The URL must be HTTPS.

## Identity URL Parameters

You can use the following parameters with the access token and identity URL. You can use the access token in an authorization request header or a request with the `oauth_token` parameter.

Parameter	Description
access token	See <a href="#">Use the Access Token</a> .
format	<p>Optional. Specify the format of the returned output. Values are:</p> <ul style="list-style-type: none"> <li><code>json</code></li> <li><code>xml</code></li> </ul> <p>Instead of using the <code>format</code> parameter, the client can also specify the returned format in an accept-request header using one of the following.</p> <ul style="list-style-type: none"> <li><code>Accept: application/json</code></li> <li><code>Accept: application/xml</code></li> <li><code>Accept: application/x-www-form-urlencoded</code></li> </ul> <p>Note the following:</p> <ul style="list-style-type: none"> <li>Wildcard accept headers are allowed. <code>*/*</code> is accepted and returns JSON.</li> <li>A list of values is also accepted and is checked left-to-right. For example: <code>application/xml,application/json,application/html,*/*</code> returns XML.</li> <li>The <code>format</code> parameter takes precedence over the accept request header.</li> </ul>
version	Optional. Specify a SOAP API version number or the literal string <code>latest</code> . If this value isn't specified, the returned API URLs contain the literal value <code>{version}</code> in place of the version number for the client to do string replacement. If the value is specified as <code>latest</code> , the most recent API version is used.
PrettyPrint	Optional and accepted only in a header, not as a URL parameter. Specify to optimize the returned XML or JSON output for readability rather than size. For example, use the following in a header: <code>X-PrettyPrint:1</code> .

Parameter	Description
callback	Optional. Specify a valid JavaScript function name. You can use this parameter when the specified format is JSON. The output is wrapped in this function name (JSONP). For example, if a request to <code>https://server/id/orgid/userid/</code> returns <code>{"foo":"bar"}</code> , a request to <code>https://server/id/orgid/userid/?callback=baz</code> returns <code>baz({"foo":"bar"});</code> .

## Identity URL Response

A valid request returns the following information in JSON format.

- `id`—Identity URL (the same URL that was queried)
- `asserted_user`—Boolean value indicating whether the specified access token was issued for this identity
- `user_id`—Salesforce user ID
- `username`—Salesforce username
- `organization_id`—Salesforce org ID
- `nick_name`—Community nickname of the queried user
- `display_name`—Display name (full name) of the queried user
- `email`—Email address of the queried user
- `email_verified`—Indicates whether the user’s email was verified after the user clicked a link in an email confirmation message.

The `email_verified` value is set to `true` when org and community users click a link in the email they receive after:


- They change their email address
- They change their password, or a Salesforce admin resets their password
- They verify their identity, such as in two-factor authentication
- A Salesforce admin creates them as a new user

For example, a Salesforce admin creates the user Roberta Smith. Roberta receives a “Welcome to Salesforce” email message with a link to verify her account. After she clicks the link, the `email_verified` value is set to `true`.

- `first_name`—First name of the user
- `last_name`—Last name of the user
- `timezone`—Time zone in the user’s settings
- `photos`—Map of URLs to the user’s profile pictures

 **Note:** Accessing these URLs requires passing an access token. See [Use the Access Token](#).

- `picture`
- `thumbnail`
- `addr_street`—Street specified in the address of the user’s settings
- `addr_city`—City specified in the address of the user’s settings
- `addr_state`—State specified in the address of the user’s settings
- `addr_country`—Country specified in the address of the user’s settings
- `addr_zip`—Zip or postal code specified in the address of the user’s settings
- `mobile_phone`—Mobile phone number in the user’s settings

- `mobile_phone_verified`—User confirmed that the mobile phone number is valid (see the [Mobile User field description](#))
- `status`—User’s current Chatter status
  - `created_date`—`xsd datetime` value of the creation date of the last post by the user, for example, 2010-05-08T05:17:51.000Z
  - `body`—Body of the post
- `urls`—Map containing various API endpoints that can be used with the specified user
  -  **Note:** Accessing the REST endpoints requires passing an access token. See [Use the Access Token](#).
  - `enterprise` (SOAP)
  - `metadata` (SOAP)
  - `partner` (SOAP)
  - `rest` (REST)
  - `subjects` (REST)
  - `search` (REST)
  - `query` (REST)
  - `recent` (REST)
  - `profile`
  - `feeds` (Chatter)
  - `feed-items` (Chatter)
  - `groups` (Chatter)
  - `users` (Chatter)
  - `custom_domain`—This value is omitted if the org doesn’t have a custom domain configured and propagated
- `active`—Boolean specifying whether the queried user is active
- `user_type`—Type of the queried user
- `language`—Queried user’s language
- `locale`—Queried user’s locale
- `utcOffset`—Offset from UTC of the time zone of the queried user, in milliseconds
- `last_modified_date`—`xsd datetime` format of the last modification of the user, for example, 2010-06-28T20:54:09.000Z
- `is_app_installed`—Value is `true` when the connected app is installed in the user’s org, and the user’s access token was created using an OAuth flow. If the connected app isn’t installed, the property doesn’t exist (instead of being `false`). When parsing the response, check both for the existence and value of this property.
- `mobile_policy`—Specific values for managing mobile connected apps. These values are available only when the connected app is installed in the current user’s org, the app has a defined session timeout value, and a PIN (Personal Identification Number) has a length value.
  - `screen_lock`—Length of time to wait to lock the screen after inactivity
  - `pin_length`—Length of the identification number required to gain access to the mobile app
- `push_service_type`—Set to `apple` if the connected app is registered with Apple Push Notification Service (APNS) for iOS push notifications or `androidGcm` if it’s registered with Google Cloud Messaging (GCM) for Android push notifications. The response value type is an array.
- `custom_permissions`—When a request includes the `custom_permissions` scope parameter, the response includes a map containing custom permissions in an org associated with the connected app. If the connected app isn’t installed in the org



or has no associated custom permissions, the response doesn't contain a `custom_permissions` map. Here's an example request.

```
http://login.salesforce.com/services/oauth2/authorize?response_type=token&client_id=3MVG91KcPoNINVBKv6EgVJiF.snSDwh6_2wSS7BrOhHGEJkC_&redirect_uri=http://www.example.org/qa/security/oauth/useragent_flow_callback.jsp&scope=api%20id%20custom_permissions
```

Here's the JSON block in the identity URL response.

```
"custom_permissions":
{
 "Email.View":true,
 "Email.Create":false,
 "Email.Delete":false
}
```

Here's a response in XML format.

```
<?xml version="1.0" encoding="UTF-8"?>
<user xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
 <id>https://yourInstance.salesforce.com/id/00Dx0000001T0zk/005x0000001S2b9</id>
 <asserted_user>true</asserted_user>
 <user_id>005x0000001S2b9</user_id>
 <organization_id>00Dx0000001T0zk</organization_id>
 <nick_name>admin1.2777578168398293E12foofoofoofoo</nick_name>
 <display_name>Alan Van</display_name>
 <email>admin@2060747062579699.com</email>
 <status>
 <created_date xsi:nil="true"/>
 <body xsi:nil="true"/>
 </status>
 <photos>
 <picture>https://yourInstance.salesforce.com/profilephoto/005/F</picture>
 <thumbnail>https://yourInstance.salesforce.com/profilephoto/005/T</thumbnail>
 </photos>
 <urls>
 <enterprise>https://yourInstance.salesforce.com/services/Soap/c/{version}/00Dx0000001T0zk

 </enterprise>
 <metadata>https://yourInstance.salesforce.com/services/Soap/m/{version}/00Dx0000001T0zk

 </metadata>
 <partner>https://yourInstance.salesforce.com/services/Soap/u/{version}/00Dx0000001T0zk

 </partner>
 <rest>https://yourInstance.salesforce.com/services/data/v{version}/
 </rest>
 <subjects>https://yourInstance.salesforce.com/services/data/v{version}/subjects/
 </subjects>
 <search>https://yourInstance.salesforce.com/services/data/v{version}/search/
 </search>
 <query>https://yourInstance.salesforce.com/services/data/v{version}/query/
 </query>
 <profile>https://yourInstance.salesforce.com/005x0000001S2b9
 </profile>
```

```

</urls>
<active>true</active>
<user_type>STANDARD</user_type>
<language>en_US</language>
<locale>en_US</locale>
<utcOffset>-28800000</utcOffset>
<last_modified_date>2010-06-28T20:54:09.000Z</last_modified_date>
</user>

```

Here's a response in JSON format.

```

{"id":"https://yourInstance.salesforce.com/id/00Dx0000001T0zk/005x0000001S2b9",
"asserted_user":true,
"user_id":"005x0000001S2b9",
"organization_id":"00Dx0000001T0zk",
"nick_name":"admin1.2777578168398293E12foofoofoofoo",
"display_name":"Alan Van",
"email":"admin@2060747062579699.com",
"status":{"created_date":null,"body":null},
"photos":{"picture":"https://yourInstance.salesforce.com/profilephoto/005/F",
"thumbnail":"https://yourInstance.salesforce.com/profilephoto/005/T"},
"urls":

{"enterprise":"https://yourInstance.salesforce.com/services/Soap/c/{version}/00Dx0000001T0zk",

"metadata":"https://yourInstance.salesforce.com/services/Soap/m/{version}/00Dx0000001T0zk",

"partner":"https://yourInstance.salesforce.com/services/Soap/u/{version}/00Dx0000001T0zk",

"rest":"https://yourInstance.salesforce.com/services/data/v{version}/",
"subjects":"https://yourInstance.salesforce.com/services/data/v{version}/subjects/",
"search":"https://yourInstance.salesforce.com/services/data/v{version}/search/",
"query":"https://yourInstance.salesforce.com/services/data/v{version}/query/",
"profile":"https://yourInstance.salesforce.com/005x0000001S2b9"},
"active":true,
"user_type":"STANDARD",
"language":"en_US",
"locale":"en_US",
"utcOffset":-28800000,
"last_modified_date":"2010-06-28T20:54:09.000+0000"}

```

After making an invalid request, the following are possible responses from Salesforce.

Error Code	Request Problem
403 (forbidden) — HTTPS_Required	HTTP
403 (forbidden) — Missing_OAuth_Token	Missing access token
403 (forbidden) — Bad_OAuth_Token	Invalid access token
403 (forbidden) — Wrong_Org	Users in a different org

Error Code	Request Problem
404 (not found) — Bad_Id	Invalid or bad user or org ID
404 (not found) — Inactive	Deactivated user or inactive org
404 (not found) — No_Access	User lacks proper access to org or information
404 (not found) — No_Site_Endpoint	Request to an invalid endpoint of a site
404 (not found) — Internal Error	No response from server
406 (not acceptable) — Invalid_Version	Invalid version
406 (not acceptable) — Invalid_Callback	Invalid callback

## Setting Custom Login Servers in Android Apps

For special cases—for example, if you’re a Salesforce partner using Trialforce—you can redirect your user’s login requests to a custom login URI.

In Android, login hosts are known as server connections. You can see the standard list of server connections in the `res/xml/servers.xml` file of the `SalesforceSDK` project. Mobile SDK uses this file to define production and sandbox servers.

For Android, the default login host can potentially be set through any of the following means.

### 1. MDM enforced

- At startup, your app’s MDM provider configures the login URI.
- The MDM policy can also hide the navigation bar and Settings icon to prevent users from changing the login host.

### 2. App configuration through the `servers.xml` file

You can add your custom servers to the runtime list by creating your own `res/xml/servers.xml` file in your native Android project. The first server listed in your `servers.xml` file is used as the default login server at app startup. The root XML element for `servers.xml` is `<servers>`. This root can contain any number of `<server>` entries. Each `<server>` entry requires two attributes: `name` (an arbitrary human-friendly label) and `url` (the web address of the login server, including the “https://” prefix).

Here’s an example of a `servers.xml` file.

```
<?xml version="1.0" encoding="utf-8"?>
<servers>
 <server name="XYZ.com Login" url="https://myloginserver.cloudforce.com"/>
</servers>
```

 **Note:** To test XML changes in an Android emulator, we’ve found that it’s best to:

- a. Force stop the app if it’s already running in the emulator.
- b. Uninstall the app in the emulator.
- c. Do a full clean and rebuild.
- d. Run the app.

### 3. User configuration through the Add Connection button

Here’s how a user can configure a custom login server.

- a. Start the app without logging in.
- b. In the login screen, tap the Settings icon in the upper left corner.
- c. Tap **Change Server**.
- d. Tap **Add Connection**.
- e. To help identify this configuration in future visits, enter a name.
- f. Enter your custom login host's URI. Be sure to include the `https://` prefix. For example, here's how you enter a typical community URI:

```
https://mycommunity-developer-edition.na15.force.com/fineapps
```

Mobile SDK enables this functionality by default. You can't disable the **Change Server** or **Add Connection** option programmatically in Mobile SDK for Android.

### Important:

- In Android, always include the "https://" prefix when specifying the login URL.
- At startup, MDM runtime configuration overrides compile-time settings.

## Setting Custom Login Servers in iOS Apps

For special cases—for example, if you're a Salesforce partner using Trialforce—you can redirect your user's login requests to a custom login URI.

In iOS apps, login servers are often called *login hosts*. Mobile SDK defines standard login URIs for production and sandbox servers in the `SalesForceSDKCore` project. These two login hosts appear in the Choose Connection login screen.

For iOS, the default login host can potentially be set through any of the following means.

### 1. MDM enforced



- At startup, your app's MDM provider configures the login URI.
- The MDM policy can also hide the navigation bar and Settings icon to prevent users from changing the login host.

### 2. App configuration through the `info.plist` file

- Your app can configure the default login URI in the project's `info.plist` properties file. The login host property name is `SFDCOAuthLoginHost`.
- At startup, the `SFDCOAuthLoginHost` setting overrides user-defined login hosts.
- By default, `SFDCOAuthLoginHost` property is set to "login.salesforce.com".
- Do not use a protocol prefix such as "https://" when specifying the login URI.

### 3. User configuration through the Add Connection screen

Here's how a user can configure a custom login server.

- a. Start the app without logging in.
- b. In the login screen, tap the Settings, or "gear," icon  in the top navigation bar.
- c. In the Choose Connection screen, tap the Plus icon .
- d. (Optional but recommended) To help identify this configuration in future visits, enter a label.

- e. Enter your custom login host's URI. Be sure to omit the `https://` prefix. For example, here's how you enter a typical community URI:

```
mycommunity-developer-edition.na15.force.com/fineapps
```

Mobile SDK enables this functionality by default. You can disable the Add Connection option by setting `SFLoginHostViewController` properties.

### Important:


- At startup, MDM runtime configuration overrides compile-time settings.
- Before version 4.1, Mobile SDK apps for iOS defined their custom login URIs in the app's Settings bundle. In Mobile SDK 4.1 and later, iOS apps lose the Settings bundle. Instead, you can use the `SFDCOAuthLoginHost` property in the app's `info.plist` file to build in a custom login URI.

SEE ALSO:

[Hiding the Settings Icon in iOS Apps](#)

## Hiding the Settings Icon in iOS Apps

Currently, the Mobile SDK login screen for iOS provides a top navigation bar that includes a Settings icon. Customers can use the Settings icon to select a login server from a built-in list, or to specify a custom login URI. Some companies, however, don't allow users to choose the login server. If you're bound by such restrictions, here's how you can use code to hide the Settings icon and customize the navigation bar appearance.

By default, the Salesforce Mobile SDK login screen shows both the top navigation bar and its embedded Settings icon. The Settings icon is often referred to as the "gear" icon due to its sprocket-like shape . To disable switching login servers, you can hide either the Settings icon itself or the navigation bar that contains it. You can also customize colors and font. Use the following `SFSDKLoginViewControllerConfig` properties to control the visibility and appearance of these UI elements.

### showSettingsIcon

Controls the display of the Settings icon only. Does not affect the visibility of the navigation bar.

#### Behavior


Value	Meaning
YES (default)	Default value. The Settings icon is visible and accessible.
NO	The Settings icon is hidden. Users cannot access the login host list and cannot add custom hosts.

### showNavbar

Controls the display of the navigation bar, which in turn hides the Settings icon.

**Behavior**


Value	Meaning
YES (default)	Default value. The navigation bar is visible. The Settings icon display depends on the <code>showSettingsIcon</code> property.
NO	The navigation bar and the Settings icon are hidden. Users cannot access the login host list and cannot add custom hosts.

 **Note:** To hide the gear icon in hybrid apps, apply these steps to the native wrapper app created by Cordova.

## Navigation Bar Colors and Font

You can set the following style properties:

- `navBarColor`
- `navBarTextColor`
- `navBarFont`

 **Example:** Import the header file, then add the subsequent lines to the `application:didFinishLaunchingWithOptions:` method of your `AppDelegate` class.

```
#import <SalesforceSDKCore/SFSDKLoginViewControllerConfig.h>
...
SFSDKLoginViewControllerConfig *loginViewConfig = [[SFSDKLoginViewControllerConfig
alloc] init];
loginViewConfig.showSettingsIcon = NO;
loginViewConfig.showNavbar = YES;
loginViewConfig.navBarColor = [UIColor redColor];
loginViewConfig.navBarTextColor = [UIColor whiteColor];
loginViewConfig.navBarFont = [UIFont boldSystemFontOfSize:20.0f];
[SFUserAccountManager sharedInstance].loginViewControllerConfig = loginViewConfig;
```

SEE ALSO:

[Setting Custom Login Servers in iOS Apps](#)

## Revoking OAuth Tokens

When a user logs out of an app, or the app times out or in other ways becomes invalid, the logged-in users' credentials are cleared from the mobile app. This effectively ends the connection to the server. Also, Mobile SDK revokes the refresh token from the server as part of logout.

### Revoking Tokens

To revoke OAuth 2.0 tokens, use the revocation endpoint.

```
https://login.salesforce.com/services/oauth2/revoke
```

Construct a POST request that includes the following parameters using the `application/x-www-form-urlencoded` format in the HTTP request entity-body. For example:

```
POST /revoke HTTP/1.1
Host: https://login.salesforce.com/services/oauth2/revoke
Content-Type: application/x-www-form-urlencoded

token=currenttoken
```

If an access token is included, Salesforce invalidates it and revokes the token. If a refresh token is included, Salesforce revokes it and any associated access tokens.

The authorization server indicates successful processing of the request by returning an HTTP status code 200. For all error conditions, a status code 400 is used along with one of the following error responses.

- `unsupported_token_type`—Token type not supported
- `invalid_token`—Token was invalid

For a [sandbox](#), use `test.salesforce.com` instead of `login.salesforce.com`.

## Refresh Token Revocation in Android Native Apps

When a refresh token is revoked by an administrator, the default behavior is to automatically log out the current user. As a result of this behavior:

- Any subsequent REST API calls your app makes will fail.
- The system discards your user's account information and cached offline data.
- The system forces the user to navigate away from your page.
- The user must log into Salesforce again to continue using your app.

These side effects provide a secure response to the administrator's action.

## Token Revocation Events

When a token revocation event occurs, the `ClientManager` object sends an Android-style notification. The intent action for this notification is declared in the `ClientManager.ACCESS_TOKEN_REVOKE_INTENT` constant.

`SalesforceActivity.java`, `SalesforceListActivity.java`, `SalesforceExpandableListActivity.java`, and `SalesforceDroidGapActivity.java` implement `ACCESS_TOKEN_REVOKE_INTENT` event listeners. These listeners automatically take logged out users to the login page when the refresh token is revoked. A toast message notifies the user of this occurrence.

## Connected Apps

---

A connected app integrates an application with Salesforce using APIs. Connected apps use standard SAML and OAuth protocols to authenticate, provide single sign-on, and provide tokens for use with Salesforce APIs. In addition to standard OAuth capabilities, connected apps allow Salesforce admins to set various security policies and have explicit control over who can use the corresponding apps.

Here's a general list of information that you provide when you create a connected app.

- Name, description, logo, and contact information
- URL where Salesforce can locate the app for authorization or identification
- Authorization protocol: OAuth, SAML, or both

- IP ranges from where users can log in to connected app (optional)
- Information about mobile policies that the connected app can enforce (optional)

Salesforce Mobile SDK apps use connected apps to access Salesforce OAuth services and to call Salesforce REST APIs.

## About PIN Security

Salesforce connected apps have an additional layer of security via PIN protection on the app. This PIN protection is for the mobile app itself, and isn't the same as the PIN protection on the device or the login security provided by the Salesforce organization.

In order to use PIN protection, the developer must select the **Implements Screen Locking & Pin Protection** checkbox when creating the connected app. Mobile app administrators then have the options of enforcing PIN protection, customizing timeout duration, and setting PIN length.

 **Note:** Because PIN security is implemented in the mobile device's operating system, only native and hybrid mobile apps can use PIN protection; HTML5 Web apps can't use PIN protection.

In practice, PIN protection can be used so that the mobile app locks up if it isn't used for a specified number of minutes. When a mobile app is sent to the background, the clock continues to tick.

To illustrate how PIN protection works:

1. Customer turns on a phone and enters the PIN for the device.
2. Customer launches a Mobile SDK app.
3. Customer enters login information for Salesforce organization.
4. Customer enters PIN code for the Mobile SDK app.
5. Customer works in the app and then sends it to the background by opening another app (or receiving a call, and so on).
6. The app times out.
7. Customer reopens the app, and the app PIN screen displays (for the Mobile SDK app, not the device).
8. Customer enters app PIN and can resume working.

## Portal Authentication Using OAuth 2.0 and Salesforce Sites

---

The Salesforce Spring '13 Release adds enhanced flexibility for portal authentication. If your app runs in a Salesforce portal, you can use OAuth 2.0 with a Salesforce site to obtain API access tokens on behalf of portal users. In this configuration you can:

- Authenticate portal users via Auth providers and SAML, rather than a SOAP API `login()` call.
- Avoid handling user credentials in your app.
- Customize the login screen provided by the Salesforce site.

Here's how to get started.

1. Associate a Salesforce site with your portal. The site generates a unique URL for your portal. See [Associating a Portal with Salesforce Sites](#).
2. Create a custom login page on the Salesforce site. See [Managing Salesforce Site Login and Registration Settings](#).
3. Use the unique URL that the site generates as the redirect domain for your users' login requests.

The OAuth 2.0 service recognizes your custom host name and redirects the user to your site login page if the user is not yet authenticated.



 **Example:** For example, rather than redirecting to `https://login.salesforce.com`:

```
https://login.salesforce.com/services/oauth2/authorize?
response_type=code&client_id=<your_client_id>&
redirect_uri=<your_redirect_uri>
```

redirect to your unique Salesforce site URL, such as `https://mysite.secure.force.com`:

```
https://mysite.secure.force.com/services/oauth2/authorize?
response_type=code&client_id=<your_client_id>&
redirect_uri=<your_redirect_uri>
```

For more information and a demonstration video, see [OAuth for Portal Users](#) on the Lightning Platform Developer Relations Blogs page.

## Using MDM with Salesforce Mobile SDK Apps

---

Mobile Device Management (MDM) can facilitate app configuration, updating, and authentication. Salesforce and Mobile SDK support the use of MDM for connected apps.

To use MDM, you work with a Salesforce administrator and an MDM provider. The Salesforce administrator configures your connected app to suit your use case. The MDM provider is a trusted third party who distributes your mobile app settings to your customers' devices. For example, you can use MDM to configure custom login URLs for your app. You can also use MDM for certificate-based authentication. In this case, you upload certificates to the MDM provider.

MDM enablement does not require changes to your Mobile SDK app code.

The following outline explains the basic MDM runtime flow.

### Authentication and Configuration Runtime Flow

1. To download an MDM-enabled Mobile SDK app, a customer first installs the MDM provider's app.
2. The MDM provider uses its app to push the following items to the device:
  - Your Mobile SDK app
  - Any configuration details you've specified, such as custom login URLs or enhanced security settings
  - A user certificate if you're also using MDM for authentication
3. When the customer launches your app, behavior varies according to the mobile operating system.
  - **Android:** If you're supporting for certificate-based authentication, the login server requests a certificate. Android launches a web view and presents a list of one or more available certificates for the customer's selection.
  - **iOS:** The Mobile SDK app checks whether the Salesforce connected app definition enables certificate-based authentication. If so, the app navigates to a Safari window. Safari retrieves the stored MDM certificate and transparently authenticates the device.
4. After it accepts the certificate, the login server sends access and refresh tokens to the app.
5. Salesforce posts a standard screen requesting access to the customer's data.

The following sections describe the MDM configuration options that Mobile SDK supports.


## Certificate-Based Authentication

Using certificates to authenticate simplifies provisioning your mobile users, and your day-to-day mobile administration tasks by eliminating usernames and passwords. Salesforce uses X.509 certificates to authenticate users more efficiently, or as a second factor in the login process.

### MDM Settings for Certificate-Based Authentication

To enable certificate-based authentication for your mobile users, you need to configure key-value pair assignments through your MDM suite. Here are the supported keys:

Key	Data Type	Platform	Description
RequireCertAuth	Boolean	Android, iOS	If true, the certificate-based authentication flow initiates.  <b>Android:</b> Uses the user certificate on the device for authentication inside a webview.  <b>iOS:</b> Redirects the user to Safari for all authentication requests.
ManagedAppCertAlias	String	Android	Alias of the certificate deployed on the device picked by the application for user authentication. Required for Android only.

 **Note:** There's a minimum device OS version requirement to use certificate-based authentication. For Android, the minimum supported version is 5.0. For iOS, the minimum supported version is 7.0.

Once you save your key-value pair assignments, you can push the mobile app with the updated certificate-based authentication flow to your users via your MDM suite.

## Automatic Custom Host Provisioning

You can now push custom login host settings to your mobile users. This spares your mobile users from having to manually type long URLs for login hosts—typically a frustrating and error-prone activity. You can configure key-value pair assignments through your MDM to define multiple custom login hosts for your mobile users.

### MDM Settings for Automatic Custom Host Provisioning

To push custom login host configurations to your mobile users, you need to configure key-value pair assignments through your MDM suite. Here are the supported keys:

Key	Data Type	Platform	Description
AppServiceHosts	String, String Array	Android, iOS	Login hosts. First value in the array is the default host.  <b>Android:</b> Requires https:// in the host URL.

