



Version 29.0: Winter '14

# Salesforce Mobile SDK Development Guide

## Salesforce.com Mobile Development



Last updated: November 7, 2013



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# Chapter 1

## Introduction to Mobile Development

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### In this chapter ...

- [Intended Audience](#)
- [When to Use Salesforce1 Platform vs. Creating a Custom App](#)
- [About Native, HTML5, and Hybrid Development](#)
- [Enough Talk; I'm Ready](#)
- [Development Prerequisites](#)
- [Keeping Up With the Mobile SDK](#)

Force.com has proven itself as an easy, straightforward, and highly productive platform for cloud computing. Developers can define application components, such as custom objects and fields, workflow rules, Visualforce pages, and Apex classes and triggers, using point-and-click tools of the Web interface, and assembling the components into killer apps. As a mobile developer, you might be wondering how you can leverage the power of the Force.com platform to create sophisticated apps.

The Mobile SDK seamlessly integrates with the Force.com cloud architecture by providing:

- SmartSync Data Framework for accessing Salesforce data through JavaScript
- Secure offline storage
- Data syncing for hybrid apps
- Implementation of Force.com Connected App policy that works out of the box
- OAuth credentials management, including persistence and refresh capabilities
- Wrappers for Salesforce REST APIs
- Libraries for building native iOS and Android applications
- Containers for building hybrid applications



### Note:

Be sure to visit [Salesforce Platform Mobile Services](#) website regularly for tutorials, blog postings, and other updates.

## Intended Audience

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

If you're an admin setting up users for mobile devices, you're probably looking for the [Salesforce Mobile Implementation Guide](#).

## When to Use Salesforce1 Platform vs. Creating a Custom App

When it comes to developing functionality for your Salesforce mobile users, you have options. Here are some differences between extending Salesforce1 and creating custom apps using the Mobile SDK.

### Salesforce1 Platform

- Has a defined user interface.
- Has full access to Salesforce data.
- You can create an integrated experience with functionality developed in the Salesforce1 Platform.
- Publisher actions give you a way to include your own apps/functionality.
- You can customize Salesforce1 with point-and-click or programmatic customizations.
- Functionality can be added programmatically through Visualforce pages or Force.com Canvas apps.
- Salesforce1 customizations or apps adhere to the Salesforce1 navigation. So, for example, a Visualforce page can be called from the navigation menu or from the publisher.
- You can leverage existing Salesforce development experience, both point-and-click and programmatic.
- Included in all Salesforce editions and supported by salesforce.com.

### Custom Apps

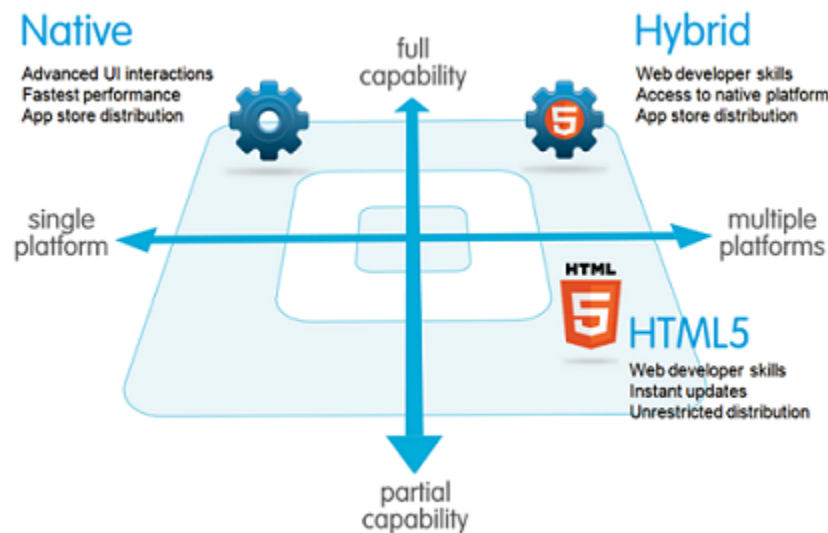
Custom apps can be either free-standing apps you create with Salesforce Mobile SDK or browser apps using plain HTML5 and JQuery Mobile/Ajax. With custom apps, you can:

- Define a custom user experience.
- Access Salesforce data 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 (Developer Preview in Winter '14; available for Mobile SDK native apps only).
- 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. No licensing required.
  - ◇ Requires you to develop and compile your apps in an external development environment (Xcode for iOS, Eclipse or similar for Android).
  - ◇ Development costs range from \$0 to \$1M or more, plus maintenance costs.

## About Native, HTML5, and Hybrid Development

Many factors play a part in your mobile strategy, such as your team's development skills, required device functionality, the importance of security, offline capability, interoperability, and so on. In the end, it's not just a question of what your app will do, but how you'll get it there. The Mobile SDK offers three ways to create mobile apps:

- **Native** apps are specific to a given mobile platform (iOS or Android) and use the development tools and language that the respective platform supports (for example, Xcode and Objective-C with iOS, Eclipse and Java with Android). 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, such as session management, secure offline storage, and access to native device functionality (such as camera, calendar, notifications, and so on).
- **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 can leverage the device's native capabilities and be delivered through the app store. You can also create hybrid apps using Visualforce pages delivered through the Salesforce hybrid container.



### 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, which might not be a big deal if you're showing a static screen with only a few elements, or a very big deal if you're using a lot of data and require a fast refresh.
- **Fluid animation**—related to the fast graphics API is the ability to have fluid animation. This 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 apps are usually developed using 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 level of experience required is higher than in other development scenarios. If you're a professional developer, you don't have to be sold on proven APIs and frameworks, painless special effects through established components, or the benefits of having all your code in one place.

## HTML5 Apps

An HTML5 mobile app is basically a web page, or series of 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).

If you're new to mobile development, the technological bar is lower for Web apps; it's easier to get started here than in 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 additional burden of testing on different devices. Browser incompatibility is especially common on Android devices, for example.

An important part of the "write once, run anywhere" HTML5 methodology is that distribution and support is much easier than for native apps. Need to make a bug fix or add features? Done and deployed for all users. For a native app, there are longer development and testing cycles, after which the consumer typically must log into a store and download a new version to get the latest fix.

If HTML5 apps are easier to develop, easier to support, and can reach the widest range of devices, where do these apps lose out?

- **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.
- **Security** — In general, implementing even trivial security measures on a native platform can be complex tasks for a mobile Web developer. It 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.
- **Native features** — the camera, address book, and other native features are accessible on limited, if any, browser platforms.
- **Native look and feel** — HTML5 can only emulate the native look, while customers won't be able to 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. For the most part, hybrid apps provide the best of both worlds, being almost as easy to develop as HTML5 apps with all the functionality of native. In addition, hybrid apps can use the SmartSync Data Framework in JavaScript to model Salesforce data, query and search it, edit it, securely cache it for offline use, and synchronize it with the Salesforce server.

You know that native apps are installed on the device, while HTML5 apps reside on a Web server, so you might be wondering whether hybrid apps store their files on the device or on a server? You can implement a hybrid app locally or remotely.

### Local

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

### Server

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 browser window.

Both types of hybrid development are covered in this guide.

## Native, HTML5, and Hybrid Summary

The following table sums up how the three mobile development scenarios stack up.

	Native	HTML5	Hybrid
<b>Graphics</b>	Native APIs	HTML, Canvas, SVG	HTML, Canvas, SVG
<b>Performance</b>	Fastest	Fast	Fast
<b>Look and feel</b>	Native	Emulated	Emulated
<b>Distribution</b>	App store	Web	App store
<b>Camera</b>	Yes	Browser dependent	Yes
<b>Notifications</b>	Yes	No	Yes
<b>Contacts, calendar</b>	Yes	No	Yes
<b>Offline storage</b>	Secure file system	Shared SQL	Secure file system, shared SQL
<b>Geolocation</b>	Yes	Yes	Yes
<b>Swipe</b>	Yes	Yes	Yes
<b>Pinch, spread</b>	Yes	Yes	Yes
<b>Connectivity</b>	Online, offline	Mostly online	Online, offline
<b>Development skills</b>	Objective C, Java	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.

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

## Development Prerequisites

It's helpful to have some experience with Force.com. You'll need a Force.com Developer Edition organization.

This guide also assumes you are familiar with the following technologies and platforms:

- OAuth, login and passcode flows, and Salesforce connected apps. See [Authentication, Security, and Identity in Mobile Apps](#).
- To build iOS applications (hybrid or native), you'll need Mac OS X "Lion" or higher, iOS 6.0 or higher, and Xcode 4.5 or higher.
- To build Android applications (hybrid or native), you'll need the Java JDK 6, Eclipse, Android ADT plugin, and the Android SDK.
- To build remote hybrid applications, you'll need an organization that has Visualforce.
- Most of our resources are on GitHub, a social coding community. You can access all of our files in our public repository, but we think it's a good idea to join. <https://github.com/forcedotcom>

## Sign Up for Force.com

1. In your browser go to [developer.force.com/join](https://developer.force.com/join).
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.force.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.

## Keeping Up With the Mobile SDK

The Mobile SDK evolves rapidly, so you'll want to check the following regularly.

- You can always find the most current releases in the [NPM registry](#) or our [Mobile SDK GitHub Repository](#)
- Keep up to date with [What's New](#).
- The latest articles, blog posts, tutorials, and webinars are on <http://www2.developerforce.com/mobile/resources>.
- Join the conversation on our message boards at <http://boards.developerforce.com/t5/Mobile/bd-p/mobile>.

## What's New in This Release

For a summary of what's new and changed in this release of the Salesforce Mobile SDK, visit the [Mobile SDK Release Notes](#). This page also provides a history of previous releases.

## Chapter 2

### Installing Mobile SDK

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#### In this chapter ...

- [Mobile SDK npm Packages](#)
- [iOS Installation](#)
- [Android Installation](#)
- [Uninstalling Mobile SDK npm Packages](#)
- [Mobile SDK GitHub Repository](#)

Salesforce Mobile SDK provides two installation paths:

- You can install the SDK in a ready-made development setup using a Node Packaged Module (npm) script.
- You can download the Mobile SDK open source code from GitHub.

## Mobile SDK npm Packages

Many mobile developers want to use the SDK as a “black box” and begin creating Mobile SDK apps as quickly as possible. These developers prefer the npm installers. Salesforce provides two npm packages: **forceios** for the iOS Mobile SDK, and **forcedroid** for the Android version of the Mobile SDK. These packages provide a static snapshot of an SDK release. In the case of iOS, the npm installer package provides binary modules rather than uncompiled source code. In the case of Android, the npm installer package provides a snapshot of the SDK source code rather than binaries. You use the npm script both to install Mobile SDK and to create new template projects.

Npm packages for the Salesforce Mobile SDK reside at <https://www.npmjs.org>.



**Note:** 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 Installation

For the fastest, easiest route to iOS development, use npm to install Salesforce Mobile SDK for iOS.

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.
  - a. Download Node.js from [www.nodejs.org/download](http://www.nodejs.org/download).
  - b. Run the downloaded installer to install Node.js and npm. Accept all prompts asking for permission to install.
3. At a command prompt, type npm and press ENTER 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. Use the forceios package to install the Mobile SDK either globally (recommended) or locally.
  - a. To install Salesforce Mobile SDK in a global location, use the sudo command and append the “global” option, -g:

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

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.

- b. To install Salesforce Mobile SDK in a local folder, cd to that folder and use the npm command without sudo or -g:

```
npm install forceios
```

This command installs Salesforce Mobile SDK in a node\_modules folder under your current folder. It links binary modules in ./node\_modules/.bin/. In this scenario, you rarely use sudo because you typically install in a local folder where you already have read-write permissions.

## Android Installation

For the fastest, easiest route to Android development, use npm to install Salesforce Mobile SDK for Android.

1. If you’ve already successfully installed Node.js and npm, skip to Step 4.



2. Install Node.js and npm on your system.
  - a. Download Node.js from [www.nodejs.org/download](http://www.nodejs.org/download).
  - b. Run the downloaded installer to install Node.js and npm. Accept all prompts asking for permission to install.
3. At a command prompt, type `npm` and press ENTER 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. Use the `forcedroid` package to install the Mobile SDK either globally (recommended) or locally.
  - a. To install Salesforce Mobile SDK in a global location, append the "global" option, `-g`, to the end of the command. For non-Windows environments, use the `sudo` command:

```
sudo npm install forcedroid -g
```

On Windows:

```
npm install forcedroid -g
```

With the `-g` option, you run `npm install` from any directory. In non-Windows environments, 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`. In Windows environments, global packages are installed in `%APPDATA%\npm\node_modules`, and binaries are linked in `%APPDATA%\npm`.

- b. To install Salesforce Mobile SDK in a local directory, `cd` to that directory and use the npm command without `sudo` or the `-g` option:

```
npm install forcedroid
```

This command installs Salesforce Mobile SDK in a `node_modules` directory under your current directory. It links binary modules in `./node_modules/.bin/`. In this scenario, you rarely use `sudo` because you typically install in a local folder where you already have read-write permissions.

## Uninstalling Mobile SDK npm Packages

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

### Uninstalling the Forcedroid Package

The instructions for uninstalling the `forcedroid` package vary with whether you installed the package globally or locally.

If you installed the package globally, you can run the `uninstall` command from any folder. Be sure to use the `-g` option. On a Unix-based platform such as Mac OS X, use `sudo` as well.

```
$ pwd
/Users/joeuser
$ sudo npm uninstall forcedroid -g
$
```

If you installed the package locally, run the `uninstall` command from the folder where you installed the package. For example:

```
cd <my_projects/my_sdk_folder>
npm uninstall forcedroid
```

If you try to uninstall a local installation from the wrong directory, you'll get an error message similar to this:

```
npm WARN uninstall not installed in /Users/joeuser/node_modules:
"my_projects/my_sdk_folder/node_modules/forcedroid"
```

## Uninstalling the Forceios Package

Instructions for uninstalling the forceios package vary with whether you installed the package globally or locally. If you installed the package globally, you can run the `uninstall` command from any folder. Be sure to use `sudo` and the `-g` option.

```
$ pwd
/Users/joeuser
$ sudo npm uninstall forceios -g
$
```

To uninstall a package that you installed locally, run the `uninstall` command from the folder where you installed the package. For example:

```
$ pwd
/Users/joeuser
cd <my_projects/my_sdk_folder>
npm uninstall forceios
```

If you try to uninstall a local installation from the wrong directory, you'll get an error message similar to this:

```
npm WARN uninstall not installed in /Users/joeuser/node_modules:
"my_projects/my_sdk_folder/node_modules/forceios"
```

## Mobile SDK GitHub Repository

More adventurous developers who want to delve into the SDK, keep up with the latest changes, and possibly contribute to SDK development can clone the open source repository from GitHub. Using GitHub allows you to monitor source code in public pre-release development branches. In this scenario, both iOS and Android apps include the SDK source code, which is built along with your app.

You don't need to sign up for GitHub to access the Mobile SDK, but we think it's a good idea to be part of 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>

### iOS: Cloning the Mobile SDK GitHub Repository (Optional)

1. Clone the Mobile SDK 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. By default, this is the `SalesforceMobileSDK-iOS` directory.
3. Run the install script from the command line: `./install.sh`

## Android: Cloning the Mobile SDK GitHub Repository (Optional)

1. In your browser, navigate to the Mobile SDK 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 command prompt in the directory where you installed the cloned repository, and run the install script from the command line: `./install.sh`



**Note: Windows users:** Run `cscript install.vbs`.

## Chapter 3

### Creating a Connected App

---

#### In this chapter ...

- [How to Create 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.

## How to Create a Connected App

1. Log into your Force.com instance.
2. In Setup, navigate to **Create > Apps**.
3. Under Connected Apps, click **New**.
4. For Connected App Name, enter a name, such as `Test Client`
5. Under Developer Name, enter your developer ID.
6. For Callback URL, enter `sfdc://success`



**Note:** The Callback URL does not 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://`.

7. For Contact Email, enter your email address.
8. For Selected OAuth Scopes, choose the permissions settings for your app. For descriptions, see [Scope Parameter Values](#).
9. Click **Save**.



**Note:** After you create a new connected app, wait a few minutes for the token to propagate before running your app.



**Tip:** The detail page for your connected app displays a consumer key. It's a good idea to copy the key, as you'll need it later.

# Chapter 4

## Mobile SDK Sample Apps

---

### In this chapter ...

- [Installing the Sample Apps](#)

Salesforce Mobile SDK includes a wealth of sample applications that demonstrate its major features. Use the hybrid and native samples for iOS and Android 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. You can access them there directly, or you can use an npm command to install them.

### Accessing the Samples from GitHub

If you clone Mobile SDK directly from GitHub, all sample files are placed in the correct locations. You can then build the Android samples by including the SalesforceSDK project, SmartStore project, and the sample projects in your Eclipse workspace. For iOS, remember to run `./install.sh` in the repository root folder after cloning the repository. Run the iOS sample projects by opening `SalesforceMobileSDK-iOS/SalesforceMobileSDK.xcworkspace`.

## Installing Sample Apps for Android

If you installed the SDK using npm, use the forcedroid command line utility to install the sample apps. You can either:

- Configure your target directory interactively as prompted by the forcedroid app, or
- Specify your target directory directly at the command line.

### Specifying the Target Directory Interactively

To enter the target directory interactively, do one of the following:

- If you installed Mobile SDK globally, type `forcedroid samples`.
- If you installed Mobile SDK locally, type `<forcedroid_path>/node_modules/.bin/ forcedroid samples`.

The forcedroid utility prompts you for the target directory name.

```
$node_modules/.bin/forcedroid samples
Enter the target directory of samples: MobileSDKSamples
Adjusting SalesforceSDK library project reference in project.properties.
Renaming application class to FileExplorerApp in source.
Renaming application to FileExplorer in source.
Renaming package name to com.salesforce.samples.fileexplorer in source.
Moving source files to proper package path.
Renaming the app class filename to FileExplorerApp.java.

Your application project is ready in MobileSDKSamples.

To build the new application, do the following:
- cd MobileSDKSamples/FileExplorer
- $ANDROID_SDK_DIR/android update project -p .
- ant clean debug

To run the application, start an emulator or plug in your device and run:
- ant install

To use your new application in Eclipse, do the following:
- Import the forcedroid/native/SalesforceSDK library project,
  and the FileExplorer project into your workspace
- Choose 'Build All' from the Project menu
- Run your application by choosing "Run as Android application"

Before you ship, make sure to plug your OAuth Client ID,
Callback URI, and OAuth Scopes into FileExplorer/res/values/bootconfig.xml.
INFO: SDK directory 'MobileSDKSamples/forcedroid' already exists. Skipping copy.
Adjusting SalesforceSDK library project reference in project.properties
```



**Note:** For best results, specify a target directory that doesn't already exist. If the target directory doesn't exist, forcedroid creates it. If it exists but doesn't contain the sample directories, forcedroid installs the samples in it. If it exists and already contains one or more of the sample directories, forcedroid exits upon finding an existing directory and doesn't install the rest of the samples.

## Android Sample Apps

### Native

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

1. To run the application from your Eclipse workspace, right-click the **RestExplorer** project and choose **Run As > Android Application**.
2. To run the tests, right-click the **RestExplorerTest** project and choose **Run As > Android JUnit Test**.

**NativeSqlAggregator** demonstrates SQL aggregation with SmartSQL. As such, it also demonstrates a native implementation of SmartStore. To run the application from your Eclipse workspace, right-click the **NativeSqlAggregator** project and choose **Run As > Android Application**.

**FileExplorer** demonstrates the Files API as well as the underlying Google Volley networking enhancements. To run the application from your Eclipse workspace, right-click the **FileExplorer** project and choose **Run As > Android Application**.

### Hybrid

- **AccountEditor**: Demonstrates how to use the SmartSync Data Framework to access Salesforce data.
- **SampleApps/HybridFileExplorer**: Demonstrates the Files API.
- **SampleApps/ContactExplorer**: The **ContactExplorer** sample app uses PhoneGap (also known as Cordova) to retrieve local device contacts. It also uses the `forcetk.mobilesdk.js` toolkit to implement REST transactions with the Salesforce REST API. The app uses the OAuth2 support in Salesforce SDK to obtain OAuth credentials, then propagates those credentials to `forcetk.mobilesdk.js` by sending a javascript event.
- **SampleApps/test/ContactExplorerTest**: Tests for the **ContactExplorer** sample app.
- **SampleApps/VFConnector**: The **VFConnector** sample app demonstrates how to wrap 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, then uses those credentials to set appropriate webview cookies for accessing Visualforce pages.
- **SampleApps/test/VFConnectorTest**: Test for the **VFConnector** sample app.
- **SampleApps/SmartStoreExplorer**: Lets you explore SmartStore APIs.
- **SampleApps/test/SmartStoreExplorerTest**: Tests for the **SmartStoreExplorer** sample app.

## Installing Sample Apps for iOS

If you installed the SDK using npm, use the `forceios` command line utility to install the sample apps. You can either:

- Configure your target directory interactively as prompted by the `forceios` app, or
- Specify your target directory directly at the command line.

### Specifying the Target Directory Interactively

To enter the target directory interactively, do one of the following:

- If you installed Mobile SDK globally, type `forceios samples`.
- If you installed Mobile SDK locally, type `<forceios_path>/node_modules/.bin/ forceios samples`.

The `forceios` utility prompts you for the target directory name.



```

$forceios samples
Enter the output directory for the samples: mobile_sdk_samples
Staging app dependencies...
Copying SalesforceSDKResources.bundle to /Users/rwhitley/mobile_sdk_samples/Re
Copying SalesforceCommonUtils to /Users/rwhitley/mobile_sdk_samples/RestAPIExp
Uncompressing SalesforceOAuth-Release.zip to /Users/rwhitley/mobile_sdk_sample
Uncompressing SalesforceSDKCore-Release.zip to /Users/rwhitley/mobile_sdk_samp
Copying openssl to /Users/rwhitley/mobile_sdk_samples/RestAPIExplorer/RestAPIE
Copying sqlcipher to /Users/rwhitley/mobile_sdk_samples/RestAPIExplorer/RestAPI
Uncompressing MKNetworkKit-iOS-Release.zip to /Users/rwhitley/mobile_sdk_samp
Uncompressing SalesforceNetworkSDK-Release.zip to /Users/rwhitley/mobile_sdk_s
Uncompressing SalesforceNativeSDK-Release.zip to /Users/rwhitley/mobile_sdk_sar
Dependencies copied successfully!
Staging app dependencies...
Copying SalesforceSDKResources.bundle to /Users/rwhitley/mobile_sdk_samples/Nat
Copying SalesforceCommonUtils to /Users/rwhitley/mobile_sdk_samples/NativeSqlAg
Uncompressing SalesforceOAuth-Release.zip to /Users/rwhitley/mobile_sdk_sample
Uncompressing SalesforceSDKCore-Release.zip to /Users/rwhitley/mobile_sdk_samp
s
Copying openssl to /Users/rwhitley/mobile_sdk_samples/NativeSqlAggregator/Nati
Copying sqlcipher to /Users/rwhitley/mobile_sdk_samples/NativeSqlAggregator/Na
Uncompressing MKNetworkKit-iOS-Release.zip to /Users/rwhitley/mobile_sdk_samp
Uncompressing SalesforceNetworkSDK-Release.zip to /Users/rwhitley/mobile_sdk_s

```



**Note:** For best results, specify a target directory that doesn't already exist. If the target directory doesn't exist, forceios creates it. If it exists but doesn't contain the sample directories, forceios installs the samples in it. If it exists and already contains one or more of the sample directories, forceios exits upon finding an existing sample directory and doesn't install the samples.

## iOS Sample Apps

### Native

- **RestAPIExplorer** exercises all of the native REST API wrappers. It resides in the Mobile SDK for iOS under `native/SampleApps/RestAPIExplorer`.
- **NativeSqlAggregator** shows SQL aggregation examples as well as a native SmartStore implementation. It resides in the Mobile SDK for iOS under `native/SampleApps/NativeSqlAggregator`.
- **FileExplorer** demonstrates the Files API as well as the underlying MKNetwork network enhancements. It resides in the Mobile SDK for iOS under `native/SampleApps/FileExplorer`.

### Hybrid

- **AccountEditor**: Demonstrates how to use the SmartSync Data Framework to access Salesforce data.
- **HybridFileExplorer**: Demonstrates the Files API.
- **ContactExplorer**: The ContactExplorer sample app uses PhoneGap (also known as Cordova) to retrieve local device contacts. It also uses the `forcetk.mobilesdk.js` toolkit to implement REST transactions with the Salesforce REST API. The app uses the OAuth2 support in Salesforce SDK to obtain OAuth credentials, then propagates those credentials to `forcetk.mobilesdk.js` by sending a JavaScript event.
- **VFConnector**: The VFConnector sample app demonstrates how to wrap 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, then uses those credentials to set appropriate webview cookies for accessing Visualforce pages.
- **SmartStoreExplorer**: Lets you explore SmartStore APIs.

# Chapter 5

## Native iOS Development

---

### In this chapter ...

- [iOS Native Quick Start](#)
- [Native iOS Requirements](#)
- [Creating an iOS Project](#)
- [Developing a Native iOS App](#)
- [Tutorial: Creating a Native iOS Warehouse App](#)
- [iOS Native Sample Applications](#)

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

Two main things 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 (including third-party libraries such as RestKit) to make that access as easy as possible.

When you create a native app using the forceios application, your project starts as a fully functioning native sample app. This simple 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 all of the [native iOS requirements](#).
2. Install the [Mobile SDK for iOS](#). If you prefer, you can install the [Mobile SDK for iOS](#) from GitHub instead.
3. Run the [template app](#).

## Native iOS Requirements

- Xcode—4.5 is the minimum, but we recommend the latest version.
- iOS 6.0 or higher.
- Mac OS X “Lion” or higher.
- [Install the Mobile SDK](#).
- A [Developer Edition organization](#) with a [connected app](#).

For important information on using various versions of XCode, see the Readme at <https://github.com/forcedotcom/SalesforceMobileSDK-iOS/blob/master/readme.md>.

## Creating an iOS Project

To create a new app, use forceios again on the command line. You have two options for configuring your app.

- Configure your application options interactively as prompted by the forceios app.
- Specify your application options directly at the command line.

### Specifying Application Options Interactively

To enter application options interactively, do one of the following:

- If you installed Mobile SDK globally, type `forceios create`.
- If you installed Mobile SDK locally, type `<forceios_path>/node_modules/.bin/forceios create`.

The forceios utility prompts you for each configuration value.

```
rwhitley-ltm1:Downloads rwhitley$ forceios create
Enter your application type (native, hybrid_remote, or hybrid_local): native
Enter your application name: MyNativeiOSApp
Enter your company identifier (com.mycompany): com.acme.goodapps
Enter your organization name (Acme, Inc.): GoodApps, Inc.
Enter the output directory for your app (defaults to the current directory):
Enter your Connected App ID (defaults to the sample app's ID):
Enter your Connected App Callback URI (defaults to the sample app's URI):
Creating app in /Users/rwhitley/Downloads/MyNativeiOSApp
Successfully created native app 'MyNativeiOSApp'.
```

### Specifying Application Options Directly

You can also specify your configuration directly by typing the full forceios command string. To see usage information, type `forceios` without arguments. The list of available options displays:

```
$ forceios
Usage:
forceios create
  --apptype=<Application Type> (native, hybrid_remote, hybrid_local)
  --appname=<Application Name>
```

```
--companyid=<Company Identifier> (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> (Defaults to the current working directory)]
[--appid=<Salesforce App Identifier> (The Consumer Key for your app.
    Defaults to the sample app.)]
[--callbackuri=<Salesforce App Callback URL> (The Callback URL for your app.
    Defaults to the sample app.)]
```

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

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

## Running the New Project in XCode

Apps created with the `forceios` template 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 your app’s `xcodeproj` file.
4. Click the **Run** button in the upper left corner to see your new app in action.