Key	Data Type	Platform	Description
			<b>iOS:</b> Doesn't require https:// in the host URL.
AppServiceHostLabels	String, String Array	Android, iOS	Labels for the hosts.  The number of AppServiceHostLabels entries must match the number of AppServiceHosts entries.
OnlyShowAuthorizedHosts	Boolean	Android, iOS	If true, prevents users from modifying the list of hosts that the Salesforce app can connect to.


## Additional Security Enhancements

You can add an extra layer of security for your iOS users by clearing the contents of their clipboard whenever the mobile app is in the background. Users may copy and paste sensitive data as a part of their day-to-day operations, and this enhancement ensures any data they copy onto their clipboards are cleared whenever they background the app.

### MDM Settings for More Security Enhancements

To clear the clipboards of your iOS users when the mobile app is in the background, you need to configure key-value pair assignments through your MDM suite. Here is the supported key:

Key	Data Type	Platform	Description
ClearClipboardOnBackground	Boolean	iOS	If true, the contents of the iOS clipboard are cleared when the mobile app is backgrounded. This prevents the user from accidentally copying and pasting sensitive data outside of the application.

 **Note:** If the mobile app stops working unexpectedly, the copied data can remain on the clipboard. The contents of the clipboard are cleared once the user starts and backgrounds the mobile app.

This security functionality is available through Android for Android devices running OS 5.0 and greater, and that have Android for Work set up. Contact your MDM provider to configure this functionality for your Android users.

## Sample Property List Configuration

 **Note:** Setting key-value pair assignments through a plist is only available on iOS.

One method of setting key-value pair assignments is through an XML property list, or plist. The plist contains the key-value pair assignments that an MDM provider sends to a mobile app to enforce security configurations.

Here is a sample plist:

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE plist PUBLIC "-//Apple//DTD PLIST 1.0//EN"
"http://www.apple.com/DTDs/PropertyList-1.0.dtd">
<plist version="1.0">
<dict>
 <key>AppServiceHosts</key>
 <array>
 <string>host1</string>
 <string>host2</string>
 </array>
 <key>AppServiceHostLabels</key>
 <array>
 <string>Production</string>
 <string>Sandbox</string>
 </array>
 <key>RequireCertAuth</key>
 <true/>
 <key>ClearClipboardOnBackground</key>
 <false/>
 <key>OnlyShowAuthorizedHosts</key>
 <false/>
</dict>
</plist>
```

## Using Advanced Authentication in iOS Apps

---

Mobile SDK currently supports two iOS authentication flows: standard authentication and advanced authentication. By default, Mobile SDK apps use the standard flow. To take advantage of tighter security or advanced authentication schemes, you can reconfigure your app to use the advanced flow.

- *Standard authentication flow:* This flow uses `WKWebView`. Because it is a `UIView`, `WKWebView` offers a superior user experience with access to the iOS view toolbar and other compelling features.
- *Advanced authentication flow:* Before Mobile SDK 5.2, advanced authentication used the Safari browser, which required “swizzling” out of the app to the browser and back. Mobile SDK 5.2 and later use `SFSafariViewController`. `SFSafariViewController` doesn’t swizzle away from the app, and it supports useful Safari features such as autofill, iCloud keychain, and security certificates. Advanced authentication is also the more secure option—it doesn’t allow the app to set cookies or inject content into the view without the customer’s consent. Use advanced authentication if you require any of these features, or if you’re using MDM, certificate-based login, or another advanced login flow.



**Note:** Although `SFSafariViewController` doesn’t use swizzling, the login page remains full-screen. This presentation might give some customers the impression that they’ve temporarily left your app.

## Enabling Advanced Authentication with My Domain

On orgs that use My Domain, you can enable advanced authentication through a server-side setting. However, in Mobile SDK apps, your code determines whether that setting is honored. For advanced authentication, code changes to your app are required with or without My Domain.

For information on server-side My Domain configuration, see [Customize Your Login Page with Your Own Branding](#) in the *Identity Implementation Guide*.

## Configuring Advanced Authentication Support in Your Code

Mobile SDK defines an `SFOAuthAdvancedAuthConfiguration` enum that is the gatekeeper for advanced authentication requests. This enum has three states:

### **SFOAuthAdvancedAuthConfigurationNone**

Your app uses standard authentication. No advanced authentication is allowed.

### **SFOAuthAdvancedAuthConfigurationAllow**

If the org's My Domain settings enable advanced authentication, your app will also use advanced authentication.

### **SFOAuthAdvancedAuthConfigurationRequire**

Your app uses advanced authentication regardless of the org's My Domain settings.

To enable advanced authentication:


- In the `init` method of `AppDelegate`, set the `SFAuthenticationManager.advancedAuthConfiguration` property to either `SFOAuthAdvancedAuthConfigurationAllow` or `SFOAuthAdvancedAuthConfigurationRequire`. The forceios native template app provides the pre-coded options in the comments. All you have to do is uncomment the setting you require.
- Implement the `application:openURL:options:` method in `AppDelegate`. The template app provides a stubbed version of this method with instructions and the necessary code in comments.
- Add your custom URL schemes for the OAuth redirect URI to your project's `Info.plist` file.

## Configuring Your Custom URL Schemes

To configure your app to use its custom URL schemes for the OAuth callback URI:

1. In your app's `Info.plist` file, create a key named `CFBundleURLTypes`.
2. Assign the key an array that contains a dictionary with the following keys:

Name	Type	Value
<code>CFBundleURLName</code>	String	A unique abstract name of the URL scheme, preferably an identifier in reverse-DNS style. For example: <code>com.acme.myscheme</code>
<code>CFBundleURLSchemes</code>	Array of strings	URL scheme names, such as <code>http</code> , <code>mailto</code> , and so on.

 **Example:** The following example enforces advanced authentication regardless of the org's My Domain setting.

1. In your `AppDelegate.m` file, uncomment or add the following call in the `init` method.

```
[SFAuthenticationManager sharedManager].advancedAuthConfiguration =
 SFOAuthAdvancedAuthConfigurationRequire;
```

2. In the `application:openURL:options:` method, replace the template's original `return NO` statement with the commented version. Here's how the method looks after this change:

```
- (BOOL)application:(UIApplication *)app
 openURL:(NSURL *)url
 options:(NSDictionary<UIApplicationOpenURLOptionsKey,id> *)
 options {
 // If you're using advanced authentication:
 // --Configure your app to handle incoming requests to your
 // OAuth Redirect URI custom URL scheme.
 // --Uncomment the following line and delete the original return statement:

 return [[SFAuthenticationManager sharedManager]
 handleAdvancedAuthenticationResponse:url];
}
```

3. In your `Info.plist` file, register your OAuth callback URI scheme as a custom scheme for your application. For example, if your OAuth callback URI is `com.mydomain.myapp://oauth/success`, add the following key:

```
<key>CFBundleURLTypes</key>
<array>
 <dict>
 <key>CFBundleURLName</key>
 <string>com.mydomain.myapp</string>
 <key>CFBundleURLSchemes</key>
 <array>
 <string>com.mydomain.myapp</string>
 </array>
 </dict>
</array>
```

In this example, the URL scheme and URL name are the same, but this matching is not required. You can add as many schemes as your app requires. For information on configuring iOS URL schemes, look up “Inter-App Communication” or “Custom URL Schemes” in the *App Programming Guide for iOS* at [developer.apple.com/documentation/](https://developer.apple.com/documentation/).

## Enabling Browser-Based Authentication in Android Apps

If your Mobile SDK Android app uses Google as an identity provider, a code change is coming your way. Google is dropping support for logins through embedded web views. Instead of web views, Google recommends switching to native OAuth or browser-based login flows. Mobile SDK 6.0 makes it possible for these apps to authenticate with the native browser instead of the `WebView` class.

To support native browser authentication, Mobile SDK uses a Chrome custom tab in the application. If Chrome is not available at runtime, Mobile SDK uses the default system browser.

1. In a code editor, open your `Application` subclass.
2. After your call to `initNative()` or `initHybrid()`, call the following method:

```
SalesforceSDKManager.getInstance().setBrowserLoginEnabled(true);
```

This call typically goes in the `onCreate()` method. In apps created with forcedroid templates, you can simply uncomment this line:

```
@Override
public void onCreate() {
 super.onCreate();
 SmartSyncSDKManager.initNative(getApplicationContext(),
 new NativeKeyImpl(), MainActivity.class);

 /*
 * Uncomment the following line to enable browser based login. This will use a
 * Chrome custom tab to login instead of the default WebView. You will also need
 * to uncomment a few lines of code in SalesforceSDK library project's
 AndroidManifest.xml.
 */
 // SmartSyncSDKManager.getInstance().setBrowserLoginEnabled(true);

 ...
}
```

In hybrid apps, you can uncomment the same line in the `HybridApp.java` file of the `SalesforceHybrid` library.

3. Open your app's `AndroidManifest.xml` file.
4. In the `LoginActivity` declaration, uncomment the following lines:

```
<activity android:name="com.salesforce.androidsdk.ui.LoginActivity"
 android:theme="@style/SalesforceSDK.ActionBarTheme"
 android:launchMode="singleInstance">

 <!--
 <intent-filter>
 <data android:scheme="testsfdc"
 android:host="*"
 android:path="/mobilesdk/detect/oauth/done" />
 <action android:name="android.intent.action.VIEW" />
 <category android:name="android.intent.category.BROWSABLE" />
 <category android:name="android.intent.category.DEFAULT" />
 </intent-filter>
 -->
</activity>
```

5. Replace the values for `android:scheme`, `android:host`, and `android:path` with their corresponding values from your connected app. Here are a couple of examples.

If the callback URL of your connected app is `testsfdc:///mobilesdk/detect/oauth/done`:

- `android:scheme` is `testsfdc`.
- `android:host` is `*`, meaning that it doesn't exist.
- `android:path` is `/mobilesdk/detect/oauth/done`.

If the callback URL of your connected app is `sfdc://login.salesforce.com/oauth/done`:

- `android:scheme` is `sfdc`.
- `android:host` is `login.salesforce.com`.
- `android:path` is `/oauth/done`.

Here's the updated portion of your `AndroidManifest.xml`, using the `testsfdc:///mobilesdk/detect/oauth/done` scheme.

```
<!-- Login activity -->
<!--
 Launch mode of "singleInstance" ensures that the activity isn't restarted
 by a callback from Chrome custom tab when auth flow is complete. This is
 required for the Chrome custom tab auth flow to work correctly.
-->

<!--
 To enable browser bath authentication, uncomment the lines below and replace
 'scheme', 'host' and 'path' with their corresponding values from your connected app.

 For example, if the callback URL of your connected app is
 "testsfdc:///mobilesdk/detect/oauth/done",
 'scheme' would be "testsfdc", 'host' would be "*" since it doesn't exist, and
 'path' would be "/mobilesdk/detect/oauth/done".

 If the callback URL is "sfdc://login.salesforce.com/oauth/done",
 'scheme' would be "sfdc", 'host' would be "login.salesforce.com",
 and 'path' would be "/oauth/done".
-->
<activity android:name="com.salesforce.androidsdk.ui.LoginActivity"
 android:theme="@style/SalesforceSDK.ActionBarTheme"
 android:launchMode="singleInstance">
 <intent-filter>
 <data android:scheme="testsfdc"
 android:host="*"
 android:path="/mobilesdk/detect/oauth/done" />
 <action android:name="android.intent.action.VIEW" />
 <category android:name="android.intent.category.BROWSABLE" />
 <category android:name="android.intent.category.DEFAULT" />
 </intent-filter>
</activity>
```

You're all set! Your Mobile SDK app now performs authentication through a browser tab instead of an embedded web view.

## See Also

- [Chrome Custom Tabs](#)
- [Google's developer blog](#)



# CHAPTER 15 Customizing the Salesforce Login Page

Although Mobile SDK doesn't control the Salesforce login page, you can still customize and brand it in certain cases.

## Customize the Login Screen Appearance through Mobile SDK

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On iOS, you can also configure some properties of the login page, including the navigation bar and Settings icon. See [Hiding the Settings Icon in iOS Apps](#)

## Customizing the Login Screen through the Salesforce Server

---

Salesforce Mobile SDK provides an OAuth implementation for its client apps, but it doesn't define or control the login page. Instead, it requests the page from the Salesforce server. Salesforce itself then presents a web view that gathers your customer's credentials. The login web view is not part of your Mobile SDK app.

On the server side, you can change the login web view if your Salesforce org uses either of the following features:

- Communities
- My Domain

Both of these features provide handy utilities for login page branding and customization. To use your branded page, you set the default login URL of your Mobile SDK app to the Community custom domain or My Domain subdomain address. Your app then displays your customized login page.

Use the following links to learn about these features.

- [Use Your Branded Login Page](#)
- [Customize Login, Self-Registration, and Password Management for Your Community](#)—[https://help.salesforce.com/articleView?id=networks\\_customize\\_login.htm](https://help.salesforce.com/articleView?id=networks_customize_login.htm)
- [What is My Domain?](#)—[https://help.salesforce.com/articleView?id=domain\\_name\\_overview.htm](https://help.salesforce.com/articleView?id=domain_name_overview.htm)
- [My Domain login page customization instructions](#)—[https://help.salesforce.com/articleView?id=domain\\_name\\_login\\_branding.htm](https://help.salesforce.com/articleView?id=domain_name_login_branding.htm)
- [Sample My Domain customized login page](#)—<https://github.com/salesforceidentity/MyDomain-Sample>
- [My Domain FAQ](#)—[https://help.salesforce.com/articleView?id=faq\\_domain\\_name.htm](https://help.salesforce.com/articleView?id=faq_domain_name.htm)

# CHAPTER 16 Using Mobile SDK Apps as Identity Providers

## In this chapter ...

- [Identity Providers: Architecture, Flow, and Connected App Requirements](#)
- [Android Architecture and Flow](#)
- [Configuring an Android App to Be an Identity Provider](#)
- [Configuring an Android App to Be an Identity Provider Client](#)
- [Configuring an iOS App to Be An Identity Provider](#)
- [Configuring an iOS App to Be An Identity Provider Client](#)

In version 6.0, Mobile SDK enhances its authentication handling by adding identity provider services. Identity providers help known users avoid reentering their Salesforce credentials every time they log in to a Mobile SDK app. At the same time, it preserves the stringent security level of previous Mobile SDK releases.

An identity provider setup consists of two primary components:

- An identity provider is an ordinary Mobile SDK app that's configured to manage Salesforce logins for one or more users on a single mobile device. This app serves as the broker between Mobile SDK apps on the device and the Salesforce authentication service. It tracks device users that have recently logged in and kicks off the authentication process when they return to the app.
- An identity provider client is an ordinary Mobile SDK app that's configured to use an identity provider for logins. These apps are also called "service providers" because they provide the services that the user is trying to access. A traditional service provider gives the user one choice for authentication: the Salesforce login screen. An identity provider client, on the other hand, gives the user the choice of logging in through either the Salesforce login screen or a specific identity provider. With the identity provider option, the user simply selects an account from a list of recently active users.

Typically, a single device hosts a single identity provider app, but this limitation is not enforced. A single device can host any number of identity provider client apps.

Several rules apply to identity provider apps and their clients.

- They must be built with Mobile SDK 6.0 or later.
- They must be discrete apps. You can't combine identity provider and identity provider client implementations in a single app.
- A client and the identity provider it delegates to must use different Salesforce connected apps with differing OAuth callback URLs.

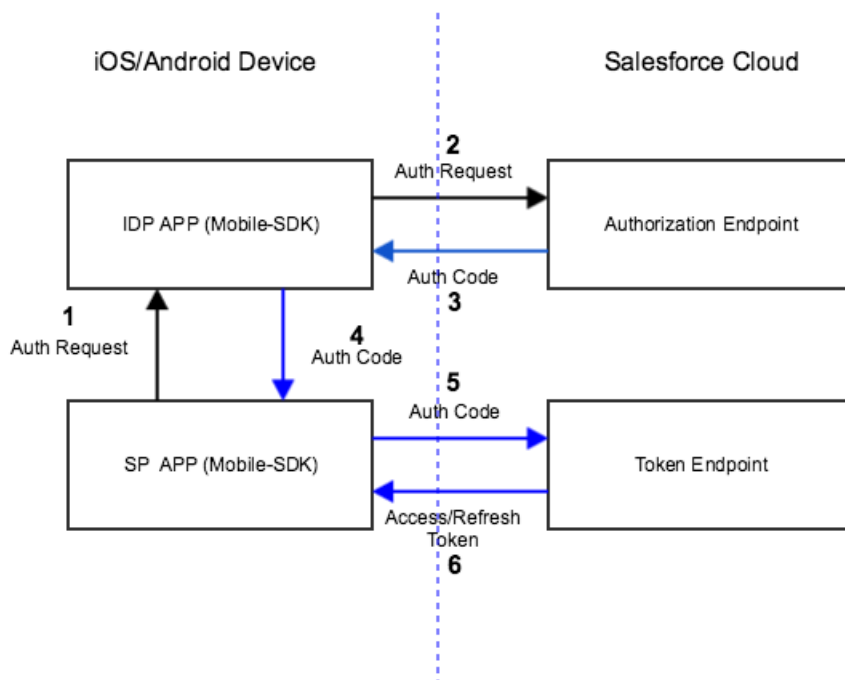
## Identity Providers: Architecture, Flow, and Connected App Requirements

All Mobile SDK identity provider setups follow the same flows and architectural outlines, regardless of platform. Salesforce connected apps for identity provider components also impose a few special requirements.

### High-Level Flow

A user can start the identity provider flow from either an identity provider app or one of its clients. When a user starts the flow by launching an identity provider client app, the first step is to choose a login preference: through either the standard Salesforce login view or an identity provider. The user can also choose identity provider login by directly launching an identity provider app. In this case, the identity provider launches the requested client app to start authentication.

Here's a high-level diagram of what happens when the flow begins in an identity provider client. The client app doesn't collect credentials from the user. Instead, it delegates login interaction to the identity provider app.



1. At the user's request, the identity provider client app requests authorization from an identity provider. The identity provider responds by displaying a list of logged-in users.
2. After the user makes a selection, the identity provider forwards an authorization request to a Salesforce authorization endpoint.
3. Salesforce sends an authorization code back to the identity provider.
4. Identity provider forwards the authorization code to the identity provider client.
5. Identity provider client forwards the authorization code to the Salesforce OAuth token endpoint.
6. Salesforce exchanges the authorization code for access and refresh tokens and returns the tokens to the identity provider client app. Only the client app handles the user's OAuth tokens.

All the user has to do is click the identity provider button, then select an account. After accepting the standard request for access to Salesforce data, the user can begin working in the client app.

## A Bit More Detail

Here's more granular information for the authentication flow. In the identity provider client:

1. If the user has a valid refresh token in the identity provider client app, they're automatically in—just the usual refresh token exchange occurs.
2. If the user doesn't have a valid refresh token, the identity provider client prompts the user to choose either standard Salesforce login or identity provider login.

Mobile SDK ignores a user's selection of identity provider login and instead displays the standard Salesforce login screen if:

- No identity provider app is configured in the identity provider client app.
- The configured identity provider app is not found or is not running.
- No users are currently logged in to the identity provider app.

If authorization succeeds, the client asks Salesforce to refresh the user's tokens. When Salesforce returns the refresh token, the flow defaults to the standard Mobile SDK post-login flow. Mobile SDK caches the refresh token returned from Salesforce.

## Connected App Requirements

- Create two connected apps—one for the identity provider app, one for identity provider client apps.
- Uncheck "Require Consumer Secret" on the connected app for identity provider client apps.
- Set the OAuth Callback URI to a custom scheme that you devise. The custom URI scheme for an identity provider client app cannot match the scheme for its identity provider app.

### Important:

- An identity provider app must enable the `web` scope on the connected app and request it in the mobile app. Otherwise, Mobile SDK redirects the user to a login page with an error message. At this point, the flow cannot continue.
- An identity provider and its clients must use different connected apps with their own `consumerKey` and `callbackUrl` values. Otherwise, the Salesforce service returns an "invalid credentials" error message when the identity provider requests an authorization code. Currently, all Mobile SDK sample apps use the same `consumerKey` and `callbackUrl`. If you plan to adopt these apps as identity provider-client pairs, make sure that each app uses its own unique values.

## Android Architecture and Flow

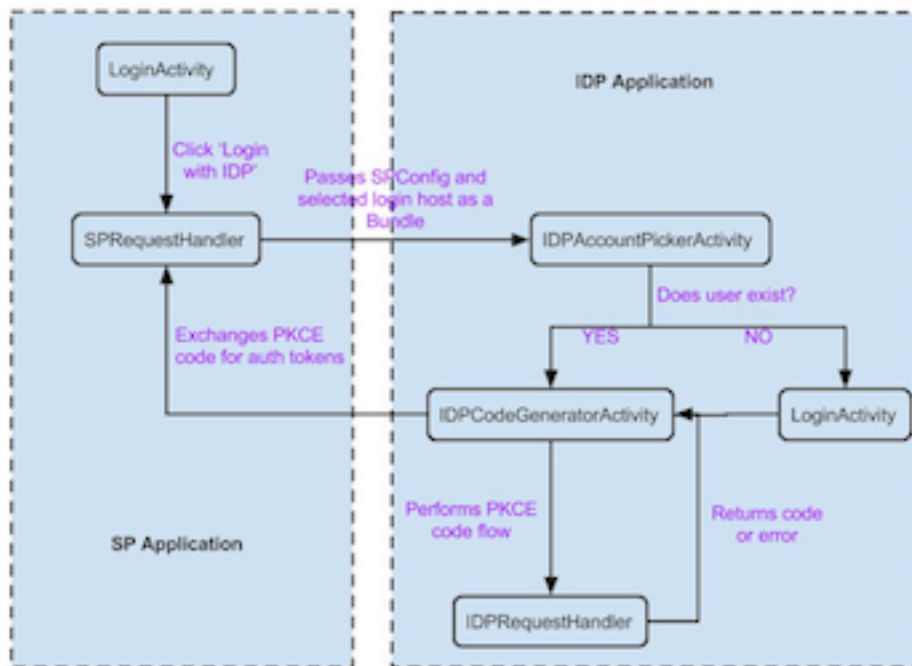
---

To kick off the identity provider flow, a user can open either an identity provider or an identity provider client app. In Android, the implementation differs depending on which side initiates it.

### Identity Provider Client

The following diagram shows the identity provider flow when launched from an identity provider client (identified here as "SP"). To summarize:

1. User launches the identity provider client and chooses "Log in with IDP".
2. Identity provider client swizzles to the identity provider for authentication.
3. Identity provider completes authentication and swizzles back to the client app.



Several specialized classes support this flow:

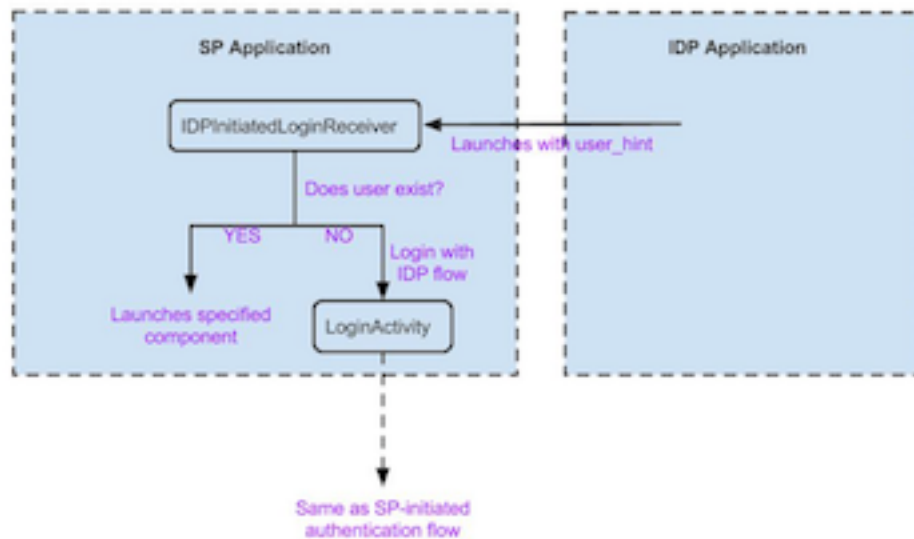
- `IDPAccountPickerActivity`
- `IDPCodeGeneratorActivity`
- `IDPRequestHandler`
- `SPRequestHandler`

Apps have the option of overriding the `IDP` activity classes to customize the identity provider's user interface. The `SPRequestHandler` and `IDPRequestHandler` classes handle internal communications. These classes usually do not require customization.

## Initiated by an Identity Provider


The following diagram shows the identity provider flow when launched from an identity provider (identified here as "IDP"). To summarize:

1. User launches the identity provider app.
2. Identity provider app displays a list of client apps it supports.
3. User selects a client app from the list.
4. Identity provider app swizzles to the selected client app, passing the username (`user_hint`).
5. If needed:
  - Client app swizzles back to the identity provider app for authentication.
  - Identity provider app completes authentication and swizzles back to the client app.
6. Client app performs the refresh token exchange, thus allowing user to begin using the app.



## Configuring an Android App to Be an Identity Provider

You can configure any app built on Mobile SDK 6.0 or later as an identity provider. You configure it to label itself as an identity provider, and Mobile SDK does the rest.

 **Example:** Beginning with forcedroid 6.0, the `AndroidManifest.xml` files in forcedroid templates contain the code shown in this example.

To configure your Mobile SDK app as an identity provider:

1. In your app's `AndroidManifest.xml` file, uncomment the lines that describe the activity named `IDPAccountPickerActivity`:

```

<!-- IDP account picker activity -->
<!--
 To enable this app as an IDP app that's
 capable of handling authentication requests originating
 from other SP apps, uncomment the lines below and replace
 'scheme' and 'host' with the values you wish to use to
 define your IDP app.

 The URI constructed from this must be unique and will be set in
 the identity provider client app as well. This will be used to
 launch the IDP app from the client app.

 In the example given below, 'scheme' is "com.salesforce.samples.smartsyncexplorer"

 and 'host' is "authenticator". The full
 URI that needs to be set on the SP app
 would be "com.salesforce.samples.smartsyncexplorer://authenticator".
-->

```

```
-->
<activity
 android:name="com.salesforce.androidsdk.auth.idp.IDPAccountPickerActivity"
 android:excludeFromRecents="true"
 android:theme="@style/SalesforceSDK.ActionBarTheme">
 <intent-filter>
 <data android:scheme="com.salesforce.samples.smartsyncexplorer"
 android:host="authenticator" />
 <action android:name="android.intent.action.VIEW" />
 <category android:name="android.intent.category.BROWSABLE" />
 <category android:name="android.intent.category.DEFAULT" />
 </intent-filter>
</activity>
```

2. In this block, replace the `<intent-filter>` scheme—in this case, `com.salesforce.samples.smartsyncexplorer`—with your app's package name.

```
<activity>
...
 <intent-filter>
 <data android:scheme="com.salesforce.samples.smartsyncexplorer"
 android:host="authenticator" />
 ...
 </intent-filter>
</activity>
```

 **Note:** You aren't required to change the `<intent-filter>` host name.

## Configuring an Android App to Be an Identity Provider Client

---

You can configure any app built on Mobile SDK 6.0 or later as an identity provider client. You configure it to identify itself as an identity provider client, and Mobile SDK does the rest.

To enable your Mobile SDK app as an identity provider client:

1. In your `Application` class, uncomment the line that calls `setIDPAppURIScheme()`.

```
/*
 * Uncomment the following line to enable IDP login flow. This will allow the user to
 * either authenticate using the current app or use a designated IDP app for login.
 * Replace 'idpAppURIScheme' with the URI scheme of the IDP app meant to be used.
 */
SalesforceSDKManager.getInstance().setIDPAppURIScheme(idpAppURIScheme);
```

2. Replace `idpAppURIScheme` with the URI scheme defined in the designated identity provider app.

## Configuring an iOS App to Be An Identity Provider

---

You can configure any app built on Mobile SDK 6.0 or later as an identity provider. You configure it to identify itself as an identity provider, and Mobile SDK does the rest.

## Configuring a Mobile SDK App to Be an Identity Provider

In the implementation block of your `AppDelegate` class:

- Add the following line to the init method:

```
[SalesforceSDKManager sharedManager].isIdentityProvider = YES;
```

- Add the following method implementation.

```
- (BOOL)application:(UIApplication *)app openURL:(NSURL
)urlOptions:(NSDictionary<UIApplicationOpenURLOptionsKey, id>)options {return
[[SFUserAccountManager sharedInstance] handleAdvancedAuthenticationResponse:url
options:options];}
```


1. Add your custom URI scheme to the info.plist configuration. For example, the following XML defines “sampleidpapp” as a custom URI scheme:

```
<key>CFBundleURLTypes</key>
<array>
 <dict>
 <key>CFBundleURLSchemes</key>
 <array>
 <string>sampleidpapp</string>
 </array>
 </dict>
</array>
```

### (Optional) Customizing the Identity Provider UI

When a client app forwards a login request, the identity provider typically presents a selection dialog box. This dialog box, which lists known users, appears only if at least one of the following conditions is true:

- A user has logged in from any other identity provider client app before this request.
- A user has directly logged in to the identity provider app before this request.
- Multiple users are currently logged in.

 **Note:** Note: If no users have logged in before this request, Mobile SDK displays a login screen and continues to authentication after the user successfully finishes the login flow.

To customize the user selection view, an identity provider app extends the `UIViewController` class and must also implement the `SFSDKUserSelectionView` protocol.

```
@protocol SFSDKUserSelectionViewDelegate
- (void)createNewUser:(NSDictionary *) spAppOptions;
- (void)selectedUser:(SFUserAccount *)user
 spAppContext:(NSDictionary *) spAppOptions;
- (void)cancel();

@protocol SFSDKUserSelectionView<NSObject>
@property (nonatomic,weak) id<SFSDKUserSelectionViewDelegate> userSelectionDelegate;
@property (nonatomic,strong) NSDictionary *spAppOptions;
@end
```



In identity provider client apps, Mobile SDK sets up an instance of the `userSelectionDelegate` and `spAppOptions` properties defined in the `SFSDKUserSelectionView` protocol. You use these objects in your identity provider's view controller to notify Mobile SDK of the user's user account selection. For example, assume that you've implemented the `SFSDKUserSelectionView` protocol in a `UIViewController` class named `UserSelectionViewController`. You then can use that view controller as the user selection dialog box by setting the `idpUserSelectionBlock` on the `SalesforceSDKManager` shared instance, as follows:

```
//optional : Customize the User Selection Screen
[SalesforceSDKManager sharedManager].idpUserSelectionBlock =
 ^UIViewController<SFSDKUserSelectionView> *{
 UserSelectionViewController *controller =
 [[UserSelectionViewController alloc] init];
 return controller;
 }
```

## Configuring an iOS App to Be An Identity Provider Client

You can configure any app built on Mobile SDK 6.0 or later as an identity provider client. You configure it to identify itself as an identity provider client and to specify its identity provider. Mobile SDK does the rest.

### Configuring an iOS App to Be an Identity Provider Client

1. In the `init` method of your `AppDelegate` class, specify the URI scheme for the identity provider you're using:

```
[SalesforceSDKManager sharedManager].idpAppURIScheme = @"sampleidpapp";
```

1. In your app's `info.plist` file, add the URI scheme defined in your identity provider clients' connected app:

```
<key>CFBundleURLTypes</key>
<array>
 <dict>
 <key>CFBundleURLSchemes</key>
 <array>
 <string>sampleidpclientapp</string>
 </array>
 </dict>
</array>
```

1. In your `AppDelegate` class implementation, add the following method:

```
- (BOOL)application:(UIApplication *)app
 openURL:(NSURL *)url
 options:(NSDictionary<UIApplicationOpenURLOptionsKey, id> *)options
{
 return
 [[SFUserAccountManager sharedInstance]handleAdvancedAuthenticationResponse:url
 options:options];
}
```

Your app is now ready for use as an identity provider client.

## (Optional) Customizing the Login Flow Selection View in the Client App

Mobile SDK provides template apps for both identity providers and their client apps. The client template defines a view that lets the user choose to log in through an identity provider or the Salesforce login screen. When a user opens an app built from the client template, the app presents this view if

- the user hasn't yet logged in, or
- the current user hasn't been set.

To customize the login style selection view, a client app extends the `UIViewController` class and also must implement the `SFSDKLoginFlowSelectionView` protocol.

```
@protocol SFSDKLoginFlowSelectionViewDelegate<NSObject>
- (void) loginFlowSelectionIDPSelected: (UIViewController *)controller
 options: (NSDictionary *)appOptions;
- (void) loginFlowSelectionLocalLoginSelected: (UIViewController *)controller
 options: (NSDictionary *)appOptions;
@end
```

```
@protocol SFSDKLoginFlowSelectionView<NSObject>
@property (weak, nonatomic) id <SFSDKLoginFlowSelectionViewDelegate>selectionFlowDelegate;

@property (nonatomic, strong) NSDictionary *appOptions;
@end
```

During the client app's identity provider flow, Mobile SDK sets up an instance of the `selectionFlowDelegate` and `appOptions` properties defined in this protocol. You use these artifacts in your view controller to notify Mobile SDK of the user's login method selection. For example, assume that you've implemented the `SFSDKUserSelectionView` protocol in a `UIViewController` class named `IDPLoginNavController`. You then can use that view controller as the user selection dialog box by setting the `idpLoginFlowSelectionAction` on the `SalesforceSDKManager` shared instance, as follows:

```
//optional : Customize the Login Flow Selection screen
[SalesforceSDKManager sharedManager].idpLoginFlowSelectionAction =
^UIViewController<SFSDKLoginFlowSelectionView> *{
 IDPLoginNavController *controller = [[IDPLoginNavController alloc] init];
 return controller;
}
```

# CHAPTER 17 Using Communities With Mobile SDK Apps

## In this chapter ...

- [Communities and Mobile SDK Apps](#)
- [Set Up an API-Enabled Profile](#)
- [Set Up a Permission Set](#)
- [Grant API Access to Users](#)
- [Configure the Login Endpoint](#)
- [Brand Your Community](#)
- [Customize Login, Self-Registration, and Password Management for Your Community](#)
- [Use Your Branded Login Page](#)
- [Using External Authentication With Communities](#)
- [Example: Configure a Community For Mobile SDK App Access](#)
- [Example: Configure a Community For Facebook Authentication](#)

Salesforce Communities is a social aggregation feature that supersedes the Portal feature of earlier releases. Communities can include up to millions of users, as allowed by [Salesforce limits](#). With proper configuration, your customers can use their community login credentials to access your Mobile SDK app. Communities also leverage Site.com to enable you to brand your community site and login screen.

To learn more about the Salesforce communities features, see "[Salesforce Communities Overview](#)" in Salesforce Help.

## Communities and Mobile SDK Apps

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To enable community members to log into your Mobile SDK app, set the appropriate permissions in Salesforce, and change your app's login server configuration to recognize your community URL.

With Communities, members that you designate can use your Mobile SDK app to access Salesforce. You define your own community login endpoint, and the Communities feature builds a branded community login page according to your specifications. It also lets you choose authentication providers and SAML identity providers from a list of popular choices.

Community membership is determined by profiles and permission sets. To enable community members to use your Mobile SDK app, configure the following:

- Make sure that each community member has the API Enabled permission. You can set this permission through profiles or permission sets.
- Configure your community to include your API-enabled profiles and permission sets.
- Configure your Mobile SDK app to use your community's login endpoint.

In addition to these high-level steps, you must take the necessary steps to configure your users properly. [Example: Configure a Community For Mobile SDK App Access](#) walks you through the community configuration process for Mobile SDK apps. For the full documentation of the Communities feature, see the Salesforce Help.

 **Note:** Community login is supported for native and hybrid local Mobile SDK apps on Android and iOS. It is not currently supported for hybrid remote apps using Visualforce.

## Set Up an API-Enabled Profile

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If you're new to communities, start by enabling the community feature in your org. See [Enable Salesforce Communities in Salesforce Help](#). When you're asked to create a domain name, be sure that it doesn't use SSL (`https://`).

To set up your community, see [Create Communities in Salesforce Help](#). Note that you'll define a community URL based on the domain name you created when you enabled the community feature.

Next, configure one or more profiles with the API Enabled permissions. You can use these profiles to enable your Mobile SDK app for community members. For detailed instructions, follow the tutorial at [Example: Configure a Community For Mobile SDK App Access](#).

1. Create a new profile or edit an existing one.
2. Edit the profile's details to select API Enabled under **Administrative Permissions**.
3. Save your changes, and then edit your community from Setup by entering *Communities* in the **Quick Find** box and then selecting **All Communities**.
4. Select the name of your community. Then click **Administration > Members**.
5. Add your API-enabled profile to **Selected Profiles**.

Users to whom these profiles are assigned now have API access. For an overview of profiles, see [User Profiles Overview](#) in Salesforce Help.

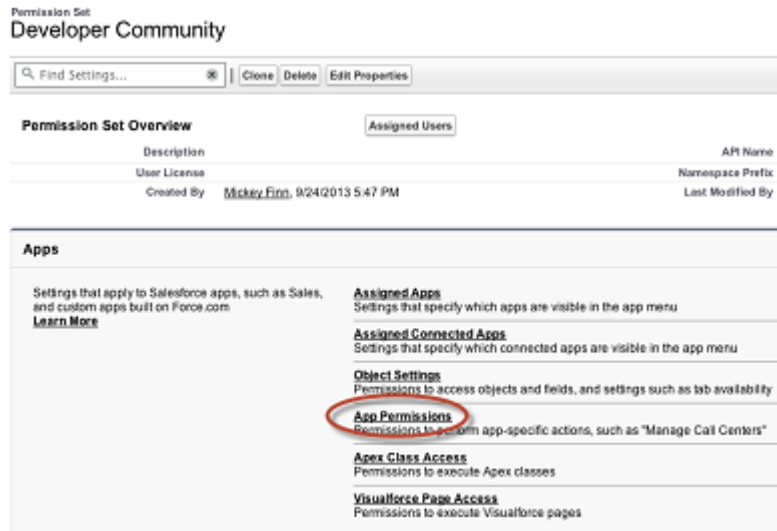
## Set Up a Permission Set

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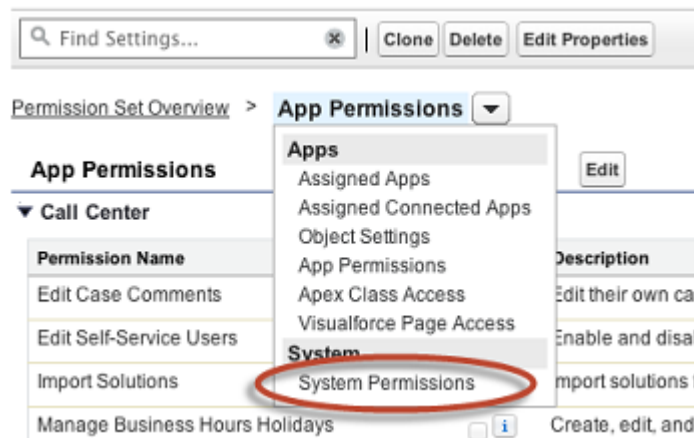
Another way to enable mobile apps for your community is through a permission set.

1. To add the API Enabled permission to an existing permission set, in Setup, enter *Permission Sets* in the **Quick Find** box, then select **Permission Sets**, select the permission set, and skip to Step 6.

2. To create a permission set, in Setup, enter *Permission Sets* in the Quick Find box, then select **Permission Sets**.
3. Click **New**.
4. Give the Permission Set a label and press *Return* to automatically create the API Name.
5. Click **Next**.
6. Under the Apps section, click **App Permissions**.



7. Click **App Permissions** and select **System > System Permissions**.



8. On the System Permissions page, click **Edit** and select **API Enabled**.
9. Click **Save**.
10. From Setup, enter *Communities* in the Quick Find box, select **All Communities**, and click **Manage** next to your community name.
11. In Administration, click **Members**.
12. Under Select Permission Sets, add your API-enabled permission set to **Selected Permission Sets**.  
Users in this permission set now have API access.

## Grant API Access to Users

---

To extend API access to your community users, add them to a profile or a permission set that sets the API Enabled permission. If you haven't yet configured any profiles or permission sets to include this permission, see [Set Up an API-Enabled Profile](#) and [Set Up a Permission Set](#).

## Configure the Login Endpoint

---

Finally, configure the app to use your community login endpoint. The app's mobile platform determines how you configure this setting.

### Android

In Android, login hosts are known as server connections. You can see the standard list of server connections in the `res/xml/servers.xml` file of the `SalesforceSDK` project. Mobile SDK uses this file to define production and sandbox servers. You can add your custom servers to the runtime list by creating your own `res/xml/servers.xml` file in your native Android project. The first server listed in your `servers.xml` file is used as the default login server at app startup. The root XML element for `servers.xml` is `<servers>`. This root can contain any number of `<server>` entries. Each `<server>` entry requires two attributes: `name` (an arbitrary human-friendly label) and `url` (the web address of the login server, including the "https://" prefix).



For example:

```
<?xml version="1.0" encoding="utf-8"?>
<servers>
 <server name="XYZ.com Login" url="https://myloginserver.cloudforce.com"/>
</servers>
```

### iOS

Before version 4.1, Mobile SDK apps for iOS defined their custom login URLs in the app's Settings bundle. In Mobile SDK 4.1 and later, iOS apps lose the Settings bundle. Instead, you can use the `SFDCOAuthLoginHost` property in the app's `info.plist` file to build in a custom login URI.


Customers can also set their own custom login hosts at runtime in your app. Here's how:

1. Start the app without logging in.
2. In the login screen, tap the Settings, or "gear," icon  in the top navigation bar.
3. In the Choose Connection screen, tap the Plus icon .
4. (Optional but recommended) To help identify this configuration in future visits, enter a label.
5. Enter your custom login host's URI. Be sure to omit the `https://` prefix. For example, here's how you enter a typical community URI:

```
mycommunity-developer-edition.na15.force.com/fineapps
```

## Brand Your Community

If you are using the Salesforce Tabs + Visualforce template, you can customize the look and feel of your community in Community Workspaces or Community Management by adding your company logo, colors, and copyright. This ensures that your community matches your company's branding and is instantly recognizable to your community members.

 **Note:** Lightning community support is coming to Mobile SDK in a future release! At present, however, Mobile SDK does not support building apps that wrap Lightning communities.

1. Open [Community Workspaces](#) or [Community Management](#).
2. Click **Administration** > **Branding**.
3. Use the lookups to choose a header and footer for the community.

The files you're choosing for header and footer must have been previously uploaded to the Documents tab and must be publicly available. The header can be .html, .gif, .jpg, or .png. The footer must be an .html file. The maximum file size for .html files is 100 KB combined. The maximum file size for .gif, .jpg, or .png files is 20 KB. So, if you have a header .html file that is 70 KB and you want to use an .html file for the footer as well, it can only be 30 KB.

The header you choose replaces the Salesforce logo below the global header. The footer you choose replaces the standard Salesforce copyright and privacy footer.

4. Click **Select Color Scheme** to select from predefined color schemes or click the text box next to the page section fields to select a color from the color picker.

Note that some of the selected colors impact your community login page and how your community looks in the Salesforce app as well.

Color Choice	Where it Appears
Header Background	Top of the page, under the black global header. If an HTML file is selected in the Header field, it overrides this color choice. Top of the login page. Login page in the Salesforce app.
Page Background	Background color for all pages in your community, including the login page.
Primary	Tab that is selected.
Secondary	Top borders of lists and tables. Button on the login page.
Tertiary	Background color for section headers on edit and detail pages.

5. Click **Save**.

### EDITIONS

Available in: Salesforce Classic and Lightning Experience

Available in: **Enterprise, Performance, Unlimited,** and **Developer** Editions

### USER PERMISSIONS


To create, customize, or publish a community:

- Create and Set Up Communities AND View Setup and Configuration

# Customize Login, Self-Registration, and Password Management for Your Community

Configure the standard login, logout, password management, and self-registration options for your community, or customize the behavior with Apex and Visualforce.

By default, each community comes with default login, password management, and self-registration pages and associated Apex controllers that drive this functionality under the hood. You can use Visualforce or Apex to create custom branding and change the default behavior. See the following steps in Salesforce Help.

-  **Note:** Lightning community support is coming to Mobile SDK in a future release! At present, however, Mobile SDK does not support building apps that wrap Lightning communities.
- [Brand your community's login page.](#)
- [Customize your community's login experience](#) by modifying the default login page behavior, using a custom login page, and supporting other authentication providers.
- [Redirect users to a different URL on logout.](#)
- [Use custom Change Password and Forgot Password pages.](#)
- [Set up self-registration](#) for unlicensed guest users in your community.

## Use Your Branded Login Page

Starting with Mobile SDK 5.2, you can display a branded community login page on your client app.

Typically, the authorization URL for a branded login page looks like this example:

```
https://community.force.com/services/oauth2/authorize/<brand>?response_type=code&...
```

In this URL, <brand> is the branding parameter that you reuse in your app. Use the following methods to set this value, where `loginBrand` is the branding parameter for your community login page.

### Android


```
SalesforceSDKManager.getInstance().setLoginBrand(loginBrand);
```

### iOS

```
[SalesforceSDKManager sharedInstance].brandLoginPath = loginBrand;
```

## Using External Authentication With Communities

You can use an external authentication provider, such as Facebook®, to log community users into your Mobile SDK app.

-  **Note:** Although Salesforce supports Janrain as an authentication provider, it's primarily intended for internal use by Salesforce. We've included it here for the sake of completeness.

### EDITIONS

Available in: Salesforce Classic and Lightning Experience

Available in: **Enterprise, Performance, Unlimited, and Developer** Editions

### USER PERMISSIONS

To create, customize, or publish a community:

- Create and Set Up Communities AND View Setup and Configuration



## External Authentication Providers

An authentication provider lets your users log in to your Salesforce org using their login credentials from an external service provider. Salesforce provides authentication providers for apps that support the OpenID Connect protocol, such as Google, Facebook, Twitter, and LinkedIn. For apps that don't support OpenID Connect, Salesforce provides an Apex `Auth.ProviderPluginClass` abstract class to create a custom authentication provider.

You can enable users to log in to your Salesforce org using their login credentials from an external service provider such as Facebook or Janrain.

 **Note:**  [Social Sign-On \(Salesforce Classic\)](#) (11:33 minutes)


Learn how to configure single sign-on (SSO) and OAuth-based API access to Salesforce from other sources of user identity.

Do the following to set up a custom authentication provider for SSO.

- Configure the service provider website.
- Create a registration handler using Apex.
- Define the authentication provider in your org.

When setup is complete, the authentication provider flow is as follows.

1. The user tries to log in to Salesforce using a third-party (external) identity.
2. The login request is redirected to the external authentication provider.
3. The user follows the third-party login process and approves access.
4. The external authentication provider redirects the user to Salesforce with credentials.
5. The user is signed in to Salesforce.

 **Note:** If users have an existing Salesforce session, after authentication with the third party, they're redirected to the page where they can approve the link to their Salesforce account.

## Define Your Authentication Provider

Salesforce supports the following authentication providers.

- [Facebook](#)
- [Google](#)
- [LinkedIn](#)
- [Microsoft Access Control Service](#)
- [Salesforce](#)
- [Twitter](#)
- [Janrain](#)
- [Amazon](#)
- [Microsoft Azure AD](#)
- [Any service provider who implements the OpenID Connect protocol](#)
- [Any service provider who supports OAuth but not the OpenID Connect protocol](#)

### EDITIONS

Available in: **Lightning Experience** and **Salesforce Classic**

Available in: **Enterprise, Performance, Unlimited,** and **Developer** Editions

### USER PERMISSIONS

To view the settings:

- [View Setup and Configuration](#)

To edit the settings:

- [Customize Application](#)
- AND
- [Manage Auth. Providers](#)

## Add Functionality to Your Authentication Provider

You can add functionality to your authentication provider by using extra request parameters.

- [Authorization Endpoint](#)—Sends the user to a specific endpoint for authentication (Salesforce authentication providers only)
- [Community](#)—Sends the user to a specific community after authentication
- [Expid](#)—Enables passing the dynamic user experience to the registration handler in authentication providers
- [Prompt](#)—Specifies how the authorization server prompts the user for reauthentication and reapproval
- [Scope](#)—Customizes the permissions requested from the third party
- [Site](#)—Enables using the authentication provider with a site
- [StartURL](#)—Sends the user to a specified location after authentication


## Create an Apex Registration Handler

Implement a registration handler to use authentication providers for SSO. The `ApexRegistrationHandler` class must implement the `Auth.RegistrationHandler` interface, which defines two methods. Salesforce invokes the appropriate method on callback, depending on whether the user has used the provider before. When you create an authentication provider, you can create an Apex template class for testing purposes. For more information, see [RegistrationHandler](#) in the *Apex Code Developer's Guide*.

## Use the Community URL Parameter

Send your user to a specific community after authenticating.

To direct your users to a specific community after authenticating, specify a URL with the `community` request parameter. If you don't add the parameter, Salesforce sends the user to either `/home/home.jsp` (for a portal or standard application) or the default sites page (for a site) after authentication completes.

 **Example:** For example, with `Single Sign-On Initialization URL`, Salesforce sends users to this location after they log in. For `Existing User Linking URL`, the Continue to Salesforce link on the confirmation page leads to this page.

Here's an example of a `community` parameter added to `Single Sign-On Initialization URL`, where:

- `orgID` is your Auth. Provider ID
  - `URLsuffix` is the value you specified when you defined the authentication provider
- `https://login.salesforce.com/services/ath/sso/orgID/URLsuffix?community=https://one.force.com/support`

### EDITIONS

Available in: Lightning Experience and Salesforce Classic

Available in: **Enterprise, Performance, Unlimited, and Developer** Editions

### USER PERMISSIONS

To view the settings:

- View Setup and Configuration

To edit the settings:

- Customize Application

AND

Manage Auth. Providers

## Use the Scope Parameter


Customize the permissions requested from a third party, like Facebook or Janrain, so that the returned access token has additional permissions.

You can customize requests to a third party to receive access tokens with additional permissions. Then you use `Auth.AuthToken` methods to retrieve the access token that was granted so that you can use those permissions with the third party.

The default scopes vary depending on the third party, but they usually don't allow access to much more than basic user information. Every provider type, such as Open ID Connect, Facebook, and Salesforce, has a set of default scopes that it sends along with the request to the authorization endpoint. For example, Salesforce's default scope is `id`.

You can send scopes in a space-delimited string. Salesforce sends the space-delimited string of requested scopes as-is to the third party and overrides the default permissions requested by authentication providers.

Janrain doesn't use this parameter. Configure additional permissions within Janrain.

 **Example:** Here's an example of a `scope` parameter requesting the Salesforce scopes `api` and `web`, added to `Single Sign-On Initialization URL`, where:

- `orgID` is your Auth. Provider ID
  - `URLsuffix` is the value you specified when you defined the authentication provider
- `https://login.salesforce.com/services/auth/sso/orgID/URLsuffix?scope=id%20api%20web`

Valid scopes vary depending on the third party; refer to your third-party documentation. For example, Salesforce uses these scopes.

Value	Description
<code>api</code>	Allows access to the current, logged-in user's account using APIs, such as REST API and Bulk API. This value also includes <code>chatter_api</code> , which allows access to Chatter REST API resources.
<code>chatter_api</code>	Allows access to Chatter REST API resources only.
<code>custom_permissions</code>	Allows access to the custom permissions in an organization associated with the connected app, and shows whether the current user has each permission enabled.
<code>full</code>	Allows access to all data accessible by the logged-in user, and encompasses all other scopes. <code>full</code> does not return a refresh token. You must explicitly request the <code>refresh_token</code> scope to get a refresh token.
<code>id</code>	Allows access to the identity URL service. You can request <code>profile</code> , <code>email</code> , <code>address</code> , or <code>phone</code> , individually to get the same result as using <code>id</code> ; they are all synonymous.
<code>openid</code>	Allows access to the current, logged in user's unique identifier for OpenID Connect apps.  The <code>openid</code> scope can be used in the OAuth 2.0 user-agent flow and the OAuth 2.0 Web server authentication flow to get back a signed ID token conforming to the <a href="#">OpenID Connect specifications</a> in addition to the access token.
<code>refresh_token</code>	Allows a refresh token to be returned if you are eligible to receive one. This lets the app interact with the user's data while the user is offline, and is synonymous with requesting <code>offline_access</code> .
<code>visualforce</code>	Allows access to Visualforce pages.

### EDITIONS

Available in: **Lightning Experience** and **Salesforce Classic**

Available in: **Enterprise**, **Performance**, **Unlimited**, and **Developer** Editions

### USER PERMISSIONS

To view the settings:

- [View Setup and Configuration](#)

To edit the settings:

- [Customize Application AND Manage Auth. Providers](#)

Value	Description
web	Allows the ability to use the <code>access_token</code> on the Web. This also includes <code>visualforce</code> , allowing access to Visualforce pages.

## Configure a Facebook Authentication Provider

Configure a Facebook authentication provider to let your users log in to your Salesforce org using their Facebook credentials.

Configuring Facebook as an authentication provider involves these high-level steps.

1. [Set up](#) a Facebook app, making Salesforce the app domain.
2. [Define](#) a Facebook authentication provider in your Salesforce org.
3. [Update](#) your Facebook app to use the Callback URL generated by Salesforce as the Facebook website URL.
4. [Test](#) the connection.

### Set Up a Facebook App

Before you can configure Facebook for your Salesforce org, you must set up an app in Facebook.

 **Note:** You can skip this step by allowing Salesforce to use its own default app. For more information, see [Use Salesforce-Managed Values in the Auth. Provider Setup Page](#).

1. Go to the [Facebook website](#) and create an app.
2. Modify the app settings and set the Application Domain to Salesforce.
3. Note the app ID and the app secret.

### Define a Facebook Provider in Your Salesforce Org

You need the Facebook app ID and app secret to set up a Facebook provider in your Salesforce org.

 **Note:** You can skip this step by allowing Salesforce to manage the values for you. For more information, see [Use Salesforce-Managed Values in the Auth. Provider Setup Page](#).

1. From Setup, enter `Auth. Providers` in the `Quick Find` box, then select **Auth. Providers**.
2. Click **New**.
3. For provider type, select Facebook.
4. Enter a name for the provider.
5. Enter the URL suffix, which is used in the client configuration URLs. For example, if the URL suffix of your provider is `MyFacebookProvider`, your single sign-on (SSO) URL is similar to:  