## forceios Command Parameters

These are the descriptions of the `forceios` command parameters:

Parameter Name	Description
<code>--apptype</code>	One of the following: <ul style="list-style-type: none"> <li>• “native”</li> <li>• “hybrid_remote” (server-side hybrid app using VisualForce)</li> <li>• “hybrid_local” (client-side hybrid app that doesn’t use VisualForce)</li> </ul>
<code>--appname</code>	Name of your application
<code>--companyid</code>	A unique identifier for your company. This value is concatenated with the app name to create a unique app identifier for publishing your app to the App Store. For example, “com.myCompany.apps”.
<code>--organization</code>	The formal name of your company. For example, “Acme Widgets, Inc.”.
<code>--packagename</code>	Package identifier for your application. For example, “com.acme.app”.

Parameter Name	Description
<code>--startpage</code>	(hybrid remote apps only) Server path to the remote start page. For example: <code>/apex/MyAppStartPage</code> .
<code>--outputdir</code>	(Optional) Folder in which you want your project to be created. If the folder doesn't exist, the script creates it. Defaults to the current working directory.
<code>--appid</code>	(Optional) Your connected app's Consumer Key. Defaults to the consumer key of the sample app.  <b>Note:</b> If you don't specify the value here, you're required to change it in the app before you publish to the App Store.
<code>--callbackuri</code>	(Optional) Your connected app's Callback URL. Defaults to the callback URL of the sample app.  <b>Note:</b> If you don't specify the value here, you're required to change it in the app before you publish to the App Store.
<code>--usesmartstore=true</code>	(Optional) Include only if you want to use SmartStore for offline data. Defaults to false if not specified.

## Running 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.

## 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, [Start Developing iOS Apps Today](#) 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 user logs into 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. The 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, you do need to understand the login flow and how OAuth tokens are handled. See [About PIN Security](#) on page 208 and [OAuth2 Authentication Flow](#).

## About Memory Management

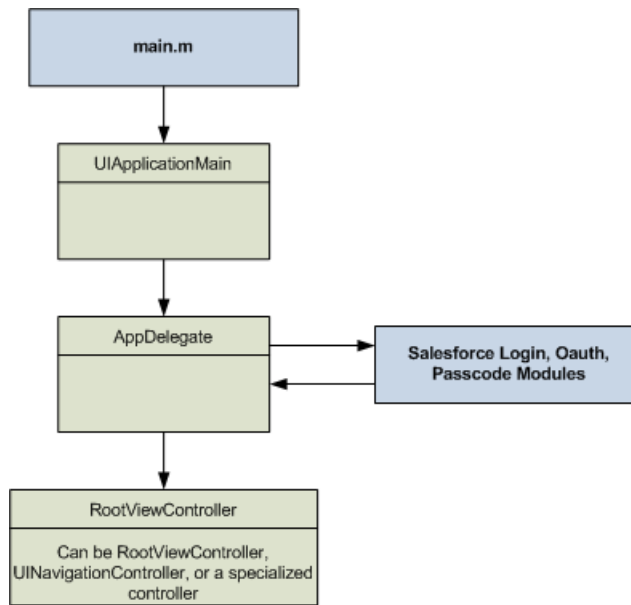
Beginning in Mobile SDK 2.0, native iOS apps use Automatic Reference Counting (ARC) to manage object memory. You don't have to allocate and then remember to deallocate your objects. See the [Mac Developer Library](#) at <https://developer.apple.com> for ARC syntax, guidelines, and best practices.

## Overview of Application Flow

When you create a project with the forceios application, your new app 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.

The workflow demonstrated by the template app is merely an example. You can tailor your `AppDelegate` and supporting classes to achieve your desired workflow. 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 quits it, or until the device is rebooted.

Native iOS apps built with the 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 Class

The `AppDelegate` class is the true entry point for an iOS app. In Mobile SDK apps, `AppDelegate` implements the standard iOS `UIApplicationDelegate` interface. The Mobile SDK template application for creating native iOS apps implements most of the Salesforce-specific startup functionality for you.

To customize the `AppDelegate` template, populate the following static variables with information from your Force.com Connected Application:

- `RemoteAccessConsumerKey`

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

- `OAuthRedirectURI`

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

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 sub-view.

### Initialization

The following high-level overview shows how the `AppDelegate` initializes the template app. Keep in mind that you can change any of these details to suit your needs.

1. When the `[AppDelegate init]` message runs, it:

- Initializes configuration items, such as Connected App identifiers, OAuth scopes, and so on.
- Adds notification observers that listen to `SFAuthenticationManager`, `logoutInitiated`, and `loginHostChanged` notifications.

The `logoutInitiated` notification lets the app respond when a user logs out voluntarily or is logged out involuntarily due to invalid credentials. The `loginHostChanged` notification lets the app respond when the user changes the login

host (for example, from Production to Sandbox). See the `logoutInitiated:` and `loginHostChanged:` handler methods in the sample app.

- Initializes authentication "success" and "failure" blocks for the `[SFAuthenticationManager loginWithCompletion:failure:]` message. These blocks determine what happens when the authentication process completes.
- 2. `application:didFinishLaunchingWithOptions:`, a `UIApplicationDelegate` method, is called at app startup. The template app uses this method to initialize the `UIWindow` property, display the initial view (see `initializeAppViewState`), and initiate authentication. If authentication succeeds, the `SFAuthenticationManager` executes `initialLoginSuccessBlock` (the "success" block).
- 3. `initialLoginSuccessBlock` calls `setupRootViewController`, which creates and displays the app's `RootViewController`.

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).

### **`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.

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

## 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 Force.com 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, 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: — Your request was processed. The delegate receives the response in JSON format. This is the only callback that indicates success.
- request:didFailLoadWithError: — Your request couldn't be processed. The delegate receives an error message.
- requestDidCancelLoad — Your request was canceled by 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, if 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, 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, 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

Native app development with the Salesforce Mobile SDK centers around the use of Salesforce REST APIs. Salesforce makes a wide range of object-based tasks available through URIs with REST parameters. Mobile SDK wraps these HTTP calls in interfaces that handle most of the low-level work in formatting a request.

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 `NSError` if the request fails.

See the [Force.com REST API Developer's Guide](#) for information on Salesforce REST response formats.

## 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. 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](#).

Supported operations are:

Operation	Delegate method	Block method
<b>Manual REST request</b> Executes a request that you've built	send:delegate:	sendRESTRequest: failBlock: completeBlock:
<b>SOQL query</b> Executes the given SOQL string and returns the resulting data set	requestForQuery:	performSOQLQuery: failBlock: completeBlock:
<b>SOSL search</b> Executes the given SOSL string and returns the resulting data set	requestForSearch:	performSOSLSearch: failBlock: completeBlock:
<b>Metadata</b> Returns the object's metadata	requestForMetadataWithObjectType:	performMetadataWithObjectType: failBlock: completeBlock:
<b>Describe global</b> Returns a list of all available objects in your org and their metadata	requestForDescribeGlobal	performDescribeGlobalWithFailBlock: completeBlock:
<b>Describe with object type</b> Returns a description of a single object type	requestForDescribeWithObjectType:	performDescribeWithObjectType: failBlock: completeBlock:
<b>Retrieve</b> Retrieves a single record by object ID	requestForRetrieveWithObjectType:  objectId:  fieldList:	performRetrieveWithObjectType: objectId: fieldList: failBlock:completeBlock:
<b>Update</b>	requestForUpdateWithObjectType:	performUpdateWithObjectType: objectId:

Operation	Delegate method	Block method
Updates an object with the given map	objectId: fields:	fields: failBlock: completeBlock:
<b>Upsert</b> Updates or inserts an object from external data, based on whether the external ID currently exists in the external ID field	requestForUpsertWithObjectType: externalIdField: externalId: fields:	performUpsertWithObjectType: externalIdField: externalId: fields: failBlock: completeBlock:
<b>Create</b> Creates a new record in the specified object	requestForCreateWithObjectType: fields:	performCreateWithObjectType: fields: failBlock: completeBlock:
<b>Delete</b> Deletes the object of the given type with the given ID	requestForDeleteWithObjectType: objectId:	performDeleteWithObjectType: objectId: failBlock: completeBlock:
<b>Versions</b> Returns Salesforce version metadata	requestForVersions	performRequestForVersionsWithFailBlock: completeBlock:
<b>Resources</b> Returns available resources for the specified API version, including resource name and URI	requestForResources	performRequestForResourcesWithFailBlock: completeBlock:

## 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:` — Your request was processed. The delegate receives the response in JSON format. This is the only callback that indicates success.
- `request:didFailLoadWithError:` — Your request couldn't be processed. The delegate receives an error message.
- `requestDidCancelLoad` — Your request was canceled by 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 don't know which type of response to expect, you must implement all of 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 the `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.

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

SFRestRequest *request =
    [SFRestRequest
        requestWithMethod:SFRestMethodPOST
        path:[NSString
            stringWithFormat:
                @\"/v26.0/chatter/feeds/
                record/%@/feed-items\",
                recordId]
        queryParams:
            (NSDictionary *)
                [SFJsonUtils objectFromJSONString:body]];
[[SFRestAPI sharedInstance] send:request delegate:self];
```

## 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.

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

- ◊ `NSMutableDictionary`—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> .
<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 SFRestAPI (Files) methods.

### Methods

SFRestAPI (Files) category supports the following operations. For a full reference of this category, see [SFRestAPI \(Files\) Category Request Methods](#). 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>.

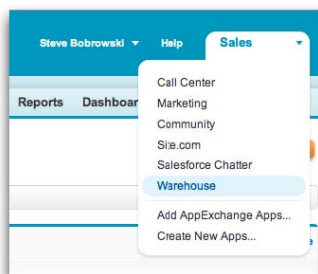
Method	Description
- (SFRestRequest *) requestForOwnedFilesList:(NSString *) userId page:(NSUInteger)page	Builds a request that fetches a page from the list of files owned by the specified user.
- (SFRestRequest *) requestForFilesInUsersGroups:(NSString )userId page:(NSUInteger)page	Builds a request 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 *)sfidId forVersion:(NSString *)version	Builds a request that fetches the file details of a particular version of a file.
- (SFRestRequest *) requestForBatchFileDetails:(NSArray )sfidIds	Builds a request that fetches the latest file details of one or more files in a single request.
- (SFRestRequest *) requestForFileRendition:(NSString *)sfidId 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).

Method	Description
<pre>- (SFRestRequest *) requestForFileContents:(NSString *) sfdcId version:(NSString*) version</pre>	Builds a request that fetches the actual binary file contents of this particular file.
<pre>- (SFRestRequest *) requestForFileShares:(NSString *)sfdcId page:(NSUInteger)page</pre>	Builds a request that fetches a page from the list of entities that share this file.
<pre>- (SFRestRequest *) requestForAddFileShare:(NSString *)fileId entityId:(NSString *)entityId shareType:(NSString*)shareType</pre>	Builds a request that add a file share for the specified file ID to the specified entity ID.
<pre>- (SFRestRequest *) requestForDeleteFileShare:(NSString *) shareId;</pre>	Builds a request that deletes the specified file share.
<pre>- (SFRestRequest *) requestForUploadFile:(NSData *)data name:(NSString *)name description:(NSString *)description mimeType:(NSString *)mimeType</pre>	Builds a request that uploads a new file to the server. Creates a new file with version set to 1.

## 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.
  - Click the installation URL link: <https://login.salesforce.com/packaging/installPackage.apexp?p0=04ti00000000MMMT>
  - If you aren't logged in already, enter the username and password of your DE org.
  - On the Package Installation Details page, click **Continue**.
  - Click **Next**, and on the Security Level page click **Next**.
  - Click **Install**.
  - Click **Deploy Now** and then **Deploy**.
  - Once the installation completes, you can select the **Warehouse** app from the app picker in the upper right corner.



- To create data, click the **Data** tab.
- Click the **Create Data** button.

- Install the latest versions of Xcode and the iOS SDK.
- 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](http://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 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.

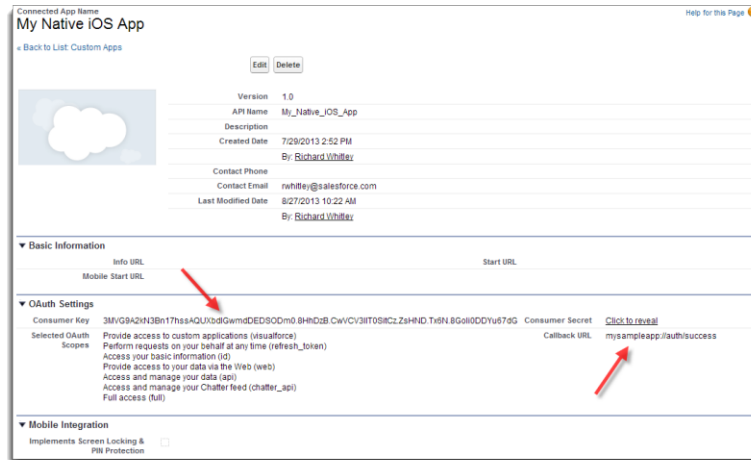
### Step 1: Create a Connected App

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 DE org, click **Your Name** > **Setup** and under App Setup, click **Create** > **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 iOS 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)”, then click **Add**.
7. Click **Save**.

After you save the configuration, notice the details of the Connected App you just created.

- Note the Callback URL and Consumer Key; you will use these when you set up your native app in the next step.
- Mobile apps do not use the Consumer Secret, so you can ignore this value.



## 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 company identifier, enter `com.acme.goodapps`.
6. For organization name, enter `GoodApps, Inc..`
7. For output directory, enter `tutorial/iOSNative`.
8. For the Connected App ID, copy and paste the Consumer Key from your Connected App definition.
9. For the Connected App Callback URI, copy and paste the Callback URL from your Connected App definition.

The input screen should look similar to this:

```
rwhitley-ltm1:Downloads rwhitley$ forceios create
Enter your application type (native, hybrid_remote, or hybrid_local): native
Enter your application name: MyNativeiOSApp
Enter your company identifier (com.mycompany): com.acme.goodapps
Enter your organization name (Acme, Inc.): GoodApps, Inc.
Enter the output directory for your app (defaults to the current directory):
Enter your Connected App ID (defaults to the sample app's ID):
Enter your Connected App Callback URI (defaults to the sample app's URI):
Creating app in /Users/rwhitley/Downloads/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 `xcodeproj` file.
4. Click the **Run** button in the upper left corner to see your new app in the iOS simulator. Make sure that you've selected **Product > Destination > iPhone 6.0 Simulator** in the Xcode menu.
5. When you start the app, after showing an initial splash screen, you should see the Salesforce login screen. Login with your DE username and password.



- 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 at the left side of the cell, and adds an arrow to 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] autorelease];
    }

    //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 = [self.dataRows objectAtIndex:indexPath.row];
    cell.textLabel.text = [obj objectForKey:@"Name"];

    //this adds the arrow to the right hand side.
    cell.accessoryType = UITableViewCellAccessoryDisclosureIndicator;
}
```



```
return cell;
}
```

### SFRestAPI Shared Object and SFRestRequest Class

You can learn how the app creates and sends the REST request 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, pre-formatted `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:

```
//Here we use a query that should work on either Force.com or Database.com
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 Warehouse view. Here's the code that implements the `SFRestDelegate` interface in the `RootViewController` class:

```
#pragma mark - SFRestAPIDelegate

- (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
}
```

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**.
6. Click **Enable** when Xcode asks you if you'd like it to take automatic snapshots before refactoring.

After the snapshot is complete, the Refactoring window goes away, and you're back in your 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:

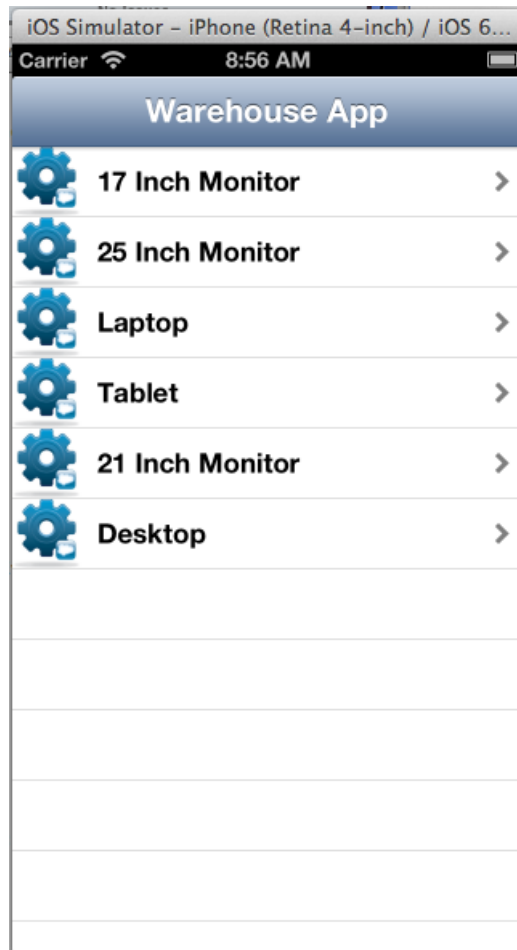
```
SFRestRequest *request = [[SFRestAPI sharedInstance] requestForQuery:@"SELECT Name  
FROM User LIMIT 10"];
```

to:

```
SELECT Name, Id, Quantity__c, Price__c FROM Merchandise__c LIMIT 10
```

## 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... > Cocoa Touch > Objective-C class**.

2. Create a new Objective-C class named `DetailViewController` that subclasses `UIViewController`. Make sure that **With XIB for user interface** is checked.
3. Click **Next**.
4. Place the new class in the Classes group under Mobile Warehouse App in the **Groups** drop-down menu.

Xcode creates three new files in the Classes folder: `DetailViewController.h`, `DetailViewController.m`, and `DetailViewController.xib`.

5. Select `DetailViewController.m` in the Project Navigator, and delete the following method declaration:

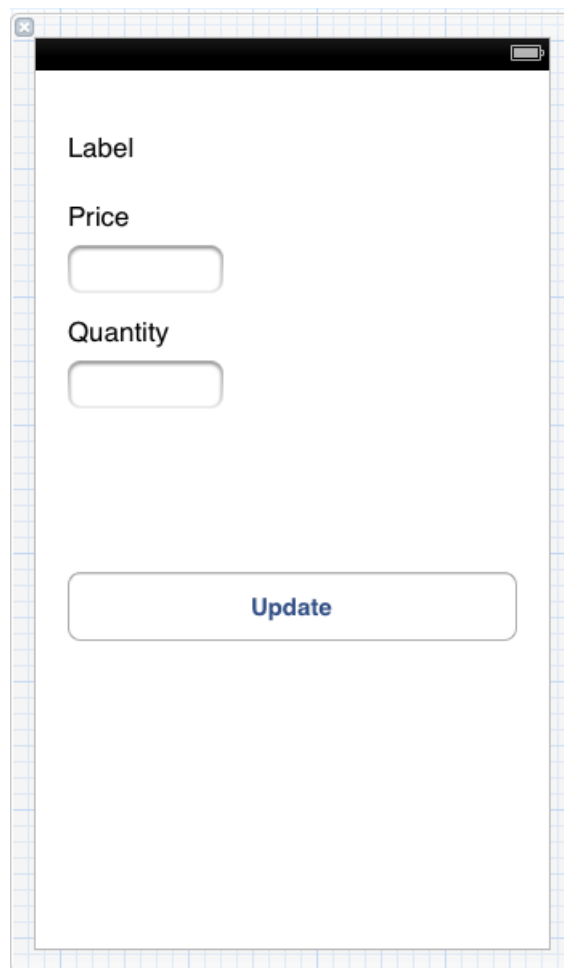
```
- (id)initWithNibName:(NSString *)nibNameOrNil bundle:(NSBundle *)nibBundleOrNil{
    self = [super initWithNibName:nibNameOrNil bundle:nibBundleOrNil];
    if (self) {
        // Custom initialization
    }
    return self;
}
```

In this app, you don't need this initialization method because you're not specifying a NIB file or bundle.

6. Select `DetailViewController.xib` in the Project Navigator to open the Interface Builder.

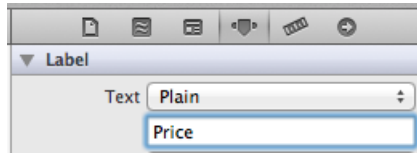


7. From the Utilities view, drag three labels, two text fields, and one button onto the view layout. Arrange and resize the controls so that the screen looks like this:



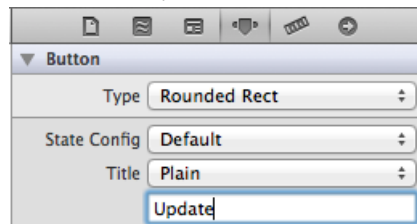
We'll refer to topmost label as the Name label. This label is dynamic. In the next tutorial, you'll add controller code that resets it at runtime to a meaningful value.

8. 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.

9. 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.



10. 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

1. 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
```

2. In `DetailViewController.m`, just after the `@implementation` tag, synthesize each of the properties.

```
@implementation DetailViewController

@synthesize nameData;
```

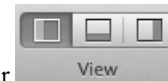
```
@synthesize quantityData;
@synthesize priceData;
@synthesize idData;
```

## 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.

1. In the Project Navigator, click the `DetailViewController.xib` file.

The `DetailViewController.xib` file opens in the Standard Editor.

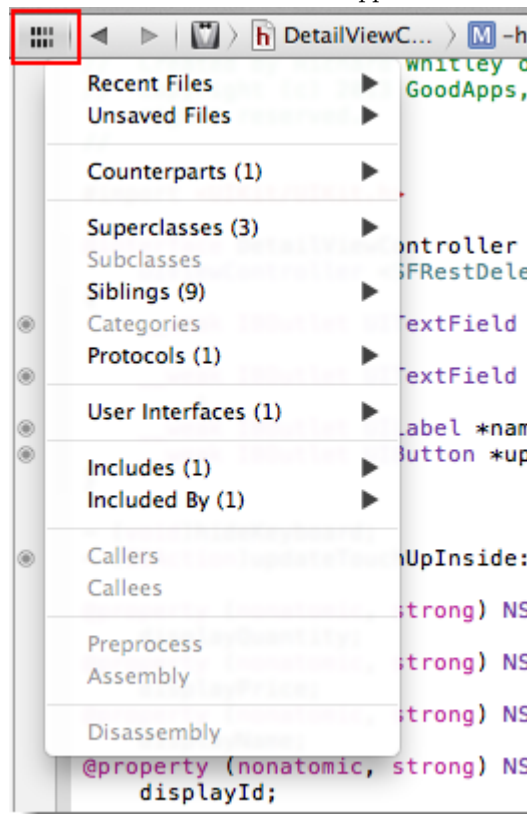


2. Hide the Navigator by clicking Hide or Show Navigator on the View toolbar. Alternatively, you can choose **View > Navigators > Hide Navigators** in the Xcode menu.



3. Open the Assistant Editor by clicking Show the Assistant editor in the Editor toolbar. Alternatively, you can choose **View > Assistant Editor > Show Assistant Editor** in the Xcode menu.

Because you opened `DetailViewController.xib` in the Standard Editor, 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.



4. At the top of the interface block in `DetailViewController.h`, add a pair of empty curly braces:

```
@interface DetailViewController : UIViewController <SFRestDelegate>
{
```

```
}
```

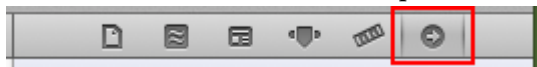
5. In the Standard Editor, control-click the Price text field control and drag it into the new curly brace block in the `DetailViewController.h` file.
6. In the popup dialog box, name the new outlet `_priceField`, and click **Connect**.
7. Repeat steps 2 and 3 for the Quantity text field, naming its outlet `_quantityField`.
8. 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

1. In the Interface Builder, select the **Update** button and open the Connections Inspector



2. 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".

1. Click **Show the Standard Editor** and open the Navigator.
2. 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`.

3. 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.
4. 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 {
}
```

5. 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
               objectId:(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"]
                                       salesforceId:[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.m file, add the following line above the @implementation block.

```
#import "SFRestAPI.h"
```

3. At the end of the 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 {
```

```

NSMutableDictionary *fields = [NSMutableDictionary 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 {

    NSMutableDictionary *fields = [NSMutableDictionary 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.

- Find the pragma that marks the `SFRestAPIDelegate` section.

```
#pragma mark - SFRestAPIDelegate
```

- 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, we need to change the `request:didLoadResponse:` method to suit the detail view purposes. Let's use the `UINavigationController` stack to return to the list view after an update occurs.

- 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");
    [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.

### Hide the Keyboard

The iOS keyboard remains visible as long as any text input control on the screen is responding to touch events. This is where the "First Responder" setting, which you might have noticed in the Interface Builder, comes into play. We didn't set a first responder because our simple app just uses the default UIKit behavior. As a result, iOS can consider any input control in the view to be the first responder. If none of the controls explicitly tell iOS to hide the keyboard, it remains active.

You can resolve this issue by making every touch-enabled edit control resign as first responder.

- In `DetailViewController.h`, below the curly brace block, add a new instance method named `hideKeyboard` that takes no arguments and returns `void`.

```
- (void)hideKeyboard;
```

2. In the implementation file, implement this method to send a `resignFirstResponder` message to each touch-enabled edit control in the view.

```
- (void)hideKeyboard {
    [_quantityField resignFirstResponder];
    [_priceField resignFirstResponder];
}
```

The only remaining question is where to call the `hideKeyboard` method. We want the keyboard to go away when the user taps outside of the text input controls. There are many likely events that we could try, but the only one that is sure to catch the background touch under all circumstances is `[UIResponder touchesEnded:withEvent:]`.

3. Since the event is already declared in a class that `DetailViewController` inherits, there's no need to re-declare it in the `DetailViewController.h` file. Rather, in the `DetailViewController.m` file, type the following incomplete code on a new line outside of any method body:

```
- (void)t
```

A popup menu displays with a list of matching instance methods from the `DetailViewController` class hierarchy.



**Note:** If the popup menu doesn't appear, just type the code described next.

4. In the popup menu, highlight the `touchesEnded:withEvent:` method and press `Return`. The editor types the full method signature into your file for you. Just type an opening brace, press `Return`, and your stub method is completed by the editor. Within this stub, send a `hideKeyboard` message to `self`.

```
- (void)touchesEnded:(NSSet *)touches withEvent:(UIEvent *)event{
    [self hideKeyboard];
}
```

Normally, in an event handler, you'd be expected to call the super class version before adding your own code. As documented in the *iOS Developer Library*, however, leaving out the super call in this case is a common usage pattern. The only "gotcha" is that you also have to implement the other touches event handlers, which include:

```
- touchesBegan:withEvent:
- touchesMoved:withEvent:
- touchesCancelled:withEvent:
```

The good news is that you only need to provide empty stub implementations.

5. Use the Xcode editor to add these stubs the same way you added the `touchesEnded:` stub. Make sure your final code looks like this:

```
- (void)touchesEnded:(NSSet *)touches withEvent:(UIEvent *)event{
    [self hideKeyboard];
}

- (void)touchesBegan:(NSSet *)touches withEvent:(UIEvent *)event{
}

- (void)touchesCancelled:(NSSet *)touches withEvent:(UIEvent *)event{
}

- (void)touchesMoved:(NSSet *)touches withEvent:(UIEvent *)event{
}
```

### 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.

1. In the `WarehouseViewController.m` file, add the following code after the `viewDidLoad` implementation.

```
- (void)viewWillAppear:(BOOL)animated {
    [super viewWillAppear:animated];
}
```

2. 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];
    //Here we use a query that should work on either Force.com or Database.com
    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 Native Sample Applications

The app you created in [Running 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 of the native REST API wrappers. It resides in the Mobile SDK for iOS under `native/SampleApps/RestAPIExplorer`.
- **NativeSqlAggregator** shows SQL aggregation examples as well as a native SmartStore implementation. It resides in the Mobile SDK for iOS under `native/SampleApps/NativeSqlAggregator`.
- **FileExplorer** demonstrates the Files API as well as the underlying MKNetwork network enhancements. It resides in the Mobile SDK for iOS under `native/SampleApps/FileExplorer`.