```
https://login.salesforce.com/auth/sso/00Dx000000000001/MyFacebookProvider.
```
6. Use the Facebook app ID for the `Consumer Key` field.
7. Use the Facebook app secret for the `Consumer Secret` field.
8. Optionally, set the following fields.

#### EDITIONS

Available in: Lightning Experience and Salesforce Classic

Available in: **Enterprise, Performance, Unlimited,** and **Developer** Editions



#### USER PERMISSIONS

To view the settings:

- View Setup and Configuration

To edit the settings:

- Customize Application AND Manage Auth. Providers

- a. Enter the base URL from Facebook for the Authorize Endpoint URL. For example, `https://www.facebook.com/v2.2/dialog/oauth`. If you leave this field blank, Salesforce uses the version of the Facebook API that your app uses.
  -  **Tip:** You can add query string parameters to the base URL, if necessary. For example, to get a refresh token from Facebook for offline access, use `https://accounts.facebook.com/o/oauth2/auth?access_type=offline&approval_prompt=force`. You need the `approval_prompt` parameter to ask the user to accept the refresh action so that Facebook continues to provide refresh tokens after the first one.
- b. Enter the Token Endpoint URL from Facebook. For example, `https://www.facebook.com/v2.2/dialog/oauth`. If you leave this field blank, Salesforce uses the version of the Facebook API that your app uses.
- c. Enter the User Info Endpoint URL to change the values requested from Facebook's profile API. See [https://developers.facebook.com/docs/facebook-login/permissions/v2.0#reference-public\\_profile](https://developers.facebook.com/docs/facebook-login/permissions/v2.0#reference-public_profile) for more information on fields. The requested fields must correspond to the requested scopes. If you leave this field blank, Salesforce uses the version of the Facebook API that your app uses.
- d. `Default Scopes` to send along with the request to the authorization endpoint. Otherwise, the hardcoded defaults for the provider type are used (see [Facebook's developer documentation](#) for these defaults).  
For more information, see [Use the Scope Parameter](#).
- e. `Custom Error URL` for the provider to use to report any errors.
- f. `Custom Logout URL` to provide a specific destination for users after they log out, if they authenticated using the SSO flow. Use this field to direct users to a branded logout page or destination other than the default Salesforce logout page. The URL must be fully qualified with an `http` or `https` prefix, such as `https://acme.my.salesforce.com`.
- g. Select an existing Apex class as the `Registration Handler` class. Or click **Automatically create a registration handler template** to create an Apex class template for the registration handler. Edit this class later, and modify the default content before using it.
  -  **Note:** A `Registration Handler` class is required for Salesforce to generate the SSO initialization URL.
- h. For `Execute Registration As`, select the user that runs the Apex handler class. The user must have the "Manage Users" permission. A user is required regardless of whether you're specifying an existing registration handler class or creating one from the template.
- i. To use a portal with your provider, select the portal from the Portal dropdown list.
- j. Use the `Icon URL` field to add a path to an icon to display as a button on the login page for a community. This icon applies to a community only. It doesn't appear on the login page for your Salesforce org or domain created with My Domain. Users click the button to log in with the associated authentication provider for the community.  
Specify a path to your own image, or copy the URL for one of our sample icons into the field.

## 9. Click **Save**.

Note the generated `Auth.ProviderId` value. You use it with the `Auth.AuthToken` Apex class.

Several client configuration URLs are generated after defining the authentication provider.

- Test-Only Initialization URL—Salesforce admins use this URL to ensure that the third-party provider is set up correctly. The admin opens this URL in a browser, signs in to the third party, and is redirected back to Salesforce with a map of attributes.
- Single Sign-On Initialization URL—Use this URL to perform SSO into Salesforce from a third party using its third-party credentials. The user opens this URL in a browser and logs in to the third party. The third party either creates a user or updates an existing user. Then the third party signs the user into Salesforce as that user.

- Existing User Linking URL—Use this URL to link existing Salesforce users to a third-party account. The user opens this URL in a browser, signs in to the third party, signs in to Salesforce, and approves the link.
- OAuth-Only Initialization URL—Use this URL to obtain OAuth access tokens for a third party. Users must authenticate with Salesforce for the third-party service to get a token. This flow doesn't provide for future SSO functionality.
- Callback URL—Use the callback URL for the endpoint that the authentication provider calls back to for configuration. The authentication provider must redirect to the callback URL with information for each client configuration URL.

Client configuration URLs support additional request parameters that enable you to direct users to log in to specific sites, obtain customized permissions from the third party, or go to a specific location after authenticating.

## Update Your Facebook App

After defining the Facebook authentication provider in your Salesforce org, go back to Facebook and update your app to use the Callback URL as the Facebook Website Site URL.

## Test the SSO Connection

In a browser, open the Test-Only Initialization URL on the Auth. Provider detail page. It redirects you to Facebook and asks you to sign in. You're then asked to authorize your app. After you authorize, you're redirected back to Salesforce.

## Configure a Salesforce Authentication Provider

To configure a Salesforce authentication provider, create a connected app that uses single sign-on (SSO).

Configuring a Salesforce authentication provider involves these high-level steps.

1. [Create a Connected App.](#)
2. [Define the Salesforce authentication provider in your org.](#)
3. [Test the connection.](#)

### Create a Connected App

You can create a connected app from either Lightning Experience or Salesforce Classic.

In Lightning Experience, from Setup, enter `App` in the `Quick Find` box, select **App Manager**, then click **New Connected App**.

In Salesforce Classic, from Setup, enter `Apps` in the `Quick Find` box, select **Apps**. Then, under the Connected Apps section, click **New**.

After you finish creating a connected app, note the values from the `Consumer Key` and `Consumer Secret` fields.

 **Note:** You can skip this step by allowing Salesforce to use its own default app. For more information, see [Use Salesforce-Managed Values in the Auth. Provider Setup Page](#).

### Define the Salesforce Authentication Provider in Your Org

To set up the authentication provider in your org, you need the values from the `Consumer Key` and `Consumer Secret` fields of the connected app definition.

#### EDITIONS

Available in: Lightning Experience and Salesforce Classic

Available in: **Enterprise, Performance, Unlimited,** and **Developer** Editions

#### USER PERMISSIONS

To view the settings:

- View Setup and Configuration

To edit the settings:


- Customize Application

AND

Manage Auth. Providers

 **Note:** You can skip this step by allowing Salesforce to manage the values for you. For more information, see [Use Salesforce-Managed Values in the Auth. Provider Setup Page](#).

1. From Setup, enter `Auth. Providers` in the `Quick Find` box, then select **Auth. Providers**.
2. Click **New**.
3. For provider type, select Salesforce.
4. Enter a name for the provider.
5. Enter the URL suffix, which is used in the client configuration URLs. For example, if the URL suffix of your provider is `MySFDCProvider`, your SSO URL is similar to `https://login.salesforce.com/auth/sso/00Dx000000000001/MySFDCProvider`.
6. Paste the consumer key value from the connected app definition into the `Consumer Key` field.
7. Paste the consumer secret value from the connected app definition into the `Consumer Secret` field.
8. Optionally, set the following fields.
  - a. `Authorize Endpoint URL` to specify an OAuth authorization URL.  
 For the `Authorize Endpoint URL`, the host name can include a sandbox or custom domain name (created using My Domain), but the URL must end in `.salesforce.com`, and the path must end in `/services/oauth2/authorize`. For example, `https://login.salesforce.com/services/oauth2/authorize`.
  - b. `Token Endpoint URL` to specify an OAuth token URL.  
 For the `Token Endpoint URL`, the host name can include a sandbox or custom domain name (created using My Domain), but the URL must end in `.salesforce.com`, and the path must end in `/services/oauth2/token`. For example, `https://login.salesforce.com/services/oauth2/token`.
  - c. `Default Scopes` to send along with the request to the authorization endpoint. Otherwise, the hardcoded default is used. For more information, see [Use the Scope Parameter](#).
  - d. `Include identity organization's organization ID for third-party account linkage`. This option doesn't appear if the authentication provider was created after the Winter '15 release. Before Winter '15, the destination org couldn't differentiate between users with the same user ID on different orgs, for example, between a production and sandbox org. As of Winter '15, user identities contain the org ID, so this option doesn't appear. For older authentication providers, enable this option to keep the identities separate in the destination org. However, if you enable this option, your users must reapprove all their third-party links. The links are listed in the Third-Party Account Links section of a user's detail page.
  - e. `Custom Error URL` for the provider to use to report any errors.
  - f. `Custom Logout URL` to provide a specific destination for users after they log out, if they authenticated using the SSO flow. Use this field to direct users to a branded logout page or destination other than the default Salesforce logout page. The URL must be fully qualified with an `http` or `https` prefix, such as `https://acme.my.salesforce.com`.
9. Select an existing Apex class as the `Registration Handler` class. Or click **Automatically create a registration handler template** to create an Apex class template for the registration handler. Edit this class later, and modify the default content before using it.
 

 **Note:** A `Registration Handler` class is required for Salesforce to generate the SSO initialization URL.
10. For `Execute Registration As`, select the user that runs the Apex handler class. The user must have the "Manage Users" permission. A user is required regardless of whether you're specifying an existing registration handler class or creating one from the template.
11. To use a portal with your provider, select the portal from the Portal dropdown list.

12. Use the `Icon URL` field to add a path to an icon to display as a button on the login page for a community. This icon applies to a community only. It doesn't appear on the login page for your Salesforce org or domain created with My Domain. Users click the button to log in with the associated authentication provider for the community.

Specify a path to your own image, or copy the URL for one of our sample icons into the field.

13. Click **Save**.

Note the value of the Client Configuration URLs. You need the callback URL to complete the last step. Use the Test-Only initialization URL to check your configuration. Also note the `Auth.Provider Id` value because you use it with the `Auth.AuthToken` Apex class.

14. Return to the connected app definition that you created earlier from Setup. Paste the callback URL value from the authentication provider into the `Callback URL` field.

Several client configuration URLs are generated after defining the authentication provider.

- Test-Only Initialization URL—Salesforce admins use this URL to ensure that the third-party provider is set up correctly. The admin opens this URL in a browser, signs in to the third party, and is redirected back to Salesforce with a map of attributes.
- Single Sign-On Initialization URL—Use this URL to perform SSO into Salesforce from a third party using its third-party credentials. The user opens this URL in a browser and logs in to the third party. The third party either creates a user or updates an existing user. Then the third party signs the user into Salesforce as that user.
- Existing User Linking URL—Use this URL to link existing Salesforce users to a third-party account. The user opens this URL in a browser, signs in to the third party, signs in to Salesforce, and approves the link.
- OAuth-Only Initialization URL—Use this URL to obtain OAuth access tokens for a third party. Users must authenticate with Salesforce for the third-party service to get a token. This flow doesn't provide for future SSO functionality.
- Callback URL—Use the callback URL for the endpoint that the authentication provider calls back to for configuration. The authentication provider must redirect to the callback URL with information for each client configuration URL.

Client configuration URLs support additional request parameters that enable you to direct users to log in to specific sites, obtain customized permissions from the third party, or go to a specific location after authenticating.

## Test the SSO Connection

In a browser, open the Test-Only Initialization URL on the Auth. Provider detail page. It redirects you to the authentication provider and asks you to sign in. You're then asked to authorize your app. After you authorize, you're redirected to Salesforce.



## Configure an OpenID Connect Authentication Provider

You can use any third-party web app that implements the server side of the OpenID Connect protocol, such as Amazon, Google, and PayPal, as an authentication provider.

Complete these steps to configure an OpenID authentication provider.

1. [Register](#) your app, making Salesforce the app domain.
2. [Define](#) an OpenID Connect authentication provider in your Salesforce org.
3. [Update](#) your app to use the callback URL generated by Salesforce.
4. [Test](#) the connection.

### Register an OpenID Connect App

Before you can configure a web app for your Salesforce org, you must register it with your service provider. The process varies depending on the service provider. For example, to register a Google app, [Create an OAuth 2.0 Client ID](#).

1. Register your app on your service provider's website.
2. Modify the app settings and set the app domain (or Home Page URL) to Salesforce.
3. From the provider's documentation, get the client ID, client secret, authorize endpoint URL, token endpoint URL, and the user info endpoint URL. Here are some common OpenID Connect service providers.
  - [Amazon](#)
  - [Google](#)
  - [PayPal](#)

### Define an OpenID Connect Provider in Your Salesforce Org

1. From Setup, enter *Auth. Providers* in the *Quick Find* box, then select **Auth. Providers**.
2. Click **New**.
3. For provider type, select **OpenID Connect**.
4. Enter a name for the provider.
5. Enter the URL suffix, which is used in the client configuration URLs. For example, if the URL suffix of your provider is *MyOpenIDConnectProvider*, your single sign-on URL is similar to:  
`https://login.salesforce.com/auth/sso/00Dx000000000001/MyOpenIDConnectProvider.`
6. Use the client ID from your provider for the *Consumer Key* field.
7. Use the client secret from your provider for the *Consumer Secret* field.
8. Enter the base URL from your provider for the *Authorize Endpoint URL*.



**Tip:** You can add query string parameters to the base URL, if necessary. For example, to get a refresh token from Google for offline access, use

`https://accounts.google.com/o/oauth2/auth?access_type=offline&approval_prompt=force.`  
 You need the `approval_prompt` parameter to ask the user to accept the refresh action so that Google continues to provide refresh tokens after the first one.

#### EDITIONS

Available in: **Lightning Experience** and **Salesforce Classic**

Available in: **Enterprise, Performance, Unlimited,** and **Developer** Editions

#### USER PERMISSIONS

To view the settings:

- **View Setup and Configuration**

To edit the settings:


- **Customize Application AND Manage Auth. Providers**

9. Enter the token endpoint URL from your provider.
10. Optionally, set the following fields.
  - a. `User Info Endpoint URL` from your provider.
  - b. `Token Issuer`. This value identifies the source of the authentication token in the form `https://URL`. If this value is specified, the provider must include an `id_token` value in the response to a token request. The `id_token` value isn't required for a refresh token flow (but will be validated by Salesforce if provided).
  - c. `Default Scopes` to send along with the request to the authorization endpoint. Otherwise, the hardcoded defaults for the provider type are used. See the [OpenID Connect developer documentation](#) for these defaults.  
For more information, see [Use the Scope Parameter](#).

11. Optionally, select **Send access token in header** to have the token sent in a header instead of a query string.

12. Optionally, set the following fields.

- a. `Custom Error URL` for the provider to use to report any errors.
- b. `Custom Logout URL` to provide a specific destination for users after they log out, if they authenticated using the SSO flow. Use this field to direct users to a branded logout page or destination other than the default Salesforce logout page. The URL must be fully qualified with an `http` or `https` prefix, such as `https://acme.my.salesforce.com`.
- c. Select an existing Apex class as the `Registration Handler` class. Or click **Automatically create a registration handler template** to create an Apex class template for the registration handler. Edit this class later, and modify the default content before using it.

 **Note:** A `Registration Handler` class is required for Salesforce to generate the single sign-on initialization URL.

- d. For `Execute Registration As`, select the user that runs the Apex handler class. The user must have the "Manage Users" permission. A user is required regardless of whether you're specifying an existing registration handler class or creating one from the template.
- e. To use a portal with your provider, select the portal from the Portal dropdown list.
- f. Use the `Icon URL` field to add a path to an icon to display as a button on the login page for a community. This icon applies to a community only. It doesn't appear on the login page for your Salesforce org or domain created with My Domain. Users click the button to log in with the associated authentication provider for the community.

Specify a path to your own image, or copy the URL for one of our sample icons into the field.

13. Click **Save**.

Be sure to note the generated `Auth.ProviderId` value. You must use it with the `Auth.AuthToken` Apex class.

Several client configuration URLs are generated after defining the authentication provider.

- **Test-Only Initialization URL**—Salesforce admins use this URL to ensure that the third-party provider is set up correctly. The admin opens this URL in a browser, signs in to the third party, and is redirected back to Salesforce with a map of attributes.
- **Single Sign-On Initialization URL**—Use this URL to perform SSO into Salesforce from a third party using its third-party credentials. The user opens this URL in a browser and logs in to the third party. The third party either creates a user or updates an existing user. Then the third party signs the user into Salesforce as that user.
- **Existing User Linking URL**—Use this URL to link existing Salesforce users to a third-party account. The user opens this URL in a browser, signs in to the third party, signs in to Salesforce, and approves the link.
- **OAuth-Only Initialization URL**—Use this URL to obtain OAuth access tokens for a third party. Users must authenticate with Salesforce for the third-party service to get a token. This flow doesn't provide for future SSO functionality.

- **Callback URL**—Use the callback URL for the endpoint that the authentication provider calls back to for configuration. The authentication provider must redirect to the callback URL with information for each client configuration URL.

Client configuration URLs support additional request parameters that enable you to direct users to log in to specific sites, obtain customized permissions from the third party, or go to a specific location after authenticating.

## Update Your OpenID Connect App

After defining the authentication provider in your Salesforce org, go back to your provider and update your app's callback URL. For Google apps, the callback URL is called the Authorized Redirect URI. For PayPal, it's called the Return URL.

## Test the SSO Connection

In a browser, open the Test-Only Initialization URL on the Auth. Provider Setup page. It redirects you to your provider's service and asks you to sign in. You're then asked to authorize your app. After you authorize, you're redirected back to Salesforce.

## Example: Configure a Community For Mobile SDK App Access

---

Configuring your community to support logins from Mobile SDK apps can be tricky. This tutorial helps you see the details and correct sequence first-hand.

When you configure community users for mobile access, sequence and protocol affect your success. For example, a user that's not associated with a contact cannot log in on a mobile device. Here are some important guidelines to keep in mind:


- Create users only from contacts that belong to accounts. You can't create the user first and then associate it with a contact later.
- Be sure you've assigned a role to the owner of any account you use. Otherwise, the user gets an error when trying to log in.
- When you define a custom login host in an iOS app, be sure to remove the `http[s]://` prefix. The iOS core appends the prefix at runtime. Explicitly including it could result in an invalid address.

1. [Add Permissions to a Profile](#)
2. [Create a Community](#)
3. [Add the API User Profile To Your Community](#)
4. [Create a New Contact and User](#)
5. [Test Your New Community Login](#)


## Add Permissions to a Profile

Create a profile that has API Enabled and Enable Chatter permissions.

1. From Setup, enter *Profiles* in the *Quick Find* box, then select **Profiles**.
2. Click **New Profile**.
3. For Existing Profile select **Customer Community User**.
4. For **Profile Name** type *FineApps API User*.
5. Click **Save**.
6. On the FineApps API User page, click **Edit**.
7. For **Administrative Permissions** select **API Enabled** and **Enable Chatter**.

 **Note:** A user who doesn't have the Enable Chatter permission gets an insufficient privileges error immediately after successfully logging into your community in Salesforce.

8. Click **Save**.

 **Note:** In this tutorial we use a profile, but you can also use a permission set that includes the required permissions.

## Create a Community

Create a community and a community login URL.

The following steps are fully documented at [Enable Salesforce Communities](#) and [Creating Communities](#) in Salesforce Help.

1. In Setup, enter *Communities* in the **Quick Find** box.
2. If you don't see **All Communities**:
  - a. Click **Communities Settings**.
  - b. Select **Enable communities**.
  - c. Enter a unique name for your domain name, such as *fineapps.<your\_name>.force.com* for **Domain name**.
  - d. Click **Check Availability** to make sure the domain name isn't already being used.
  - e. Click **Save**.
3. From Setup, enter *Communities* in the **Quick Find** box, then select **All Communities**.
4. Click **New Community**.
5. Choose a template and name the new community *FineApps Users*.
6. For **URL**, type *customers* in the suffix edit box.

The full URL shown, including your suffix, becomes the new URL for your community.
7. Click **Create Community**, and then click **Go to Community Management**.

## Add the API User Profile To Your Community

Add the API User profile to your community setup on the Members page.

1. Click **Administration > Members**.
2. For Search, select **All**.
3. Select **FineApps API User** in the Available Profiles list and then click **Add**.
4. Click **Save**.
5. Click **Publish**.
6. Dismiss the confirmation dialog box and click **Close**.

## Create a New Contact and User

Instead of creating users directly, create a contact on an account and then create the user from that contact.

If you don't currently have any accounts,

1. Click the **Accounts** tab.

2. If your org doesn't yet contain any accounts:
  - a. In Quick Create, enter *My Test Account* for **Account Name**.
  - b. Click **Save**
3. In Recent Accounts click **My Test Account** or any other account name. Note the Account Owner's name.
4. From Setup, enter *Users* in the *Quick Find* box, select **Users**, and then click **Edit** next to your Account Owner's name.
5. Make sure that **Role** is set to a management role, such as CEO.
6. Click **Save**.
7. Click the **Accounts** tab and again click the account's name.
8. In Contacts, click **New Contact**.
9. Fill in the following information: First Name: *Jim*, Last Name: *Parker*. Click **Save**.
10. On the Contact page for Jim Parker, click **Manage External User** and then select **Enable Customer User**.
11. For User License select **Customer Community**.
12. For Profile select the FineApps API User.
13. Use the following values for the other required fields:

Field	Value
Email	Enter your active valid email address.
Username	<i>jimparker@fineapps.com</i>
Nickname	<i>jimmyp</i>

You can remove any non-required information if it's automatically filled in by the browser.

14. Click **Save**.
15. Wait for an email to arrive in your inbox welcoming Jim Parker and then click the link in the email to create a password. Set the password to "mobile333".

## Test Your New Community Login



Test your community setup by logging in to your Mobile SDK native or hybrid local app as your new contact.

To log in to your community from your Mobile SDK app, configure your app to recognize your community login URL.

1. For Android:
  - a. Open your Android project in Android Studio.
  - b. In the Project Explorer, go to the `res` folder and create a new (or select the existing) `xml` folder.
  - c. In the `xml` folder, create a text file. You can do this using either the **File** menu or the *CTRL-Click* (or *Right-Click*) menu.
  - d. In the new text file, add the following XML. Replace the server URL with your community login URL:

```
<?xml version="1.0" encoding="utf-8"?>
<servers>
 <server name="Community Login" url=
```


```
"https://fineapps-developer-edition.<instance>.force.com/fineapps">
</servers>
```

- e. Save the file as `servers.xml`.
2. For iOS:
    - a. Start the app without logging in.
    - b. In the login screen, tap the Settings, or "gear," icon  in the top navigation bar.
    - c. In the Choose Connection screen, tap the Plus icon .
    - d. (Optional but recommended) To help identify this configuration in future visits, enter a label.
    - e. Enter your custom login host's URI. Be sure to omit the `https://` prefix. For example, here's how you enter a typical community URI:

```
mycommunity-developer-edition.na15.force.com/fineapps
```

Alternatively, set the login screen through MDM if you're using MDM for configuration.

3. Start your app on your device, simulator, or emulator, and log in with username `jimparker@fineapps.com` and password `mobiletest1234`.

 **Note:** If your mobile app remains at the login screen for an extended time, you can get an "insufficient privileges" error upon login. In this case, close and reopen the app, and then log in immediately.

## Example: Configure a Community For Facebook Authentication

You can extend the reach of your community by configuring an external authentication provider to handle community logins.

This example extends the previous example to use Facebook as an authentication front end. In this simple scenario, we configure the external authentication provider to accept any authenticated Facebook user into the community.

If your community is already configured for mobile app logins, you don't need to change your mobile app or your connected app to use external authentication. Instead, you define a Facebook app, a Salesforce Auth. Provider, and an Auth. Provider Apex class. You also make a minor change to your community setup.

### Create a Facebook App

To enable community logins through Facebook, start by creating a Facebook app.

A Facebook app is comparable to a Salesforce connected app. It is a container for settings that govern the connectivity and authentication of your app on mobile devices.

1. Go to [developers.facebook.com](https://developers.facebook.com).
2. Log in with your Facebook developer account, or register if you're not a registered Facebook developer.
3. Go to **Apps > Create a New App**.
4. Set display name to "FineApps Community Test".
5. Add a Namespace, if you want. Per Facebook's requirements, a namespace label must be twenty characters or less, using only lowercase letters, dashes, and underscores. For example, "my\_fb\_goodapps".
6. For Category, choose **Utilities**.

7. Copy and store your App ID and App Secret for later use.

You can log in to the app using the following URL:


`https://developers.facebook.com/apps/<App ID>/dashboard/`

## Define a Salesforce Auth. Provider


To enable external authentication in Salesforce, create an Auth. Provider.

External authentication through Facebook requires the App ID and App Secret from the Facebook app that you created in the previous step.

1. In Setup, enter *Auth. Providers* in the *Quick Find* box, then select **Auth. Providers**.
2. Click **New**.
3. Configure the Auth. Provider fields as shown in the following table.

Field	Value
Provider Type	Select <b>Facebook</b> .
Name	Enter <i>FB Community Login</i> .
URL Suffix	Accept the default.  <b>Note:</b> You may also provide any other string that conforms to URL syntax, but for this example the default works best.
Consumer Key	Enter the App ID from your Facebook app.
Consumer Secret	Enter the App Secret from your Facebook app.
Custom Error URL	Leave blank.

4. For Registration Handler, click **Automatically create a registration handler template**.

5. For Execute Registration As;, click Search  and choose a community member who has administrative privileges.

6. Leave Portal blank.

7. Click **Save**.

Salesforce creates a new Apex class that extends `RegistrationHandler`. The class name takes the form `AutocreatedRegHandlerxxxxx....`

8. Copy the Auth. Provider ID for later use.

9. In the detail page for your new Auth. Provider, under Client Configuration, copy the Callback URL for later use.

The callback URL takes the form

`https://login.salesforce.com/services/authcallback/<id>/<Auth.Provider_URL_Suffix>.`

## Configure Your Facebook App

Next, you need to configure the community to use your Salesforce Auth. Provider for logins.

Now that you've defined a Salesforce Auth. Provider, complete the authentication protocol by linking your Facebook app to your Auth. Provider. You provide the Salesforce login URL and the callback URL, which contains your Auth. Provider ID and the Auth. Provider's URL suffix.

1. In your Facebook app, go to **Settings**.
2. In App Domains, enter `login.salesforce.com`.
3. Click **+Add Platform**.
4. Select **Website**.
5. For Site URL, enter your Auth. Provider's callback URL.
6. For **Contact Email**, enter your valid email address.
7. In the left panel, set Status & Review to **Yes**. With this setting, all Facebook users can use their Facebook logins to create user accounts in your community.
8. Click **Save Changes**.
9. Click **Confirm**.


## Customize the Auth. Provider Apex Class

Use the Apex class for your Auth. Provider to define filtering logic that controls who may enter your community.

1. In Setup, enter `Apex Classes` in the `Quick Find` box, then select **Apex Classes**.
2. Click **Edit** next to your Auth. Provider class. The default class name starts with "AutocreatedRegHandlerxxxxx..."
3. To implement the `canCreateUser()` method, simply return true.