## Chapter 6

### Native Android Development

---

#### In this chapter ...

- [Android Native Quick Start](#)
- [Native Android Requirements](#)
- [Creating an Android Project](#)
- [Setting Up Sample Projects in Eclipse](#)
- [Developing a Native Android App](#)
- [Tutorial: Creating a Native Android Warehouse Application](#)
- [Android Native Sample Applications](#)

Salesforce Mobile SDK delivers libraries and sample projects for developing native mobile apps on Android.

The Android native SDK provides two main features:

- Automation of the OAuth2 login process, making it easy to integrate the process with your app.
- Access to the Salesforce REST API, with utility classes that simplify that access.

The Android Salesforce Mobile SDK includes several sample native applications. It also provides an `ant` target for quickly creating a new application.



## 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 the [Mobile SDK for Android](#).
3. At the command line, run the forcedroid application to create a new [Android project](#), and then run that app in Eclipse or from the command line.
4. Set up [sample projects in Eclipse](#).

## Native Android Requirements

- Java JDK 6.
- Apache Ant 1.8 or later.
- Android SDK, version 21 or later—<http://developer.android.com/sdk/installing.html>.



**Note:** For best results, install all previous versions of the Android SDK as well as your target version.

- Eclipse 3.6 or later. See <http://developer.android.com/sdk/requirements.html> for other versions.
- Android ADT (Android Development Tools) plugin for Eclipse, version 21 or later—<http://developer.android.com/sdk/eclipse-adt.html#installing>.
- In order to run the application in the Emulator, you need to set up at least one Android Virtual Device (AVD) that targets Platform 2.2 or above (we recommend 4.0 or above). To learn how to set up an AVD in Eclipse, follow the instructions at <http://developer.android.com/guide/developing/devices/managing-avds.html>.
- A [Developer Edition organization](#) with a [connected app](#).

The SalesforceSDK project is built with the Android 3.0 (Honeycomb) library. The primary reason for this is that we want to be able to make a conditional check at runtime for file system encryption capabilities. This check is bypassed on earlier Android platforms; thus, you can still use the `salesforcesdk.jar` in earlier Android application versions, down to the minimum-supported Android 2.2.

## Creating an Android Project

To create a new app, use forcedroid again on the command line. You have two options for configuring your app.

- Configure your application options interactively as prompted by the forcedroid app.
- Specify your application options directly at the command line.

### Specifying Application Options Interactively

To enter application options interactively, do one of the following:

- If you installed Mobile SDK globally, type `forcedroid create`.
- If you installed Mobile SDK locally, type `<forcedroid_path>/node_modules/.bin/forcedroid create`.

The forcedroid utility prompts you for each configuration option.

```

rwhitley-ltm1:Downloads rwhitley$ forcedroid create
Enter your application type (native, hybrid_remote, or hybrid_local): native
Enter your application name: MyNativeAndroidApp
Enter the target directory of your app: /Users/rwhitley/Development/AndroidApps
Enter the package name for your app (com.mycompany.my_app): com.acme.goodapps
Do you want to use SmartStore in your app? [yes/NO] ('No' by default)
Adjusting SalesforceSDK library project reference in project.properties.
Renaming application class to MyNativeAndroidAppApp in source.
Renaming application to MyNativeAndroidApp in source.
Renaming package name to com.acme.goodapps in source.
Moving source files to proper package path.
Renaming the app class filename to MyNativeAndroidAppApp.java.

Your application project is ready in /Users/rwhitley/Development/AndroidApps.

```

## Specifying Application Options Directly

You can also specify your configuration directly by typing the full forcedroid command string. To see usage information, type forcedroid without arguments. The list of available options displays:

```

$ node_modules/.bin/forcedroid
Usage:
forcedroid create
  --apptype=<Application Type> (native, hybrid_remote, hybrid_local)
  --appname=<Application Name>
  --targetdir=<Target App Folder>
  --packagename=<App Package Identifier> (com.my_company.my_app)
  --apexpage=<Path to Apex start page> (/apex/MyPage - Only required/used for
'hybrid_remote')
  [--usesmartstore=<Whether or not to use SmartStore> (--usesmartstore=true - false by
default)]

```

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

```

$ node_modules/.bin/forcedroid create --apptype="native" --appname="package-test"
--targetdir="PackageTest" --packagename="com.test.my_new_app"

```

## 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 only if you want to build and run your app from the command line.

1. Before building the new application, build the SalesforceSDK project by running the following commands at the command prompt:

```

cd $SALESFORCE_SDK_DIR/native/SalesforceSDK
$ANDROID_SDK_DIR/tools/android update project -p . -t <id>
ant clean debug

```

where SALESFORCE\_SDK\_DIR points to your Salesforce SDK installation directory, and ANDROID\_SDK\_DIR points to your Android SDK directory.



**Note:** The -t <id> parameter specifies API level of the target Android version. Use android.bat list targets to see the IDs for API versions installed on your system. See [Native Android Requirements](#) for supported API levels.

2. Build the SmartStore project by running the following commands at the command prompt:

```

cd $SALESFORCE_SDK_DIR/hybrid/SmartStore
$ANDROID_SDK_DIR/tools/android update project -p . -t <id>
ant clean debug

```

where `SALESFORCE_SDK_DIR` points to your Salesforce SDK installation directory, and `ANDROID_SDK_DIR` points to your Android SDK directory.

3. To build the new application, run the following commands at the command prompt:

```
cd <your_project_directory>
$ANDROID_SDK_DIR/tools/android update project -p . -t <id>
ant clean debug
```

where `ANDROID_SDK_DIR` points to your Android SDK directory.

4. If your emulator is not running, use the Android AVD Manager to start it. If you're using a device, connect it.
5. Type the following command at the command prompt:

```
ant installld
```



**Note:** You can safely ignore the following warning:

```
It seems that there are sub-projects. If you want to update them please use the
--subprojects parameter.
```

The Android project you created contains a simple application you can build and run.

## Importing and Building Your App in Eclipse

The forcedroid script also prints instructions for running the new app in the Eclipse editor.

1. Launch Eclipse and select your target directory as the workspace directory.
2. Select **Eclipse > Preferences**, choose the **Android** section, and enter the Android SDK location.
3. Click OK.
4. Select **File > Import** and select **General > Existing Projects into Workspace**.
5. Click Next.
6. Specify the `forcedroid/native` directory as your root directory. Next to the list that displays, click **Deselect All**, then browse the list and check the `SalesforceSDK` project.
7. If you set `-use_smartstore=true`, check the `SmartStore` project as well.
8. Click **Import**.
9. Repeat Steps 4–8. In Step 6, choose your target directory as the root, then select only your new project.

When you've finished importing the projects, Eclipse automatically builds your workspace. This process can take several minutes. When the status bar reports zero errors, you're ready to run the project.

1. In your Eclipse workspace, Control-click or right-click your project.
2. From the popup menu, choose **Run As > Android Application**.

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

## forcedroid Command Parameters

These are descriptions of the forcedroid command parameters:

Parameter Name	Description
<code>--apptype</code>	One of the following:

Parameter Name	Description
	<ul style="list-style-type: none"> <li>• “native”</li> <li>• “hybrid_remote” (server-side hybrid app using VisualForce)</li> <li>• “hybrid_local” (client-side hybrid app that doesn’t use VisualForce)</li> </ul>
--appname	Name of your application
--targetdir	Folder in which you want your project to be created. If the folder doesn’t exist, the script creates it.
--packagename	Package identifier for your application (for example, “com.acme.app”).
--apexpage	(hybrid remote apps only) Server path to the Apex start page. For example: /apex/MyAppStartPage.
--usesmartstore=true	(Optional) Include only if you want to use SmartStore for offline data. Defaults to false if not specified.

## Setting Up Sample Projects in Eclipse

The repository you cloned has other sample apps you can run. To import those into Eclipse:

1. Launch Eclipse and select `--target_dir` as your workspace directory.
2. If you haven’t done so already, select **Window > Preferences**, choose the **Android** section, and enter the Android SDK location. Click OK.
3. Select **File > Import** and select **General > Existing Projects into Workspace**.
4. Click Next.
5. Select `forcedroid/native` as your root directory and import the projects listed in [Android Project Files](#).

## Android Project Files

Inside the `$NATIVE_DIR`, you will find several projects:

- `SalesforceSDK`—Salesforce Mobile SDK project. Provides support for OAuth2 and REST API calls
- `test/SalesforceSDKTest`—App for testing the SalesforceSDK project
- `TemplateApp`—App used as a template when creating new native applications using Mobile SDK
- `test/TemplateAppTest`—App for testing the TemplateApp project
- `SampleApps/RestExplorer`—Sample app using SalesforceSDK to explore the REST API calls
- `SampleApps/FileExplorer`—Sample app that demonstrates the Files API
- `SampleApps/NativeSqlAggregator` —Sample native app that uses SmartStore

## 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.

### The `create_native` Script

The `create_native` script creates the app folder you specify, then populates it with a project file, build file, manifest file and resource files. Next, it copies the entire `TemplateApp` project to the new folder. It then updates the project properties, file names, class names, and directory paths to match the new app's configuration. As a result, your new project replicates all the settings and components used by the `TemplateApp` project.

If your new app supports SmartStore, the script also:

- Adds the SmartStore support library to the app directory.
- References the SmartStore library in the new project's properties.
- Changes the application class to extend `SalesforceSDKManagerWithSmartStore` rather than `SalesforceSDKManager`.

Finally, the script posts an important message:

"Before you ship, make sure to plug in your oauth client id and callback url in:

```
${target.dir}/res/values/bootconfig.xml"
```

If you're wondering where to get the OAuth client ID and callback URL, look in your connected app definition in your Salesforce organization. The OAuth client ID is the connected app's Consumer Key. The callback URL is the one you specified when you created your connected app. You enter these keys in the `res/values/bootconfig.xml` file of your project, which contains a few clearly named `<string>` nodes. Here's an example `bootconfig.xml` file:

```
<?xml version="1.0" encoding="utf-8"?>

<resources>
  <string name="remoteAccessConsumerKey">3MVG92.uWdyphVj4bnolD7yuIpCQsNgddW
    tqRND3faxrv9uKnbj47H4RkwheHA2lKY4cBusvDVp0M6gdGE8hp</string>
  <string name="oauthRedirectURI">sfdc:///axm/detect/oauth/done</string>
  <string-array name="oauthScopes">
    <item>api</item>
  </string-array>
</resources>
```

The `create_native` script pre-populates `oauthRedirectURI` and `remoteAccessConsumerKey` strings with dummy values. Replace those values with the strings from your connected app definition.

## Android Application Structure

Typically, native Android apps that use the Mobile SDK require:

- An application entry point class that extends `android.app.Application`.
- At least one activity that extends `android.app.Activity`.

With the Mobile SDK, you:

- Create a stub class that extends `android.app.Application`.

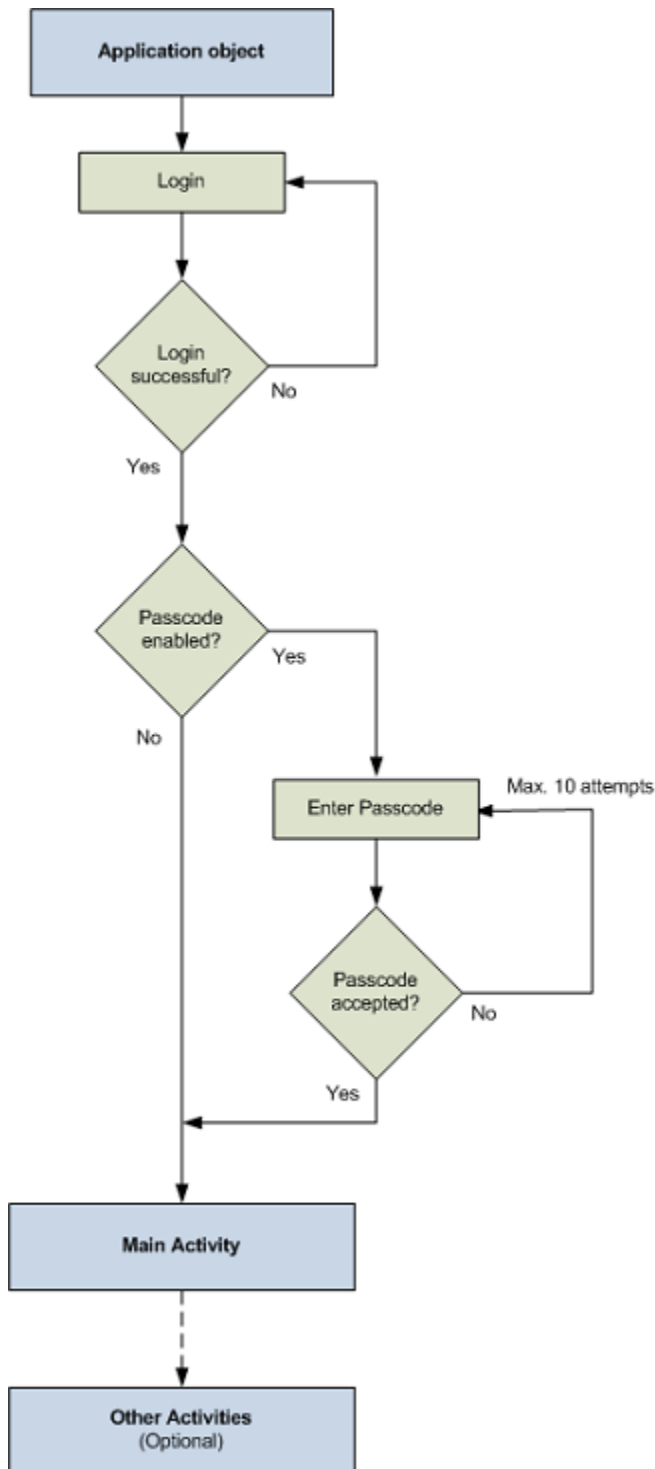
- Implement `onCreate()` in your `Application` stub class to call `SalesforceSDKManager.initNative()`.
- Extend `SalesforceActivity`, `SalesforceListActivity`, or `SalesforceExpandableListActivity`. This extension is optional but recommended.

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 APIs into seven packages. Here's a quick overview of these packages and points of interest within them.

Package name	Description
app	Contains <code>SalesforceSDKManager</code> , the entry point class for all Mobile SDK applications. This package also contains app utility classes for internal use.
auth	Internal use only. Handles login, OAuth authentication, and HTTP access.
phonegap	Internal classes used by hybrid applications to create a bridge between native code and Javascript code. Includes plugins that implement Mobile SDK Javascript libraries. If you want to implement your own Javascript plugin within an SDK app, extend <code>ForcePlugin</code> and implement the abstract <code>execute()</code> function. See <a href="#">ForcePlugin Class</a> .
push	Components of this package register and unregister devices for Salesforce push notifications. These components then receive the notifications from a Salesforce connected app through Google Cloud Messaging (GCM). See <a href="#">Push Notifications and Mobile SDK</a> , on page 191
rest	Provides classes for handling REST API activities. These classes manage the communication with the Salesforce instance and handle the HTTP protocol for your REST requests. See <code>ClientManager</code> and <code>RestClient</code> for information on available synchronous and asynchronous methods for sending requests.
security	Internal classes that handle passcodes and encryption. If you provide your own key, you can use the <code>Encryptor</code> class to generate hashes. See <code>Encryptor</code> .
ui, ui.sfhybrid, ui.sfnative	Mostly internal classes that define the UI activities common to all Mobile SDK apps. These packages include <code>SalesforceActivity</code> , <code>SalesforceListActivity</code> , and <code>SalesforceExpandableListActivity</code> , which are intended to serve individually as potential base classes for all app activities.
util	<p>Contains utility and test classes. These classes are mostly for internal use, with some notable exceptions.</p> <ul style="list-style-type: none"> <li>You can register an instance of the <code>TokenRevocationReceiver</code> class to detect when an OAuth access token has been revoked.</li> <li>You can implement the <code>EventObserver</code> interface to eavesdrop on any event type.</li> <li>The <code>EventsListenerQueue</code> class is useful for implementing your own tests.</li> <li>Browse the <code>EventsObservable</code> source code to see a list of all supported event types.</li> </ul>



## 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.

## AccountWatcher Class

`AccountWatcher` informs your app when the user's account is removed through Settings. Without `AccountWatcher`, the application gets no notification of these changes. It's important to know when an account is removed so that its passcode and data can be disposed of properly, and logout can begin.

`AccountWatcher` defines an internal interface, `AccountRemoved`, that each app must implement. `SalesforceSDKManager` implements this interface to terminate the app's current (front) activity and reset the passcode, if used, and encryption key.

## 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](#) on page 111.

## 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	Parameters	Description
Versions	None	Returns Salesforce version metadata
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

Operation	Parameters	Description
Create	API version, object type, map of field names to value objects	Creates a new record in the specified object
Retrieve	API version, object type, object ID, list of fields	Retrieves a record by object ID
Update	API version, object type, object ID, map of field names to value objects	Updates an object with the given map
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
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.

- `getRequestForCreate()`
- `getRequestForDelete()`
- `getRequestForDescribe()`
- `getRequestForDescribeGlobal()`
- `getRequestForMetadata()`
- `getRequestForQuery()`
- `getRequestForResources()`
- `getRequestForRetrieve()`
- `getRequestForSearch()`
- `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.

## 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](#). 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.

## WrappedRestRequest Class

The `WrappedRestRequest` class subclasses the Volley Request class. You don't create `WrappedRestRequest` objects. The `RestClient.sendAsync()` method uses this class to wrap the `RestRequest` object that you passed in and returns it to the caller. You can use this returned object to cancel the request "in flight" by calling the `cancel()` method.

## 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.



Class	Description
<code>TokenRevocationReceiver</code>	This class handles what happens when an administrator revokes a user's refresh token. See <a href="#">Handling Refresh Token Revocation in Android Native Apps</a> .
<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 plugins that access native code. The base class for these Mobile SDK plugins is `ForcePlugin`. If you want to implement your own Javascript plugin 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 plugin with `CordovaPlugin`, then you create a Javascript file that mirrors it. Cordova calls the plugin's `execute()` function when a script calls one of the plugin'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 `native/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
<code>drawable-ldpi</code>	Low resolution; for low-end feature phones
<code>drawable-mdpi</code>	Medium resolution; for low-end smart phones
<code>drawable-xlarge</code>	For tablet screens in landscape orientation
<code>drawable-xlarge-port</code>	For tablet screens in portrait orientation
<code>layout</code>	Generic versions of layouts
<code>layout-land</code>	For landscape orientation
<code>layout-xlarge</code>	For tablet screens
<code>values</code>	Generic styles and values
<code>values-xlarge</code>	For tablet screens

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 plugins for hybrid apps.

## Using REST APIs

To query, describe, create, or update data from a Salesforce org, native apps call Salesforce REST APIs. Salesforce REST APIs honor SOQL strings and can accept and return data in either JSON or XML format. REST APIs are fully documented at [REST API Developer's Guide](#). You can find links to related Salesforce development documentation at the [Force.com developer documentation website](#).

With Android native apps, you do only 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 include:

- `ClientManager`—Serves as a factory for `RestClient` instances. It also handles account logins and handshakes with the Salesforce server. Implemented by the Mobile SDK.
- `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. Implemented by the Mobile SDK.
- `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()`. Implemented by the SDK.
- `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. Implemented by the SDK.

The `RestRequest` class natively handles the standard Salesforce data operations offered by the Salesforce REST and SOAP APIs. Supported operations are:

Operation	Parameters	Description
Versions	None	Returns Salesforce version metadata
Resources	API version	Returns available resources for the specified API version, including resource name and URI
Metadata	API version, object type	
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

Operation	Parameters	Description
Retrieve	API version, object type, object ID, list of fields	Retrieves a record by object ID
Update	API version, object type, object ID, map of field names to value objects	Updates an object with the given map
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
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.

- `getRequestForCreate()`
- `getRequestForDelete()`
- `getRequestForDescribe()`
- `getRequestForDescribeGlobal()`
- `getRequestForMetadata()`
- `getRequestForQuery()`
- `getRequestForResources()`
- `getRequestForRetrieve()`
- `getRequestForSearch()`
- `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.

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.

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) {
            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.

## Android Template App: Deep Dive

The TemplateApp sample project implements everything you need to create a basic 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. You can gain a quick understanding of the native Android SDK by studying this project.

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`. 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);
    }
}
```

The `TemplateApp` class accomplishes two main tasks:

- Calls `initNative()` to initialize the app
- Passes in the app's implementation of `KeyInterface`

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 `MainActivity` class for the Template app extends `com.salesforce.androidsdk.ui.sfnative.SalesforceActivity`. This superclass is the Mobile SDK's basic abstract activity class. `SalesforceActivity`, 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 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) {
            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.

#### **Java Note:**

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` an `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:

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 the `create_native` script 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, using the Android Manifest editor in Eclipse.

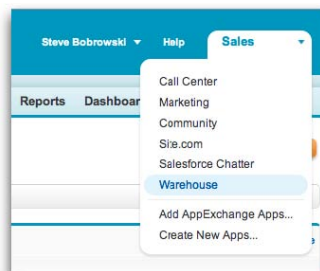
## Tutorial: Creating a Native Android Warehouse Application

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 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.
  - Click the installation URL link: <https://login.salesforce.com/packaging/installPackage.apexp?p0=04ti0000000MMMT>
  - If you aren't logged in already, enter the username and password of your DE org.
  - On the Package Installation Details page, click **Continue**.
  - Click **Next**, and on the Security Level page click **Next**.
  - Click **Install**.
  - Click **Deploy Now** and then **Deploy**.
  - Once the installation completes, you can select the **Warehouse** app from the app picker in the upper right corner.



- To create data, click the **Data** tab.

9. Click the **Create Data** button.

- Install the latest versions of:

- ◊ Java JDK 6.
- ◊ Apache Ant 1.8 or later.
- ◊ Android SDK, version 21 or later—<http://developer.android.com/sdk/installing.html>.



**Note:** For best results, install all previous versions of the Android SDK as well as your target version.

- ◊ Eclipse 3.6 or later. See <http://developer.android.com/sdk/requirements.html> for other versions.
- ◊ Android ADT (Android Development Tools) plugin for Eclipse, version 21 or later—<http://developer.android.com/sdk/eclipse-adt.html#installing>.
- ◊ In order to run the application in the Emulator, you need to set up at least one Android Virtual Device (AVD) that targets Platform 2.2 or above (we recommend 4.0 or above). To learn how to set up an AVD in Eclipse, follow the instructions at <http://developer.android.com/guide/developing/devices/managing-avds.html>.
- ◊ A [Developer Edition organization](#) with a [connected app](#).

- 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](http://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

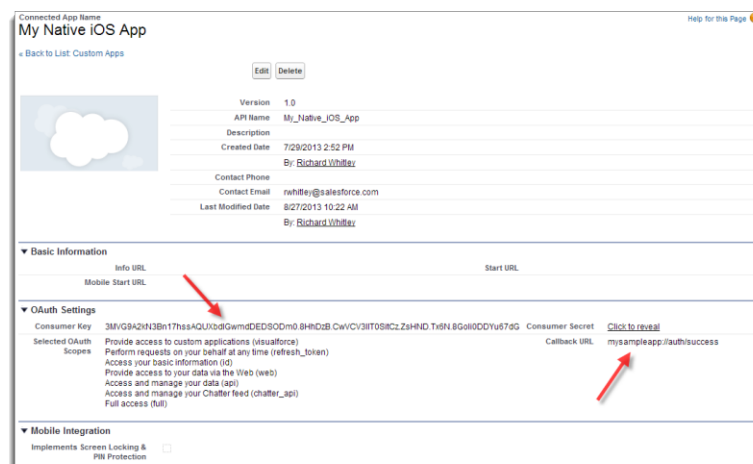
In this step, you learn how to configure a Connected App in Force.com. Doing so authorizes the mobile app you will soon build to communicate securely with Force.com and access Force.com APIs on behalf of users via the industry-standard OAuth 2.0 protocol.

1. In your DE org, click **Your Name** > **Setup** then click **Create** > **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)”, then click **Add**.
  7. Click **Save**.

After you save the configuration, notice the details of the Connected App you just created.

- Note the Callback URL and Consumer Key; you will use these when you set up your native app in the next step.
- Mobile apps do not use the Consumer Secret, so you can ignore this value.



## 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 target directory, enter `tutorial/AndroidNative`.
6. For package name, enter `com.samples.warehouse`.
7. When asked if you want to use SmartStore, press **Return** to accept the default.

## Step 3: Run the New Android App

Now that you’ve successfully created a new Android app, build and run it in Eclipse to make sure that your environment is properly configured.



**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 **Window > Android SDK**

**Manager** in Eclipse. 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 Eclipse

The forcedroid script also prints instructions for running the new app in the Eclipse editor.

1. Launch Eclipse and select `tutorial/AndroidNative` as your workspace directory.
2. Select **Eclipse > Preferences**, choose the **Android** section, and enter the Android SDK location.
3. Click OK.
4. Select **File > Import** and select **General > Existing Projects into Workspace**.
5. Click Next.
6. Specify the `forcedroid/native` directory as your root directory. Next to the list that displays, click **Deselect All**, then browse the list and check the `SalesforceSDK` project.
7. Click **Import**.
8. Repeat Steps 4–8. In Step 6, choose `tutorial/AndroidNative` as the root, then select only your new project.

When you've finished importing the projects, Eclipse automatically builds your workspace. This process can take several minutes. When the status bar reports zero errors, you're ready to run the project.

1. In your Eclipse workspace, Control-click or right-click your project.
2. From the popup menu, choose **Run As > Android Application**.

Eclipse 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 sends it 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 Package Explorer in Eclipse, 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="fill_parent"
    android:layout_height="fill_parent" android:background="#454545"
    android:id="@+id/root">

    <include layout="@layout/header" />

    <ListView android:id="@+id/contacts_list" android:layout_width="fill_parent"
        android:layout_height="fill_parent" />
</LinearLayout>
```

3. Save the file, 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. We can reuse some of this code while customizing the rest to suite our new app.

### 1. Rename `sendRequest()` to `fetchDataForList()`. Replace

```
private void sendRequest(String soql) throws UnsupportedOperationException
```

with

```
private void fetchDataForList()
```

Note that we've removed the `throw` declaration. We'll reinstate it within the method body to keep the exception handling local. We'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. Add the `try...catch` block. 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) {
            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

To test the app, Control-Click the app in Package Explorer and select **Run As > Android Application**. 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="fill_parent"
    android:layout_height="fill_parent"
    android:background="#454545"
    android:orientation="vertical" >

    <include layout="@layout/header" />

    <LinearLayout
        android:layout_width="fill_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="fill_parent"
            android:layout_height="wrap_content"
            android:inputType="text" />
    </LinearLayout>

    <LinearLayout
        android:layout_width="fill_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="fill_parent"
```



```

        android:layout_height="wrap_content"
        android:inputType="numberDecimal" />
    </LinearLayout>

    <LinearLayout
        android:layout_width="fill_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="fill_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, 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.sfnative.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
 */
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 `SOQL` 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()` as follows:

```
public void onSuccess(RestRequest request, RestResponse result) {
    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, we 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 handle for list view
    listView = (ListView) findViewById(R.id.contacts_list);
    listView.setOnItemClickListener(this);

    super.onResume();
}

```

Now we're ready to add the implementation for 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) {
}

```

- 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);
}
```

- 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.