```
global boolean canCreateUser(Auth.UserData data) {
 return true;
}
```

This implementation allows anyone who logs in through Facebook to join your community.

 **Note:** If you want your community to be accessible only to existing community members, implement a filter to recognize every valid user in your community. Base your filter on any unique data in the Facebook packet, such as username or email address, and then validate that data against similar fields in your community members' records.

4. Change the `createUser()` code:
  - a. Replace "Acme" with `FineApps` in the account name query.
  - b. Replace the username suffix ("`@acmecorp.com`") with `@fineapps.com`.
  - c. Change the profile name in the profile query ("Customer Portal User") to `API Enabled`.
5. In the `updateUser()` code, replace the suffix to the username ("`myorg.com`") with `@fineapps.com`.
6. Click **Save**.

## Configure Your Salesforce Community

For the final step, configure the community to use your Salesforce Auth. Provider for logins.



1. In Setup, enter *Communities* in the Quick Find box, then select **All Communities**.
2. Click **Manage** next to your community name.
3. Click **Administration > Login & Registration**.
4. Under Login, select your new Auth. Provider.
5. Click **Save**.

You're done! Now, when you log into your mobile app using your community login URL, look for an additional button inviting you to log in using Facebook. Click the button and follow the on-screen instructions to see how the login works.

To test the external authentication setup in a browser, customize the Single Sign-On Initialization URL (from your Auth. Provider) as follows:

```
https://login.salesforce.com/services/auth/sso/orgID/
URLsuffix?community=<community_login_url>
```

For example:

```
https://login.salesforce.com/services/auth/sso/00Da000000TPNEAA4/
FB_Community_Login?community=
https://mobilesdk-developer-edition.server_instance.force.com/fineapps
```

To form the Existing User Linking URL, replace *sso* with *link*:

```
https://login.salesforce.com/services/auth/link/00Da000000TPNEAA4/
FB_Community_Login?community=
https://mobilesdk-developer-edition.server_instance.force.com/fineapps
```

# CHAPTER 18 Multi-User Support in Mobile SDK

## In this chapter ...

- [About Multi-User Support](#)
- [Implementing Multi-User Support](#)

If you need to enable simultaneous logins for multiple users, Mobile SDK provides a basic implementation and APIs for user switching.

Mobile SDK provides a default dialog box that lets the user select from authenticated accounts. Your app implements some means of launching the dialog box and calls the APIs that initiate the user switching workflow.

## About Multi-User Support

---

Beginning in version 2.2, Mobile SDK supports simultaneous logins from multiple user accounts. These accounts can represent different users from the same organization, or different users on different organizations (such as production and sandbox, for instance.)

Once a user signs in, that user's credentials are saved to allow seamless switching between accounts, without the need to re-authenticate against the server. If you don't wish to support multiple logins, you don't have to change your app. Existing Mobile SDK APIs work as before in the single-user scenario.

Mobile SDK assumes that each user account is unrelated to any other authenticated user account. Accordingly, Mobile SDK isolates data associated with each account from that of all others, thus preventing the mixing of data between accounts. Data isolation protects `SharedPreferences` files, `SmartStore` databases, `AccountManager` data, and any other flat files associated with an account.



**Example:** For native Android, the `RestExplorer` sample app demonstrates multi-user switching:

For native iOS, the `RestAPIExplorer` sample app demonstrates multi-user switching:

The following hybrid sample apps demonstrate multi-user switching:

- **Without SmartStore:** `ContactExplorer`
- **With SmartStore:** `AccountEditor`

## Implementing Multi-User Support

---

Mobile SDK provides APIs for enabling multi-user support in native Android, native iOS, and hybrid apps.

Although Mobile SDK implements the underlying functionality, multi-user switching isn't initialized at runtime unless and until your app calls one of the following APIs:

### Android native (`UserAccountManager` class methods)

```
public void switchToUser(UserAccount user)
public void switchToNewUser()
```

### iOS native (`SFUserAccountManager` class methods)

```
- (void)switchToUser:(SFUserAccount *)newCurrentUser
- (void)switchToNewUser
```

### Hybrid (JavaScript method)

```
switchToUser
```

To let the user switch to a different account, launch a selection screen from a button, menu, or some other control in your user interface. Mobile SDK provides a standard multi-user switching screen that displays all currently authenticated accounts in a radio button list. You can choose whether to customize this screen or just show the default version. When the user makes a selection, call the Mobile SDK method that launches the multi-user flow.

Before you begin to use the APIs, it's important that you understand the division of labor between Mobile SDK and your app. The following lists show tasks that Mobile SDK performs versus tasks that your app is required to perform in multi-user contexts. In particular, consider how to manage:

- [Push Notifications](#) (if your app supports them)
- [SmartStore Soups](#) (if your app uses SmartStore)
- [Account Management](#)

## Push Notifications Tasks

Mobile SDK (for all accounts):

- Registers push notifications at login
- Unregisters push notifications at logout
- Delivers push notifications

Your app:

- Differentiates notifications according to the target user account
- Launches the correct user context to display each notification

## SmartStore Tasks

Mobile SDK (for all accounts):

- Creates a separate SmartStore database for each authenticated user account
- Switches to the correct backing database each time a user switch occurs

Your app:

- Refreshes its cached credentials, such as instances of SmartStore held in memory, after every user switch or logout

## Account Management Tasks

Mobile SDK (for all accounts):

- Loads the correct account credentials every time a user switch occurs

Your app:

- Refreshes its cached credentials, such as authenticated REST clients held in memory, after every user switch or logout

## Android Native APIs

Native classes in Mobile SDK for Android do most of the work for multi-user support. Your app makes a few simple calls and handles any data cached in memory. You also have the option of customizing the user switching activity.

To support user switching, Mobile SDK for Android defines native classes in the `com.salesforce.androidsdk.accounts`, `com.salesforce.androidsdk.ui`, and `com.salesforce.androidsdk.util` packages. Classes in the `com.salesforce.androidsdk.accounts` package include:

- `UserAccount`
- `UserAccountManager`

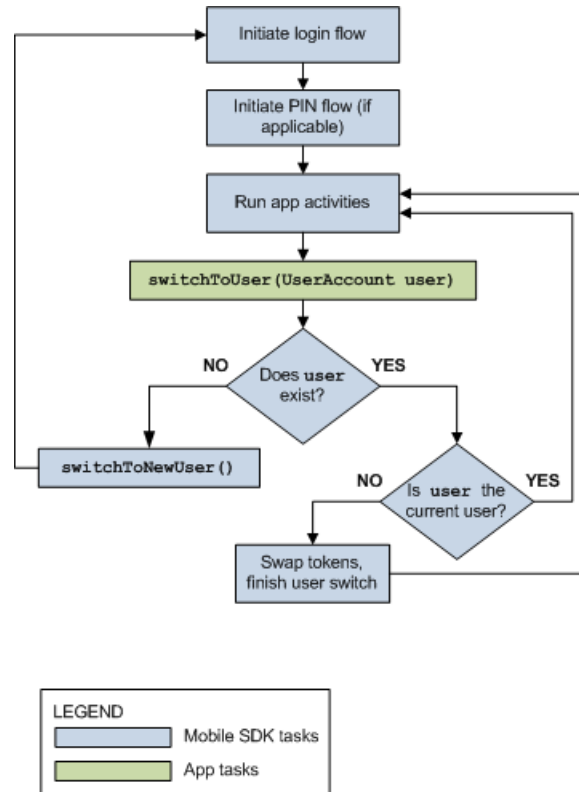
The `com.salesforce.androidsdk.ui` package contains the `AccountSwitcherActivity` class. You can extend this class to add advanced customizations to the account switcher activity.

The `com.salesforce.androidsdk.util` package contains the `UserSwitchReceiver` abstract class. You must implement this class if your app caches data other than tokens.

The following sections briefly describe these classes. For full API reference documentation, see <http://forcedotcom.github.io/SalesforceMobileSDK-Android/index.html>.

## Multi-User Flow

For native Android apps, the `UserAccountManager.switchToUser()` Mobile SDK method launches the multi-user flow. Once your app calls this method, the Mobile SDK core handles the execution flow through all possible paths. The following diagram illustrates this flow.



### IN THIS SECTION:

#### [UserAccount Class](#)

The `UserAccount` class represents a single user account that is currently authenticated. It encapsulates data that can be used to uniquely identify a user account.

#### [UserAccountManager Class](#)

The `UserAccountManager` class provides methods to access authenticated accounts, add new accounts, log out existing accounts, and switch between existing accounts.

#### [AccountSwitcherActivity Class](#)

Use or extend the `AccountSwitcherActivity` class to display the user switching interface.

#### [UserSwitchReceiver Class](#)

If your native Android app caches data other than tokens, implement the `UserSwitchReceiver` abstract class to receive notifications of user switching events.

## UserAccount Class

The `UserAccount` class represents a single user account that is currently authenticated. It encapsulates data that can be used to uniquely identify a user account.

## Constructors

You can create `UserAccount` objects directly, from a JSON object, or from a bundle.

Constructor	Description
<pre>public UserAccount (     String authToken,     String refreshToken,     String loginServer,     String idUrl,     String instanceServer,     String orgId,     String userId,     String username,     String accountName,     String clientId,     String communityId,     String communityUrl )</pre>	Creates a <code>UserAccount</code> object using values you specify.
<pre>public UserAccount (JSONObject object)</pre>	Creates a <code>UserAccount</code> object from a JSON string.
<pre>public UserAccount (Bundle bundle)</pre>	Creates a <code>UserAccount</code> object from an Android application bundle.

## Methods

Method	Description
<pre>public String getOrgLevelStoragePath ()</pre>	Returns the organization level storage path for this user account, relative to the higher level directory of app data. The higher level directory could be <code>files</code> . The output is in the format <code>/{orgID}/</code> . This storage path is meant for data that can be shared across multiple users of the same organization.
<pre>public String getUserLevelStoragePath ()</pre>	Returns the user level storage path for this user account, relative to the higher level directory of app data. The higher level directory could be <code>files</code> . The output is in the format <code>/{orgID}/{userID}/</code> . This storage path is meant for data that is unique to a particular user in an organization, but common across all the communities that the user is a member of within that organization.
<pre>public String getCommunityLevelStoragePath (String communityId)</pre>	Returns the community level storage path for this user account, relative to the higher level directory of app data. The higher level directory could be <code>files</code> . The output is in the format <code>/{orgID}/{userID}/{communityID}/</code> . If <code>communityID</code> is null and then the output would be <code>/{orgID}/{userID}/internal/</code> . This storage path is

Method	Description
	meant for data that is unique to a particular user in a specific community.
<code>public String getOrgLevelFilenameSuffix()</code>	Returns a unique suffix for this user account, that can be appended to a file to uniquely identify this account, at an organization level. The output is in the format <code>_{orgID}</code> . This suffix is meant for data that can be shared across multiple users of the same organization.
<code>public String getUserLevelFilenameSuffix()</code>	Returns a unique suffix for this user account, that can be appended to a file to uniquely identify this account, at a user level. The output is in the format <code>_{orgID}_{userID}</code> . This suffix is meant for data that is unique to a particular user in an organization, but common across all the communities that the user is a member of within that organization.
<code>public String getCommunityLevelFilenameSuffix(String communityId)</code>	Returns a unique suffix for this user account, that can be appended to a file to uniquely identify this account, at a community level. The output is in the format <code>_{orgID}_{userID}_{communityID}</code> . If <code>communityID</code> is null and then the output would be <code>_{orgID}_{userID}_internal</code> . This suffix is meant for data that is unique to a particular user in a specific community.

## UserAccountManager Class

The `UserAccountManager` class provides methods to access authenticated accounts, add new accounts, log out existing accounts, and switch between existing accounts.

You don't directly create instances of `UserAccountManager`. Instead, obtain an instance using the following call:

```
SalesforceSDKManager.getInstance().getUserAccountManager();
```

## Methods

Method	Description
<code>public <a href="#">UserAccount</a> getCurrentUser()</code>	Returns the currently active user account.
<code>public List&lt;<a href="#">UserAccount</a>&gt; getAuthenticatedUsers()</code>	Returns the list of authenticated user accounts.
<code>public boolean doesUserAccountExist(<a href="#">UserAccount</a> account)</code>	Checks whether the specified user account is already authenticated.
<code>public void switchToUser(<a href="#">UserAccount</a> user)</code>	Switches the application context to the specified user account. If the specified user account is invalid or null, this method launches the login flow.
<code>public void switchToNewUser()</code>	Launches the login flow for a new user to log in.

Method	Description
<code>public void signoutUser (UserAccount userAccount, Activity frontActivity)</code>	Logs the specified user out of the application and wipes the specified user's credentials.

## AccountSwitcherActivity Class

Use or extend the `AccountSwitcherActivity` class to display the user switching interface.

The `AccountSwitcherActivity` class provides the screen that handles multi-user logins. It displays a list of existing user accounts and lets the user switch between existing accounts or sign into a new account. To enable multi-user logins, launch the activity from somewhere in your app using the following code:

```
final Intent i = new Intent(this, SalesforceSDKManager.getInstance().
 getAccountSwitcherActivityClass());
i.setFlags(Intent.FLAG_ACTIVITY_NEW_TASK);
this.startActivity(i);
```

For instance, you might launch this activity from a "Switch User" button in your user interface. See `SampleApps/RestExplorer` for an example.

If you like, you can customize and stylize `AccountSwitcherActivity` through XML.

For more control, you can extend `AccountSwitcherActivity` and replace it with your own custom sub-class. To replace the default class, call `SalesforceSDKManager.setAccountSwitcherActivityClass()`. Pass in a reference to the class file of your replacement activity class, such as `AccountSwitcherActivity.class`.

## UserSwitchReceiver Class

If your native Android app caches data other than tokens, implement the `UserSwitchReceiver` abstract class to receive notifications of user switching events.

Every time a user switch occurs, Mobile SDK broadcasts an intent. The intent action is declared in the `UserAccountManager` class as:

```
public static final String USER_SWITCH_INTENT_ACTION =
 "com.salesforce.USERSWITCHED";
```

This broadcast event gives applications a chance to properly refresh their cached resources to accommodate user switching. To help apps listen for this event, Mobile SDK provides the `UserSwitchReceiver` abstract class. This class is implemented in the following Salesforce activity classes:

- `SalesforceActivity`
- `SalesforceListActivity`
- `SalesforceExpandableListActivity`

**If your main activity extends one of the Salesforce activity classes, you don't need to implement `UserSwitchReceiver`.**

If you've cached only tokens in memory, you don't need to do anything—Mobile SDK automatically refreshes tokens.

If you've cached user data other than tokens, override your activity's `refreshIfUserSwitched()` method with your custom refresh actions.

**If your main activity does not extend one of the Salesforce activity classes, implement `UserSwitchReceiver` to handle cached data during user switching.**

To set up the broadcast receiver:



1. Implement a subclass of `UserSwitchReceiver`.
2. Register your subclass as a receiver in your activity's `onCreate()` method.
3. Unregister your receiver in your activity's `onDestroy()` method.

For an example, see the `ExplorerActivity` class in the `RestExplorer` sample application.

**If your application is a hybrid application, no action is required.**

The `SalesforceDroidGapActivity` class refreshes the cache as needed when a user switch occurs.

## Methods

A single method requires implementation.

Method Name	Description
<code>protected abstract void onUserSwitch();</code>	Implement this method to handle cached user data (other than tokens) when user switching occurs.

## iOS Native APIs

Native classes in Mobile SDK for iOS do most of the work for multi-user support. Your app makes a few simple calls and handles any data cached in memory. You also have the option of customizing the user switching activity.

To support user switching, Mobile SDK for iOS defines native classes in the `Security` folder of the `SalesforceSDKCore` library. Classes include:

- `SFUserAccount`
- `SFUserAccountManager`

The following sections briefly describe these classes. For full API reference documentation, see [SalesforceSDKCore Reference](#).

### IN THIS SECTION:

#### [SFUserAccount Class](#)

The `SFUserAccount` class represents a single user account that's currently authenticated. It encapsulates data that can be used to uniquely identify a user account.

#### [SFUserAccountManager Class](#)

The `SFUserAccountManager` class provides methods to access authenticated accounts, add new accounts, log out accounts, and switch between accounts.

## SFUserAccount Class

The `SFUserAccount` class represents a single user account that's currently authenticated. It encapsulates data that can be used to uniquely identify a user account.

## Properties

You can create `SFUserAccount` objects directly, from a JSON object, or from a bundle.

Property	Description
<code>@property (nonatomic, copy) NSSet *accessScopes</code>	The access scopes for this user.
<code>@property (nonatomic, strong) SFOAuthCredentials *credentials;</code>	The credentials that are associated with this user.
<code>@property (nonatomic, strong) SFIdentityData *idData;</code>	The identity data that's associated with this user.
<code>@property (nonatomic, copy, readonly) NSURL *apiUrl;</code>	The URL that can be used to invoke any API on the server side. This URL takes into account the current community if available.
<code>@property (nonatomic, copy) NSString *email;</code>	The user's email address.
<code>@property (nonatomic, copy) NSString *organizationName;</code>	The name of the user's organization.
<code>@property (nonatomic, copy) NSString *fullName;</code>	The user's first and last names.
<code>@property (nonatomic, copy) NSString *userName;</code>	The user's username.
<code>@property (nonatomic, strong) UIImage *photo;</code>	The user's photo, typically a thumbnail of the user. The consumer of this class must set this property at least once in order to use the photo. This class doesn't fetch the photo from the server; it stores and retrieves the photo locally.
<code>@property (nonatomic) SFUserAccountAccessRestriction accessRestrictions;</code>	The access restrictions that are associated with this user.
<code>@property (nonatomic, copy) NSString *communityId;</code>	The current community ID, if the user is logged into a community. Otherwise, this property is nil.
<code>@property (nonatomic, readonly, getter = isSessionValid) BOOL sessionValid;</code>	Returns YES if the user has an access token and, presumably, a valid session.

Property	Description
<pre>@property (nonatomic, copy) NSDictionary *customData;</pre>	The custom data for the user. Because this data can be serialized, the objects that are contained in <code>customData</code> must follow the <code>NSCoding</code> protocol.

## Global Function

Function Name	Description
<pre>NSString *SFKeyForUserAndScope (SFUserAccount *user, SFUserAccountScope scope);</pre>	Returns a key that uniquely identifies this user account for the given scope. If you set <code>scope</code> to <code>SFUserAccountScopeGlobal</code> , the same key will be returned regardless of the user account.

## SFUserAccountManager Class

The `SFUserAccountManager` class provides methods to access authenticated accounts, add new accounts, log out accounts, and switch between accounts.

To access the singleton `SFUserAccountManager` instance, send the following message:

```
[SFUserAccountManager sharedInstance]
```


## Properties

Property	Description
<pre>@property (nonatomic, strong) SFUserAccount *currentUser</pre>	The current user account. If the user has never logged in, this property may be nil.
<pre>@property (nonatomic, readonly) NSString *currentUserId</pre>	A convenience property to retrieve the current user's ID. This property is an alias for <code>currentUser.credentials.userId</code> .
<pre>@property (nonatomic, readonly) NSString *currentCommunityId</pre>	A convenience property to retrieve the current user's community ID. This property is an alias for <code>currentUser.communityId</code> .
<pre>@property (nonatomic, readonly) NSArray *allUserAccounts</pre>	An <code>NSArray</code> of all the <code>SFUserAccount</code> instances for the app.
<pre>@property (nonatomic, readonly) NSArray *allUserIds</pre>	Returns an array that contains all user IDs.
<pre>@property (nonatomic, copy) NSString *activeUserId</pre>	The most recently active user ID. If the user that's specified by <code>activeUserId</code> is removed from the accounts list, this user may be temporarily different from the current user.
<pre>@property (nonatomic, strong) NSString *loginHost</pre>	The host to be used for login.

Property	Description
@property (nonatomic, assign) BOOL retryLoginAfterFailure	A flag that controls whether the login process restarts after it fails. The default value is YES.
@property (nonatomic, copy) NSString *oauthCompletionUrl	The OAuth callback URL to use for the OAuth login process. Apps can customize this property. By default, the property's value is copied from the <code>SFDCOAuthRedirectUri</code> property in the main bundle. The default value is <code>@"testsfdc:///mobilesdk/detect/oauth/done"</code> .
@property (nonatomic, copy) NSSet *scopes	The OAuth scopes that are associated with the app.

## Methods

Method	Description
- (NSString*) userAccountPlistFileForUser:(SFUserAccount*) user	Returns the path of the <code>.plist</code> file for the specified user account.
- (void) addDelegate:(id<SFUserAccountManagerDelegate>) delegate	Adds a delegate to this user account manager.
- (void) removeDelegate:(id<SFUserAccountManagerDelegate>) delegate	Removes a delegate from this user account manager.
- (SFLoginHostUpdateResult*) updateLoginHost	Sets the app-level login host to the value in app settings.
- (BOOL) loadAccounts:(NSError**) error	Loads all accounts.
- (SFUserAccount*) createUserAccount	Can be used to create an empty user account if you want to configure all of the account information yourself. Otherwise, use <code>[SFAuthenticationManager loginWithCompletion:failure:]</code> to automatically create an account when necessary.
- (SFUserAccount*) userAccountForUserId:(NSString*) userId	Returns the user account that's associated with a given user ID.
- (NSArray*) accountsForOrgId:(NSString*) orgId	Returns all accounts that have access to a particular organization.

Method	Description
<pre>- (NSArray *) accountsForInstanceURL:(NSString *)instanceURL</pre>	Returns all accounts that match a particular instance URL.
<pre>- (void)addAccount:(SFUserAccount *)acct</pre>	Adds a user account.
<pre>- (BOOL) deleteAccountForUserId:(NSString*)userId error:(NSError **)error</pre>	Removes the user account that's associated with the given user ID.
<pre>- (void)clearAllAccountState</pre>	Clears the account's state in memory (but doesn't change anything on the disk).
<pre>- (void) applyCredentials: (SFOAuthCredentials*)credentials</pre>	Applies the specified credentials to the current user. If no user exists, a user is created.
<pre>- (void)applyCustomDataToCurrentUser: (NSDictionary*)customData</pre>	<p>Applies custom data to the <code>SFUserAccount</code> that can be accessed outside that user's sandbox. This data persists between app launches. Because this data will be serialized, make sure that objects that are contained in <code>customData</code> follow the <code>NSCoding</code> protocol.</p> <p> <b>Important:</b> Use this method only for nonsensitive information.</p>
<pre>- (void)switchToNewUser</pre>	Switches from the current user to a new user context.
<pre>- (void)switchToUser:(SFUserAccount *)newCurrentUser</pre>	Switches from the current user to the specified user account.
<pre>- (void) userChanged:(SFUserAccountChange)change</pre>	Informs the <code>SFUserAccountManager</code> object that something has changed for the current user.

## Hybrid APIs

Hybrid apps can enable multi-user support through Mobile SDK JavaScript APIs. These APIs reside in the `SFAccountManagerPlugin` Cordova-based module.

## SFAccountManagerPlugin Methods

Before you call any of these methods, you need to load the `sfaccountmanager` plug-in. For example:

```
cordova.require("com.salesforce.plugin.sfaccountmanager").logout();
```

Method Name	Description
<code>getUsers</code>	Returns the list of users already logged in.
<code>getCurrentUser</code>	Returns the current active user.
<code>logout</code>	Logs out the specified user if a user is passed in, or the current user if called with no arguments.
<code>switchToUser</code>	Switches the application context to the specified user, or launches the account switching screen if no user is specified.

Hybrid apps don't need to implement a receiver for the multi-user switching broadcast event. This handler is implemented by the `SalesforceDroidGapActivity` class.

# CHAPTER 19 Mobile SDK Tools for Developers

## In this chapter ...

- [In-App Developer Support](#)

Mobile SDK provides tools that help developers see what's happening in their apps at runtime.

For instance, you can inspect and query SmartStore soups, browse authenticated users, and view the user agent string. These tools are designed primarily for debugging purposes. In most cases, you disable this information in production builds.

## In-App Developer Support

---

Mobile SDK 6.0 introduces several new screens in all types of apps for debugging during app development. These features usually do not require coding and are designed for debug builds.

The Dev Support dialog box is the launchpad for all available support screens and other useful actions. The dialog box presents only the options that are pertinent to the type of app you're running. During debugging on a desktop, you can access the Dev Support through a keyboard shortcut or gesture.

By default, these tools are available only in debug builds. However, you can use an API call to enable or disable the Dev Support screen at other times.

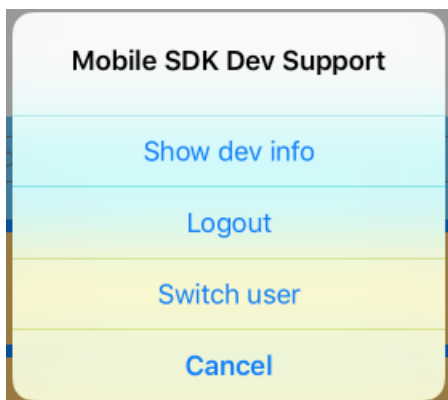
### Launching the Dev Support Dialog Box

#### iOS

To launch the Dev Support dialog box, use one of the following options.

- Shake your physical device.
- From the iOS Simulator menu, select **Hardware** > **Shake Gesture**.
- When your app is running in the iOS Simulator, use the `^+Command+z` keyboard shortcut.

Here's the iOS screen.



#### Android

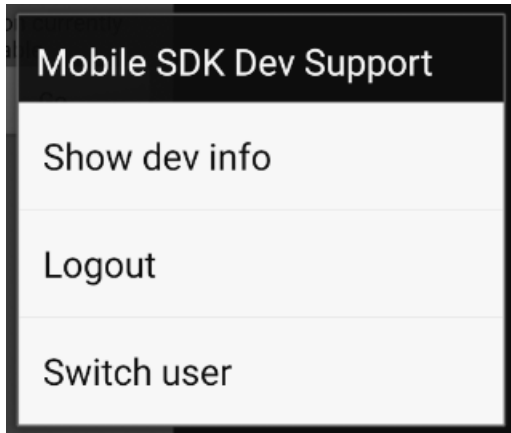
Screenshot: Dev Support dialog on Android

To launch the Dev Support dialog box, use one of the following options.

- When your app is running in the Android emulator, use the `Command+m` (Mac) or `Ctrl+m` (Windows) keyboard shortcut.
- In a system command shell, run: `adb shell input keyevent 82`

Here's the Android screen.





## API to Display or Hide Dev Support

If a scenario arises that requires the Developer Support tools in a production setting, call the API to enable the Dev Support dialog box.

### iOS

```
// To enable
[SalesforceSDKManager sharedInstance].isDevSupportEnabled = YES;
// To disable
[SalesforceSDKManager sharedInstance].isDevSupportEnabled = NO;
```

### Android

```
// To enable
SalesforceSDKManager.getInstance().setDevSupportEnabled(true);
// To disable
SalesforceSDKManager.getInstance().setDevSupportEnabled(false);
```

**Important:** Don't forget to disable the feature before distributing your app to the public.

## Support Options

The Dev Support dialog box presents options based on the app type. In every case you get:

- **Show dev info**—brings up the dev info screen.
- **Logout**—Logs out the current user. Useful when you're getting started and have not yet had time to add a logout button or action into your UI.
- **Switch user**—Switch to a different user. Useful when you are getting started and have not yet had time to add a switch user button or action into your UI.

### If your application uses SmartStore, you also see:

**Inspect SmartStore**—Displays the SmartStore inspector screen.

SmartStore inspector is useful during development because it decrypts the data for display purposes. This decryption applies only to the inspector display—data remains encrypted on disk.

### If your application is a React Native application, you also see:

**React native dev support**—The React Native dev menu.

## Dev Info Screen

The Dev Info screen shows a collection of information about the app, its configuration, and so on, based on the app type. In every case you get:

- SDK version
- App type
- User agent
- Native browser for login enabled (indicates whether advanced authentication is configured)
- Identity Provider login enabled (indicates whether the app can use another app to provide login)
- Current user
- Authenticated users
- Boot config settings
- Managed (indicates whether the app is managed)
- Managed preferences (app settings pushed to the app by the MDM provider, if applicable)

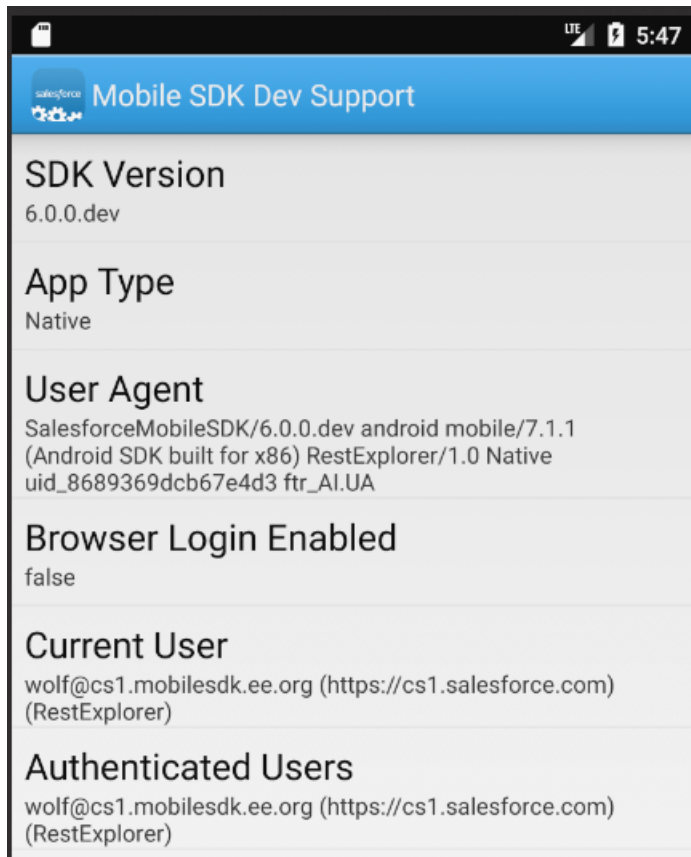
For SmartStore apps, you get the following additional information:

- SQLCipher version
- SQLCipher compile options
- Names of user stores
- Names of global stores

Here's the iOS info screen.



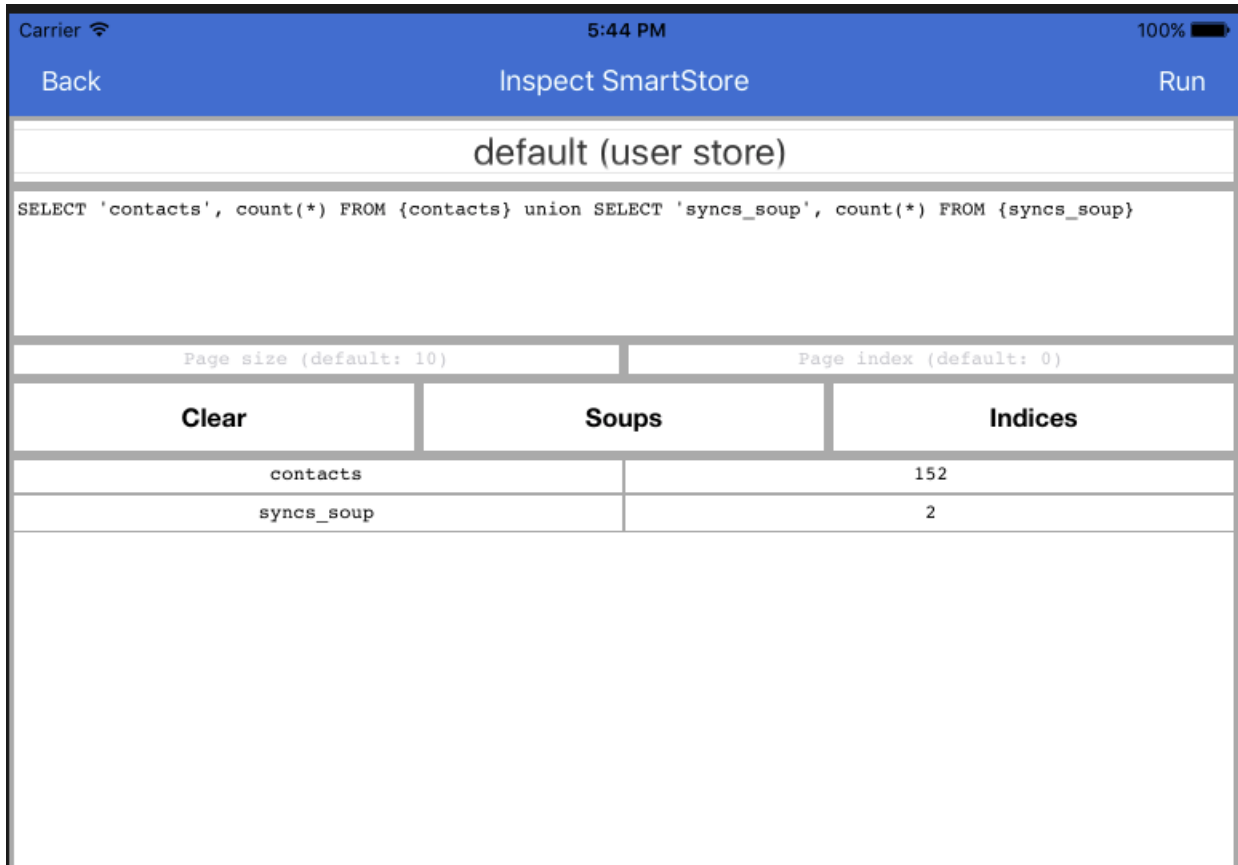
And here's the Android info screen.



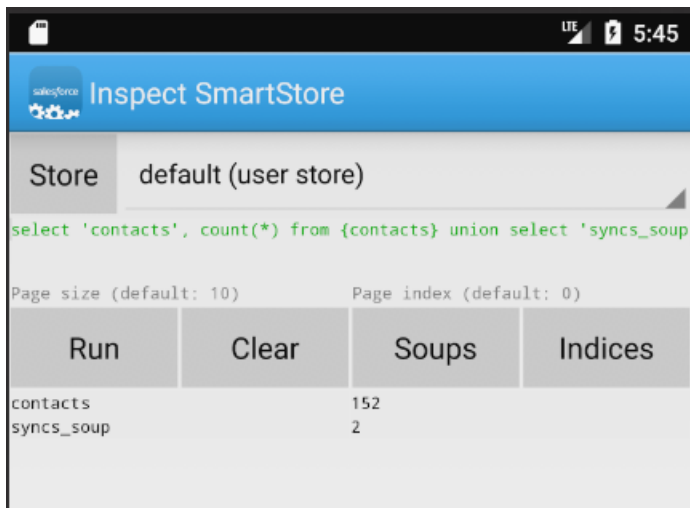
## SmartStore Inspector

The SmartStore Inspector screen is a legacy feature that lets user see a list of SmartStore soups and their indices, and run custom queries. In Mobile SDK 6.0, this screen adds a store picker that lets you choose which global or user store to inspect.

Here's the SmartStore Inspector for iOS.



And here’s the SmartStore Inspector for Android.



## Extending the Dev Info Screen

The Dev Info screen gets the information shown in its screen from a method named `getDevSupportInfos` in `SalesforceSDKManager`. This method is overridden by some subclasses of `SalesforceSDKManager`. To show your own custom information, you can also override this method. Just implement a subclass of `SalesforceSDKManager`, override the method, and use it in your application.

**iOS**

```
/**
 * @return Array of name1, value1, name2, value2, etc.) to show in
 SFSDKDevInfoViewController
 */
- (NSArray*) getDevSupportInfos;
```

**Android**

```
/**
 * @return Dev info (list of name1, value1, name2, value2, etc.) to show in DevInfoActivity
 */
public List<String> getDevSupportInfos();
```

# CHAPTER 20 Analytics and Logging

## In this chapter ...

- [Salesforce Mobile SDK Logging Framework](#)
- [Instrumentation and Event Collection](#)

Mobile SDK uses analytics and logging for its own purposes and also provides a logging framework for apps. You can disable the analytics feature in your app, and you can use the logging framework to output messages for your custom components.

## Salesforce Mobile SDK Logging Framework

---

Mobile SDK 5.2 introduces a logging framework that allows developers to easily create logs for app components.

With this framework, you can

- Output logs to both console and file.
- Output logs for your custom components and Mobile SDK components.
- Log at a component level. For example, SmartSync Data Framework and SmartStore use separate loggers. You can also create custom loggers for your own components.
- Set logging levels, such as ERROR, DEBUG, and VERBOSE.
- Configure logging levels per component. For example, you can set SmartSync Data Framework to the ERROR level and SmartStore to VERBOSE.

Using the logging framework is like playing tunes on a juke box. To obtain and use a logger instance:

1. **Browse the tunes**—Obtain a list of your app’s available components. This runtime-only step isn’t necessary if you already know the name of the component.
2. **Make your selection**—Pass the name of a component to the framework. To “play” your selection, Mobile SDK returns a logger instance for the chosen component. It doesn’t matter whether the logger exists—Mobile SDK creates one if necessary.
3. **Bust a move**—Set the logging level, write a line to the log, limit the number of log lines, turn logging off or on.

Not a perfect analogy, but hopefully you get the point. To get the details, continue reading.

### Get All Components

The following methods return a list of the names of all components that currently have an associated logger. If you don’t know the names of Mobile SDK internal components, your code can discover them at runtime in this list. You can use this list, for instance, to turn off logging for all components. How your app uses this information is up to your business logic.

#### Android

```
public synchronized static Set<String> getComponents();
```

#### iOS

```
+ (nonnull NSArray<NSString *> *)allComponents;
```

### Create a Logger for Your Component

A component represents a virtual domain in your app’s functionality. The component can represent your entire app or just a portion of its feature set. You devise a name for the component when you create the logger. You can then use the logger to document any notable conditions arising in the component’s domain.

To create a logger for your own component, you don’t have to override, extend, or implement anything. Instead, you request a logger from the logging framework using the name of your component. If the logger isn’t already in the components list, the logging framework creates a singleton logger and adds the component to the list. Otherwise, it returns the existing logger. All threads share this logger.

You can create a single logger or multiple loggers. For example, to log all messages from your app at the same level, create a single logger that uses your app name. One logger is often sufficient for an app. However, if you want to differentiate logging levels between various parts of your app, you can create more loggers with component-based names. Be careful not to go overboard—you don’t want excessive logging activity to degrade your app’s performance.



You request loggers through the following objects.

- **Android:** `com.salesforce.androidsdk.analytics.logger.SalesforceLogger`
- **iOS:** `SFSDKLogger` (`#import <SalesforceAnalytics/SFSDKLogger.h>`)

Use the following APIs to get loggers for custom components or standard Mobile SDK components.

#### Android

```
public synchronized static SalesforceLogger getLogger(String componentName, Context context);
```

For example:

```
SalesforceLogger.getLogger("MyComponent", context);
```

#### iOS

```
+ (nonnullinstancetype) sharedInstanceWithComponent:(nonnull NSString *) componentName;
```

For example:

```
[SFSDKLogger sharedInstanceWithComponent:@"MyComponent"];
```

## Customize Logger Output

Once you get a logger instance, you can control the type and quantity of information the logger outputs.

- **Set a Component's Log Level**

Each app component can have its own logger instance and its own log level. The default log level is DEBUG for a debug build and ERROR for a release build. Use the following APIs to set a component's log levels.

#### Android

```
public void setLogLevel(Level level);
```

Android loggers use an internal public enum that mirrors the Android default log levels. For example:

```
logger.setLogLevel(Level.INFO);
```

#### iOS

```
@property (nonatomic, readwrite, assign, getter=getLogLevel) DDLogLevel logLevel;
```

iOS loggers use the Lumberjack `DDLogLevel` enum defined in the `DDLog.h` file. For example:

```
logger.logLevel = DDLogLevelInfo;
```

- **Write a Log Line**

The following APIs can be used to write a log line using the new framework. The log line is automatically written to both console and file, unless file logging is disabled for that component.

#### Android

```
public void log(Level level, String tag, String message);
```

```
public void log(Level level, String tag, String message, Throwable e);
```

#### iOS

Write a log line:

```
- (void)log:(nonnull Class)class level:(DDLogLevel)level message:(nonnull NSString *)message;
```

Write a log line with variadic arguments:

```
- (void)log:(nonnull Class)class level:(DDLogLevel)level format:(nonnull NSString *)format, ...;
```

Convenience methods are available for each log level on both Android and iOS.

- **Enable or Disable File Logging**

The logging framework logs messages to both console and file by default. File logging can be disabled if necessary, using the following APIs.

#### Android

```
public synchronized void disableFileLogging();
```

Enable file logging:

```
public synchronized void enableFileLogging(int maxSize);
```

In this API, `maxSize` represents the maximum number of log lines that the file can hold before the log lines are rolled.

#### iOS

```
@property (nonatomic, readwrite, assign, getter=isFileLoggingEnabled) BOOL fileLoggingEnabled;
```

## Mobile SDK Logging Components

Mobile SDK provides a default logger for each of its standard components. This architecture allows you to control the log level of each component independently of other components. For example, you could set the log level of SmartSync Data Framework to INFO while the log level of SmartStore is set to ERROR.

Here are lists of the standard component loggers in Mobile SDK.

#### Android

- `SalesforceAnalyticsLogger`
- `SalesforceSDKLogger`
- `SmartStoreLogger`
- `SmartSyncLogger`
- `SalesforceReactLogger`
- `SalesforceHybridLogger`

#### iOS

- `SFSDKAnalyticsLogger`
- `SFSDKCoreLogger`
- `SFSDKSmartStoreLogger`
- `SFSDKSmartSyncLogger`
- `SFSDKReactLogger`

- SFSDKHybridLogger

Each of these logging components has convenience methods for adjusting log levels and logging messages associated with those core components.

## Instrumentation and Event Collection

---

Mobile SDK 5.0 introduces a new framework that adds analytical instrumentation to Mobile SDK apps. Through this instrumentation, apps collect event data that describe how consuming apps use Mobile SDK. Mobile SDK periodically uploads logs of these events to the Salesforce cloud. This information helps us focus on the features that matter most to your customers. We do not collect any data specific to users or their Salesforce organizations.

Mobile SDK app users and developers do not have access to the information Salesforce gathers. Salesforce collects it solely for its own use. The software that collects the data is maintained in Mobile SDK open source repos at [github.com/forcedotcom](https://github.com/forcedotcom).

Mobile SDK 5.0 and later enable instrumentation by default. Mobile SDK automatically publishes collected framework events to the Salesforce cloud on the following schedule:

- **iOS:** When the app goes to the background.
- **Android:** Every 8 hours.

Your app can toggle event logging on or off. On Android, your app can also change the collection upload frequency.

To manage the event logging service, use the following APIs. You call each API on an instance of an analytics manager object, which you initialize with your app's current user account.

## Toggle Event Logging

### Android

For Android, call the `enableLogging(boolean enabled)` method.

```
final UserAccount curAccount = UserAccountManager.getInstance().getCurrentUser();
final SalesforceAnalyticsManager sfAnalyticsManager =
 SalesforceAnalyticsManager.getInstance(curAccount);
sfAnalyticsManager.enableLogging(false);
```

### iOS

For iOS, set the `BOOL loggingEnabled` property.

```
SFUserAccount *account = [SFUserAccountManager
sharedInstance].currentUser;
SFSDKSalesforceAnalyticsManager *sfAnalyticsManager =
 [SFSDKSalesforceAnalyticsManager
sharedInstanceWithUser:account];
sfAnalyticsManager.loggingEnabled = NO;
```

## Check Event Logging Status

### Android

For Android, call the `isLoggingEnabled(boolean enabled)` method.

```
final UserAccount curAccount = UserAccountManager.getInstance().getCurrentUser();
final SalesforceAnalyticsManager sfAnalyticsManager =
```

```
SalesforceAnalyticsManager.getInstance(curAccount);
boolean enabled = sfAnalyticsManager.isLoggingEnabled();
```

## iOS

For iOS, check the `BOOL isLoggingEnabled` property.

```
SFUserAccount *account = [SFUserAccountManager sharedInstance].currentUser;
SFSDKSalesforceAnalyticsManager *sfAnalyticsManager =
 [SFSDKSalesforceAnalyticsManager sharedInstanceWithUser:account];
BOOL enabled = sfAnalyticsManager.isLoggingEnabled;
```

## Set Upload Frequency (Android Only)

On Android, you can set the frequency, in hours, of event log uploads. The default value is 8.

```
final UserAccount curAccount = UserAccountManager.getInstance().getCurrentUser();
final SalesforceAnalyticsManager sfAnalyticsManager =
 SalesforceAnalyticsManager.getInstance(curAccount);
sfAnalyticsManager.setPublishFrequencyInHours(numHours); // numHours is the desired upload
interval in hours.
```

# CHAPTER 21 Migrating from Previous Releases

## In this chapter ...

- [Migrate All Apps from 5.3 to 6.0](#)
- [Migrating from Earlier Releases](#)

If you're upgrading an app built with Salesforce Mobile SDK 5.3, follow these instructions to update your app to 6.0.

If you're upgrading an app that's built with a version earlier than Salesforce Mobile SDK 5.3, start upgrading with [Migrating from Earlier Releases](#).

## Migrate All Apps from 5.3 to 6.0

---

Migration is easy in Mobile SDK 6.0 if you use the npm scripts.

Mobile SDK 6.0 require a few code changes, but the Mobile SDK npm scripts can handle almost every case for you. Check the following instructions for exceptions. Note that we've added forcereact and forcehybrid npm scripts for creating React Native and hybrid.

### Native Android

Recreate your app with forcedroid, and then migrate your app's artifacts into the new template. Follow the instructions in "Updating Native and React Native Apps" at [Updating Mobile SDK Apps \(5.0 and Later\)](#).

### Native iOS

Recreate your app with forceios, and then migrate your app's artifacts into the new template. Follow the instructions in "Updating Native and React Native Apps" at [Updating Mobile SDK Apps \(5.0 and Later\)](#).

If you're using the `SFLoginViewController` class to manage the Settings icon on the login screen, update your code to use the `SFSDKLoginViewControllerConfig` class instead. Import `SalesforceSDKCore/SFSDKLoginViewControllerConfig.h` and change this line:

```
SFLoginViewController *loginViewController =
[SFLoginViewController sharedInstance];
```

to this one:

```
SFSDKLoginViewControllerConfig *loginViewConfig = [[SFSDKLoginViewControllerConfig
alloc] init];
```

For a list of new features in this version, see [What's New in Mobile SDK 6.0](#).

### React Native

Recreate your app with forcereact, and then migrate your app's artifacts into the new template. Follow the instructions in "Updating Native and React Native Apps" at [Updating Mobile SDK Apps \(5.0 and Later\)](#).

### Hybrid

Recreate your app with forcehybrid, and then migrate your app's artifacts into the new template. Follow the instructions in "Updating Hybrid Apps" at [Updating Mobile SDK Apps \(5.0 and Later\)](#).

For a list of new features in this version, see [What's New in Mobile SDK 6.0](#).

## Migrating from Earlier Releases

---

To migrate from versions older than the previous release, perform the code upgrade steps for each intervening release, starting at your current version.

### Migrate All Apps from 5.2 to 5.3

Migration is easy in Mobile SDK 5.3.

Mobile SDK 5.3 doesn't require code changes. Instead, use the following steps to update your apps to version 5.3.

#### Native Android

Follow the instructions in "Updating Native and React Native Apps" at [Updating Mobile SDK Apps \(5.0 and Later\)](#).

### Native iOS

1. Add the following line to your podfile:

```
pod 'FMDB', :path => 'mobile_sdk/SalesforceMobileSDK-iOS'
```

2. Follow additional instructions in “Updating Native and React Native Apps” at [Updating Mobile SDK Apps \(5.0 and Later\)](#).

### React Native

Follow the instructions in “Updating Native and React Native Apps” at [Updating Mobile SDK Apps \(5.0 and Later\)](#).

### Hybrid

We strongly recommend that you create an app with [forceios](#) or [forcedroid](#), and then migrate your app’s artifacts into the new template. Follow the instructions in “Updating Hybrid Apps” at [Updating Mobile SDK Apps \(5.0 and Later\)](#).

For a list of new features in this version, see [What's New in Mobile SDK 6.0](#).

## Migrate Android Apps from 5.1 to 5.2

Migration is easy in Mobile SDK 5.2.

Mobile SDK 5.2 doesn’t require code changes. To upgrade native Android apps, see [Updating Mobile SDK Apps \(5.0 and Later\)](#).

For a list of new features in this version, see [What's New in Mobile SDK 6.0](#).

## Migrate iOS Apps from 5.1 to 5.2

Migration is easy in Mobile SDK 5.2.

Mobile SDK 5.2 doesn’t require code changes. To upgrade iOS native apps, see [Updating Mobile SDK Apps \(5.0 and Later\)](#).

For a list of new features in this version, see [What's New in Mobile SDK 6.0](#).

## Migrate Hybrid Apps from 5.1 to 5.2

To upgrade hybrid apps, we strongly recommend that you create an app with [forceios](#) or [forcedroid](#), and then migrate your app’s artifacts into the new template. See [Updating Mobile SDK Apps \(5.0 and Later\)](#).

For a list of new features in this version, see [What's New in Mobile SDK 6.0](#).

## Migrate React Native Apps from 5.1 to 5.2

Migration is easy in Mobile SDK 5.2.

Mobile SDK 5.2 doesn’t require code changes. To upgrade React native apps, see [Updating Mobile SDK Apps \(5.0 and Later\)](#).

For a list of new features in this version, see [What's New in Mobile SDK 6.0](#).

## Migrate Android Apps from 5.0 to 5.1

Updates to SmartSync Data Framework APIs account for the majority of changes in Mobile SDK 5.1.

In Mobile SDK 5.1, we’ve refactored SmartSync Data Framework classes to decouple the `SyncManager` class from `SyncTarget` classes. This new architecture includes API changes that affect all apps that use SmartSync Data Framework. However, the majority of the changes apply only to SmartSync Data Framework apps that define custom targets.

## General API Changes

The following changes apply to all native SmartSync Data Framework apps.

- `SyncTarget` and its subclasses have moved from the `com.salesforce.smartsync.util` package to the `com.salesforce.smartsync.target` package.
- The `LOCAL`, `LOCALLY_CREATED`, `LOCALLY_UPDATED`, and `LOCALLY_DELETED` constants are now defined in `SyncTarget.java` instead of `SyncManager.java`.

## API Changes for Custom Sync Targets

The following changes apply only if your SmartSync Data Framework app defines custom targets.

### SyncTarget base class:

The following method is new:

**void saveRecordsToLocalStore(SyncManager syncManager, String soupName, JSONArray records)**

Resets given records to “clean” and saves them to the local store.

The following methods have moved from the `SyncManager` class to the `SyncTarget` class. In each case, the method’s behavior has also changed.

**SortedSet<String> getDirtyRecordIds(SyncManager syncManager, String soupName, String idField)**

Former behavior	New behavior
On dirty records, <code>__local__</code> field was set to true.	Returns IDs of “dirty” records.

**void cleanAndSaveInLocalStore(SyncManager syncManager, String soupName, JSONObject record)**

Former behavior	New behavior
Set the <code>__local*</code> fields to false and then saved the record to SmartStore.	Resets record to clean and save it to the local store.

**boolean isLocallyCreated(JSONObject record)**

Former behavior	New behavior
Returned the value of the <code>__locally_created__</code> field.	Returns true if the record was locally created.

**boolean isLocallyUpdated(JSONObject record)**

Former behavior	New behavior
Returned the value of the <code>__locally_updated__</code> field.	Returns true if the record was locally updated.



**boolean isLocallyDeleted(JSONObject record)**

Former behavior	New behavior
Returned the value of the <code>__locally_deleted__</code> field.	Returns true if the record was locally deleted.

**boolean isDirty(JSONObject record)**

Former behavior	New behavior
Returned the value of the <code>__local__</code> field.	Returns true if the record was locally created/updated or deleted.

**JSONObject getFromLocalStore(SyncManager syncManager, String soupName, String storeId)**

Former behavior	New behavior
Retrieved the record directly from SmartStore.	Gets a record from the local store.

**void deleteFromLocalStore(SyncManager syncManager, String soupName, JSONObject record)**

Former behavior	New behavior
Deleted the record directly in SmartStore.	Deletes a record from the local store.

**SyncUpTarget class:**

The following method moves from the `SyncManager` class to the `SyncUpTarget` class. It formerly returned IDs of records that had `__local__` set to `true`.

**Set<String> getIdsOfRecordsToSyncUp(SyncManager syncManager, String soupName)**

Called by the sync manager during sync up to determine which records to sync.

The following new methods complement existing methods of the same name, but with different signatures. The existing methods are no longer public. In each case, the new method, rather than the sync manager, now calls the existing method.

**void createOnServer(SyncManager syncManager, JSONObject record, List<String> fieldlist)**

Called by sync manager to create the record on the server.

**int deleteOnServer(SyncManager syncManager, JSONObject record)**

Called by sync manager to delete the record on the server.

**int updateOnServer(SyncManager syncManager, JSONObject record, List<String> fieldlist)**

Called by sync manager to update the record on the sever.

The following method moves from the `SyncManager` class to the `SyncUpTarget` class. In its former incarnation, it called the `fetchLastModifiedDate` method of the target. The `fetchLastModifiedDate` method is no longer public.

**boolean isNewerThanServer(SyncManager syncManager, JSONObject record)**

Called by the sync manager when merge mode is `LEAVE_IF_CHANGED` to decide whether the record requires syncing.

**SyncDownTarget class:**

The following method moves from the `SyncManager` class to the `SyncDownTarget` class.

**int cleanGhosts(SyncManager syncManager, String soupName)**

Called by the sync manager to clean and resync ghosts.

**Set<String> getIdsToSkip(SyncManager syncManager, String soupName)**

Called by the sync manager during sync down to determine which records should not be overwritten. In its previous form, it returned IDs of records that had `__local__` set to `true`.

## Migrate iOS Apps from 5.0 to 5.1

Updates to SmartSync Data Framework APIs account for the majority of changes in Mobile SDK 5.1.

In Mobile SDK 5.1, we've refactored SmartSync Data Framework classes to decouple the `SFSmartSyncSyncManager` class from `SFSyncTarget` classes. This new architecture includes API changes that affect all apps that use SmartSync Data Framework. However, the majority of the changes apply only to SmartSync Data Framework apps that define custom targets.

### General API Changes

The following changes apply to all native SmartSync Data Framework apps.

- `SFSyncTarget` and its subclasses have moved from the `Util` folder to the `Target` folder.
- We've renamed the following constants and moved them from `SFSmartSyncSyncManager.h` to `SFSyncTarget.h`.

Old Name (in <code>SFSmartSyncSyncManager.h</code> )	New Name (in <code>SFSyncTarget.h</code> )
<code>kSyncManagerLocal</code>	<code>kSyncTargetLocal</code>
<code>kSyncManagerLocallyCreated</code>	<code>kSyncTargetLocallyCreated</code>
<code>kSyncManagerLocallyUpdated</code>	<code>kSyncTargetLocallyUpdated</code>
<code>kSyncManagerLocallyDeleted</code>	<code>kSyncTargetLocallyDeleted</code>

### API Changes for Custom Sync Targets

The following changes apply only if your SmartSync Data Framework app defines custom targets.

#### **SFSyncTarget base class:**

The following method is new:

- ```
-(void) saveRecordsToLocalStore:(SFSmartSyncSyncManager*) syncManager
    soupName:(NSString*) soupName
    records:(NSArray*) records
```

Resets given records to “clean” and saves them to the local store.

The following methods have moved from the `SyncManager` class to the `SyncTarget` class. In each case, the method's behavior has also changed.

**-(NSSet*) getDirtyRecordIds:(SFSmartSyncSyncManager*) syncManager
soupName:(NSString*) soupName idField:(NSString*) idField**

| Former behavior | New behavior |
|---|---------------------------------|
| On dirty records, <code>__local__</code> field was set to true. | Returns IDs of "dirty" records. |

**-(void) cleanAndSaveInLocalStore:(SFSmartSyncSyncManager*) syncManager
soupName:(NSString*) soupName record:(NSDictionary*) record**

| Former behavior | New behavior |
|--|--|
| Set the <code>__local*</code> fields to false and then saved the record to SmartStore. | Resets record to clean and save it to the local store. |

-(BOOL) isLocallyCreated:(NSDictionary*) record

| Former behavior | New behavior |
|---|---|
| Returned the value of the <code>__locally_created__</code> field. | Returns true if the record was locally created. |

-(BOOL) isLocallyUpdated:(NSDictionary*) record

| Former behavior | New behavior |
|---|---|
| Returned the value of the <code>__locally_updated__</code> field. | Returns true if the record was locally updated. |

-(BOOL) isLocallyDeleted:(NSDictionary*) record

| Former behavior | New behavior |
|---|---|
| Returned the value of the <code>__locally_deleted__</code> field. | Returns true if the record was locally deleted. |

-(BOOL) isDirty:(NSDictionary*) record

| Former behavior | New behavior |
|---|--|
| Returned the value of the <code>__local__</code> field. | Returns true if the record was locally created/updated or deleted. |

**-(NSDictionary*) getFromLocalStore:(SFSmartSyncSyncManager *) syncManager
soupName:(NSString*) soupName storeId:(NSString*) storeId**

| Former behavior | New behavior |
|--|-------------------------------------|
| Retrieved the record directly from SmartStore. | Gets a record from the local store. |

```
-(void) deleteFromLocalStore:(SFSmartSyncSyncManager *)syncManager  
soupName:(NSString*)soupName record:(NSDictionary*)record
```

| Former behavior | New behavior |
|--|--|
| Deleted the record directly in SmartStore. | Deletes a record from the local store. |

SFSyncUpTarget class:

The following method moves from the `SFSmartSyncSyncManager` class to the `SFSyncUpTarget` class. It formerly returned IDs of records that had `__local__` set to `true`.

```
-(NSArray *) getIdsOfRecordsToSyncUp:(SFSmartSyncSyncManager *)syncManager  
soupName:(NSString *)soupName
```

Called by the sync manager during sync up to determine which records to sync.

The following new methods complement existing methods of the same name, but with different signatures. The existing methods are no longer public. In each case, the new method, rather than the sync manager, now calls the existing method.

- ```
-(void) createOnServer:(SFSmartSyncSyncManager *)syncManager
record:(NSDictionary*)record
fieldlist:(NSArray*)fieldlist
completionBlock:(SFSyncUpTargetCompleteBlock)completionBlock
failBlock:(SFSyncUpTargetErrorBlock)failBlock
```

Called by the sync manager to create the record on the server.

- ```
-(void) updateOnServer:(SFSmartSyncSyncManager *)syncManager  
record:(NSDictionary*)record  
fieldlist:(NSArray*)fieldlist  
completionBlock:(SFSyncUpTargetCompleteBlock)completionBlock  
failBlock:(SFSyncUpTargetErrorBlock)failBlock
```

Called by the sync manager to delete the record on the server.

- ```
-(void) updateOnServer:(SFSmartSyncSyncManager *)syncManager
record:(NSDictionary*)record
fieldlist:(NSArray*)fieldlist
completionBlock:(SFSyncUpTargetCompleteBlock)completionBlock
failBlock:(SFSyncUpTargetErrorBlock)failBlock
```

Called by the sync manager to update the record on the server.

We've added the following new method to the `SFSyncUpTarget` class:

```
-(void) isNewerThanServer:(SFSmartSyncSyncManager *)syncManager
record:(NSDictionary*)record resultBlock:(SFSyncUpRecordNewerThanServerBlock)resultBlock
```

Called by the sync manager when merge mode is `LEAVE_IF_CHANGED` to decide whether the record requires syncing.

### SFSyncDownTarget class:

The following methods move from the `SFSmartSyncSyncManager` class to the `SFSyncDownTarget` class.

- ```
-(void) cleanGhosts:(SFSSmartSyncSyncManager *)syncManager
    soupName:(NSString *)soupName
    errorCallback:(SFSSyncDownTargetFetchErrorBlock)errorBlock
    completeBlock:(SFSSyncDownTargetFetchCompleteBlock)completeBlock
```

Called by the sync manager to clean and resync ghosts.

- ```
-(NSSet *)getIdsToSkip:(SFSSmartSyncSyncManager *)syncManager
 soupName:(NSString *)soupName
```

Called by the sync manager during sync down to determine which records should not be overwritten. In its previous form, it returned IDs of records that had `__local__` set to `true`.

## Migrate Hybrid Apps from 5.0 to 5.1

To upgrade hybrid apps, we strongly recommend that you create an app with [forceios](#) or [forcedroid](#), and then migrate your app's artifacts into the new template. See [Updating Mobile SDK Apps \(5.0 and Later\)](#).

## Migrate Android Apps from 4.3 to 5.0

To upgrade native Android apps, create an app with [forcedroid](#), and then migrate your app's artifacts into the new app.

Mobile SDK for Android now requires the following versions of third-party tools.

- Java JDK 8
- Gradle 2.14.1
- Target API version: Android Nougat (API 25)
- Android Studio 2.2
- Cordova Android 6.1.0 (hybrid apps)
- Cordova CLI 6.4.0 (hybrid apps)

## Migrate iOS Apps from 4.3 to 5.0

To upgrade native iOS apps, create an app with [forceios](#), and then migrate your app's artifacts into the new app.

Another recommended approach is to upgrade using only CocoaPods. See [Use CocoaPods with Mobile SDK](#). If you upgrade a SmartStore app with CocoaPods, be sure to update your `AppDelegate` class as described in [SDK Manager Classes](#).

Mobile SDK for iOS now requires the following versions of third-party tools.

- iOS 9 (minimum), iOS 10 (fully supported)
- Xcode 8
- CocoaPods 1.10 (minimum)
- Cordova iOS 4.3.0 (hybrid apps)
- Cordova CLI 6.4.0 (hybrid apps)

## Breaking Changes

- CocoaPods for Mobile SDK no longer includes `SalesforceRestAPI` or `SalesforceNetwork` pods. Both libraries have been rolled into `SalesforceSDKCore`.
- Mobile SDK apps now require the `SalesforceAnalytics` pod.

## Migrate Hybrid Apps from 4.3 to 5.0

- To upgrade hybrid apps, we strongly recommend that you create an app with [forceios](#) or [forcedroid](#), and then migrate your app's artifacts into the new template. See [Updating Mobile SDK Apps \(5.0 and Later\)](#).
- Mobile SDK updates its Cordova support to the following versions:
  - **iOS:** Upgraded to Cordova 4.3.0 and Cordova CLI 6.4.0.
  - **Android:** Upgraded to Cordova 6.1.0 and Cordova CLI 6.4.0.

Be sure to specify these versions when you use the `cordova platform add` command.

## Breaking Changes

- The `forcetk.mobilesdk.js` and `forcetk.ui.js` libraries have been replaced with `force.js`. All hybrid apps that upgrade to Mobile SDK 5.0 are required to change all `forcetk.mobilesdk.js` references to `force.js`. The new library handles networking natively, which means you don't have to worry about refreshing tokens. Most method prototypes are identical to their older counterparts, with a few exceptions.
  - The `update` method has changed how it handles the `Id` field.

```
// Obsolete forcetk signature. The fields argument
// must NOT contain object's "Id" field.
function update(objtype, id, fields, callback, error)

// Modernized force.js signature. Before calling,
// add object's "Id" field to the data object
function update(objectName, data, successHandler, errorHandler)
```

For example:

```
var data = new Object();
data.Quantity__c = $j("#quantity").val(); // Same as in previous version
data.Id = currentRecord.Id; // New requirement of force.js
// Update the database
// force.js version does not accept a separate ID argument
force.update("Merchandise__c", data, updateSuccess, onErrorSfdc);
```

- Files functions now live in the `force+files.js` library.
- The following Files functions are no longer available:
  - `fileRendition`
  - `fileRenditionPath`
  - `fileContents`
  - `fileContentsPath`
- The `smartsync.js` library no longer depends on jQuery. It now uses native promises. To use this library on Android 19, you're required to include the promise polyfill ([github.com/taylorhakes/promise-polyfill](https://github.com/taylorhakes/promise-polyfill)).
- Error callbacks for the `moveCursorToNextPage()` and `moveCursorToPreviousPage()` SmartStore functions have changed. In previous releases, these callbacks used the following signature:

```
function(cursor, error) {...}
```

Beginning with Mobile SDK 5.0, they use this signature:

```
function(error) {...}
```

- The technique for running hybrid tests and samples in a browser has changed.

In previous release, you ran tests and samples by opening the start page in a browser with web security disabled. Beginning with Mobile SDK 5.0, you run the [force-server](#) utility from the root of your shared repo. You then load your app in the browser through `localhost`.

For full instructions, see [github.com/forcedotcom/SalesforceMobileSDK-Shared/tree/master/test#running-the-tests-in-a-browser](https://github.com/forcedotcom/SalesforceMobileSDK-Shared/tree/master/test#running-the-tests-in-a-browser).

## Migrate Android Apps from 4.2 to 4.3

To upgrade native Android apps, we strongly recommend that you create an app with forcedroid, and then migrate your app's artifacts into the new template.

## Migrate iOS Apps from 4.2 to 4.3

To upgrade native iOS apps, we strongly recommend that you create an app with forceios, and then migrate your app's artifacts into the new template.

Another recommended approach is to upgrade using only CocoaPods. See [Use CocoaPods with Mobile SDK](#). If you upgrade a SmartStore app with CocoaPods, be sure to update your `AppDelegate` class as described in [SDK Manager Classes](#).

## Migrate Hybrid Apps from 4.2 to 4.3

- Mobile SDK 4.3 updates its Cordova support to the following versions:
  - **iOS:** Cordova 4.3.0
  - **Android:** Cordova 6.1.0
  - Cordova CLI 6.4.0 or later

Be sure to specify these versions when you use the `cordova platform add` command.

- To upgrade hybrid apps, we strongly recommend that you create an app with forceios or forcedroid, and then migrate your app's artifacts into the new template. Or, you can simply use the Cordova command line to upgrade the Salesforce Cordova plugins. First remove, then readd the plugin:

```
$ cd MyCordovaAppDir
$ cordova plugin rm com.salesforce
$ cordova plugin add https://github.com/forcedotcom/SalesforceMobileSDK-CordovaPlugin
$ cordova prepare
```

## Migrate Android Apps from 4.1 to 4.2

To upgrade native Android apps, we strongly recommend that you create an app with forcedroid, and then migrate your app's artifacts into the new template.

## Migrate iOS Apps from 4.1 to 4.2

To upgrade native iOS apps, we strongly recommend that you create an app with forceios, and then migrate your app's artifacts into the new template.

Another recommended approach is to upgrade using only CocoaPods. See [Use CocoaPods with Mobile SDK](#). If you upgrade a SmartStore app with CocoaPods, be sure to update your `AppDelegate` class as described in [SDK Manager Classes](#).

## Migrate Hybrid Apps from 4.1 to 4.2

To upgrade hybrid apps, we strongly recommend that you create an app with forceios or forcedroid, and then migrate your app's artifacts into the new template. Or, you can simply use the Cordova command line to upgrade the Salesforce Cordova plugins. First remove, then read the plugin:

```
$ cd MyCordovaAppDir
$ cordova plugin rm com.salesforce
$ cordova plugin add https://github.com/forcedotcom/SalesforceMobileSDK-CordovaPlugin
$ cordova prepare
```

## Migrate Android Apps from 4.0 to 4.1

To upgrade native Android apps, we strongly recommend that you create an app with forcedroid, and then migrate your app's artifacts into the new template.

## Migrate iOS Apps from 4.0 to 4.1

To upgrade native iOS apps, we strongly recommend that you create an app with forceios, and then migrate your app's artifacts into the new template.

Another recommended approach is to upgrade using only CocoaPods. If you upgrade a SmartStore app with CocoaPods, be sure to update your `AppDelegate` class as described in [SDK Manager Classes](#).

SEE ALSO:

[Use CocoaPods with Mobile SDK](#)

## Migrate Hybrid Apps from 4.0 to 4.1

To upgrade hybrid apps, we strongly recommend that you create an app with forceios or forcedroid, and then migrate your app's artifacts into the new template. Or, you can simply use the Cordova command line to upgrade the Salesforce Cordova plugins. First remove, then read the plugin:

```
$ cd MyCordovaAppDir
$ cordova plugin rm com.salesforce
$ cordova plugin add https://github.com/forcedotcom/SalesforceMobileSDK-CordovaPlugin
$ cordova prepare
```



# CHAPTER 22 Reference

## In this chapter ...

- [iOS Architecture](#)
- [Android Architecture](#)
- [Files API Reference](#)
- [Tool and Component Supported Versions for Mobile SDK 6.0](#)

Reference documentation is hosted on GitHub.

- For iOS:
  - *SalesforceSDKCore Library Reference* at <http://forcedotcom.github.io/SalesforceMobileSDK-iOS/Documentation/SalesforceSDKCore/html/index.html>
  - *SalesforceRestAPI Library Reference* at <http://forcedotcom.github.io/SalesforceMobileSDK-iOS/Documentation/SalesforceRestAPI/html/index.html>
  - *SalesforceNetwork Library Reference* at <http://forcedotcom.github.io/SalesforceMobileSDK-iOS/Documentation/SalesforceNetwork/html/index.html>
  - *SmartStore Library Reference* at <http://forcedotcom.github.io/SalesforceMobileSDK-iOS/Documentation/SmartStore/html/index.html>
  - *SmartSync Data Framework Library Reference* at <http://forcedotcom.github.io/SalesforceMobileSDK-iOS/Documentation/SmartSync/html/index.html>
  - *SalesforceHybridSDK Library Reference* at <http://forcedotcom.github.io/SalesforceMobileSDK-iOS/Documentation/SalesforceHybridSDK/html/index.html>
  - *SalesforceReact Library Reference* at <http://forcedotcom.github.io/SalesforceMobileSDK-iOS/Documentation/SalesforceReact/html/index.html>
- For Android: <http://forcedotcom.github.com/SalesforceMobileSDK-Android/index.html>

## iOS Architecture

---

Mobile SDK is essentially one library that depends on and exposes the following modules:

- `SalesforceAnalytics`—Implements a logging and instrumentation framework for Mobile SDK.
- `SalesforceHybridSDK`—Defines the Mobile SDK Cordova plugin. For use only in hybrid apps.
- `SalesforceReact`—Native bridges to Mobile SDK features. For use only in React Native apps.
- `SalesforceSDKCore`—Implements OAuth authentication, passcode, and networking.
- `SmartStore`—Mobile SDK offline secure storage solution.
- `SmartSync`—Mobile SDK offline synchronization solution.

If you use `forceios` to create native apps, `CocoaPods` incorporates the required modules based on the app type you specify. If you create native apps with a clone of the `SalesforceMobileSDK-iOS` git repo, your project uses these modules as dynamic libraries.

SEE ALSO:

[Analytics and Logging](#)

## Native REST API Classes for iOS

Use these Objective-C APIs to access Salesforce data in your native app:

- `SFRestAPI` class
- `SFRestAPI (Blocks)` category
- `SFRestRequest` class
- `SFRestAPI (QueryBuilder)` category
- `SFRestDelegate` protocol

### SFRestAPI

`SFRestAPI` is the entry point for making REST requests and is accessed as a singleton instance via `[SFRestAPI sharedInstance]`.

You can easily create many standard canned queries from this object, such as:

```
SFRestRequest* request = [[SFRestAPI sharedInstance]
requestForUpdateWithObjectType:@"Contact"
 objectId:contactId
 fields:updatedFields];
```

You can then initiate the request with the following:

```
[[SFRestAPI sharedInstance] send:request delegate:self];
```

### SFRestAPI (Blocks)

Use this category extension of the `SFRestAPI` class to specify blocks as your callback mechanism. For example:

```
NSMutableDictionary *fields = [NSMutableDictionary dictionaryWithObjectsAndKeys:
 @"John", @"FirstName",
 @"Doe", @"LastName",
```

```

 nil];
[[SFRestAPI sharedInstance] performCreateWithObjectType:@"Contact"
 fields:fields
 failBlock:^(NSError *e) {
 NSLog(@"Error: %@", e);
 }
 completeBlock:^(NSDictionary *d) {
 NSLog(@"ID value for object: %@", [d objectForKey:@"id"]);
 }];

```

## SFRestRequest

In addition to the standard REST requests that `SFRestAPI` provides, you can use `SFRestRequest` methods directly to create your own:

```

NSString *path = @"/v31.0";
SFRestRequest* request = [SFRestRequest
 requestWithMethod:SFRestMethodGET path:path queryParams:nil];

```

## SFRestAPI (QueryBuilder)

This category extension provides utility methods for creating SOQL and SOSL query strings. Examples:

```

NSString *soqlQuery =
 [SFRestAPI SOQLQueryWithFields:[NSArray arrayWithObjects:@"Id", @"Name", @"Company",
 @"Status", nil]
 sObject:@"Lead"
 where:nil
 limit:10];

NSString *soslQuery =
 [SFRestAPI
 SOSLSearchWithSearchTerm:@"all of these will be escaped:~{}"
 objectScope:[NSDictionary
 dictionaryWithObject:@"WHERE isactive=true
 ORDER BY lastname
 asc limit 5"
 forKey:@"User"]];

```

## SFRestDelegate

A class that implements this protocol can serve as the target for REST responses. This protocol defines four abstract methods for handling various request states. When you implement these methods, remember to wrap any code that accesses UI elements in a `dispatch_async(dispatch_get_main_queue(), ^{...})` block. Example:

```

- (void)request:(SFRestRequest *)request didLoadResponse:(id)dataResponse {
 dispatch_async(dispatch_get_main_queue(), ^{
 _tfResult.backgroundColor =
 [UIColor colorWithRed:1.0 green:204/255.0 blue:102/255.0 alpha:1.0];
 _tfResponseFor.text = [self formatRequest:request];
 _tfResult.text = [dataResponse description];
 });
}

```

```

}

- (void)request:(SFRestRequest*)request didFailLoadWithError:(NSError*)error {
 dispatch_async(dispatch_get_main_queue(), ^{
 _tfResult.backgroundColor = [UIColor redColor];
 _tfResponseFor.text = [self formatRequest:request];
 _tfResult.text = [error description];

 });
}

- (void)requestDidCancelLoad:(SFRestRequest *)request {
 dispatch_async(dispatch_get_main_queue(), ^{
 _tfResult.backgroundColor = [UIColor redColor];
 _tfResponseFor.text = [self formatRequest:request];
 _tfResult.text = @"Request was cancelled";
 });
}