- In the Package Explorer, open `srccom.samples.warehouseDetailActivity.java`.
- In the `onCreate()` method, add code in bold font to 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

- Reopen `detail.xml` and add the following `<Button>` node to the layout.

```
<Button
    android:id="@+id/update_button"
    android:layout_width="fill_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, 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 will 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 to 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) {
            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 Native Sample Applications

Salesforce Mobile SDK includes the following native Android sample applications.

- **RestExplorer** demonstrates the OAuth and REST API functions of the SalesforceSDK. It's also useful for investigating REST API actions from a Honeycomb tablet.
  1. To run the application from your Eclipse workspace, right-click the **RestExplorer** project and choose **Run As > Android Application**.
  2. To run the tests, right-click the **RestExplorerTest** project and choose **Run As > Android JUnit Test**.
- **NativeSqlAggregator** demonstrates SQL aggregation with SmartSQL. As such, it also demonstrates a native implementation of SmartStore. To run the application from your Eclipse workspace, right-click the **NativeSqlAggregator** project and choose **Run As > Android Application**.
- **FileExplorer** demonstrates the Files API as well as the underlying Google Volley networking enhancements. To run the application from your Eclipse workspace, right-click the **FileExplorer** project and choose **Run As > Android Application**.

# Chapter 7

## Introduction to Hybrid Development

---

### In this chapter ...

- [iOS Hybrid Development](#)
- [Android Hybrid Development](#)
- [JavaScript Files for Hybrid Applications](#)
- [Versioning and Javascript Library Compatibility](#)
- [Managing Sessions in Hybrid Applications](#)
- [Example: Serving the Appropriate Javascript Libraries](#)

Hybrid apps combine the ease of HTML5 Web app development with the power and features of the native platform. They run within the Salesforce Mobile Container, a native layer that translates the app into device-specific code.

Hybrid apps depend on HTML and JavaScript files. These files can be stored on the device or on the server.

- **Device**—Hybrid apps developed with the `forcetk.mobilesdk.js` library wrap a Web app inside the Salesforce Mobile Container. In this scenario, the JavaScript and HTML files are stored on the device.
- **Server** — Hybrid apps developed using Visualforce technology store their HTML and JavaScript files on the Salesforce server and are delivered through the Salesforce Mobile Container.

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>).



## iOS Hybrid Development

In order to develop hybrid applications, you'll need to meet some of the prerequisites for both the iOS native and the vanilla HTML5 scenarios.

1. Make sure you meet the requirements for [HTML5 Development](#).
2. Follow the installation instructions for [iOS](#).
3. After installing Mobile SDK for iOS, create a new hybrid app as described in [Creating an iOS Project](#). For the `apptype` parameter:
  - Use `--apptype="hybrid_local"` for a hybrid app with all code in the local project. Put your HTML and JavaScript files in `${target.dir}/assets/www/`.
  - Use `--apptype="hybrid_remote"` for a hybrid app with code in a Visualforce app on the server

## iOS Hybrid Sample Applications

The sample applications contained under the `HybridShared/SampleApps` folder are designed around the [PhoneGap SDK](#). PhoneGap is also known as Cordova. Salesforce Mobile SDK v. 1.4 and later include the Cordova libraries, so no separate installation is required. You can find documentation for the Cordova SDK in the [Getting Started Guide](#).

Inside the `hybrid/SampleApps` folder, you can find sample projects:

- **AccountEditor:** Demonstrates how to use the SmartSync Data Framework to access Salesforce data.
- **HybridFileExplorer:** Demonstrates the Files API.
- **ContactExplorer:** The `ContactExplorer` sample app uses PhoneGap (also known as Cordova) to retrieve local device contacts. It also uses the `forcetk.mobilesdk.js` toolkit to implement REST transactions with the Salesforce REST API. The app uses the OAuth2 support in Salesforce SDK to obtain OAuth credentials, then propagates those credentials to `forcetk.mobilesdk.js` by sending a JavaScript event.
- **VFConnector:** The `VFConnector` sample app demonstrates how to wrap 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, then uses those credentials to set appropriate webview cookies for accessing Visualforce pages.
- **SmartStoreExplorer:** Lets you explore SmartStore APIs.

## Android Hybrid Development

To develop hybrid applications, you'll need to meet some of the prerequisites for both the Android native and the plain HTML5 scenarios.

1. Make sure you meet the requirements for [HTML5 Development](#).
2. Follow the installation instructions for [Android Native](#).
3. After installing Mobile SDK for Android, create a new hybrid app as described in [Creating an Android Project](#). For the `apptype` parameter:
  - Use `--apptype="hybrid_local"` for a hybrid app with all code in the local project. Put your HTML and JavaScript files in `${target.dir}/assets/www/`.
  - Use `--apptype="hybrid_remote"` for a hybrid app with code in a Visualforce app on the server

## Android Hybrid Sample Applications

Inside the `./hybrid` folder, you can find sample projects and related test applications:

- **AccountEditor:** Demonstrates how to use the SmartSync Data Framework to access Salesforce data.
- **SampleApps/HybridFileExplorer:** Demonstrates the Files API.
- **SampleApps/ContactExplorer:** The `ContactExplorer` sample app uses PhoneGap (also known as Cordova) to retrieve local device contacts. It also uses the `forcetk.mobilesdk.js` toolkit to implement REST transactions with the Salesforce REST API. The app uses the OAuth2 support in Salesforce SDK to obtain OAuth credentials, then propagates those credentials to `forcetk.mobilesdk.js` by sending a javascript event.
- **SampleApps/test/ContactExplorerTest:** Tests for the `ContactExplorer` sample app.
- **SampleApps/VFConnector:** The `VFConnector` sample app demonstrates how to wrap 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, then uses those credentials to set appropriate webview cookies for accessing Visualforce pages.
- **SampleApps/test/VFConnectorTest:** Test for the `VFConnector` sample app.
- **SampleApps/SmartStoreExplorer:** Lets you explore SmartStore APIs.
- **SampleApps/test/SmartStoreExplorerTest:** Tests for the `SmartStoreExplorer` sample app.

## JavaScript Files for Hybrid Applications

In Salesforce Mobile SDK 2.0, we've refactored some JavaScript files and added new ones to support SmartSync. JavaScript files reside in the `forcedotcom/SalesforceMobileSDK-Shared` repository on GitHub.

### Refactored JavaScript Files

These files are now collected in the `cordova.force.js` file.

- `SFHybridApp.js`
- `SalesforceOAuthPlugin.js`
- `SmartStorePlugin.js`

### New JavaScript Files

These files are new in Mobile SDK 2.0.

JavaScript File	Description
<code>cordova.force.js</code>	Contains plugins for hybrid apps using the Cordova libraries
<code>SmartSync.js</code>	The SmartSync Data Framework library

### New External Dependencies

Mobile SDK 2.0 introduces new external dependencies.

External JavaScript File	Description
<code>jquery.js</code>	Popular HTML utility library
<code>underscore.js</code>	SmartSync support
<code>backbone.js</code>	SmartSync support

## Which JavaScript Files Do I Include?

Files that you include depend on the type of hybrid project. For each type described here, include all files in the list.

### For basic hybrid apps:

- cordova.js
- cordova.force.js

### To make REST API calls from a basic hybrid app:

- cordova.js
- cordova.force.js
- forcetk.mobilesdk.js

### To use SmartSync in a hybrid app:

- jquery.js
- underscore.js
- backbone.js
- cordova.js
- cordova.force.js
- forcetk.mobilesdk.js
- SmartSync.js

## Versioning and Javascript Library Compatibility

In hybrid applications, client Javascript code interacts with native code through Cordova (formerly PhoneGap) and SalesforceSDK plugins. When you package your Javascript code with your mobile application, your testing assures that the code works with native code. However, when 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 PhoneGap or 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

## Using the User Agent to Find the Mobile SDK Version

Fortunately, you can look up the Mobile SDK version in the user agent. 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 sdinfo Plugin

In Javascript, you can also retrieve the Mobile SDK version and other information by using the `sdinfo` plugin. This plugin, 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 plugins installed in the container. For example: "com.salesforce.oauth", "com.salesforce.smartstore", and so on.

The following code retrieves the information stored in the `sdinfo` plugin and displays it in alert boxes.

```
var sdinfo = cordova.require("salesforce/plugin/sdinfo");
sdinfo.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](#)

## Managing Sessions in Hybrid Applications

Mobile users expect their apps to just work. To help iron out common difficulties that plague many mobile apps, the Mobile SDK uses native containers for hybrid applications. These containers provide seamless authentication and session management by abstracting the complexity of web session management. 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.

Mobile SDK 1.4 begins to transition hybrid apps away from predefined, proactive session management to more flexible, reactive session management. Rather than letting the hybrid container automatically control the session, developers can participate in the management by responding to session events. This change gives developers more control over managing sessions in the Salesforce Touch Platform.

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	Proactive Behavior in SDK 1.3 and Earlier	Reactive Behavior in SDK 1.4	Steps for Upgrading Code
REST API	Background session refresh	Refresh from JavaScript	No change for forcetk.mobilesdk.js. For other frameworks, add refresh code.
JavaScript Remoting in Visualforce	Restart app	Refresh session and CSRF token from JavaScript	Catch timeout, then either reload page or load a new iFrame.
jQuery Mobile	Restart app	Reload page	Catch timeout, then reload page.

These sections provide detailed coding steps for each architecture.

## REST APIs (Including Apex2REST)

If you're writing or upgrading a hybrid app that leverages REST APIs, detect an expired session and request a new access token at the time the REST call is made. We encourage authors of apps based on this framework to leverage API wrapping libraries, such as forcetk.mobilesdk.js, to manage session retention.

The following code, from `index.html` in the ContactExplorer sample application, demonstrates the recommended technique. When the application first loads, call `getAuthCredentials()` on the Salesforce OAuth plugin, passing the handle to your refresh function (in this case, `salesforceSessionRefreshed`.) The OAuth plugin function calls your refresh function, passing it the session and refresh tokens. Use these returned values to initialize forcetk.mobilesdk.

- From the `onDeviceReady()` function:

```
cordova.require("salesforce/plugin/oauth").getAuthCredentials(salesforceSessionRefreshed,
getAuthCredentialsError);
```

- `salesforceSessionRefreshed()` function:

```
function salesforceSessionRefreshed(credsData) {
    forcetkClient = new forcetk.Client(credsData.clientId, credsData.loginUrl);
    forcetkClient.setSessionToken(credsData.accessToken, apiVersion,
credsData.instanceUrl);
    forcetkClient.setRefreshToken(credsData.refreshToken);
    forcetkClient.setUserAgentString(credsData.userAgent);
}
```

For the complete code, see the ContactExplorer sample application (SalesforceMobileSDK-Android\hybrid\SampleApps\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. You can 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 developers:* Reloading the entire page might not provide the optimal user experience. If you want 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

In `hasSessionExpired()`, instead of fully reloading the page as follows:

```
window.location.reload();
```

Do something like this:

```
// Refresh oauth token  
cordova.require("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  
    <provider>.refresh(function() {  
      <Retry call for a seamless user experience>;  
    });  
  },  
  function(error) {  
    console.log("Refresh failed");  
  }  
);
```

## JQuery Mobile

jQueryMobile makes Ajax calls to transfer data for rendering a page. If a session expires, a 302 error is masked by the framework. To recover, incorporate the following code to force a page refresh.

```
$(document).on('pageloadfailed', function(e, data) {  
  console.log('page load failed');
```

```

    if (data.xhr.status == 0) {
        // reloading the VF page to initiate authentication
        window.location.reload();
    }
});

```

## 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 additional 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, click **Develop** > **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.



# Chapter 8

## HTML5 Development

---

### In this chapter ...

- [HTML5 Development Requirements](#)
- [Delivering HTML5 Content With Visualforce](#)
- [Accessing Salesforce Data: Controllers vs. APIs](#)

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.

You can create an HTML5 application that leverages the Force.com platform by:

- Using Visualforce to deliver the HTML content.
- Using JavaScript remoting to invoke Apex controllers for fetching records from Force.com.

## HTML5 Development Requirements

- You'll need a Force.com organization.
- Some knowledge of Apex and Visualforce is necessary.



**Note:** This type of development uses Visualforce. You can't use Database.com.

## 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 `forcetk.mobilesdk.js`.

### Using JavaScript Remoting to Invoke Your Apex Controller

Like `apex:actionFunction`, [JavaScript remoting](#) lets you invoke methods in your Apex controller through JavaScript code hosted on your Visualforce page.

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 [http://www.salesforce.com/us/developer/docs/apexcode/Content/apex\\_classes\\_annotation\\_RemoteAction.htm](http://www.salesforce.com/us/developer/docs/apexcode/Content/apex_classes_annotation_RemoteAction.htm) to learn more about `@RemoteAction` annotations.

## Accessing the Salesforce API with ForceTK and jQuery

The following code sample uses the jQuery Mobile library for the user interface. To run this code, your Visualforce page must include jQuery and the ForceTK library. To add these resources:

1. Create an archive file, such as a ZIP file, that contains `app.js`, `forcetk.mobilesdk.js`, `jquery.js`, and any other static resources your project requires.
2. In Salesforce, upload the archive file via **Your Name > App Setup > Develop > Static Resources**.

After obtaining an instance of the jQuery Mobile library, the sample code creates a ForceTK client object and initializes it with a session ID. It then calls the asynchronous ForceTK `query()` method to process a SOQL query. The query callback function uses jQuery Mobile to display the first Name field returned by the query as HTML in an object with ID “accountname.” At the end of the Apex page, the HTML5 content defines the `accountname` element as a simple `<span>` tag.

```
<apex:page>
<apex:includeScript value="{!URLFOR($Resource.static, 'jquery.js')}" />
<apex:includeScript value="{!URLFOR($Resource.static, 'forcetk.mobilesdk.js')}" />
<script type="text/javascript">
    // Get a reference to jQuery that we can work with
    $j = jQuery.noConflict();

    // Get an instance of the REST API client and set the session ID
    var client = new forcetk.Client();
    client.setSessionToken('{!$Api.Session_ID}');

    client.query("SELECT Name FROM Account LIMIT 1", function(response){
        $j('#accountname').html(response.records[0].Name);
    });
</script>
<p>The first account I see is <span id="accountname"></span>.</p>
</apex:page>
```



### Note:

- Using the REST API—even from a Visualforce page—consumes API calls.
- SalesforceAPI 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 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 Force.com offline.

- <http://blogs.developerforce.com/developer-relations/2011/06/using-html5-offline-with-forcecom.html>
- <http://blogs.developerforce.com/developer-relations/2013/03/using-javascript-with-force-com.html>

# Chapter 9

## Files and Networking

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Mobile SDK 2.1 introduces an API for files and networking. This API includes two levels of technology. For file management, the SDK provides a set of convenience methods that wraps the file requests in the Chatter REST API. Under the REST API wrapper level, a networking layer exposes objects that let the app control pending REST requests. Together, these two sides of the same coin give the SDK a more robust feature set as well as enhanced networking performance.

## Architecture

Beginning with Mobile SDK 2.1, the Android REST request system uses Google Volley, an open-source external library, as its underlying architecture. This architecture allows you to access the `Volley QueueManager` object to manage requests. At runtime you can use the `QueueManager` to cancel pending requests on asynchronous threads. You can learn about Volley at <https://developers.google.com/events/io/sessions/325304728>

In iOS, file management and networking rely on the `SalesforceNetworkSDK` library. All REST API call—for files as well as any other REST requests—go through this library. The `SalesforceNetworkSDK` library itself implements `MKNetworkKit`, a popular open source library.



**Note:** If you directly accessed the `RestKit` library in old versions of your Mobile SDK iOS app, you'll need to update that code to use the `MKNetworkKit` library.

Hybrid JavaScript functions use the architecture of the Mobile SDK for the device operating system (Android or iOS) to implement file operations. These functions are defined in `forcetk.mobilesdk.js`.

## Downloading Files and Managing Sharing

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 2.1 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.

## Managing the Request Queue

The `RestClient` class internally uses an instance of the `Volley RequestQueue` class to manage REST API requests. 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.

### Example: Canceling All Pending Requests

The following code calls `getRequestQueue()` on an instance of `RestClient` (`client`). It then calls the `RequestQueue.cancelAll()` method to cancel all pending requests in the queue. The `cancelAll()` method accepts a

`RequestFilter` parameter, so the code passes in an object of a custom class, `CountingFilter`, which implements the `Volley RequestFilter` interface.

```
CountingFilter countingFilter = new CountingFilter();
client.getRequestQueue().cancelAll(countingFilter);
int count = countingFilter.getCancelCount();
...

/**
 * Request filter that cancels all requests and also counts the number of requests canceled
 *
 */
class CountingFilter implements RequestFilter {

    private int count = 0;

    public int getCancelCount() {
        return count;
    }

    @Override
    public boolean apply(Request<?> request) {
        count++;
        return true;
    }
}
```

`RequestQueue.cancelAll()` lets the `RequestFilter`-based object inspect each item in the queue before allowing the operation to continue. Internally, `cancelAll()` calls the filter's `apply()` method on each iteration. If `apply()` returns true, the cancel operation continues. If it returns false, `cancelAll()` does not cancel that request and continues to the next request in the queue.

In this code example, the `CountingFilter.apply()` merely increments an internal counter on each call. After the `cancelAll()` operation finishes, the sample code calls `CountingFilter.getCancelCount()` to report the number of canceled objects.

## FileRequests Methods

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 **Chatter REST API Resources > FilesResources** at <http://www.salesforce.com/us/developer/docs/chatterapi>.

### ownedFilesList Method

Generates a request that retrieves a list of files 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	An ID of an existing user. If null, the ID of the context (currently logged in) user is used.



Name	Type	Description
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 Method

Generates a request that retrieves a list of files owned by groups that include the specified user.

#### Signature

```
public static RestRequest filesInUsersGroups(String userId, Integer pageNum);
```

#### Parameters

Name	Type	Description
userId	String	An ID of an existing user. If null, the ID of the context (currently 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 Method

Generates a request that retrieves a list of files shared with the specified user.

#### Signature

```
public static RestRequest filesSharedWithUser(String userId, Integer pageNum);
```

#### Parameters

Name	Type	Description
userId	String	An ID of an existing user. If null, the ID of the context (currently 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 Method**

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	An ID of an existing file. If null, <code>IllegalArgumentException</code> is thrown.
version	String	The version to fetch. If null, fetches the most recent version.

**Example**

```
String id = <some_file_id>;
RestRequest request = FileRequests.fileDetails(id, null);
```

**batchFileDetails Method**

Generates a request that can fetch details of multiple files.

**Signature**

```
public static RestRequest batchFileDetails(List sfdcIds);
```

**Parameters**

Name	Type	Description
sfdcIds	List	A list of IDs of one or more existing 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 Method**

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 an existing file to be rendered. If null, <code>IllegalArgumentException</code> is thrown.
version	String	The version to fetch. If null, fetches the most recent version.
renditionType	RenditionType	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.
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 Method**

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
sfdcId	String	ID of an existing file to be rendered. If null, <code>IllegalArgumentException</code> is thrown.
version	String	The version to fetch. If null, fetches the most recent version.

### Example

```
String id = <some_file_id>;  
RestRequest request = FileRequests.fileContents(id, null);
```

### fileShares Method

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
sfdcId	String	ID of an existing file to be rendered. If null, <code>IllegalArgumentException</code> is thrown.
pageNum	Integer	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 Method

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
fileId	String	ID of an existing file to be shared. If null, <code>IllegalArgumentException</code> is thrown.
entityId	String	ID of an existing user or group with whom to share the file. If null, <code>IllegalArgumentException</code> is thrown.
shareType	String	The 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 Method

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 an existing file share to be deleted. If null, <code>IllegalArgumentException</code> is thrown.

### Example

```
String id = <some_fileShare_id>;
RestRequest request = FileRequests.deleteFileShare(id);
```

### uploadFile 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

```
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.
mimeType	String	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");
```

## 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.

### iOS Project Settings

If you're updating Salesforce Mobile SDK apps built prior to Mobile SDK 2.1, you'll need to adjust your project settings for all targets to include the `SalesforceNetworkSDK` library.

1. Download the `MKNetworking` library bundled with Mobile SDK 2.1. Get the binary libraries and their headers from compressed files at <https://github.com/forcedotcom/SalesforceMobileSDK-iOS-Distribution>.
2. Link the following modules in your project:

- `libMKNetworkKit-iOS.a`
- `libSalesforceNetworkSDK.a`
- `ImageIO.framework`

The Files API also requires the following frameworks which are normally linked by default:

- `CFNetwork.framework`
- `SystemConfiguration.framework`
- `Security.framework`

### REST Responses and Multithreading

The networking 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.

## Managing Requests

`MKNetworkKit`, the underlying networking architecture for the iOS Mobile SDK, uses two key objects: `MKNetworkEngine` and `MKNetworkOperation`. The Salesforce Network SDK for iOS in turn defines two primary objects, `SFNetworkEngine` and `SFNetworkOperation`, that wrap the corresponding `MKNetworkKit` objects. `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;
```

## 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];
}
```

## SFRestAPI (Files) Category Request Methods

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 this 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: Method**

Generates a request that retrieves a list of files owned by the specified user. Returns one page of results.

#### Signature

```
- (SFRestRequest *)
  requestForOwnedFilesList:(NSString *)userId
                    page:(NSUInteger)page;
```

**Parameters**

Name	Type	Description
userId	NSString *	An ID of an existing user. If nil, the ID of the context (currently 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] requestForOwnedFilesList:nil
                                     page:0];
```

**requestForFilesInUsersGroups:page: Method**

Generates a request that retrieves a list of files owned by groups that include the specified user.

**Signature**

```
- (SFRestRequest *)
requestForFilesInUsersGroups:(NSString *)userId
                        page:(NSUInteger)page;
```

**Parameters**

Name	Type	Description
userId	NSString *	An ID of an existing user. If nil, the ID of the context (currently 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: Method**

Generates a request that retrieves a list of files shared with the specified user.

**Signature**

```
- (SFRestRequest *)
requestForFilesSharedWithUser:(NSString *)userId
                        page:(NSUInteger)page;
```



### Parameters

Name	Type	Description
userId	NSString *	An ID of an existing user. If nil, the ID of the context (currently 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: Method

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
sfdcId	NSString *	An ID of an existing file. If nil, the request fails.
version	NSString *	The 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: Method

Generates a request that can fetch details of multiple files.

#### Signature

```
- (SFRestRequest *)  
    requestForBatchFileDetails:(NSArray *)sfdcIds;
```

**Parameters**

Name	Type	Description
sfdcIds	NSArray *	An array of IDs of one or more existing files. IDs are expressed as strings.

**Example**

```
NSArray *ids = [NSArray arrayWithObject:@"id1",@"id2",...,nil];
SFRestRequest *request =
    [[SFRestAPI sharedInstance] requestForBatchFileDetails:ids];
```

**requestForFileRendition:version:renditionType:page: Method**

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
sfdcId	NSString *	ID of an existing file to be rendered. If nil, the request fails.
version	NSString *	The version to fetch. If nil, fetches the most recent version.
renditionType	NSString *	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 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: Method**

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 an existing file to be rendered. If nil, the request fails.
version	NSString *	The 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: Method**

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 an existing 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 an existing file to be shared. If nil, the request fails.
entityId	NSString *	ID of an existing user or group with whom to share the file. If nil, the request fails.
shareType	NSString *	The 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: Method**

Generates a request that can delete the specified file share.

**Signature**

```
- (SFRestRequest *)
  requestForDeleteFileShare:(NSString *)shareId;
```

**Parameters**

Name	Type	Description
shareId	NSString *	ID of an existing 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"];
```

## Using Files in Hybrid Apps

Except for uploading, you can use the same file requests in hybrid apps as in native apps. Hybrid file request wrappers reside in the `forcetk.mobilesdk.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 `forcetk.mobilesdk.js` libraries to build your HTML app. The `HybridFileExplorer` sample app demonstrates this.



**Note:** Mobile SDK does not support file uploads in hybrid apps.

## Files Methods For Hybrid Apps

Hybrid methods for the Files API reside in the `forcetk.mobilesdk.js` library. Examples in the following reference topics assume that you've declared a local `ftkclient` variable, such as:

```
var ftkclient = new forcetk.Client(creds.clientId, creds.loginUrl, creds.proxyUrl, reauth);
```



**Note:** In `SmartSync.js`, the `forcetk.Client` object is wrapped as `Force.forcetkClient`. You're free to use either client in a SmartSync app. However, REST API methods called on `Force.forcetkClient` differ from their `forcetk.Client` cousins in that they return JavaScript promises. If you use `Force.forcetkClient`, reformat the examples that require success and error callbacks in the following manner:

```
Force.forcetkClient.ownedFilesList(null, null)
  .done(function(response) { /* do something with the returned JSON data */ })
  .fail(function(error) { alert("Error!"); });
```

## ownedFilesList Method

Returns a page from the list of files owned by the specified user.

### Signature

```
forcetk.Client.prototype.
ownedFilesList =
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

```
ftkclient.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

```
forcetk.Client.prototype.
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

```
ftkclient.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

```
forcetk.Client.prototype.  
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

```
ftkclient.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

```
forcetk.Client.prototype.  
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

```
ftkclient.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

```
forcetk.Client.prototype.  
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

```
ftkclient.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

```
forcetk.Client.prototype.  
fileRenditionPath =  
  function(fileId, version, renditionType,  
    page)
```

### Parameters

Name	Description
fileId	ID of an existing file to be rendered. If null, an error is returned.
version	The version to fetch. If null, fetches the most recent version.
renditionType	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.
page	Zero-based index of the page to be fetched. If null, fetches the first page.

### Example

```
ftkclient.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

```
forcetk.Client.prototype.  
fileContentsPath =  
function(fileId, version)
```

### Parameters

Name	Description
fileId	ID of an existing file to be rendered. If null, an error is returned.
version	The version to fetch. If null, fetches the most recent version.

### Example

```
ftkclient.fileContentsPath(id, null);
```

## fileShares Method

Returns a page from the list of entities that share this file.

### Signature

```
forcetk.Client.prototype.  
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

```
ftkclient.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

```
forcetk.Client.prototype.  
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.

Name	Description
callback	A function that receives the server response asynchronously and handles it.
error	A function that handles server errors.

### Example

```
ftkclient.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

```
forcetk.Client.prototype.
deleteFileShare =
function(sharedId, callback, error)
```

### Parameters

Name	Description
shareId	ID of an existing file share to be deleted. If null, <code>IllegalArgumentException</code> is thrown.
callback	A function that receives the server response asynchronously and handles it.
error	A function that handles server errors.

### Example

```
ftkclient.deleteFileShare(id,
    function(response){ /* do something with the returned JSON data */},
    function(error){ alert("Error!");}
);
```

## Chapter 10

# Using SmartSync to Access Salesforce Objects

---

### In this chapter ...

- [About Backbone Technology](#)
- [Models and Model Collections](#)
- [Using the SmartSync Data Framework in JavaScript](#)
- [Offline Caching](#)
- [Conflict Detection](#)
- [Accessing Custom API Endpoints](#)
- [Tutorial: Creating a SmartSync Application](#)
- [SmartSync Sample Apps](#)

The SmartSync Data Framework is a Mobile SDK library that represents Salesforce objects as JavaScript objects. Using SmartSync in a hybrid app, you can 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.

Underlying the SmartSync technology is the `backbone.js` open-source JavaScript library. `Backbone.js` defines an extensible mechanism for modeling data. To understand the basic technology behind the SmartSync Data Framework, browse the examples and documentation at [backbonejs.org](http://backbonejs.org).

Three sample hybrid applications demonstrate SmartSync.

- Account Editor (`AccountEditor.html`)
- User Search (`UserSearch.html`)
- User and Group Search (`UserAndGroupSearch.html`)

You can find these sample apps in the

`./hybrid/SampleApps/AccountEditor/assets/www` folder.

## About Backbone Technology

The SmartSync 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 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, 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 in JavaScript

To use SmartSync in a hybrid app, include:

- `jquery-x.x.x.min.js` (use version of file in `external/shared/jquery/`)
- `underscore-x.x.x.min.js` (use version of file in `external/shared/backbone/`)
- `backbone-x.x.x.min.js` (use version of file in `external/shared/backbone/`)
- `cordova.js`
- `cordova.force.js`
- `forcetk.mobilesdk.js`
- `SmartSync.js`

**Implementing a Model Object**

To begin using SmartSync 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—`objectType` and `fieldlist`—and defines a `cacheMode()` function.

```
app.models.Account = Force.SObject.extend({
  objectType: "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 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 provides a configurable mechanism that gives you full control over caching operations.

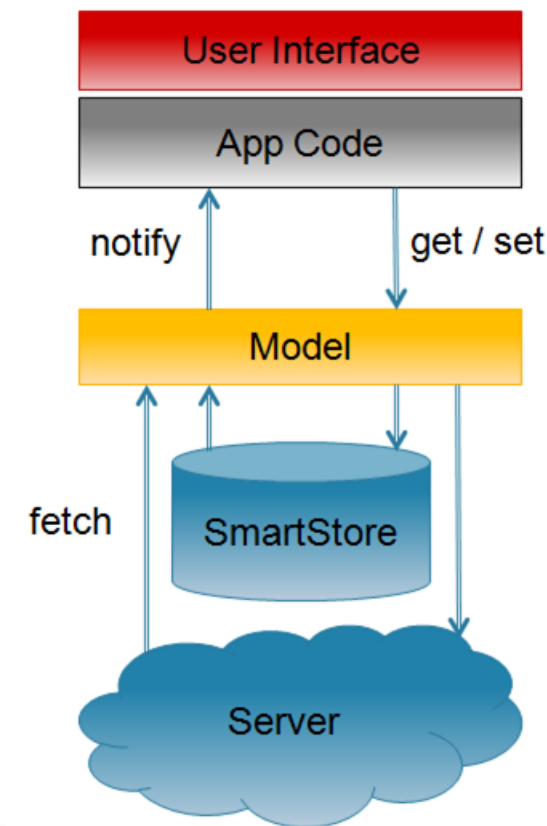
### Default Cache and Custom Cache Implementations

For its default cache, the SmartSync library defines StoreCache, a cache implementation that uses SmartStore. Both StoreCache and SmartStore are optional components for SmartSync 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 requires cache objects to support these operations:

- retrieve
- save
- save all
- remove
- find

### SmartSync Caching Workflow

The SmartSync 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 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"	Force.CACHE_MODE.CACHE_ONLY	Read from, or write to, the cache. Do not perform the operation on the server.
"server-only"	Force.CACHE_MODE.SERVER_ONLY	Read from, or write to, the server. Do not perform the operation on the cache.
"cache-first"	Force.CACHE_MODE.CACHE_FIRST	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" (default)	Force.CACHE_MODE.SERVER_FIRST	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 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 uses `StoreCache` as its default cache, `StoreCache` is a stand-alone component. Even if you don't use SmartSync, you can still leverage `StoreCache` for SmartStore operations.



**Note:** Although `StoreCache` is intended for use with SmartSync, you can use any cache mechanism with SmartSync 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. 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 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
overwrite	<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.)
merge-accept-yours	<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.
merge-fail-if-conflict	<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.
merge-fail-if-changed	<code>Force.MERGE_MODE.MERGE_FAIL_IF_CHANGED</code>	Merge "theirs" and "yours". If any field is changed remotely, the operation fails.

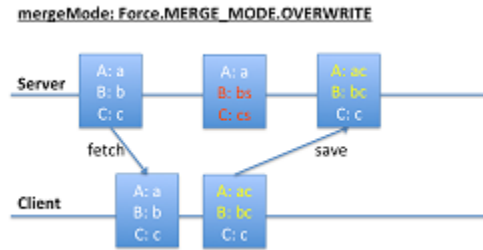
If a save or delete operation fails, you receive a report object with the following fields:

Field Name	Contains
base	Originally fetched attributes
theirs	Latest server attributes
yours	Locally modified attributes
remoteChanges	List of fields changed between base and theirs
localChanges	List of fields changed between base and yours
conflictingChanges	List of fields changed both in theirs and yours, with different values

Diagrams can help clarify how merge modes operate.

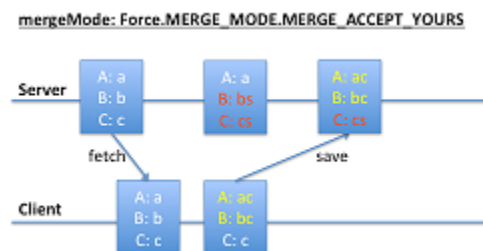
### **MERGE\_MODE.OVERWRITE**

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.



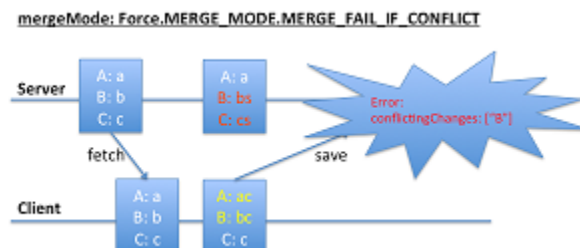
## MERGE\_ACCEPT\_YOURS

In the `MERGE_MODE.MERGE_ACCEPT_YOURS` diagram, the client changes A and B, and the server changes B and C. Client changes (A and B) overwrite corresponding fields on the server, regardless of whether conflicts exist. However, fields that the client leaves unchanged (C) do not overwrite corresponding server values.



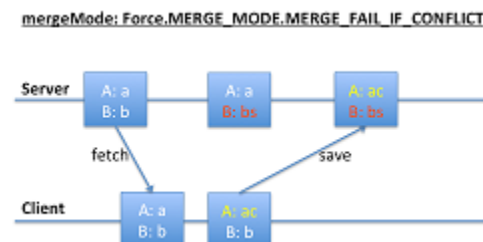
## MERGE\_FAIL\_IF\_CONFLICT (Fails)

In the first `MERGE_MODE.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 Force.com 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 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 Force.com 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

The `HybridFileExplorer` sample application is a SmartSync 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 `forcetk.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.forcetkClient.fileDetails(id, null);
  }
});
```

```
    }
  })
}
```

## Force.RemoteObjectCollection Class

To support collections of fetched objects, SmartSync 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 Force.com REST API to run SOQL/SOSL and MRU queries. If you want to use arbitrary server end points, 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

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.forcetkClient.ownedFilesList("me", 0);
        break;
      case "filesInUsersGroups": fetchPromise =
        Force.forcetkClient.filesInUsersGroups("me", 0);
        break;
      case "filesSharedWithUser": fetchPromise =
        Force.forcetkClient.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
                        forcetkClient.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 `sobjectType`, `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

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, 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:"&lt;valid id&gt;"})
acc2.fetch();

```

You can delete a "simple account".

```

acc.destroy();

```



**Note:** In SmartSync 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

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, 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 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");}});
```

## Using External Objects (Beta)



**Note:** Any unreleased services or features referenced in this or other press releases or public statements are not currently available and may not be delivered on time or at all. Customers who purchase our services should make their purchase decisions based upon features that are currently available.

### About External Objects (Beta)

If you have data stored outside of Salesforce, you might need to use it with data inside your organization. For example, you might need to access inventory information that resides in an external database to more easily reconcile your stock. Salesforce lets you connect to an external data source from within your organization, access the data you want, create an external object for the data, and make it accessible to specific users from a tab. You can learn more about defining external objects at [http://help.salesforce.com/apex/HTViewHelpDoc?id=external\\_object\\_manage.htm](http://help.salesforce.com/apex/HTViewHelpDoc?id=external_object_manage.htm).



**Note:** The Salesforce API only lets you read external objects. CRUD operations are not supported.

### Accessing External Objects (Beta) in Mobile SDK Apps

To access an external object with Mobile SDK, use `SmartSync.js`. Create an instance of either `Force.SObject` itself or a subclass of `Force.SObject`. Configure this instance as follows:

- Set `idAttribute` to "ExternalId".
- If you use a cache, set `idField` to "ExternalId".

### Example: Fetch an External Object Using SmartSync

The following JavaScript example accesses an external object named `Categories__x` with a field named `CategoryName__c` by extending `Force.SObject`.

1. Set up a cache using `StoreCache`.

```
var cache = new Force.StoreCache("categories",
    ["CategoryName__c"], "ExternalId");
cache.init();
```

2. Create a `Force.SObject` subclass to represent `Categories__x` objects on the client. Set `idAttribute` to "ExternalId", and pass in `cache` to enable caching.

```
var Category = Force.SObject.extend({
    objectType:"Categories__x",
    idAttribute:"ExternalId",
    fieldlist:["CategoryName__c"],
    cache:cache});
```

3. Create an instance of `Category` that can fetch an external object whose external ID is “1”, then fetch that object.

```
var cat = new Category({"ExternalId": "1"});
cat.fetch();
```

4. Retrieve the fetched object from the cache:

```
var cat1 = cache.retrieve("1");
```

### Example: Fetch a Collection of External Objects Using SmartSync

You can also use a `Force.SObjectCollections` object to represent a collection of `Category` objects on the client.

1. Create a subclass of `Force.SObjectCollection`.

```
var Categories = Force.SObjectCollection.extend({model:Category, cache:cache});
```

2. Fetch `Categories__x` objects by running a SOQL query.

```
var categories = new Categories();
categories.fetch({config:{
  type:"soql",
  query:"SELECT ExternalId, CategoryName__c
        FROM Categories__x"}
});
```

3. Retrieve the fetched object whose external ID is “2” from the collection within the cache.

```
var cat2 = cache.retrieve("2");
```

## Tutorial: Creating a SmartSync Application

This tutorial demonstrates how to create a local hybrid app that uses the SmartSync Data Framework. It recreates the User Search sample application that ships with Mobile SDK 2.0. User Search 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

## Set Up Your Project

First, make sure you’ve installed Salesforce Mobile SDK using the NPM installer. For iOS instructions, see [iOS Installation](#). For Android instructions, see [Android Installation](#).

Also, download the `ratchet.css` file from <http://maker.github.io/ratchet/>.

1. Once you’ve installed Mobile SDK, create a local hybrid project for your platform.



- a. For **iOS**: At the command terminal, enter the following command:

```
forceios create --apptype=hybrid_local
--appname=UserSearch --companyid=com.acme.UserSearch
--organization=Acme --outputdir=.
```

The forceios script creates your project at `./UserSearch/UserSearch.xcode.proj`.

- b. For **Android**: At the command terminal or the Windows command prompt, enter the following command:

```
forcedroid create --apptype="hybrid_local"
--appname="UserSearch" --targetdir=.
--packagename="com.acme.usersearch"
```

The forcedroid script creates the project at `./UserSearch`.

2. Follow the onscreen instructions to open the new project in Eclipse (for Android) or Xcode (for iOS).
3. Open the `www` folder.
4. Remove the `inline.js` file from the project.
5. Create a new folder. Name it `css`.
6. Copy the `ratchet.css` file into your new `css` folder.
7. In the `www` folder, open `index.html` in your code editor and delete all of 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. In Xcode, edit `index.html` and add the following basic structure:

```
<!DOCTYPE html>
<html>
  <head>
  </head>
  <body>
  </body>
</html>
```

2. In the `<head>` element:

- a. 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;" />
```

- b. Set the content type.

```
<meta http-equiv="Content-type" content="text/html; charset=utf-8">
```

- c. Add a link to the `ratchet.css` file to provide the mobile look:

```
<link rel="stylesheet" href="css/ratchet.css"/>
```

- d. Include the necessary JavaScript files.

```
<script src="jquery/jquery-2.0.0.min.js"></script>
<script src="backbone/underscore-1.4.4.min.js"></script>
```

```
<script src="backbone/backbone-1.0.0.min.js"></script>
<script src="cordova-2.3.0.js"></script>
<script src="forcetk.mobilesdk.js"></script>
<script src="cordova.force.js"></script>
<script src="SmartSync.js"></script>
```

3. Now let's start adding content to the body. In the `<body>` block, add a `div` tag to contain the app UI.

```
<body>
<div id="content"></div>
```

It's good practice to keep your objects and classes in a namespace. In this sample, we use the app namespace to contain our models and views.

4. In a `<script>` tag, create an application namespace. Let's call it app.

```
<script>
var app = {
  models: {},
  views: {}
}
```

For the remainder of this procedure, continue adding your code in the `<script>` block.

5. Add an event listener and handler to wait for jQuery, and then call Cordova to start the authentication flow. Also, specify a callback function, `appStart`, to handle the user's credentials.

```
jQuery(document).ready(function() {
  document.addEventListener("deviceready", onDeviceReady, false);
});

function onDeviceReady() {
  cordova.require("salesforce/plugin/oauth").
    getAuthCredentials(appStart);
}
```

Once the application has initialized and authentication is complete, the Salesforce OAuth plugin calls `appStart()` and passes it the user's credentials. The `appStart()` function passes the credentials to SmartSync by calling `Force.init()`, which initializes SmartSync. The `appStart()` function also creates a Backbone Router object for the application.

6. Add the `appStart()` function definition at the end of the `<script>` block.

```
function appStart(creds) {
  Force.init(creds, null, null,
    cordova.require("salesforce/plugin/oauth").forcetkRefresh);
  app.router = new app.Router();
  Backbone.history.start();
}
```

Here's the complete application to this point.

```
<!DOCTYPE html>
<html>
<head>
  <meta name="viewport" content="width=device-width, initial-scale=1.0,
    maximum-scale=1.0; user-scalable=no" />
  <meta http-equiv="Content-type" content="text/html; charset=utf-8">
  <link rel="stylesheet" href="css/ratchet.css"/>
  <script src="jquery/jquery-2.0.0.min.js"></script>
  <script src="backbone/underscore-1.4.4.min.js"></script>
  <script src="backbone/backbone-1.0.0.min.js"></script>
  <script src="cordova-2.3.0.js"></script>
```

```

<script src="forcetk.mobilesdk.js"></script>
<script src="cordova.force.js"></script>
<script src="SmartSync.js"></script>
</head>
<body>
  <div id="content"></div>
  <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"></ul>
    </div>
  </script>

  <script id="user-list-item" type="text/template">
    
    <div class="details-short">
      <b><%= FirstName %> <%= LastName %></b><br/>
      Title<%= Title %>
    </div>
  </script>

  <script>
  var app = {
    models: {},
    views: {}
  };

  jQuery(document).ready(function() {
    document.addEventListener("deviceready", onDeviceReady, false);
  });

  function onDeviceReady() {
    cordova.require("salesforce/plugin/oauth").
      getAuthCredentials(appStart);
  }

  function appStart(creds) {
    console.log(JSON.stringify(creds));
    Force.init(creds, null, null,
      cordova.require("salesforce/plugin/oauth").forcetkRefresh);
    app.router = new app.Router();
    Backbone.history.start();
  }
  </script>
</body>
</html>

```

## Create a SmartSync Model and a Collection

Now that we've configured the HTML infrastructure, let's get started using SmartSync 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 model object for the Salesforce User `sObject`. Extend `Force.SObject` to 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"]
});
```

2. Immediately after setting the User object, create a collection to hold user search results. Extend `Force.SObjectCollection` to indicate your new model (`app.models.User`) as the model for items in the collection.

```
app.models.UserCollection = Force.SObjectCollection.extend({
  model: app.models.User
});
```

Here's the complete model code.

```
// Models
app.models.User = Force.SObject.extend({
  objectType: "User",
  fieldlist: ["Id", "FirstName", "LastName", "SmallPhotoUrl", "Title", "Email",
    "MobilePhone", "City"]
});

app.models.UserCollection = Force.SObjectCollection.extend({
  model: app.models.User
});
```

## Create a Template

Templates let you describe an HTML layout within another HTML page. You can define an inline template in your HTML page by using a `<script>` tag of type `"text/template"`. Your JavaScript code can use the template as 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.

1. Add a new script block. Place the block within the `<body>` block just 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"></ul>
  </div>
</script>
```

## Add the Search View

To create the view for a screen, you extend `Backbone.View`. In the search view extension, you load the template, define sub-views and event handlers, and implement the functionality for rendering the views and performing a SOQL search query.

1. In the `<body>` block, 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.

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. Instantiate a sub-view named `UserListView` to contain the list of search results. (You'll define the `app.views.UserListView` view later.)

```
initialize: function() {
    this.listView = new app.views.UserListView({model: this.model});
},
```

4. Create a `render()` function for the search page view. Rendering the view consists simply of loading the template as the app's HTML content. Restore any criteria previously typed in the search field and render the sub-view inside the `<ul>` element.

```
render: function(eventName) {
    $(this.el).html(this.template());
    $(".search-key", this.el).val(this.model.criteria);
    this.listView.setElement($(".ul", this.el)).render();
    return this;
},
```

5. Add a `keyup` event handler that performs a search when the user types a character in the search field.

```
events: {
    "keyup .search-key": "search"
},

search: function(event) {
    this.model.criteria = $(".search-key", this.el).val();
    var soql = "SELECT Id, FirstName, LastName, SmallPhotoUrl, Title FROM User WHERE Name like '" + this.model.criteria + "%' ORDER BY Name LIMIT 25 ";
    this.model.fetch({config: {type:"soql", query:soql}});
}
```

This function defines a SOQL query. It then uses the backing model to send that query to the server and fetch the results.

Here's the complete extension.

```
app.views.SearchPage = Backbone.View.extend({
    template: _.template($("#search-page").html()),

    initialize: function() {
        this.listView = new app.views.UserListView({model: this.model});
    },
```

```

render: function(eventName) {
  $(this.el).html(this.template());
  $(".search-key", this.el).val(this.model.criteria);
  this.listView.setElement($(".ul", this.el)).render();
  return this;
},

events: {
  "keyup .search-key": "search"
},

search: function(event) {
  this.model.criteria = $(".search-key", this.el).val();
  var soql = "SELECT Id, FirstName, LastName, SmallPhotoUrl, Title FROM User WHERE
Name like '" + this.model.criteria + "%' ORDER BY Name LIMIT 25 ";
  this.model.fetch({config: {type:"soql", query:soql}});
}
});

```

## 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 keeps track of these views in the `listItemViews` member. If the underlying collection changes, it renders itself again.

1. In the `<body>` block, create the view for the search result list by extending `Backbone.View`. Let's add an array for list item views as well as 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 to clean up any existing list item views by calling `close()` on each one.

```

render: function(eventName) {
  _.each(this.listItemViews, function(itemView) { itemView.close(); });

```

3. In the `render()` function, create a new set of list item views for the records in the underlying collection. Each of these views is just an entry in the list. You'll define the `app.views.UserListItemView` later.

```

this.listItemViews = _.map(this.model.models, function(model) { return new
app.views.UserListItemView({model: model}); });

```

4. Append the list item views to the root DOM element.

```

$(this.el).append(_.map(this.listItemViews, function(itemView) {
  return itemView.render().el; }));
return this;
}

```

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. In the `<body>` block, create a template for a search result list item.

```

<script id="user-list-item" type="text/template">
  
  <div class="details-short">
    <b><%= FirstName %> <%= LastName %></b><br/>
    Title<%= Title %>
  </div>
</script>

```

2. Immediately after the template, create the view for the search result list item. Once again, subclass `Backbone.View` and indicate that the whole view should be rendered as a list by defining the `tagName` member. For the remainder of this procedure, add all code in the `extend({})` block.

```

app.views.UserListItemView = Backbone.View.extend({
  tagName: "li",
});

```

3. Load template by calling `_.template()` with the raw content of the `user-list-item` script.

```

template: _.template($("#user-list-item").html()),

```

4. In the `render()` function, simply render the template using data from the model.

```

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 to do necessary cleanup and avoid memory leaks.

```

close: function() {
  this.remove();
}

```

```

    this.off();
  }

```

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();
  }
});

```

## Router

A Backbone router defines navigation paths among views. To learn more about routers, see [What is a router?](#)

1. Just before the closing tag of the `<body>` block, define the application router by extending `Backbone.Router`.

```

app.Router = Backbone.Router.extend({
});

```

For the remainder of this procedure, add all code in the `extend({})` block.

2. Because the app supports only one screen, you need only one “route”. Add a `routes` object.

```

routes: {
  "": "list"
},

```

3. Define an `initialize()` function that creates the search result collections and search page view.

```

initialize: function() {
  Backbone.Router.prototype.initialize.call(this);

  // Collection behind search screen
  app.searchResults = new app.models.UserCollection();
  app.searchView = new app.views.SearchPage({model: app.searchResults});
},

```

4. Define the `list()` function to handle the only item in this route. When the list screen displays, fetch the search results and render the search view.

```

list: function() {
  app.searchResults.fetch();
  $('#content').html(app.searchView.render().el);
}

```

5. Run the application by double-clicking `index.html` to open it in a browser.



You've finished! Here's the entire application:

```
<!DOCTYPE html>
<html>
  <head>
    <meta name="viewport" content="width=device-width,
      initial-scale=1.0, maximum-scale=1.0; user-scalable=no" />
    <meta http-equiv="Content-type" content="text/html;
      charset=utf-8">
    <link rel="stylesheet" href="css/ratchet.css"/>
    <script src="jquery/jquery-2.0.0.min.js"></script>
    <script src="backbone/underscore-1.4.4.min.js"></script>
    <script src="backbone/backbone-1.0.0.min.js"></script>
    <script src="cordova-2.3.0.js"></script>
    <script src="forcetk.mobilesdk.js"></script>
    <script src="cordova.force.js"></script>
    <script src="SmartSync.js"></script>
  </head>
  <body>
    <div id="content"></div>
    <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"></ul>
      </div>
    </script>

    <script id="user-list-item" type="text/template">
      
      <div class="details-short">
        <b><%= FirstName %> <%= LastName %></b><br/>
        Title<%= Title %>
      </div>
    </script>

    <script>
var app = {
  models: {},
  views: {}
};

jQuery(document).ready(function() {
  document.addEventListener("deviceready",onDeviceReady,false);
});

function onDeviceReady() {
  cordova.require("salesforce/plugin/oauth").
    getAuthCredentials(appStart);
}

function appStart(creds) {
  console.log(JSON.stringify(creds));
  Force.init(creds, null, null,
    cordova.require("salesforce/plugin/oauth").forcetkRefresh);
  app.router = new app.Router();
  Backbone.history.start();
}

// Models
```

```

app.models.User = Force.SObject.extend({
  objectType: "User",
  fieldlist: ["Id", "FirstName", "LastName",
    "SmallPhotoUrl", "Title", "Email", "MobilePhone",
    "City"]
});

app.models.UserCollection = Force.SObjectCollection.extend({
  model: app.models.User
});

// Views

app.views.SearchPage = Backbone.View.extend({
  template: _.template($("#search-page").html()),

  initialize: function() {
    this.listView =
      new app.views.UserListView({model: this.model});
  },

  render: function(eventName) {
    $(this.el).html(this.template());
    $(".search-key", this.el).val(this.model.criteria);
    this.listView.setElement($(".ul", this.el)).render();
    return this;
  },

  events: {
    "keyup .search-key": "search"
  },

  search: function(event) {
    this.model.criteria = $(".search-key", this.el).val();
    var soql = "SELECT Id, FirstName, LastName,
      SmallPhotoUrl, Title
      FROM User WHERE Name like '" + this.model.criteria + "%'
      ORDER BY Name LIMIT 25 ";
    this.model.fetch({config: {type:"soql", query:soql}});
  }
});

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();
    }
});

// Router
app.Router = Backbone.Router.extend({
    routes: {
        "": "list"
    },

    initialize: function() {
        Backbone.Router.prototype.initialize.call(this);

        // Collection behind search screen
        app.searchResults = new app.models.UserCollection();
        app.searchView =
            new app.views.SearchPage({model: app.searchResults});
        console.log("here");
    },

    list: function() {
        app.searchResults.fetch();
        $('#content').html(app.searchView.render().el);
    }
});

</script>
</body>
</html>

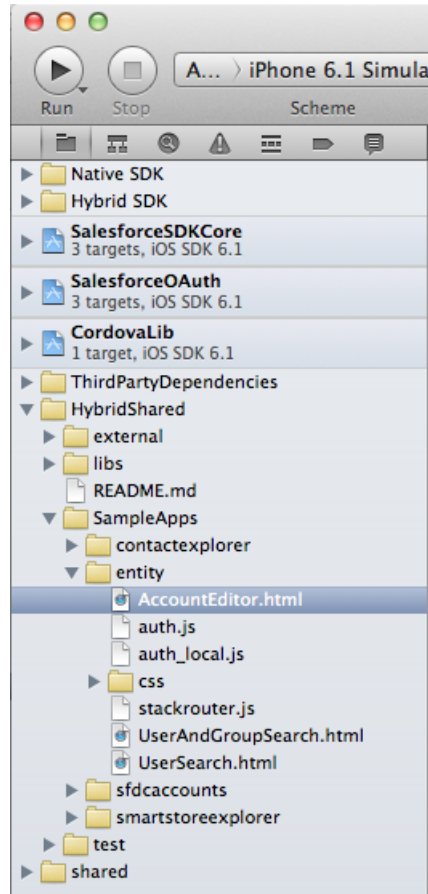
```

## SmartSync Sample Apps

Salesforce Mobile SDK provides sample apps that demonstrate how to use SmartSync 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, open `HybridShared/sampleApps/smartsync/AccountEditor.html`.



## Running the Samples in Android

In Android, you can run the sample from the command prompt. In your Salesforce Mobile SDK for Android installation directory, change to the `hybrid/SampleApps/AccountEditor` directory and run:

```
ant debug
ant install
```



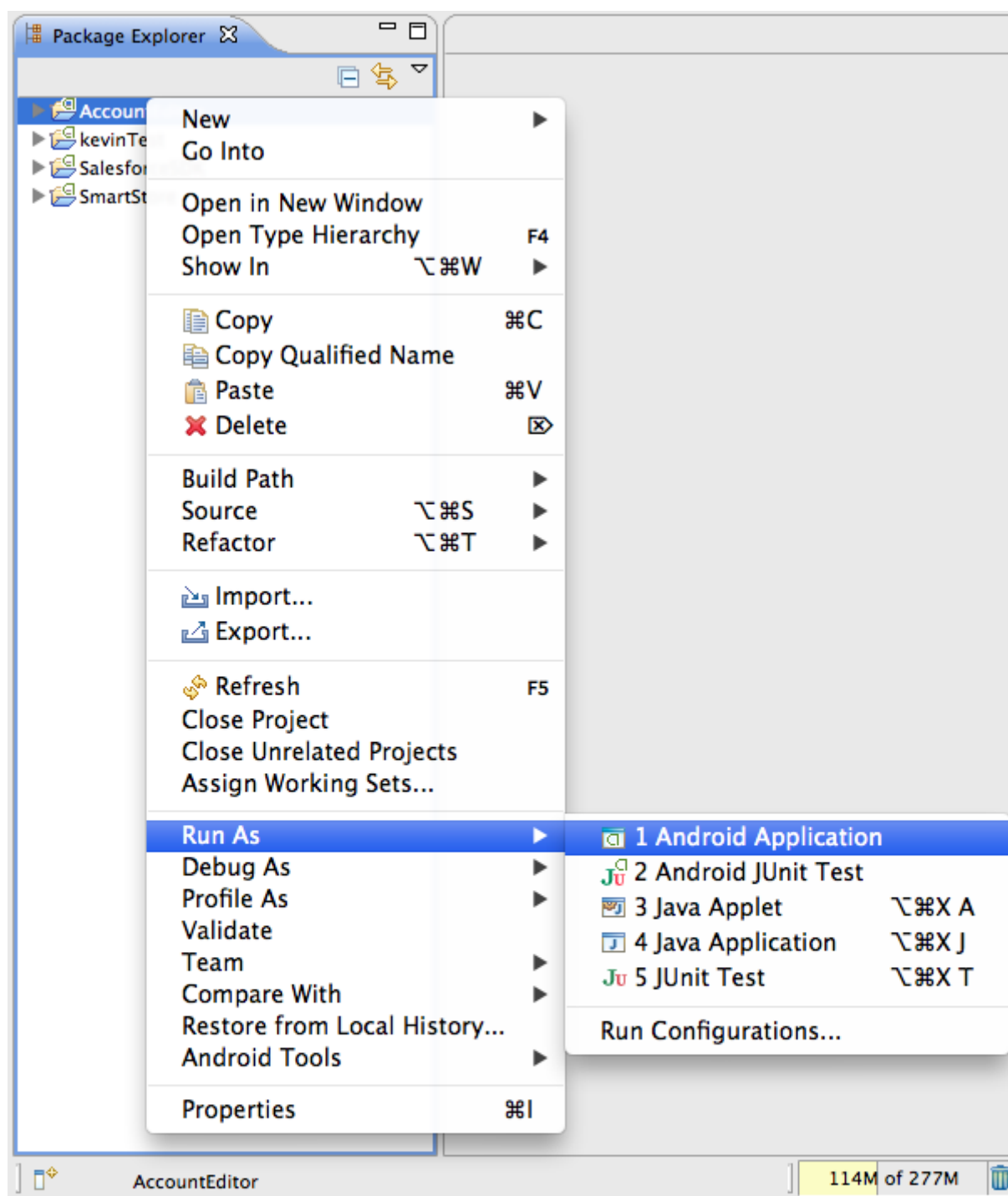
**Note:** If you get any errors saying that the `local.properties` file does not exist, run the following command from the directory shown in the error message:

```
%ANDROID_SDK%/tools/android update project -p .
```

To run the sample in Eclipse, import the following projects into your workspace:

- forcedroid/native/SalesforceSDK
- forcedroid/hybrid/SmartStore
- forcedroid/hybrid/SampleApps/AccountEditor

After Eclipse finishes building, Control-click or right-click **AccountEditor** in the Package Explorer, then click **Run As > Android application**.