- (void)requestDidTimeout:(SFRestRequest *)request {
 dispatch_async(dispatch_get_main_queue(), ^{
 _tfResult.backgroundColor = [UIColor redColor];
 _tfResponseFor.text = [self formatRequest:request];
 _tfResult.text = @"Request timedout";
 });
}
}

```

## Android Architecture

---

Salesforce Mobile SDK is provided as a library project. Android apps reference the `SalesforceSDK` project from their application project. See the [Android developer documentation](#).

## Android Packages and Classes

Java source files for the Android Mobile SDK are under `libs/SalesforceSDK/src`.

## Catalog of Top-Level Packages

For package and class descriptions, see the [Salesforce Mobile SDK Android Reference](#).

## Android Resources

Resources are under `/res`.

### drawable-hdpi

File	Use
<code>sf__edit_icon.png</code>	Server picker screen

File	Use
<code>sf__highlight_glare.png</code>	Login screen
<code>sf__icon.png</code>	Native application icon

### drawable-ldpi

File	Use
<code>sf__icon.png</code>	Application icon

### drawable-mdpi

File	Use
<code>sf__edit_icon.png</code>	Server picker screen
<code>sf__highlight_glare.png</code>	Login screen
<code>sf__ic_refresh_sync_anim0.png</code>	Application icon
<code>sf__icon.png</code>	Application icon

### drawable-xhdpi

File	Use
<code>sf__icon.png</code>	Native application icon

### drawable-xlarge

File	Use
<code>sf__header_bg.png</code>	Login screen (tablet)
<code>sf__header_drop_shadow.xml</code>	Login screen (tablet)
<code>sf__header_left_border.xml</code>	Login screen (tablet)
<code>sf__header_refresh.png</code>	Login screen (tablet)
<code>sf__header_refresh_press.png</code>	Login screen (tablet)
<code>sf__header_refresh_states.xml</code>	Login screen (tablet)
<code>sf__header_right_border.xml</code>	Login screen (tablet)
<code>sf__login_content_header.xml</code>	Login screen (tablet)

File	Use
sf__nav_shadow.png	Login screen (tablet)
sf__oauth_background.png	Login screen (tablet)
sf__oauth_container_dropshadow.9.png	Login screen (tablet)
sf__progress_spinner.xml	Login screen (tablet)
sf__refresh_loader.png	Login screen (tablet)
sf__toolbar_background.xml	Login screen (tablet)

### drawable-xlarge-port

File	Use
sf__oauth_background.png	Login screen (tablet)

### drawable-xxhdpi

File	Use
sf__icon.png	Native application icon

### drawable

File	Use
sf__header_bg.png	Login screen
sf__progress_spinner.xml	Login screen
sf__toolbar_background.xml	Login screen

### layout

File	Use
sf__account_switcher.xml	Account switching screen
sf__custom_server_url.xml	Server picker screen
sf__login.xml	Login screen
sf__manage_space.xml	Screen that allows the user to clear app data and log out
sf__passcode.xml	Pin screen

File	Use
<code>sf__server_picker.xml</code>	Server picker screen (deprecated)
<code>sf__server_picker_list.xml</code>	Server picker screen

## menu

File	Use
<code>sf__clear_custom_url.xml</code>	Add connection dialog
<code>sf__login.xml</code>	Login menu (phone)

## values

File	Use
<code>bootconfig.xml</code>	Connected app configuration settings
<code>sf__colors.xml</code>	Colors
<code>sf__dimens.xml</code>	Dimensions
<code>sf__strings.xml</code>	SDK strings
<code>sf__style.xml</code>	Styles
<code>strings.xml</code>	Other strings (app name)

## xml

File	Use
<code>authenticator.xml</code>	Preferences for account used by application
<code>servers.xml</code>	Server configuration.

## Files API Reference

---

API access for the Files feature is available in Android, iOS, and hybrid flavors.

### FileRequests Methods (Android)

All `FileRequests` methods are static, and each returns a `RestRequest` instance. Use the `RestClient.sendAsync()` or the `RestClient.sendSync()` method to send the `RestRequest` object to the server. See [Using REST APIs](#).

For a full description of the REST request and response bodies, see “Files Resources” under *Chatter REST API Resources* at <http://www.salesforce.com/us/developer/docs/chatterapi>.

## ownedFilesList

Generates a request that retrieves a list of files that are owned by the specified user. Returns one page of results.

### Signature

```
public static RestRequest ownedFilesList(String userId, Integer pageNum);
```

### Parameters

Name	Type	Description
userId	String	ID of a user. If null, the ID of the context (logged-in) user is used.
pageNum	Integer	Zero-based index of the page of results to be fetched. If null, fetches the first page.

### Example

```
RestRequest request = FileRequests.ownedFilesList(null, null);
```

## filesInUsersGroups

Generates a request that retrieves a list of files that are owned by groups that include the specified user.

### Signature

```
public static RestRequest filesInUsersGroups(String userId, Integer pageNum);
```

### Parameters

Name	Type	Description
userId	String	ID of a user. If null, the ID of the context (logged-in) user is used.
pageNum	Integer	Zero-based index of the page of results to be fetched. If null, fetches the first page.

### Example

```
RestRequest request = FileRequests.filesInUsersGroups(null, null);
```

## filesSharedWithUser

Generates a request that retrieves a list of files that are shared with the specified user.

### Signature

```
public static RestRequest filesSharedWithUser(String userId, Integer pageNum);
```



**Parameters**

Name	Type	Description
userId	String	ID of a user. If null, the ID of the context (logged-in) user is used.
pageNum	Integer	Zero-based index of the page of results to be fetched. If null, fetches the first page.

**Example**

```
RestRequest request = FileRequests.filesSharedWithUser(null, null);
```

**fileDetails**

Generates a request that can fetch the file details of a particular version of a file.

**Signature**

```
public static RestRequest fileDetails(String sfdcId, String version);
```

**Parameters**

Name	Type	Description
sfdcId	String	ID of a file. If null, <code>IllegalArgumentException</code> is thrown.
version	String	Version to fetch. If null, fetches the most recent version.

**Example**

```
String id = <some_file_id>;
RestRequest request = FileRequests.fileDetails(id, null);
```

**batchFileDetails**

Generates a request that can fetch details of multiple files.

**Signature**

```
public static RestRequest batchFileDetails(List sfdcIds);
```

**Parameters**

Name	Type	Description
sfdcIds	List	List of IDs of one or more files. If any ID in the list is null, <code>IllegalArgumentException</code> is thrown.

**Example**

```
List<String> ids = Arrays.asList("id1", "id2", ...);
RestRequest request = FileRequests.batchFileDetails(ids);
```

**fileRendition**

Generates a request that can fetch a rendered preview of a page of the specified file.

**Signature**

```
public static RestRequest fileRendition(String sfdcId,
 String version,
 RenditionType renditionType,
 Integer pageNum);
```

**Parameters**

Name	Type	Description
sfdcId	String	ID of a file to be rendered. If null, <code>IllegalArgumentException</code> is thrown.
version	String	Version to fetch. If null, fetches the most recent version.
renditionType	RenditionType	Specifies the type of rendition to be returned. Valid values include: <ul style="list-style-type: none"> <li>• PDF</li> <li>• FLASH</li> <li>• SLIDE</li> <li>• THUMB120BY90</li> <li>• THUMB240BY180</li> <li>• THUMB720BY480</li> </ul> If null, <code>THUMB120BY90</code> is used.
pageNum	Integer	Zero-based index of the page to be fetched. If null, fetches the first page.

**Example**

```
String id = <some_file_id>;
RestRequest request = FileRequests.fileRendition(id, null, "PDF", 0);
```

**fileContents**

Generates a request that can fetch the binary contents of the specified file.

**Signature**

```
public static RestRequest fileContents(String sfdcId, String version);
```

**Parameters**

Name	Type	Description
<code>sfdcId</code>	<code>String</code>	ID of a file to be rendered. If null, <code>IllegalArgumentException</code> is thrown.
<code>version</code>	<code>String</code>	Version to fetch. If null, fetches the most recent version.

**Example**

```
String id = <some_file_id>;
RestRequest request = FileRequests.fileContents(id, null);
```

## fileShares

Generates a request that can fetch a page from the list of entities that share the specified file.

**Signature**

```
public static RestRequest fileShares(String sfdcId, Integer pageNum);
```

**Parameters**

Name	Type	Description
<code>sfdcId</code>	<code>String</code>	ID of a file to be rendered. If null, <code>IllegalArgumentException</code> is thrown.
<code>pageNum</code>	<code>Integer</code>	Zero-based index of the page of results to be fetched. If null, fetches the first page.

**Example**

```
String id = <some_file_id>;
RestRequest request = FileRequests.fileShares(id, null);
```

## addFileShare

Generates a request that can share the specified file with the specified entity.

**Signature**

```
public static RestRequest addFileShare(String fileId, String entityId,
 String shareType);
```

**Parameters**

Name	Type	Description
<code>fileId</code>	<code>String</code>	ID of a file to be shared. If null, <code>IllegalArgumentException</code> is thrown.

Name	Type	Description
entityID	String	ID of a user or group with whom to share the file. If null, <code>IllegalArgumentException</code> is thrown.
shareType	String	Type of share. Valid values are "V" for view and "C" for collaboration.

**Example**

```
String idFile = <some_file_id>;
String idEntity = <some_user_or_group_id>;
RestRequest request = FileRequests.addFileShare(idFile, idEntity, "V");
```

## deleteFileShare

Generates a request that can delete the specified file share.

**Signature**

```
public static RestRequest deleteFileShare(String shareId);
```

**Parameters**

Name	Type	Description
shareId	String	ID of a file share to be deleted. If null, <code>IllegalArgumentException</code> is thrown.

**Example**

```
String id = <some_fileShare_id>;
RestRequest request = FileRequests.deleteFileShare(id);
```

## uploadFile

Generates a request that can upload a local file to the server. On the server, this request creates a file at version 1.

**Signature**

```
public static RestRequest uploadFile(File theFile,
 String name, String description, String mimeType)
 throws UnsupportedOperationException;
```

**Parameters**

Name	Type	Description
theFile	File	Path of the local file to be uploaded to the server.
name	String	Name of the file.
description	String	Description of the file.

Name	Type	Description
<code>mimeType</code>	<code>String</code>	MIME type of the file, if known. Otherwise, null.

**Throws**

`UnsupportedEncodingException`

**Example**

```
RestRequest request = FileRequests.uploadFile("/Users/JayVee/Documents/",
 "mypic.png", "Profile pic", "image/png");
```

## SFRestAPI (Files) Category—Request Methods (iOS)

In iOS native apps, the `SFRestAPI (Files)` category defines file request methods. You send request messages to the `SFRestAPI` singleton.

```
SFRestRequest *request = [[SFRestAPI sharedInstance] requestForOwnedFilesList:nil page:0];
```

Each method returns an `SFRestRequest` instance. Use the `SFRestAPI` singleton again to send the request object to the server. In the following example, the calling class (`self`) is the delegate, but you can specify any other object that implements `SFRestDelegate`.

```
[[SFRestAPI sharedInstance] send:request delegate:self];
```

### `requestForOwnedFilesList:page:`

Generates a request that retrieves a list of files that are owned by the specified user. Returns one page of results.

**Signature**

```
- (SFRestRequest *)
 requestForOwnedFilesList:(NSString *)userId
 page:(NSUInteger)page;
```

**Parameters**

Name	Type	Description
<code>userId</code>	<code>NSString *</code>	ID of a user. If nil, the ID of the context (logged-in) user is used.
<code>page</code>	<code>NSUInteger</code>	Zero-based index of the page to be fetched. If nil, fetches the first page.

**Example**

```
SFRestRequest *request =
 [[SFRestAPI sharedInstance] requestForOwnedFilesList:nil
 page:0];
```

### `requestForFilesInUsersGroups:page:`

Generates a request that retrieves a list of files that are owned by groups that include the specified user.

**Signature**

```
- (SFRestRequest *)
 requestForFilesInUsersGroups:(NSString *)userId
 page:(NSUInteger)page;
```

**Parameters**

Name	Type	Description
userId	NSString *	ID of a user. If nil, the ID of the context (logged-in) user is used.
page	NSUInteger	Zero-based index of the page to be fetched. If nil, fetches the first page.

**Example**

```
SFRestRequest *request = [[SFRestAPI sharedInstance]
 requestForFilesInUsersGroups:nil
 page:0];
```

**requestForFilesSharedWithUser:page:**

Generates a request that retrieves a list of files that are shared with the specified user.

**Signature**

```
- (SFRestRequest *)
 requestForFilesSharedWithUser:(NSString *)userId
 page:(NSUInteger)page;
```

**Parameters**

Name	Type	Description
userId	NSString *	ID of a user. If nil, the ID of the context (logged-in) user is used.
page	NSUInteger	Zero-based index of the page to be fetched. If nil, fetches the first page.

**Example**

```
SFRestRequest *request =
 [[SFRestAPI sharedInstance] requestForFilesSharedWithUser:nil
 page:0];
```

**requestForFileDetails:forVersion:**

Generates a request that can fetch the file details of a particular version of a file.

**Signature**

```
- (SFRestRequest *)
 requestForFileDetails:(NSString *)sfdcId
 forVersion:(NSString *)version;
```

**Parameters**

Name	Type	Description
<code>sfdcId</code>	<code>NSString *</code>	ID of a file. If nil, the request fails.
<code>version</code>	<code>NSString *</code>	Version to fetch. If nil, fetches the most recent version.

**Example**

```
NSString *id = [NSString stringWithString:@"some_file_id"];
SFRestRequest *request =
 [[SFRestAPI sharedInstance] requestForFileDetails:id
 forVersion:nil];
```

**requestForBatchFileDetails:**

Generates a request that can fetch details of multiple files.

**Signature**

```
- (SFRestRequest *)
 requestForBatchFileDetails:(NSArray *)sfdcIds;
```

**Parameters**

Name	Type	Description
<code>sfdcIds</code>	<code>NSArray *</code>	Array of IDs of one or more files. IDs are expressed as strings.

**Example**

```
NSArray *ids = [NSArray arrayWithObject:@"id1",@"id2",...,nil];
SFRestRequest *request =
 [[SFRestAPI sharedInstance] requestForBatchFileDetails:ids];
```

**requestForFileRendition:version:renditionType:page:**

Generates a request that can fetch a rendered preview of a page of the specified file.

**Signature**

```
- (SFRestRequest *)
 requestForFileRendition:(NSString *)sfdcId
 version:(NSString *)version
 renditionType:(NSString *)renditionType
 page:(NSUInteger)page;
```

**Parameters**

Name	Type	Description
<code>sfdcId</code>	<code>NSString *</code>	ID of a file to be rendered. If nil, the request fails.

Name	Type	Description
version	NSString *	Version to fetch. If nil, fetches the most recent version.
renditionType	NSString *	Specifies the type of rendition to be returned. Valid values include: <ul style="list-style-type: none"> <li>• "PDF"</li> <li>• "FLASH"</li> <li>• "SLIDE"</li> <li>• "THUMB120BY90"</li> <li>• "THUMB240BY180"</li> <li>• "THUMB720BY480"</li> </ul> If nil, THUMB120BY90 is used.
page	NSUInteger	Zero-based index of the page to be fetched. If nil, fetches the first page.

**Example**

```
NSString *id = [NSString stringWithString:@"some_file_id"];
SFRestRequest *request =
 [[SFRestAPI sharedInstance] requestForFileRendition:id
 version:nil
 renditionType:nil
 page:nil];
```

**requestForFileContents:version:**

Generates a request that can fetch the binary contents of the specified file.

**Signature**

```
- (SFRestRequest *)
 requestForFileContents:(NSString *) sfdcId
 version:(NSString*) version;
```

**Parameters**

Name	Type	Description
sfdcId	NSString *	ID of a file to be rendered. If nil, the request fails.
version	NSString *	Version to fetch. If nil, fetches the most recent version.

**Example**

```
NSString *id = [NSString stringWithString:@"some_file_id"];
SFRestRequest *request =
 [[SFRestAPI sharedInstance] requestForFileContents:id
 version:nil];
```



## requestForFileShares:page:

Generates a request that can fetch a page from the list of entities that share the specified file.

### Signature

```
- (SFRestRequest *)
 requestForFileShares:(NSString *)sfdcId
 page:(NSUInteger)page;
```

### Parameters

Name	Type	Description
sfdcId	NSString *	ID of a file to be rendered. If nil, the request fails.
page	NSUInteger	Zero-based index of the page to be fetched. If nil, fetches the first page.

### Example

```
NSString *id = [NSString stringWithString:@"some_file_id"];
SFRestRequest *request =
 [[SFRestAPI sharedInstance] requestForFileShares:id
 page:nil];
```

## requestForAddFileShare:entityId:shareType: Method

Generates a request that can share the specified file with the specified entity.

### Signature

```
- (SFRestRequest *)
 requestForAddFileShare:(NSString *)fileId
 entityId:(NSString *)entityId
 shareType:(NSString*)shareType;
```

### Parameters

Name	Type	Description
fileId	NSString *	ID of a file to be shared. If nil, the request fails.
entityId	NSString *	ID of a user or group with whom to share the file. If nil, the request fails.
shareType	NSString *	Type of share. Valid values are "V" for view and "C" for collaboration.

### Example

```
NSString *id = [NSString stringWithString:@"some_file_id"];
NSString *entId = [NSString stringWithString:@"some_entity_id"];
SFRestRequest *request =
 [[SFRestAPI sharedInstance] requestForAddFileShare:id
 entityId:entId
 shareType:@"V"];
```

## requestForDeleteFileShare:

Generates a request that can delete the specified file share.

### Signature

```
- (SFRestRequest *)
 requestForDeleteFileShare:(NSString *)shareId;
```

### Parameters

Name	Type	Description
shareId	NSString *	ID of a file share to be deleted. If nil, the request fails.

### Example

```
NSString *id = [NSString stringWithString:@"some_fileshare_id"];
SFRestRequest *request =
 [[SFRestAPI sharedInstance] requestForDeleteFileShare:id];
```

## requestForUploadFile:name:description:mimeType: Method

Generates a request that can upload a local file to the server. On the server, this request creates a new file at version 1.

### Signature

```
- (SFRestRequest *)
 requestForUploadFile:(NSData *)data
 name:(NSString *)name
 description:(NSString *)description
 mimeType:(NSString *)mimeType;
```

### Parameters


Name	Type	Description
data	NSData *	Data to upload to the server.
name	NSString *	Name of the file.
description	NSString *	Description of the file.
mimeType	NSString *	MIME type of the file, if known. Otherwise, nil.

### Example

```
NSData *data = [NSData dataWithContentsOfFile:@"~/Users/JayVee/Documents/mypic.png"];
SFRestRequest *request =
 [[SFRestAPI sharedInstance] requestForUploadFile:data
 name:@"mypic.png"
 description:@"Profile pic"
 mimeType:@"image/png"];
```

## Files Methods For Hybrid Apps

Hybrid methods for the Files API reside in the `force+files.js` library. Examples in the following reference topics assume that you've included `force+files.js` in your project. These examples use the `force` client object, which implements a traditional callback model.

 **Note:** In `smartsync.js`, the `force.js` library is passed in as `Force.forceJsClient`. You're free to use either client for Files API calls in a SmartSync Data Framework app. However, REST API methods called on `Force.forceJsClient` differ from their `force.Client` cousins in that they return JavaScript promises. If you use `Force.forceJsClient`, reformat the examples that require success and error callbacks in the following manner:

```
Force.forceJsClient.ownedFilesList(null, null)
 .done(function(response) { /* do something with the returned JSON data */ })
 .fail(function(error) { alert("Error!"); });
```

See the [FileExplorer](https://github.com/forcedotcom/SalesforceMobileSDK-Shared) sample app in the [github.com/forcedotcom/SalesforceMobileSDK-Shared](https://github.com/forcedotcom/SalesforceMobileSDK-Shared) repo for examples.

### ownedFilesList Method

Returns a page from the list of files owned by the specified user.

#### Signature

```
force.ownedFilesList =
function(userId, page, callback, error)
```

#### Parameters

Name	Description
<code>userId</code>	An ID of an existing user. If null, the ID of the context (currently logged in) user is used.
<code>page</code>	Zero-based index of the page of results to be fetched. If null, fetches the first page.
<code>callback</code>	A function that receives the server response asynchronously and handles it.
<code>error</code>	A function that handles server errors.

#### Example

```
force.ownedFilesList(null, null,
 function(response){ /* do something with the returned JSON data */ },
 function(error){ alert("Error!"); }
);
```

### filesInUsersGroups Method

Returns a page from the list of files owned by groups that include specified user.

#### Signature

```
force.filesInUsersGroups =
function(userId, page, callback, error)
```

**Parameters**

Name	Description
userId	An ID of an existing user. If null, the ID of the context (currently logged in) user is used.
page	Zero-based index of the page of results to be fetched. If null, fetches the first page.
callback	A function that receives the server response asynchronously and handles it.
error	A function that handles server errors.

**Example**

```
force.filesInUsersGroups(null, null,
 function(response) {
 /* do something with the returned JSON data */
 },
 function(error) { alert("Error!"); }
);
```

**filesSharedWithUser Method**

Returns a page from the list of files shared with the specified user.

**Signature**

```
force.filesSharedWithUser =
function(userId, page, callback, error)
```

**Parameters**

Name	Description
userId	An ID of an existing user. If null, the ID of the context (currently logged in) user is used.
page	Zero-based index of the page of results to be fetched. If null, fetches the first page.
callback	A function that receives the server response asynchronously and handles it.
error	A function that handles server errors.

**Example**

```
force.filesSharedWithUser(null, null,
 function(response) {
 /* do something with the returned JSON data */
 },
 function(error) { alert("Error!"); }
);
```

## fileDetails Method

Generates a request that can fetch the file details of a particular version of a file.

### Signature

```
force.fileDetails = function
(fileId, version, callback, error)
```

### Parameters

Name	Description
sfdcId	An ID of an existing file. If null, an error is returned.
version	The version to fetch. If null, fetches the most recent version.
callback	A function that receives the server response asynchronously and handles it.
error	A function that handles server errors.

### Example

```
force.fileDetails(id, null,
 function(response){
 /* do something with the returned JSON data */
 },
 function(error){ alert("Error!"); }
);
```

## batchFileDetails Method

Returns file details for multiple files.

### Signature

```
force.batchFileDetails =
function(fileIds, callback, error)
```

### Parameters

Name	Description
fileIds	A list of IDs of one or more existing files. If any ID in the list is null, an error is returned.
callback	A function that receives the server response asynchronously and handles it.
error	A function that handles server errors.

### Example

```
force.batchFileDetails(ids,
 function(response){
 /* do something with the returned JSON data */
 },
```

```
function(error){ alert("Error!");}
);
```

## fileRenditionPath Method

Returns file rendition path relative to `service/data`. In HTML (for example, an `img` tag), use the bearer token URL instead.

### Signature

```
force.fileRenditionPath =
function(fileId, version, renditionType, page)
```

### Parameters

Name	Description
<code>fileId</code>	ID of an existing file to be rendered. If null, an error is returned.
<code>version</code>	The version to fetch. If null, fetches the most recent version.
<code>renditionType</code>	Specify the type of rendition to be returned. Valid values include: <ul style="list-style-type: none"> <li>• PDF</li> <li>• FLASH</li> <li>• SLIDE</li> <li>• THUMB120BY90</li> <li>• THUMB240BY180</li> <li>• THUMB720BY480</li> </ul> If null, THUMB120BY90 is used.
<code>page</code>	Zero-based index of the page to be fetched. If null, fetches the first page.

### Example

```
force.fileRenditionPath(id, null, "THUMB240BY180", null);
```

## fileContentsPath Method

Returns file content path (relative to `service/data`). From html (for example, an `img` tag), use the bearer token URL instead.

### Signature

```
force.fileContentsPath =
function(fileId, version)
```

### Parameters

Name	Description
<code>fileId</code>	ID of an existing file to be rendered. If null, an error is returned.
<code>version</code>	The version to fetch. If null, fetches the most recent version.

**Example**

```
force.fileContentsPath(id, null);
```

**fileShares Method**

Returns a page from the list of entities that share this file.

**Signature**

```
force.fileShares =
function(fileId, page, callback, error)
```

**Parameters**

Name	Description
fileId	ID of an existing file to be rendered. If null, an error is returned.
page	Zero-based index of the page of results to be fetched. If null, fetches the first page.
callback	A function that receives the server response asynchronously and handles it.
error	A function that handles server errors.

**Example**

```
force.fileShares(id, null,
 function(response) {
 /* do something with the returned JSON data */
 },
 function(error) { alert("Error!"); }
);
```

**addFileShare Method**

Adds a file share for the specified file ID to the specified entity ID.

**Signature**

```
force.addFileShare =
function(fileId, entityId, shareType, callback, error)
```

**Parameters**

Name	Description
fileId	ID of an existing file to be shared. If null, <code>IllegalArgumentException</code> is thrown.
entityID	ID of an existing user or group with whom to share the file. If null, <code>IllegalArgumentException</code> is thrown.
shareType	The type of share. Valid values are "V" for view and "C" for collaboration.
callback	A function that receives the server response asynchronously and handles it.

Name	Description
<code>error</code>	A function that handles server errors.

**Example**

```
force.addFileShare(id, null, "v",
 function(response) {
 /* do something with the returned JSON data */
 },
 function(error) { alert("Error!"); }
);
```

## deleteFileShare Method

Deletes the specified file share.

**Signature**

```
force.deleteFileShare =
function(sharedId, callback, error)
```

**Parameters**

Name	Description
<code>shareId</code>	ID of an existing file share to be deleted. If null, <code>IllegalArgumentException</code> is thrown.
<code>callback</code>	A function that receives the server response asynchronously and handles it.
<code>error</code>	A function that handles server errors.

**Example**

```
force.deleteFileShare(id,
 function(response) {
 /* do something with the returned JSON data */
 },
 function(error) { alert("Error!"); }
);
```

## Tool and Component Supported Versions for Mobile SDK 6.0

### All Platforms

Tool or Component	Supported Version	Installation Details
Node.js	Latest	Install from <a href="http://nodejs.org">nodejs.org</a>
npm	3.10	Installed by Node.js



Tool or Component	Supported Version	Installation Details
shelljs	0.7.0	Installed by Node.js
SQLite	3.15.2	Installed by Mobile SDK
SQLCipher	3.5.7 for Android, 3.4.1 for iOS	Installed by Mobile SDK
Full Text Search (FTS)	FTS5	Installed by Mobile SDK

## Hybrid

Tool or Component	Supported Version	Installation Details
Cordova	7.0.0 (for Android), 4.5.4 (for iOS)	Install from <a href="http://cordova.apache.org">cordova.apache.org</a>
Cordova command line	7.0.0	At a command line or Terminal prompt, type: <code>npm install -g cordova</code>
Default Android SDK version for hybrid apps	Target version is Android Oreo (API 27), minimum version is Android KitKat (API 21)	Install through the Android SDK Manager in Android Studio

## Android

Tool or Component	Supported Version	Installation Details
Java JDK	1.8.x	Install from <a href="http://oracle.com">oracle.com</a>
Android Studio	3.0	Install from <a href="http://developer.android.com/studio/">developer.android.com/studio/</a>
Gradle	4.1	Installed by Android Studio
Android SDK minApi	Android KitKat (API 21)	Install through the Android SDK Manager in Android Studio
Android SDK targetApi	Android Oreo (API 27)	Install through the Android SDK Manager in Android Studio
Default Android SDK version for hybrid apps	Target version is Android Oreo (API 27), minimum version is Android KitKat (API 21)	Install through the Android SDK Manager in Android Studio
OkHttp	3.9.0	Installed by Mobile SDK
forcedroid	6.0	At a command line or Terminal prompt, type: <code>npm install -g forcedroid</code>

## iOS

Tool or Component	Supported Version	Installation Details
Xcode	9	Install from the Mac App Store
iOS SDK	10	Installed by Xcode
CocoaPods	1.2	Install from <a href="http://cocoapods.org">cocoapods.org</a>
forceios	6.0	At a command line or Terminal prompt, type: <code>npm install -g forceios</code>

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