## User and Group Search Sample

User and group search is the simplest SmartSync sample app. Its single screen lets you search users and collaboration groups and display matching records in a list.

To run the sample, edit `external/shared/sampleApps/smartsync/bootconfig.json`. Change `startPage` to `UserAndGroupSearch.html`:

```
{
  "remoteAccessConsumerKey":
    "3MVG9Iu66FKeHhINKB1l7xt7kR8czFcCTUhgoA80l2LtflEYHOU4SqQRSEitYFDUpqRWcoQ2.
    dBv_alDyu5xa",
  "oauthRedirectURI": "testsfdc:///mobilesdk/detect/oauth/done",
  "oauthScopes": ["api", "web"],
  "isLocal": true,
  "startPage": "UserAndGroupSearch.html",
  "errorPage": "error.html",
  "shouldAuthenticate": true,
  "attemptOfflineLoad": true
  "remoteAccessConsumerKey":
    "3MVG9Iu66FKeHhI2LtflEYHOU4SqQRSEitYFDUpqRWcoQ2.
    dBv_alDyu5xa",
  "oauthRedirectURI": "testsfdc:///mobilesdk/detect/oauth/done",
  "oauthScopes": ["api", "web"],
  "isLocal": true,
  "startPage": "UserAndGroupSearch.html",
  "errorPage": "error.html",
  "shouldAuthenticate": true,
  "attemptOfflineLoad": true
"remoteAccessConsumerKey":
  "3MVG9Iu66FKeHhINKB1l7xt7kR8czFcCTUhgoA80l2LtflEYHOU4SqQRSEitYFDUpqRWcoQ2.
  dBv_alDyu5xa",
  "oauthRedirectURI": "testsfdc:///mobilesdk/detect/oauth/done",
  "oauthScopes": ["api", "web"],
  "isLocal": true,
  "startPage": "UserAndGroupSearch.html",
  "errorPage": "error.html",
  "shouldAuthenticate": true,
  "attemptOfflineLoad": true
}
```

To run the app from Xcode in iOS, click **Run** to launch the AccountEditor project. After you've logged in, type at least two characters in the search box to see matching results.

## Looking Under the Hood

Open `UserAndGroupSearch.html` in your favorite 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 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-2.3.0.js—Required for all hybrid application used the SalesforceMobileSDK.
- 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—template for the entire search page
- user-list-item—template for user list items
- group-list-item—template for collaboration group list items

## Models

This application defines a SearchCollection model.

SearchCollection subclasses the Force.SObjectCollection class, which in turn subclasses the Collection class from the Backbone library. Its only method configures the SOSL query used by the fetch() method to populate the collection.

```
app.models.SearchCollection = Force.SObjectCollection.extend({
  setCriteria: function(key) {
    this.config = {type:"sosl", query:"FIND {" + key + "*} IN ALL FIELDS RETURNING "
      + "CollaborationGroup (Id, Name, SmallPhotoUrl, MemberCount), "
      + "User (Id, FirstName, LastName, SmallPhotoUrl, Title ORDER BY Name) "
      + "LIMIT 25"
    };
  }
});
```

## Views

User and Group Search defines three views:

### SearchPage

The search page expects a SearchCollection as its model. It watches the search input field for changes and updates the model accordingly.

```
events: {
  "keyup .search-key": "search"
},

search: function(event) {
  var key = $(".search-key", this.el).val();
  if (key.length >= 2) {
    this.model.setCriteria(key);
    this.model.fetch();
  }
}
```

### ListView

The list portion of the search screen. ListView also expects a Collection as its model and creates ListViewItem objects for each record in the Collection.

### ListItemView

Shows details of a single list item, choosing the User or Group template based on the data.

## Router

The router does very little because this application defines only one screen.

## User Search Sample

User Search is a more elaborate sample than User and Group search. Instead of a single screen, it defines two screens. If your search returns a list of matches, User Search lets you tap on each of them to see a basic detail screen. Because it defines more than one screen, this sample also demonstrates the use of a router.

To run the sample, edit `external/shared/sampleApps/smartsync/bootconfig.json`. Change `startPage` to `UserSearch.html`:

```
{
  "remoteAccessConsumerKey": "3MVG9Iu66FKeHhI2Ltf1eYHOU4SqQRSEitYFDUpqRWcoQ2.dBv_a1Dyu5xa",
  "oauthRedirectURI": "testsfdc:///mobilesdk/detect/oauth/done",
  "oauthScopes": ["api", "web"],
  "isLocal": true,
  "startPage": "UserSearch.html",
  "errorPage": "error.html",
  "shouldAuthenticate": true,
  "attemptOfflineLoad": true
}
```

In Xcode or Eclipse, launch the AccountEditor. Log in if prompted to do so. Unlike the User and Group Search example, you need to type only a single character in the search box to begin seeing search results. That's because this application uses SOQL, rather than SOSL, to query the server.

When you tap an entry in the search results list, you see a basic detail screen.

## Looking Under the Hood

Open the `UserSearch.html` file in your favorite 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 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-2.3.0.js`—Required for all hybrid application used the SalesforceMobileSDK.
- `forcetk.mobilesdk.js`—Force.com JavaScript library for making Rest API calls. Required by SmartSync.
- `cordova.force.js`—As of Mobile SDK 2.0, this file combines all Force.com Cordova plugins. Replaces the `SFHybridApp.js`, `SalesforceOAuthPlugin.js`, and `SmartStorePlugin.js` files.
- `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`—template for the whole search page
- `user-list-item`—template for user list items
- `user-page`—template for user detail page

## Models

This application defines two models: `UserCollection` and `User`.

`UserCollection` subclasses the `Force.SObjectCollection` class, which in turn subclasses the `Collection` class from the Backbone library. Its only method configures the SOQL query used by the `fetch()` method to populate the collection.

```
app.models.UserCollection = Force.SObjectCollection.extend({
  model: app.models.User,
  fieldlist: ["Id", "FirstName", "LastName", "SmallPhotoUrl", "Title"],

  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 "
    };
  }
});
```

`User` subclasses SmartSync's `Force.SObject` class. The `User` model defines:

- An `objectType` field to indicate which type of `sObject` it represents (`User`, in this case).
- A `fieldlist` field that contains the list of fields to be fetched from the server

Here's the code:

```
app.models.User = Force.SObject.extend({
  objectType: "User",
  fieldlist: ["Id", "FirstName", "LastName", "SmallPhotoUrl", "Title", "Email",
    "MobilePhone", "City"]
});
```

## Views

This sample defines four views:

### SearchPage

View for the entire search page. It expects a `UserCollection` as its model. It watches the search input field for changes 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();
}
```

**UserListView**

View for the list portion of the search screen. It also expects a `UserCollection` as its model and creates `UserListItemView` objects for each user in the `UserCollection` object.

**UserListItemView**

View for a single list item.

**UserPage**

View for displaying user details.

**Router**

The router class handles navigation between the app's two screens. This class uses a `routes` field to map those view to router class method.

```
routes: {
  "": "list",
  "list": "list",
  "users/:id": "viewUser"
},
```

The list page calls `fetch()` to fill the search result collections, then 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 user detail page calls `fetch()` to fill the user model, then brings the user detail page into view.

```
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);
    }
  });
}
```

## Account Editor Sample

Account Editor is the most complex SmartSync-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 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-2.3.0.js`—Required for hybrid applications using the Salesforce Mobile SDK.
- `forcetk.mobilesdk.js`—Force.com JavaScript library for making REST API calls. Required by SmartSync.
- `cordova.force.js`—As of Mobile SDK 2.0, this file combines all Force.com Cordova plugins. Replaces the `SFHybridApp.js`, `SalesforceOAuthPlugin.js`, and `SmartStorePlugin.js` files.

- `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'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'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
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);
}
```

# Chapter 11

## Securely Storing Data Offline

### In this chapter ...

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- [Adding SmartStore to Android Apps](#)
- [Offline Hybrid Development](#)
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- [NativeSqlAggregator Sample App: Using SmartStore in Native Apps](#)

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.

The Mobile SDK uses SmartStore, a secure offline storage solution on your device. SmartStore allows you to continue working even when the device is not connected to the Internet. SmartStore stores data as JSON documents in a data structure called a *soup*. A soup is a simple one-table database of “entries” that can be indexed in different ways and queried by a variety of methods.

Mobile SDK 2.0 provides a StoreCache mechanism that works with SmartStore soups to provide offline synchronization and conflict resolution services. You can control these services by providing simple configuration settings. We recommend that you use StoreCache to manage operations on Salesforce data. See [Using StoreCache For Offline Caching](#) and [Conflict Detection](#).



**Note:** Pure HTML5 apps store offline information in a browser cache. Browser caching isn't part of the 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.

### Sample Objects

The code snippets in this chapter use two objects, Account and Opportunity, which come predefined with every Salesforce organization. Account and Opportunity have a master-detail relationship; an account can have more than one opportunity.

## Accessing SmartStore in Hybrid Apps

Hybrid apps access SmartStore from JavaScript. To enable offline access in a hybrid mobile application, you need to include a couple of JavaScript and CSS files in your Visualforce or HTML page.

- `cordova-x.x.x.js`—The Cordova library (formerly PhoneGap).
- `cordova.force.js`—Contains the JavaScript portion of Salesforce OAuth and SmartStore plug-ins. Also includes methods that perform utility tasks, such as determining whether you're offline.

## Adding SmartStore to Android Apps

In Android apps, SmartStore is an optional component. It is not optional in iOS apps.

To use SmartStore in an Android app, you need to configure your project to include it. When you create a new Android project with the forcedroid utility, include SmartStore by setting the optional `--usesmartstore=true` parameter. See [Creating an Android Project](#) for examples.

To add SmartStore to an existing Android project (hybrid or native):

1. Add the SmartStore library project to your project. In Eclipse, choose Properties from the Project menu. Select Android from the left panel, then click **Add** on the right-hand side. Choose the `hybrid/SmartStore` project.
2. In your `projectnameApp.java` file, import the `SalesforceSDKManagerWithSmartStore` class instead of `SalesforceSDKManager`. Replace this statement:

```
import com.salesforce.androidsdk.app.SalesforceSDKManager
```

with this one:

```
import com.salesforce.androidsdk.smartstore.app.SalesforceSDKManagerWithSmartStore
```

3. In your `projectnameApp.java` file, change your App class to extend the `SalesforceSDKManagerWithSmartStore` class rather than `SalesforceSDKManager`.

## Offline Hybrid Development

Developing a hybrid application inside the container requires a build/deploy step for every change. For that reason, we recommend you develop your hybrid application directly in a browser, and only run your code in the container in the final stages of testing. JavaScript development in a browser is easier because there is no build/compile step. Whenever you make changes to the code, you can refresh the browser to see your changes.

We recommend using the Google Chrome browser because it comes bundled with developer tools that let you access the internals of your web applications. For more information, see [Chrome Developer Tools: Overview](#).

## SmartStore Soups

You store your offline data in SmartStore in one or more *soups*. A soup, conceptually speaking, is a logical collection of data records—represented as JSON objects—that you want to store and query offline. In the Force.com world, a soup will typically map to a standard or custom object that you wish to store offline, but that is not a hard and fast rule. You can store as many soups as you want in an application, but remember that soups are meant to be self-contained data sets; there is no direct

correlation between them. In addition to storing the data itself, you can also specify indices that map to fields within the data, for greater ease and customization of data queries.



### Warning:

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.

## Registering a Soup

In order to access a soup, you first need to register it. Provide a name, index specifications, and names of callback functions for success and error conditions:

```
navigator.smartstore.registerSoup(soupName, indexSpecs, successCallback, errorCallback)
```

If the soup does not already exist, this function creates it. If the soup already exists, registering gives you access to the existing soup. To find out if a soup already exists, use:

```
navigator.smartstore.soupExists(soupName, successCallback, errorCallback);
```

A soup is indexed on one or more fields found in its entries. Insert, update, and delete operations on soup entries are tracked in the soup indices. 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.

### indexSpecs

The `indexSpecs` array is used to create the soup with predefined indexing. Entries in the `indexSpecs` array specify how the soup should be indexed. Each entry consists of a `path:type` pair. `path` is the name of an index field; `type` is either “string”, “integer”, or “floating”. Index paths are case-sensitive and can include compound paths, such as `Owner.Name`.



**Note:** Performance can suffer if the index path is too deep. If index entries are missing any fields described in a particular `indexSpec`, they will not be tracked in that index.

```
"indexSpecs":[
  {
    "path":"Name",
    "type":"string"
  }
  {
    "path":"Id",
    "type":"string"
  }
  {
    "path":"ParentId",
    "type":"string"
  }
  {
    "path":"lastModifiedDate",
    "type":"integer"
  }
]
```



**Note:** Currently, the Mobile SDK supports three index types: “string”, “integer”, and “floating”. These types apply only to the index itself, and not to the way data is stored or retrieved. It’s OK to have a null field in an index column.

## successCallback

The success callback function for `registerSoup` takes one argument (the soup name).

```
function(soupName) { alert("Soup " + soupName + " was successfully created"); };
```

A successful creation of the soup returns a `successCallback` that indicates 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 for `registerSoup` takes one argument (the error description string).

```
function(err) { alert ("registerSoup failed with error:" + err); }
```

During soup creation, errors can happen for a number of 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

# Retrieving Data From a Soup

SmartStore provides a set of helper methods that build query strings for you. To query a specific set of records, call the `build*` method that suits your query specification. 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>indexPath</code>	This is what you’re searching for; for example a name, account number, or date.
<code>beginKey</code>	Optional. Used to define the start of a range query.
<code>endKey</code>	Optional. Used to define the end of a range query.
<code>order</code>	Optional. Either “ascending” or “descending.”
<code>pageSize</code>	Optional. If not present, the native plugin can return whatever page size it sees fit in the resulting <code>Cursor.pageSize</code> .



**Note:** All queries are single-predicate searches. Only SmartSQL queries support joins.

## Query Everything

`buildAllQuerySpec(indexPath, order, [pageSize])` returns all entries in the soup, with no particular order. Use this query to traverse everything in the soup.

`order` and `pageSize` are optional, and default to ascending and 10, respectively. You can specify:

- `buildAllQuerySpec(indexPath)`
- `buildAllQuerySpec(indexPath, order)`
- `buildAllQuerySpec(indexPath, order, [pageSize])`

However, you can't specify `buildAllQuerySpec(indexPath, [pageSize])`.

See [Working With Cursors](#) 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 might want to increase the value to two or three times the number of entries actually shown.

## Query with a Smart SQL SELECT Statement

`buildSmartQuerySpec(smartSql, [pageSize])` executes the query specified by `smartSql`. This function allows greater flexibility than other query factory functions because you provide your own Smart SQL SELECT statement. See [Smart SQL Queries](#).

`pageSize` is optional and defaults to 10.

Sample code, in various development environments, for 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
});
```

### iOS native:

```
SFQuerySpec* querySpec = [SFQuerySpec newSmartQuerySpec:@"select count(*) from {employees}"
  withPageSize:1];
NSArray* result = [_store queryWithQuerySpec:querySpec pageIndex:0];
// result should be [[ n ]] if there are n employees
```

### Android native:

```
SmartStore store = SalesforceSDKManagerWithSmartStore.getInstance().getSmartStore();
JSONArray result = store.query(QuerySpec.buildSmartQuerySpec("select count(*) from
{employees}", 1), 0);
// result should be [[ n ]] if there are n employees
```

## Query by Exact

`buildExactQuerySpec(indexPath, matchKey, [pageSize])` finds entries that exactly match the given `matchKey` for the `indexPath` value. Use this to find child entities of a given ID. For example, you can find Opportunities by Status. However, you can't specify order in the results.

Sample code for retrieving children by ID:

```
var querySpec = navigator.smartstore.buildExactQuerySpec("sfidId", "some-sfdc-id");
navigator.smartstore.querySoup("Catalogs", querySpec, function(cursor) {
  // we expect the catalog to be in: cursor.currentPageOrderedEntries[0]
});
```

Sample code for retrieving children by parent ID:

```
var querySpec = navigator.smartstore.buildExactQuerySpec("parentSfidId", "some-sfdc-id");
navigator.smartstore.querySoup("Catalogs", querySpec, function(cursor) {});
```

## Query by Range

`buildRangeQuerySpec(indexPath, beginKey, endKey, [order, pageSize])` 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.

`order` and `pageSize` are optional, and default to ascending and 10, respectively. You can specify:

- `buildRangeQuerySpec(indexPath, beginKey, endKey)`
- `buildRangeQuerySpec(indexPath, beginKey, endKey, order)`
- `buildRangeQuerySpec(indexPath, beginKey, endKey, order, pageSize)`

However, you can't specify `buildRangeQuerySpec(indexPath, beginKey, endKey, pageSize)`.

By passing null values to `beginKey` and `endKey`, you can perform open-ended searches:

- Passing null to `endKey` finds all records where the field at `indexPath` is  $\geq$  `beginKey`.
- Passing null to `beginKey` finds all records where the field at `indexPath` is  $\leq$  `endKey`.
- Passing null to both `beginKey` and `endKey` is the same as querying everything.

## Query by Like

`buildLikeQuerySpec(indexPath, likeKey, [order, pageSize])` finds entries whose `indexPath` values are like the given `likeKey`. You can use “foo%” to search for terms that begin with your keyword, “%foo” to search for terms that end with your keyword, and “%foo%” to search for your keyword anywhere in the `indexPath` value. Use this function for general searching and partial name matches. `order` and `pageSize` are optional, and default to ascending and 10, respectively.



**Note:** Query by Like is the slowest of the query methods.

## Executing the Query

Queries run asynchronously and return a cursor to your JavaScript callback. Your success callback should be of the form `function(cursor)`. Use the `querySpec` parameter to pass your query specification to the `querySoup` method.

```
navigator.smartstore.querySoup(soupName, querySpec, successCallback, errorCallback);
```

## 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. Soup entries can be looked up by `_soupEntryId` by using the `retrieveSoupEntries` method. Note that the return order is not guaranteed, and if entries have been deleted they will be missing from the resulting array. This method 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)
```

# Smart SQL 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.

## 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}
```



## 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}
```

The NativeSqlAggregator sample app delivers a fully implemented native implementation of SmartStore, including SmartSQL support for aggregate functions and joins. See [NativeSqlAggregator Sample App: Using SmartStore in Native Apps](#).

## Working With Cursors

Queries can potentially have long result sets that are too large to load. Instead, only a small subset of the query results (a single page) is copied from the native realm to the JavaScript realm at any given time. When you perform a query, a cursor object is returned from the native realm that provides a way to page through a list of query results. The JavaScript code can then move forward and back through the pages, causing pages to be copied to the JavaScript realm.



**Note:** For advanced users: Cursors are not snapshots of data; they are dynamic. If you make changes to the soup and then start paging through the cursor, you will see those changes. 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. Thus, newly created soup entries can be returned (assuming they satisfy the original query).

Use the following cursor functions to navigate the results of a query:

- `navigator.smartstore.moveCursorToPageIndex(cursor, newPageIndex, successCallback, errorCallback)`—Move the cursor to the page index given, where 0 is the first page, and the last page is defined by `totalPages - 1`.
- `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:** `successCallback` for those functions should expect one argument (the updated cursor).

## Manipulating Data

In order to track soup entries for insert, update, and delete, 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`—The number of milliseconds since 1/1/1970.
  - ◊ To convert 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 inserting or updating soup entries, SmartStore automatically sets these fields. When removing or retrieving specific entries, you can reference them by `_soupEntryId`.

## Inserting or Updating Soup Entries

If the provided soup entries already have the `_soupEntryId` slots set, then entries identified by that slot are updated in the soup. If an entry does not have a `_soupEntryId` slot, or the value of the slot doesn't match any existing entry in the soup, then the entry is added (inserted) to the soup, and the `_soupEntryId` slot is overwritten.



**Note:** You must not manipulate the `_soupEntryId` or `_soupLastModifiedDate` value yourself.

Use the `upsertSoupEntries` method to insert or update entries:

```
navigator.smartStore.upsertSoupEntries(soupName, entries[], successCallback, errorCallback)
```

where `soupName` is the name of the target soup, and `entries` is an array of one or more entries that match the soup's data structure. The `successCallback` and `errorCallback` parameters function much like the ones for `registerSoup`. However, the success callback for `upsertSoupEntries` indicates that either a new record has been inserted, or an existing record has been updated.

## Upserting with an External ID

If your soup entries mirror data from an external system, you might need to refer to those entities by their ID (primary key) in the external system. For that purpose, we support upsert with an external ID. When you perform an upsert, you can designate any index field as the external ID field. SmartStore will look 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, a new soup entry will be created.
- If the external ID field is found, it will be updated.
- If more than one field matches the external ID, an error will be returned.

When creating a new entry locally, use a regular upsert. Set the external ID field to a value that you can later query when uploading the new entries to the server.

When updating entries with data coming from the server, use the upsert with external ID. Doing so guarantees that you don't end up with duplicate soup entries for the same remote record.

In the following sample code, we chose the value `new` for the `id` field because the record doesn't yet exist on the server. Once we are online, we 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 the actual ID for the records, we can update their `id` fields locally. If you create products that belong to catalogs that have not yet been created on the server, you will be able to capture the relationship with the catalog through the `parentSoupEntryId` field. Once the catalogs are created on the server, update the local records' `parentExternalId` fields.

The following code contains sample scenarios. First, it calls `upsertSoupEntries` to create a new soup entry. In the success callback, the code retrieves the new record with its newly assigned soup entry ID. It then changes the description and calls `forcetk.mobiledsk` methods to create the new account on the server and then update it. The final call demonstrates the

upsert with external ID. To make the code more readable, no error callbacks are specified. Also, because all SmartStore calls are asynchronous, real applications should do each step in the callback of the previous step.

```
// 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 acc has no _soupEntryId field
navigator.smartstore.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
navigator.smartstore.upsertSoupEntries("accounts", [ acc ], function(accounts) {
  acc = accounts[0];
});

// Create account on server (sync client -> server for entities created locally)
forcetkClient.create("account", {"Name": acc["Name"], "Description": acc["Description"]},
function(result) {
  acc["id"] = result["id"];
  // Update account in SmartStore
  navigator.smartstore.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
forcetkClient.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
forcetkClient.retrieve("account", someSfdcId, "id,Name,Description", function(result) {
  // Create or update account in SmartStore (looking for an account with the same sfdcId)
  navigator.smartstore.upsertSoupEntriesWithExternalId("accounts", [ result ], "id");
});
```

## Removing Soup Entries

Entries are removed from the soup asynchronously and your callback is called with success or failure. The `soupEntryIds` is a list of the `_soupEntryId` values from the entries you wish to delete.

```
navigator.smartstore.removeFromSoup(soupName, soupEntryIds, successCallback, errorCallback)
```

## Removing a Soup

To remove a soup, call `removeSoup()`. Note that once a user signs out, the soups get deleted automatically.

```
navigator.smartstore.removeSoup(soupName, successCallback, errorCallback);
```

## 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. The MockSmartStore is a JavaScript implementation of the SmartStore that stores the data in local storage (or optionally just in memory).



**Note:** The MockSmartStore doesn't encrypt data and is not meant to be used in production applications.

Inside the PhoneGap directory, there's a local directory containing the following files:

- `MockCordova.js`—A minimal implementation of Cordova functions meant only for testing plugins outside the container.
- `MockSmartStore.js`—A JavaScript implementation of the SmartStore meant only for development and testing outside the container.
- `MockSmartStorePlugin.js`—A JavaScript helper class that intercepts SmartStore Cordova plugin calls and handles them using a MockSmartStore.
- `CordovaInterceptor.js`—A JavaScript helper class that intercepts Cordova plugin calls.

When writing an application using SmartStore, make the following changes to test your app outside the container:

- Include `MockCordova.js` instead of `cordova-x.x.x.js`.
- Include `MockSmartStore.js` after `cordova.force.js`.

To see a MockSmartStore example, check out `Cordova/local/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 `Force.com` 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 `forcetk.mobilesdk` JavaScript toolkit.

## NativeSqlAggregator Sample App: Using SmartStore in Native Apps

The NativeSqlAggregator app demonstrates how to use SmartStore in a native app. It also demonstrates the ability to make complex SQL-like queries, including aggregate functions, such as SUM and COUNT, and joins across different soups within SmartStore.

### Creating a Soup

The first step to storing a Salesforce object in SmartStore is to create a soup for the object. The function call to register a soup takes two arguments—the name of the soup, and the index specs for the soup. Indexing supports three types of data: string,

integer, and floating decimal. The following example illustrates how to initialize a soup for the Account object with indexing on Name, Id, and OwnerId fields.

#### Android:

```
SalesforceSDKManagerWithSmartStore sdkManager =
SalesforceSDKManagerWithSmartStore.getInstance();

SmartStore smartStore = sdkManager.getSmartStore();

IndexSpec[] ACCOUNTS_INDEX_SPEC = {
    new IndexSpec("Name", Type.string),
    new IndexSpec("Id", Type.string),
    new IndexSpec("OwnerId", Type.string)
};

smartStore.registerSoup("Account", ACCOUNTS_INDEX_SPEC);
```

#### iOS:

```
SFSmartStore *store = [SFSmartStore sharedStoreWithName:kDefaultSmartStoreName];

NSArray *keys = [NSArray arrayWithObjects:@"path", @"type", nil];
NSArray *nameValues = [NSArray arrayWithObjects:@"Name", kSoupIndexTypeString, nil];
NSDictionary *nameDictionary = [NSDictionary dictionaryWithObjects:nameValues
forKeys:keys];
NSArray *idValues = [NSArray arrayWithObjects:@"Id", kSoupIndexTypeString, nil];
NSDictionary *idDictionary = [NSDictionary dictionaryWithObjects:idValues forKeys:keys];
NSArray *ownerIdValues = [NSArray arrayWithObjects:@"OwnerId", kSoupIndexTypeString,
nil];
NSDictionary *ownerIdDictionary = [NSDictionary dictionaryWithObjects:ownerIdValues
forKeys:keys];
NSArray *accountIndexSpecs = [[NSArray alloc] initWithObjects:nameDictionary,
idDictionary, ownerIdDictionary, nil];

[store registerSoup:@"Account" withIndexSpecs:accountIndexSpecs];
```

## Storing Data in a Soup

Once the soup is created, the next step is to store data in the soup. In the following example, account represents a single record of the object Account. On Android, account is of type JSONObject. On iOS, its type is NSDictionary.

#### Android:

```
SmartStore smartStore = sdkManager.getSmartStore();
smartStore.upsert("Account", account);
```

#### iOS:

```
SFSmartStore *store = [SFSmartStore sharedStoreWithName:kDefaultSmartStoreName];
[store upsertEntries:[NSArray arrayWithObject:account] toSoup:@"Account"];
```

## Running Queries Against SmartStore

Beginning with Mobile SDK 2.0, you can run advanced SQL-like queries against SmartStore that span multiple soups. The syntax of a SmartStore query is similar to standard SQL syntax, with a couple of minor variations. A colon (":") serves as the delimiter between a soup name and an index field. A set of curly braces encloses each `<soup-name>:<field-name>` pair. See [Smart SQL Queries](#).

Here's an example of an aggregate query run against SmartStore:

```
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}
```

This query represents an implicit join between two soups, Account and Opportunity. It returns:

- Name of the Account
- Number of opportunities associated with an Account
- Sum of all the amounts associated with each Opportunity of that Account
- Average amount associated with an Opportunity of that Account
- Grouping by Account name

The code snippet below demonstrates how to run such queries from within a native app. In this example, `smartSql` is the query and `pageSize` is the requested page size. The `pageIndex` argument specifies which page of results you want returned.

**Android:**

```
QuerySpec querySpec = QuerySpec.buildSmartQuerySpec(smartSql, pageSize);  
JSONArray result = smartStore.query(querySpec, pageIndex);
```

**iOS:**

```
SFSmartStore *store = [SFSmartStore sharedStoreWithName:kDefaultSmartStoreName];  
SFQuerySpec *querySpec = [SFQuerySpec newSmartQuerySpec:queryString  
withPageSize:pageSize];  
NSArray *result = [store queryWithQuerySpec:querySpec pageIndex:pageIndex];
```

## Chapter 12

### Push Notifications and Mobile SDK

---

#### In this chapter ...

- [About Push Notifications](#)
- [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 Developer Preview of the Salesforce Mobile Push Notification Service lets you configure and test push notifications in Developer Edition orgs.

## About Push Notifications

Salesforce introduces support for push notifications as a Developer Preview at Dreamforce '13. You can begin developing and testing push notifications in native mobile apps that connect to a Developer Edition org. Salesforce Mobile SDK for native iOS and Android apps 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
- Modifying code in your Mobile SDK app
- Runtime registration on the mobile device

Salesforce Mobile SDK handles runtime registration transparently, using setup details from the other three steps. You're responsible for Apple or Google service configuration, connected app configuration, and minor changes to your code.

## 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.

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 org.

### Connected App Configuration for Android

To configure your Salesforce connected app to support push notifications:

1. In your Salesforce org, go to **Setup > Create > 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 [Creating a Connected App](#).
3. Under **Mobile App Settings**, select **Push Messaging Enabled**.
4. Under **Mobile App Settings > Supported Push Platform**, select **Android GCM**.
5. Under **Mobile App Settings > Server Key**, enter the key provided during your GCM configuration.



The screenshot shows the 'Mobile App Settings' form. The 'Supported Push Platform' is set to 'Android GCM'. A red arrow points to the 'Server Key' field, which is empty.

## 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">35123627573</string>
```

- In `assets/www/bootconfig.json` (for hybrid apps):

```
"androidPushNotificationClientId": "35123627573"
```

This value represents 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 an `appkey.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`

### Connected App Configuration for iOS

To configure your Salesforce connected app to support push notifications:

1. In your Salesforce org, go to **Setup > Create > 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 [Creating a Connected App](#).
3. Under **Mobile App Settings**, select **Push Messaging Enabled**.
4. Under **Mobile App Settings > Supported Push Platform**, select **Apple**.

When you select the **Supported Push Platform** option, the dialog expands to show additional settings.

The screenshot shows the 'Mobile App Settings' dialog box. It contains the following fields and controls:

- Mobile Start URL: A text input field.
- Pin Protect: A checkbox.
- Push Messaging Enabled: A checked checkbox.
- Supported Push Platform: A dropdown menu set to 'Apple'.
- Apple Environment: A dropdown menu set to 'Sandbox'.
- Certificate: A button labeled 'Choose File' next to the text 'No file chosen'. This entire row is circled in red.
- Current certificate expires on 10/16/2014: A text label.
- Certificate Password: A text input field containing 'test1234'.

5. Add the `appkey.p12` file and its password to your connected app configuration under **Mobile App Settings > Certificate** and **Mobile App Settings > Certificate Password**.

This is an identical screenshot to the one above, showing the 'Mobile App Settings' dialog box with the 'Certificate' field highlighted by a red circle.

You obtain the values for Apple Environment, Certificate, and Certificate Password when you configure your app with Apple Push Notification Services.

## 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
```

Mobile SDK calls `registerForSalesforceNotifications` after login and `unregisterSalesforceNotifications` at logout. You call the other two methods from your `AppDelegate` class.

### SFPushNotificationManager Example

To configure your `AppDelegate` class to support push notifications:

1. Register with Apple for push notifications by calling `registerForRemoteNotifications`. Place the call 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 sharedInstance]
    loginWithCompletion:self.initialLoginSuccessBlock
                    failure:self.initialLoginFailureBlock];

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`. Make this call 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. Add the following method to log an error if registration with Apple fails.

```

- (void)application:(UIApplication*)application
    didFailToRegisterForRemoteNotificationsWithError:(NSError*)error
{
    NSLog(@"Failed to get token, error: %@", error);
}

```

## Chapter 13

# Authentication, Security, and Identity in Mobile Apps

---

### In this chapter ...

- [OAuth Terminology](#)
- [OAuth2 Authentication Flow](#)
- [Connected Apps](#)
- [Portal Authentication Using OAuth 2.0 and Force.com Sites](#)

Secure authentication is essential for enterprise applications running on mobile devices. OAuth2 is the industry-standard protocol that allows secure authentication for access to a user's data, without handing out the username and password. It is often described as the valet key of software access: a valet key only allows access to certain features of your car; you cannot open the trunk or glove compartment using a valet key.

Mobile app developers can quickly and easily embed the Salesforce OAuth2 implementation. The implementation uses an HTML view to collect the username and password, which are then sent to the server. A session token is returned and securely stored on the device for future interactions.

A Salesforce *connected app* is the primary means by which a mobile device 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 be restricted to certain users, can set or relax an IP range, and so forth.

## 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. Replaces remote access application.

### Consumer Key

A value used by the consumer to identify itself to Salesforce. Referred to as `client_id`.

### 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” in the Salesforce Help. Remote access applications have been deprecated in favor of connected apps.

## OAuth2 Authentication Flow

The authentication flow depends on the state of authentication on the device.

### First Time Authentication Flow

1. User opens a mobile application.
2. An authentication dialog/window/overlay appears.
3. User enters username and password.
4. App receives session ID.
5. User grants access to the app.
6. App starts.

### Ongoing Authentication

1. User opens a mobile application.
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. App starts.

### PIN Authentication (Optional)

1. User opens a mobile application after not using it for some time.
2. If the elapsed time exceeds the configured PIN timeout value, a passcode entry screen appears. User enters the PIN.



**Note:** 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](#).

3. App re-uses existing session ID.
4. 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.

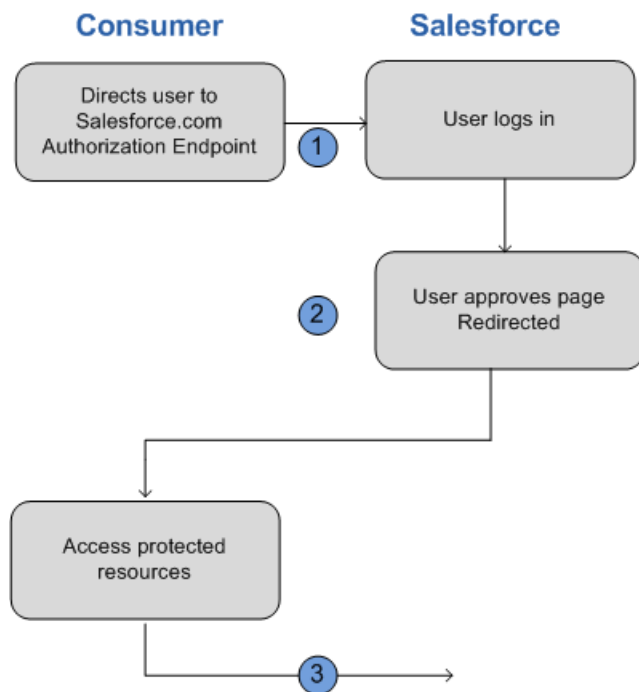
In the user-agent flow, the client application receives the access token in the form of an HTTP redirection. The client application requests the authorization server to redirect the user-agent to another web server or local resource accessible to the user-agent, which is capable of extracting the access token from the response and passing it to the client application. Note that the token response is provided as a hash (#) fragment on the URL. This is for security, and prevents the token from being passed to the server, as well as to other servers in referral headers.

This user-agent authentication flow doesn't utilize the client secret since the client executables reside on the end-user's computer or 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 end-user and other applications residing on the computer or device.

If you are authenticating using JavaScript, call `window.location.replace()` ; to remove the callback from the browser's history.



1. The client application directs the user to Salesforce to authenticate and authorize the application.
2. The user must always approve access for this authentication flow. After approving access, the application 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, they can use a refresh token to get a new access token (session ID.) This is only done after the consumer already has received a refresh token using either the Web server or user-agent flow. It is 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 only be used after the consumer has received a refresh token.

The following are the steps for the refresh token authentication flow. More detail about each step follows:

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. For most native Mobile SDK apps, `refresh_token` and `api` are 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

The `scope` parameter enables you to fine-tune what the client application can access in a Salesforce organization. The valid values for `scope` are:

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>full</code>	Allows access to all data accessible by the logged-in user. <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 only to the identity URL service.
<code>refresh_token</code>	Allows a refresh token to be returned if you are eligible to receive one.



Value	Description
visualforce	Allows access to Visualforce pages.
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.



**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 Web instead.

## Using Identity URLs

In addition to the access token, an identity URL is also returned as part of a token response, in the `id` parameter.

The identity URL is both a string that uniquely identifies a user, as well as a RESTful API that can be used to query (with a valid access token) for additional information about the user. Salesforce returns basic personalization information about the user, as well as important endpoints that the client can talk to, such as photos for the user, and API endpoints it can access.

The format of the URL is: `https://login.salesforce.com/id/orgID/userID`, where `orgID` is the ID of the Salesforce organization 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 always be HTTPS.

## Identity URL Parameters

The following parameters can be used with the access token and identity URL. They are used in an authorization request header or in a request with the `oauth_token` parameter. For more details, see “Using the Access Token” in the Salesforce Help.

Parameter	Description
Access token	See “Using the Access Token” in the Salesforce Help.
Format	<p>This parameter is optional. Specify the format of the returned output. Valid values are:</p> <ul style="list-style-type: none"> <li>• <code>urlencoded</code></li> <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	<p>This parameter is optional. Specify a SOAP API version number, or the literal string, <code>latest</code>. If this value isn't specified, the returned API URLs contains 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.</p>
PrettyPrint	<p>This parameter is optional, and is only accepted in a header, not as a URL parameter. Specify the output to be better formatted. For example, use the following in a header: <code>X-PrettyPrint:1</code>. If this value isn't specified, the returned XML or JSON is optimized for size rather than readability.</p>
Callback	<p>This parameter is optional. Specify a valid JavaScript function name. This parameter is only used when the format is specified as 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>.</p>

## Identity URL Response

After making a valid request, a **302 redirect** to an instance URL is returned. That subsequent request returns the following information in JSON format:

- `id`—The identity URL (the same URL that was queried)
- `asserted_user`—A boolean value, indicating whether the specified access token used was issued for this identity
- `user_id`—The Salesforce user ID
- `username`—The Salesforce username
- `organization_id`—The Salesforce organization ID
- `nick_name`—The community nickname of the queried user
- `display_name`—The display name (full name) of the queried user
- `email`—The email address of the queried user
- `status`—The 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`: the body of the post

- `photos`—A map of URLs to the user's profile pictures



**Note:** Accessing these URLs requires passing an access token. See “Using the Access Token” in the Salesforce Help.

- ◊ `picture`
- ◊ `thumbnail`

- `urls`—A map containing various API endpoints that can be used with the specified user.



**Note:** Accessing the REST endpoints requires passing an access token. See “Using the Access Token” in the Salesforce Help.

- ◊ `enterprise (SOAP)`
- ◊ `metadata (SOAP)`
- ◊ `partner (SOAP)`
- ◊ `profile`
- ◊ `feeds (Chatter)`
- ◊ `feed-items (Chatter)`
- ◊ `groups (Chatter)`
- ◊ `users (Chatter)`
- ◊ `custom_domain`—This value is omitted if the organization doesn't have a custom domain configured and propagated
- `active`—A boolean specifying whether the queried user is active
- `user_type`—The type of the queried user
- `language`—The queried user's language
- `locale`—The queried user's locale
- `utcOffset`—The offset from UTC of the timezone of the queried user, in milliseconds
- `last_modified_date`—xsd datetime format of last modification of the user, for example, 2010-06-28T20:54:09.000Z

The following is a response in XML format:

```
<?xml version="1.0" encoding="UTF-8"?>
<user xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
<id>http://na1.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>http://na1.salesforce.com/profilephoto/005/F</picture>
  <thumbnail>http://na1.salesforce.com/profilephoto/005/T</thumbnail>
</photos>
<urls>
  <enterprise>http://na1.salesforce.com/services/Soap/c/{version}/00Dx0000001T0zk
  </enterprise>
  <metadata>http://na1.salesforce.com/services/Soap/m/{version}/00Dx0000001T0zk
  </metadata>
  <partner>http://na1.salesforce.com/services/Soap/u/{version}/00Dx0000001T0zk
  </partner>
  <rest>http://na1.salesforce.com/services/data/v{version}/
  </rest>
  <subjects>http://na1.salesforce.com/services/data/v{version}/subjects/
  </subjects>
  <search>http://na1.salesforce.com/services/data/v{version}/search/
  </search>
  <query>http://na1.salesforce.com/services/data/v{version}/query/
  </query>
  <profile>http://na1.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>

```

The following is a response in JSON format:

```

{"id":"http://na1.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":"http://na1.salesforce.com/profilephoto/005/F",
"thumbnail":"http://na1.salesforce.com/profilephoto/005/T"},
"urls":{
  "enterprise":"http://na1.salesforce.com/services/Soap/c/{version}/00Dx0000001T0zk",
  "metadata":"http://na1.salesforce.com/services/Soap/m/{version}/00Dx0000001T0zk",
  "partner":"http://na1.salesforce.com/services/Soap/u/{version}/00Dx0000001T0zk",
  "rest":"http://na1.salesforce.com/services/data/v{version}/",
  "subjects":"http://na1.salesforce.com/services/data/v{version}/subjects/",
  "search":"http://na1.salesforce.com/services/data/v{version}/search/",
  "query":"http://na1.salesforce.com/services/data/v{version}/query/",
  "profile":"http://na1.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:

Request Problem	Error Code
HTTP	403 (forbidden) — HTTPS_Required
Missing access token	403 (forbidden) — Missing_OAuth_Token
Invalid access token	403 (forbidden) — Bad_OAuth_Token
Users in a different organization	403 (forbidden) — Wrong_Org
Invalid or bad user or organization ID	404 (not found) — Bad_Id
Deactivated user or inactive organization	404 (not found) — Inactive
User lacks proper access to organization or information	404 (not found) — No_Access
Request to the endpoint of a site	404 (not found) — No_Site_Endpoint
Invalid version	406 (not acceptable) — Invalid_Version
Invalid callback	406 (not acceptable) — Invalid_Callback

## Setting a Custom Login Server

For special cases—for example, if you’re a Salesforce partner using Trialforce—you might need to redirect your customer login requests to a non-standard login URI. For iOS apps, you set the Custom Host in your app’s iOS settings bundle. If you’ve configured this setting, it will be used as the default connection.

### Android Configuration

In Android, login hosts are known as server connections. Prior to Mobile SDK v. 1.4, server connections for Android apps were hard-coded in the SalesforceSDK project. In v. 1.4 and later, the host list is defined in the `res/xml/servers.xml` file. The SalesforceSDK library project uses this file to define production and sandbox servers.

You can add your servers to the runtime list by creating your own `res/xml/servers.xml` file in your application project. The root XML element for this file 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.)

Here’s an example of a `servers.xml` file.

```
<?xml version="1.0" encoding="utf-8"?>
<servers>
  <server name="XYZ.com Login" url="https://<username>.cloudforce.com"/>
</servers>
```

### Server Whitelisting Errors

If you get a whitelist rejection error, you’ll need to add your custom login domain to the `ExternalHosts` list for your project. This list is defined in the `<project_name>/<platform_path>/config.xml` file. Add those domains (e.g. `cloudforce.com`) to the app’s whitelist in the following files:

For Mobile SDK 2.0:

- **iOS:** `/Supporting Files/config.xml`
- **Android:** `/res/xml/config.xml`

## 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, we invalidate it and revoke the token. If a refresh token is included, we revoke it as well as 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`—the token was invalid

For a sandbox, use `test.salesforce.com` instead of `login.salesforce.com`.

## Handling Refresh Token Revocation in Android Native Apps

Beginning with Salesforce Mobile SDK version 1.5, native Android apps can control what happens when a refresh token is revoked by an administrator. The default behavior in this case 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, but they might or might not be suitable for your application. In your code you can choose whether to accept the default behavior or implement your own response. In either case, continue reading to determine whether you need to adapt your code.

### 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.

`TokenRevocationReceiver`, a utility class, is designed to respond to this intent action. To provide your own handler, you'll extend this class and override the `onReceive()` method. See [Token Revocation: Active Handling](#).

`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.

## Token Revocation: Passive Handling

You can let the SDK handle all token revocation events with no active involvement on your part. However, even if you take this passive approach, you might still need to change your code. You do not need to change your code if:

- Your app contains any services, or
- All of your activities extend `SalesforceActivity`, `SalesforceListActivity`, or `SalesforceExpandableListActivity`.

If your app fails to satisfy at least one of these conditions, implement the following code changes.

1. (For legacy apps written before the Mobile SDK 1.5 release) In the `ClientManager` constructor, set the `revokedTokenShouldLogout` parameter to `true`.



**Note:** This step is not necessary for apps that are new in Mobile SDK 1.5 or later.

2. In any activity that does not extend `SalesforceActivity`, `SalesforceListActivity`, or `SalesforceExpandableListActivity`, amend the code as follows.

- a. Declare a new variable:

```
private TokenRevocationReceiver tokenRevocationReceiver;
```

- b. In the `onCreate()` method add the following code:

```
tokenRevocationReceiver = new TokenRevocationReceiver(this);
```

- c. In the `onResume()` method add the following code:

```
registerReceiver(tokenRevocationReceiver, new  
IntentFilter(ClientManager.ACCESS_TOKEN_REVOKE_INTENT));
```

- d. In the `onPause()` method add the following code:

```
unregisterReceiver(tokenRevocationReceiver);
```

## Token Revocation: Active Handling

If you choose to implement your own token revocation event handler, be sure to fully analyze the security implications of your customized flow, and then test it thoroughly. Be especially careful with how you dispose of cached user data. Because the user's access has been revoked, that user should no longer have access to sensitive data.

To provide custom handling of token revocation events:

1. The starting point for implementing your own response is the `SalesforceSDKManager.shouldLogoutWhenTokenRevoked()` method. By default, this method returns true. Override this method to return false in your `SalesforceSDKManager` subclass.

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

2. The `ClientManager` constructor provides a boolean parameter, `revokedTokenShouldLogout`. Set this parameter to false. You can do this by calling `shouldLogoutWhenTokenRevoked()` on your `SalesforceSDKManager` subclass.
3. Implement your handler by extending `TokenRevocationReceiver` and overriding the `onReceive()` method.
4. Regardless of whether your activity subclasses `SalesforceActivity`, perform step 2 in [Token Revocation: Passive Handling](#).

## Connected Apps

A connected app is an application that integrates with `salesforce.com` 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 administrators to set various security policies and have explicit control over who may use the applications.

Connected apps begin with a developer defining OAuth metadata about the application, including:

- Basic descriptive and contact information for the connected app
- The OAuth scopes and callback URL for the connected app
- Optional IP ranges where the connected app might be running
- Optional information about mobile policies the connected app can enforce

In return, the developer is provided an OAuth client Id and client secret for the connected app. The developer can then package the app and provide it to a Salesforce administrator.

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's 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. User turns on phone and enters PIN for the device.



2. User starts mobile app (Connected App).
3. User enters login information for Salesforce organization.
4. User enters PIN code for mobile app.
5. User works in the app, then sends it to the background by opening another app (or receiving a call, and so on).
6. The mobile app times out.
7. User re-opens the app, and the app PIN screen displays (for the mobile app, not the device).
8. User enters app PIN and can resume working.

## Portal Authentication Using OAuth 2.0 and Force.com 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 Force.com 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 Force.com site.

Here's how to get started.

1. Associate a Force.com site with your portal. The site generates a unique URL for your portal. See [Associating a Portal with Force.com Sites](#).
2. Create a custom login page on the Force.com site. See [Managing Force.com 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.

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 Force.com 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 Force.com Developer Relations Blogs page.

# Chapter 14

## Using Communities With Mobile SDK Apps

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### In this chapter ...

- [Set Up an API-Enabled Profile](#)
- [Set Up a Permission Set](#)
- [Grant API Access to Users](#)
- [Configure a Self-Registration Profile](#)
- [Configure the Login Endpoint](#)

Salesforce Communities is a new feature that supersedes the Portal feature of earlier releases. Communities can include up to five million users, with logical zones for sharing knowledge with Ideas, Answers, and Chatter Answers.

With Communities, it's also much easier to create a mobile app that accesses Salesforce APIs for your community members. The Community feature automatically builds your custom community login page with your branding and configuration. 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 your community 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.
- Set a profile to handle self-registrations.
- Configure your Mobile SDK app to use your community's login endpoint.

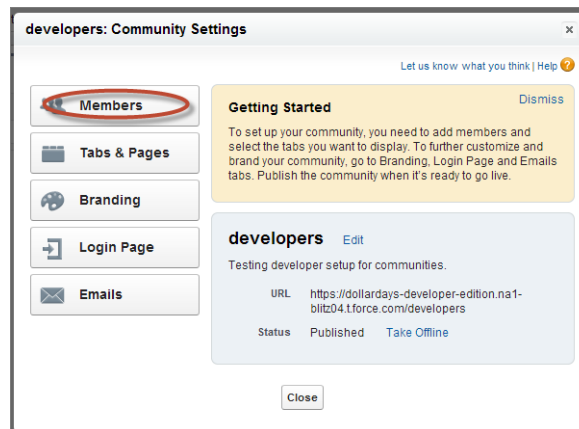
## Set Up an API-Enabled Profile

If you're new to communities, start by enabling the community feature in your org. See [https://help.salesforce.com/apex/HTViewHelpDoc?id=networks\\_enable.htm](https://help.salesforce.com/apex/HTViewHelpDoc?id=networks_enable.htm). When you're asked to create a domain name, be sure that it doesn't use SSL (<https://>).

To set up your community, see [https://help.salesforce.com/apex/HTViewHelpDoc?id=networks\\_creating.htm](https://help.salesforce.com/apex/HTViewHelpDoc?id=networks_creating.htm). 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.

1. To add the API Enabled permission to an existing profile, go to **Setup > Manage Users > Profiles** and either create a new profile or edit an existing one.  
For an overview of profiles, see [User Profiles Overview](#) in Salesforce Help.
2. On the Profile Details page, click **Edit** and go to **Administrative Settings**.
3. Select the **API Enabled** checkbox.
4. Click **Save**.
5. Go to **Settings > Customize > Communities > Manage Communities** and click **Edit** next to your community name.
6. In *My Community*: Community Settings, click **Members**.



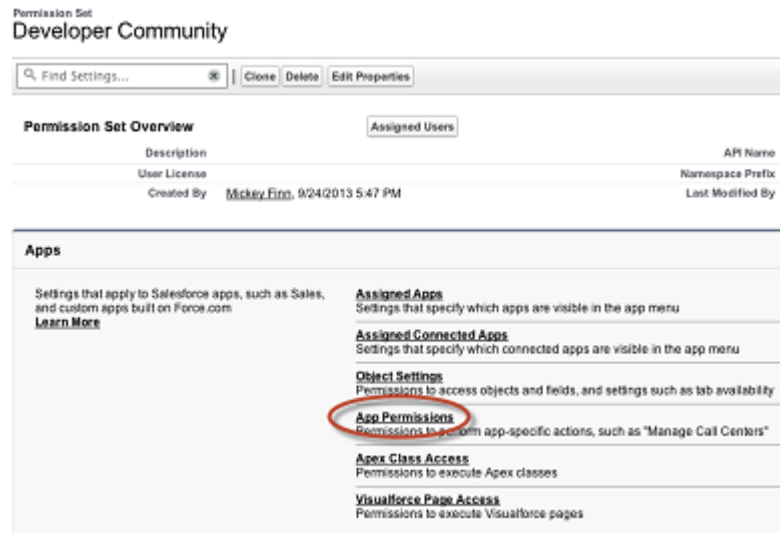
7. Under **Select Profiles**, add your API-enabled profile to **Selected Profiles**.

Users to whom these profiles are assigned now have API access.

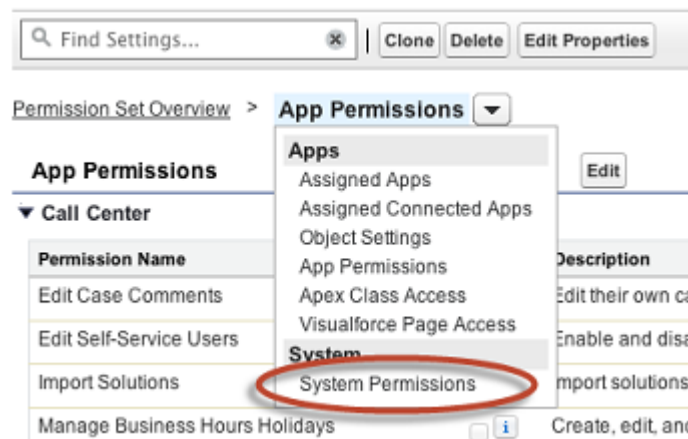
## Set Up a Permission Set

Another way to enable mobile apps for your community is through a permission set.

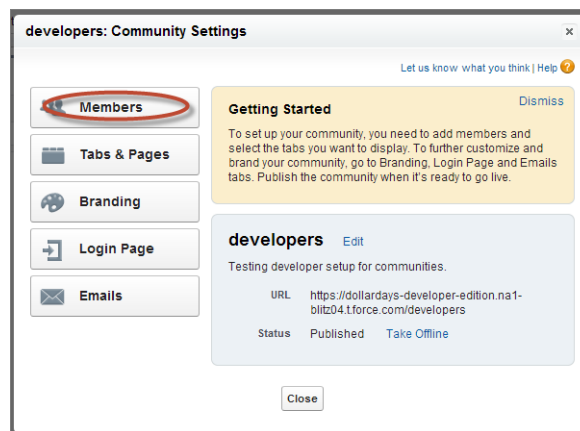
1. To add the API Enabled permission to an existing permission set, in Setup, click **Manage Users > Permissions Sets**, select the permission set, and skip to Step 6.
2. To create a permission set, in Setup, click **Administer > Manage Users > Permission Sets**.
3. Click **New**.
4. Give the Permission Set a label and press **Return** to automatically create the API Name.
5. Click **Next**.
6. Under the **Apps** section, click **App Permissions**.



- Click the arrow next to the **App Permissions** drop-down control and select **System > System Permissions**.



- On the System Permissions page, click **Edit**, then select the **API Enabled** checkbox.
- Click **Save**.
- Go to **Settings > Customize > Communities > Manage Communities** and click **Edit** next to your community name.
- In *My Community*: Community Settings, click **Members**.



- Under Select Permission Sets, add your API-enabled permission set to **Selected Permission Sets**.

Users in this permission set now have API access.

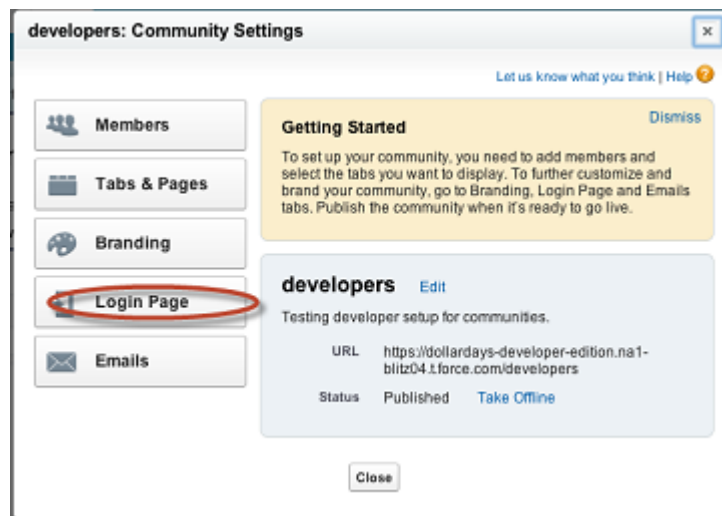
## Grant API Access to Users

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 a Self-Registration Profile

The Communities feature lets you allow external users to self-register as guests. You can enable your Mobile SDK app for guests by assigning them a default community profile.

1. In **CustomizeCommunitiesManage Communities**, click **Edit** next to your community name.
2. In *My Community*: Community Settings, click **Login Page**.



3. Under Registration, select **Allow external users to self-register**.
4. From the **Default profile for users that self-register** drop-down menu, choose a default profile that includes API access.

5. Click **Save**.

## 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. Prior to Mobile SDK v. 1.4, server connections for Android apps were hard-coded in the SalesforceSDK project. In v. 1.4 and later, the host list is defined in the `res/xml/servers.xml` file. The SalesforceSDK library project uses this file to define production and sandbox servers. You can add your servers to the runtime list by creating your own `res/xml/servers.xml` file in your application project. The root XML element for this file 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.)

Here's an example.

```
<?xml version="1.0" encoding="utf-8"?>
<servers>
  <server name="XYZ.com Login" url="https://<username>.cloudforce.com"/>
</servers>
```

## iOS

For iOS apps, you set the Custom Host in your app's iOS settings bundle. If you've configured this setting, it will be used as the default connection. Add the following to your *<appname>-Info.plist* file:

```
<key>SFDCOAuthLoginHost</key>
<string>your_community_login_url</string>
```

Optionally, you can remove `Settings.bundle` from your class if you don't want users to change the value.

# Chapter 15

## Migrating from the Previous Release

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### In this chapter ...

- [Migrate Mobile SDK Android Applications From 2.0 to 2.1](#)
- [Migrate Mobile SDK iOS Applications From 2.0 to 2.1](#)
- [Migrating From Version 1.5 to Version 2.0](#)

If you developed code with Salesforce Mobile SDK 2.0, follow these instructions to update your app to version 2.1.

If you're upgrading code developed with Salesforce Mobile SDK 1.5, upgrade first to version 2.0, then upgrade from 2.0 to 2.1. Start with [Migrating From Version 1.5 to Version 2.0](#) on page 219.



## Migrate Mobile SDK Android Applications From 2.0 to 2.1

Perform these tasks to upgrade your Android applications (native or hybrid) from Salesforce Mobile SDK 2.0 to version 2.1.

1. Replace the existing SalesforceSDK project in Eclipse with the Mobile SDK 2.1 SalesforceSDK project.
2. (Optional) If your app uses SmartStore, replace the existing SmartStore project in Eclipse with the Mobile SDK 2.1 SmartStore project.
3. Right-click your project and select **Properties**.
4. Select **Android**.
5. Replace the existing SalesforceSDK entry in the library project section with the new SalesforceSDK project in your workspace.
6. (Optional) If your app uses SmartStore, replace the existing SmartStore entry in the library project section with the new SmartStore project in your workspace.

We've moved the Salesforce Mobile SDK Activity and Service declarations from the app's `AndroidManifest.xml` file to the `AndroidManifest.xml` file of the SalesforceSDK project. These settings are automatically merged into the app's manifest file if the `manifestmerger` attribute is enabled.

7. Add the following code to your app's `project.properties` file:

```
manifestmerger.enabled=true
```

**Note:**

You're required to perform this step to use some new Mobile SDK 2.1 features, such as push notifications.

## Migrate Mobile SDK iOS Applications From 2.0 to 2.1

To upgrade native and hybrid apps, we strongly recommend you create a new app from the app templates in [the forceios npm package](#), then migrate the artifacts specific to your app into the new template.

Perform the following manual steps only if you prefer to update the Mobile SDK artifacts in your existing app.

### iOS Hybrid Applications

#### Update Mobile SDK Library Packages

The easiest way to upgrade Mobile SDK library packages is to delete the `Dependencies` folder of your app's Xcode project, and then add the new libraries.

1. In your Xcode project, in Project Navigator, locate the `Dependencies` folder. Control-click the folder, choose **Delete**, and select **Move to Trash**.
2. Download the following binary packages from the [distribution repo](#):
  - `Cordova/Cordova-Release.zip`
  - `SalesforceHybridSDK-Release.zip`
  - `SalesforceOAuth-Release.zip`
  - `SalesforceSDKCore-Release.zip`
3. Also, download the following folders from the `ThirdParty` folder link in the distribution repo:

- SalesforceCommonUtils
- openssl
- sqlcipher

4. Recreate the `Dependencies` folder under your app folder.
5. Unzip the new packages from step 2, and copy the folders from step 3, into the `Dependencies` folder.
6. In Project Navigator, control-click your app folder and select **Add Files to "<app\_name>"**.
7. Select the `Dependencies` folder, making sure that **Create groups for any added folder** is selected.
8. Click **Add**.

## Update Header File Search Paths

Update the header file search paths of your Xcode project.

1. Select your project in Project Navigator.
2. Select the **Build Settings** tab of your main target.
3. Scroll down to (or search/filter for) **Header Search Paths**.
4. Add the following search paths:
  - `$(SRCROOT) / [App Name] / Dependencies / SalesforceSDKCore / Headers`
  - `$(SRCROOT) / [App Name] / Dependencies / SalesforceOAuth / Headers`
  - `$(SRCROOT) / [App Name] / Dependencies / SalesforceCommonUtils / Headers`
  - `$(SRCROOT) / [App Name] / Dependencies / SalesforceHybridSDK / Headers`

## Update Hybrid Local Artifacts

1. For your hybrid "local" apps, replace the following files in the `www/` folder of your app with the new versions from the `libs` folder of the [SalesforceMobileSKD-Shared repo](#):
  - `cordova.force.js`
  - `forcetk.mobilesdk.js`
  - `smartsync.js`

## iOS Native Applications

### Update Mobile SDK Library Packages

The easiest way to upgrade Mobile SDK library packages is to delete the `Dependencies` folder of your app's Xcode project, and then add the new libraries.

1. In your Xcode project, in Project Navigator, locate the `Dependencies` folder. Control-click the folder, choose **Delete**, and select **Move to Trash**.
2. Download the following binary packages from the [distribution repo](#):
  - `Cordova/Cordova-Release.zip`
  - `SalesforceHybridSDK-Release.zip`
  - `SalesforceNetworkSDK-Release.zip`

- `SalesforceOAuth-Release.zip`
- `SalesforceSDKCore-Release.zip`

3. Also, download the following folders from the `ThirdParty` folder link in the distribution repo:

- `SalesforceCommonUtils`
- `openssl`
- `sqlcipher`

4. Recreate the `Dependencies` folder, under your app folder.
5. Unzip the new packages from step 2, and copy the folders from step 3, into the `Dependencies` folder.
6. In Project Navigator, control-click your app folder and select **Add Files to "<app\_name>"**.
7. Select the `Dependencies` folder, making sure that **Create groups for any added folder** is selected.
8. Click **Add**.

## Update Header File Search Paths

Update the header file search paths of your Xcode project.

1. Select your project in Project Navigator.
2. Select the **Build Settings** tab of your main target.
3. Scroll down to (or search/filter for) **Header Search Paths**.
4. Add the following search paths:

- `$(SRCROOT) / [App Name] / Dependencies / SalesforceSDKCore / Headers`
- `$(SRCROOT) / [App Name] / Dependencies / SalesforceOAuth / Headers`
- `$(SRCROOT) / [App Name] / Dependencies / SalesforceNetworkSDK / Headers`
- `$(SRCROOT) / [App Name] / Dependencies / SalesforceCommonUtils / Headers`
- `$(SRCROOT) / [App Name] / Dependencies / SalesforceHybridSDK / Headers`

## Native Mobile SDK Library Changes

In 2.1, the Mobile SDK has replaced RestKit with `MKNetworkKit` as the network library for native apps. `MKNetworkKit` is wrapped by the new `SalesforceNetworkSDK` library, which in turn is wrapped by the `SFRestAPI` class and its supporting classes. Most of the interfaces remain the same. Here's a list of notable changes:

- `[SFRestAPI sharedInstance].rkClient` no longer exists.
- `[SFRestAPI send:delegate:]` now returns the new `SFNetworkOperation` associated with the request.
- `SFRestRequest.networkOperation` points to the underlying `SFNetworkOperation` object associated with the request.

If your app used any underlying RestKit members for networking, you'll need to look at the equivalent functionality in `MKNetworkKit` and the `SalesforceNetworkSDK` libraries.

## Migrating From Version 1.5 to Version 2.0

If you developed code with Salesforce Mobile SDK 1.5, follow these instructions to update your app to version 2.0.

## Migrate Mobile SDK Android Applications From 1.5 to 2.0

Perform these tasks to upgrade your Android applications from Salesforce Mobile SDK 1.5.3 to version 2.0.0.

### Upgrading Native Android Apps

- In your app's Eclipse workspace, replace the existing SalesforceSDK project with the 2.0 SalesforceSDK project. If your app uses SmartStore, replace the existing SmartStore project in Eclipse with the 2.0 SmartStore project.
  - Right-click your project and select **Properties**.
  - Click the **Android** tab and replace the existing SalesforceSDK entry at the bottom (in the library project section) with the new SalesforceSDK project in your workspace. Repeat this step with the SmartStore project if your app uses SmartStore.
- Change your class that extends `ForceApp` or `ForceAppWithSmartStore` to extend `Application` instead. We'll call this class `SampleApp` in the remaining steps.
- Create a new class that implements `KeyInterface`. Name it `KeyImpl` (or another name of your choice.) Move the `getKey()` implementation from `SampleApp` into `KeyImpl`.
- We've renamed `ForceApp` to `SalesforceSDKManager` and `ForceAppWithSmartStore` to `SalesforceSDKManagerWithSmartStore`.
  - Replace all occurrences of `ForceApp` with `SalesforceSDKManager`
  - Replace all occurrences of `ForceAppWithSmartStore` with `SalesforceSDKManagerWithSmartStore`.
  - Update the app's class imports to reflect this change.
  - Replace all occurrences of `ForceApp.APP` with `SalesforceSDKManager.getInstance()`.
  - Replace all occurrences of `ForceAppWithSmartStore.APP` with `SalesforceSDKManagerWithSmartStore.getInstance()`.
- In the `onCreate()` method of `SampleApp`, add the following line of code.

```
SalesforceSDKManager.initNative(getApplicationContext(), new KeyImpl(),
<mainActivityClass>.class);
```

where `<mainActivityClass>` is the class to be launched when the login flow completes.



#### Note:

- If your app supplies its own login activity, you can pass it as an additional argument to the `initNative()` method call.
  - If your app uses SmartStore, call `initNative()` on `SalesforceSDKManagerWithSmartStore` instead of `SalesforceSDKManager`.
- Remove overridden methods of `ForceApp` from `SampleApp`, such as `getKey()`, `getMainActivityClass()`, and any other overridden methods.
- You're no longer required to create a `LoginOptions` object. The Salesforce Mobile SDK now automatically reads these options from an XML file, `bootconfig.xml`, which resides in the `res/values` folder of your project.
  - Create a file called `bootconfig.xml` under the `res/values` folder of your project. Move your app's login options configuration from code to `bootconfig.xml`. See `res/values/bootconfig.xml` in the SalesforceSDK project or in one of the sample native apps for an example.

- `NativeMainActivity` has been renamed to `SalesforceActivity` and moved to a new package named `com.salesforce.androidsdk.ui.sfnative`.
  - ◊ If any of your app's classes extend `NativeMainActivity`, replace all references to `NativeMainActivity` with `SalesforceActivity`.
  - ◊ Update the app's class imports to reflect this change.
- We've moved `SmartStore` to a new package named `com.salesforce.androidsdk.smartstore`. If your app uses `SmartStore` project, update the app's class imports and other code references to reflect this change.

## Upgrading Hybrid Android Apps

- In your app's Eclipse workspace, replace the existing `SalesforceSDK` project with the 2.0 `SalesforceSDK` project. If your app uses `SmartStore`, replace the existing `SmartStore` project in Eclipse with the 2.0 `SmartStore` project.
  1. Right-click your project and select **Properties**.
  2. Click the **Android** tab and replace the existing `SalesforceSDK` entry at the bottom (in the library project section) with the new `SalesforceSDK` project in your workspace. Repeat this step with the `SmartStore` project if your app uses `SmartStore`.
- Change your class that extends `ForceApp` or `ForceAppWithSmartStore` to extend `Application` instead. We'll call this class `SampleApp` in the remaining steps.
- Create a new class that implements `KeyInterface`. Name it `KeyImpl` (or any other name of your choice.) Move the `getKey()` implementation from `SampleApp` into `KeyImpl`.
- We've renamed `ForceApp` to `SalesforceSDKManager` and `ForceAppWithSmartStore` to `SalesforceSDKManagerWithSmartStore`.
  - ◊ Replace all occurrences of `ForceApp` with `SalesforceSDKManager`
  - ◊ Replace all occurrences of `ForceAppWithSmartStore` with `SalesforceSDKManagerWithSmartStore`.
  - ◊ Update the app's class imports to reflect this change.
  - ◊ Replace all occurrences of `ForceApp.APP` with `SalesforceSDKManager.getInstance()`.
  - ◊ Replace all occurrences of `ForceAppWithSmartStore.APP` with `SalesforceSDKManagerWithSmartStore.getInstance()`.
- In the `onCreate()` method of `SampleApp`, add the following line of code.

```
SalesforceSDKManager.initHybrid(getApplicationContext(), new KeyImpl());
```



### Note:

- ◊ If your app supplies its own login activity, you can pass it as an additional argument to the `initHybrid()` method call.
- ◊ If your app uses `SmartStore`, call `initHybrid()` on `SalesforceSDKManagerWithSmartStore` instead of `SalesforceSDKManager`.
- Remove overridden methods of `ForceApp` from `SampleApp`, such as `getKey()`, `getMainActivityClass()`, and any other overridden methods.
- You're no longer required to create a `LoginOptions` object. The Salesforce Mobile SDK now automatically reads these options from an XML file, `bootconfig.xml`, which resides in the `res/values` folder of your project.

- ◇ Create a file called `bootconfig.xml` under the `res/values` folder of your project. Move your app's login options configuration from code to `bootconfig.xml`. See `res/values/bootconfig.xml` in the SalesforceSDK project or in one of the sample native apps for an example.
- `NativeMainActivity` has been renamed to `SalesforceActivity` and moved to a new package named `com.salesforce.androidsdk.ui.sfnative`.
  - ◇ If any of your app's classes extend `NativeMainActivity`, replace all references to `NativeMainActivity` with `SalesforceActivity`.
  - ◇ Update the app's class imports to reflect this change.
- We've moved `SmartStore` to a new package named `com.salesforce.androidsdk.smartstore`. If your app uses the `SmartStore` project, update the app's class imports and other code references to reflect this change.
- We've replaced `bootconfig.js` with `bootconfig.json`. Convert your existing `bootconfig.js` to the new `bootconfig.json` format. See the hybrid sample apps for examples.
- The SalesforceSDK Cordova plugins—`SFHybridApp.js`, `cordova.force.js`, and `SalesforceOAuthPlugin.js`—have been combined into a single file named `filecordova.force.js`.
  - ◇ Replace these Cordova plugin files with `cordova.force.js`.
  - ◇ Replace all references to `SFHybridApp.js`, `cordova.force.js`, and `SalesforceOAuthPlugin.js` with `cordova.force.js`.
- `forcetk.js` has now been renamed to `forcetk.mobilesdk.js`. Replace the existing copy of `forcetk.js` with the latest version of `forcetk.mobilesdk.js`. Update all references to `forcetk.js` to the new name.
- The `bootstrap.html` file is no longer required and can safely be removed.
- We've moved `SalesforceDroidGapActivity` and `SalesforceGapViewClient` to a new package named `com.salesforce.androidsdk.ui.sfhybrid`. If your app references these classes, update those references and related class imports.

## Migrate Mobile SDK iOS Applications From 1.5 to 2.0

Perform these tasks to upgrade your iOS applications from Salesforce Mobile SDK 1.5 to version 2.0.


### Upgrading Native iOS Apps

As with all upgrades, you have two choices for upgrading your existing app:

- Create a new project using the Mobile SDK 2.0 template app for your app type (native, hybrid), then move your existing code and artifacts into the new app.
- Incorporate Mobile SDK 2.0 artifacts into your existing app.

For 2.0, we strongly recommend that you take the first approach. Even if you opt for the second approach, you can profit from creating a sample app to see the change of work flow in the `AppDelegate` class. For both native and hybrid cases, the parent app delegate classes—`SFNativeRestAppDelegate` and `SFContainerAppDelegate`, respectively—are no longer supported. Your app's `AppDelegate` class now orchestrates the startup process.

- Remove `SalesforceHybridSDK.framework`, which has been replaced.
- Update your Mobile SDK library and resource dependencies, from the [SalesforceMobileSDK-iOS-Package repo](#).
  - ◇ Remove `SalesforceSDK`
  - ◇ Add `SalesforceNativeSDK` (in the `Dependencies/` folder)
  - ◇ Add `SalesforceSDKCore` (in the `Dependencies/` folder)
  - ◇ Update `SalesforceOAuth` (in the `Dependencies/` folder)

- ◇ Update `SalesforceSDKResources.bundle` (in the `Dependencies/` folder)
  - ◇ Update `RestKit` (in the `Dependencies/ThirdParty/RestKit/` folder)
  - ◇ Update `SalesforceCommonUtils` (in the `Dependencies/ThirdParty/SalesforceCommonUtils` folder)
  - ◇ Update `openssl` (`libcrypto.a` and `libssl.a`, in the `Dependencies/ThirdParty/openssl` folder)
  - ◇ Update `sqlcipher` (in the `Dependencies/ThirdParty/sqlcipher` folder)
  - Update your `AppDelegate` class. Make your `AppDelegate.h` and `AppDelegate.m` files conform to the new design patterns. Here are some key points:
    - ◇ In `AppDelegate.h`, `AppDelegate` should no longer inherit from `SFNativeRestAppDelegate`.
    - ◇ In `AppDelegate.m`, `AppDelegate` now has primary responsibility for navigating the auth flow and root view controller staging. It also handles boundary events when the user logs out or switches login hosts.
-  **Note:** The design patterns in the new `AppDelegate` are just suggestions. Mobile SDK no longer requires a specific flow. Use an authentication flow (with the updated `SFAuthenticationManager` singleton) that suits your needs, relative to your app startup and boundary use cases.)
- ◇ The only prerequisites for using authentication are the `SFAccountManager` configuration settings at the top of `[AppDelegate init]`. Make sure that those settings match the values specified in your connected app. Also, make sure that this configuration is set before the first call to `[SFAuthenticationManager loginWithCompletion:failure:]`.

## Upgrading Hybrid iOS Apps

In Mobile SDK 2.0, hybrid configuration during bootstrap moves to native code. Take a look at `SFHybridViewController` to see the new configuration. (You can also see this change in `AppDelegate` in the hybrid template app.)

New app templates are now available through the `forceios` NPM package. To install the templates, first install `node.js`. See the `forceios` README at [npmjs.org](https://npmjs.org) for more information on installing the templates and using them to create apps.

Even if you're not porting your previous contents into a 2.0 application shell, it's still a good idea to create a new hybrid app from the template and follow along.

- Remove `SalesforceHybridSDK.framework`. We've replaced this project.
- Update your Mobile SDK library and resource dependencies from the [SalesforceMobileSDK-iOS-Package](#) repo. The following modules are new additions to your Mobile SDK 1.5 application.
  - ◇ `SalesforceHybridSDK` (in the `Dependencies/` folder)
  - ◇ `SalesforceOAuth` (in the `Dependencies/` folder)
  - ◇ `SalesforceSDKCore` (in the `Dependencies/` folder)
  - ◇ `SalesforceSDKResources.bundle` (in the `Dependencies/` folder)
  - ◇ `Cordova` (in the `Dependencies/Cordova/` folder)
  - ◇ `SalesforceCommonUtils` (in the `Dependencies/ThirdParty/SalesforceCommonUtils` folder)
  - ◇ `openssl` (`libcrypto.a` and `libssl.a`, in the `Dependencies/ThirdParty/openssl` folder)
  - ◇ `sqlcipher` (in the `Dependencies/ThirdParty/sqlcipher` folder)
  - ◇ `libxml2.dylib` (System library)
- Update hybrid dependencies in your app's `www/` folder.



**Note:** If you're updating a Visualforce app, only the `bootconfig.js` change is required. Your hybrid app does not use the other files.

- ◇ Migrate your `bootconfig.js` configuration to the new `bootconfig.json` format.
- ◇ Remove `SalesforceOAuthPlugin.js`, `SFHybridApp.js`, `cordova.force.js`, and `forcetk.js`.
- ◇ If you're not using them, you can remove `SFTestRunnerPlugin.js`, `qunit.css`, and `qunit.js`.
- ◇ Add `cordova.force.js` (in the `HybridShared/libs/` folder).
- ◇ If you're using ForceTK, add `forcetk.mobilesdk.js` (in the `HybridShared/libs/` folder).
- ◇ If you're using jQuery, update jQuery (in the `HybridShared/external/` folder).
- ◇ Add `SmartSync.js` (in the `HybridShared/libs/` folder).
- ◇ Add `backbone-1.0.0.min.js` and `underscore-1.4.4.min.js` (in the `HybridShared/external/backbone/` folder).
- ◇ Add jQuery if you haven't already (in the `HybridShared/external/jquery/` folder).
- ◇ If you'd like to use the new SmartSync Data Framework:
  - Add `SmartSync.js` (in the `HybridShared/libs/` folder).
  - Add `backbone-1.0.0.min.js` and `underscore-1.4.4.min.js` (in the `HybridShared/external/backbone/` folder).
  - If you haven't already, add jQuery, (in the `HybridShared/external/jquery/` folder).
- Update your AppDelegate—Make your `AppDelegate.h` and `AppDelegate.m` files conform to the new design patterns. If you've never changed your AppDelegate class, you can simply copy the new template app's `AppDelegate.h` and `AppDelegate.m` files over the old ones. Here are some key points:
  - ◇ In `AppDelegate.h`:
    - AppDelegate no longer inherits `SFContainerAppDelegate`.
    - There's a new `viewController` property on `SFHybridViewController`.
  - ◇ In `AppDelegate.m`, AppDelegate now assumes primary responsibility for navigating the bootstrapping and authentication flow. This responsibility includes handling boundary events when the user logs out or switches login hosts.



# Chapter 16

## Reference

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### In this chapter ...

- [REST API Resources](#)
- [iOS Architecture](#)
- [Android Architecture](#)

Reference documentation is hosted on GitHub

- For iOS: <http://forcedotcom.github.com/SalesforceMobileSDK-iOS/Documentation/SalesforceSDK/index.html>
- For Android:  
<http://forcedotcom.github.com/SalesforceMobileSDK-Android/index.html>

## REST API Resources

The Salesforce Mobile SDK simplifies using the REST API by creating wrappers. All you need to do is call a method and provide the correct parameters; the rest is done for you. This table lists the resources available and what they do. For more information, see the [REST API Developer's Guide](#).

Resource Name	URI	Description
Versions	/	Lists summary information about each Salesforce version currently available, including the version, label, and a link to each version's root.
Resources by Version	/vXX.X/	Lists available resources for the specified API version, including resource name and URI.
Describe Global	/vXX.X/subjects/	Lists the available objects and their metadata for your organization's data.
SObject Basic Information	/vXX.X/subjects/ <b>SObject</b> /	Describes the individual metadata for the specified object. Can also be used to create a new record for a given object.
SObject Describe	/vXX.X/subjects/ <b>SObject</b> /describe/	Completely describes the individual metadata at all levels for the specified object.
SObject Rows	/vXX.X/subjects/ <b>SObject</b> / <b>id</b> /	Accesses records based on the specified object ID. Retrieves, updates, or deletes records. This resource can also be used to retrieve field values.
SObject Rows by External ID	/vXX.X/subjects/ <b>SObjectName</b> / <b>fieldName</b> / <b>fieldValue</b>	Creates new records or updates existing records (upserts records) based on the value of a specified external ID field.
SObject User Password	/vXX.X/subjects/User/ <b>user id</b> /password /vXX.X/subjects/SelfServiceUser/ <b>self service user id</b> /password	Set, reset, or get information about a user password.
Query	/vXX.X/query/?q= <b>soql</b>	Executes the specified SOQL query.
Search	/vXX.X/search/?s= <b>sosl</b>	Executes the specified SOSL search. The search string must be URL-encoded.

## iOS Architecture

At a high level, the current facilities that the native SDK provides to consumers are:

- OAuth authentication capabilities
- REST API communication capabilities
- SmartStore secure storage and retrieval of app data



**Note:** SmartStore is not currently exposed to native template apps, but is included in the binary distribution.

The Salesforce native SDK is essentially one library, with dependencies on (and providing exposure to) the following additional libraries:

- `libSalesforceNetworkSDK.a`—Underlying library for facilitating REST API calls. This library requires third-party libraries that are available through a Mobile SDK GitHub repository. See [iOS Project Settings](#) on page 118.
- `libSalesforceOAuth.a`—Underlying libraries for managing OAuth authentication.
- `libsqlite3.dylib`—Library providing access to SQLite capabilities. This is also a part of the standard iOS development environment.
- `fmdb`—Objective-C wrapper around SQLite.



**Note:** This wrapper is not currently exposed to native template apps, but is included in the binary distribution.

## Native iOS Objects

The following objects let you access Salesforce data in your native app:

- `SFRestAPI`
- `SFRestAPI (Blocks)`
- `SFRestRequest`

### **SFRestAPI**

`SFRestAPI` is the entry point for making REST requests, and is generally accessed as a singleton, 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)**

This is a category extension of the `SFRestAPI` class that allows you 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 canned REST requests provided by SFRestAPI, you can also create your own:

```
NSString *path = @"/v23.0";
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"]];
```

## Other Objects

Though you won't likely leverage these objects directly, their purpose in the SDK is worth noting.

- **RKRequestDelegateWrapper**—The intermediary between SFRestAPI and the RestKit libraries. RKRequestDelegateWrapper wraps the functionality of RestKit communications, providing convenience methods for determining the type of HTTP post, handling data transformations, and interpreting responses.
- **SFSessionRefresher**—Tightly-coupled with SFRestAPI, providing an abstraction around functionality for automatically refreshing a session if any REST requests fail due to session expiration.

# Android Architecture

The SalesforceSDK is provided as a library project. You need to reference the SalesforceSDK project from your application project. See the [Android developer documentation](#).

## Java Code

Java sources are under /src.

## Java Code

Package Name	Description
com.salesforce.androidsdk.app	SDK application classes (SalesforceSDKManager)
com.salesforce.androidsdk.auth	OAuth support classes
com.salesforce.androidsdk.phonegap	Native implementation of Salesforce Mobile SDK PhoneGap plugin

Package Name	Description
<code>com.salesforce.androidsdk.push</code>	Classes for registering and unregistering devices to receive push notifications, as well as an interface that the app implements to receive and handle push notifications
<code>com.salesforce.androidsdk.rest</code>	Classes for REST requests/responses
<code>com.salesforce.androidsdk.security</code>	Security-related helper classes (e.g. passcode manager)
<code>com.salesforce.androidsdk.smartstore</code>	SmartStore and supporting classes
<code>com.salesforce.androidsdk.ui</code>	Activities (e.g. login)
<code>com.salesforce.androidsdk.ui.sfhybrid</code>	App activity base classes
<code>com.salesforce.androidsdk.ui.sfnative</code>	App activity base classes
<code>com.salesforce.androidsdk.util</code>	Miscellaneous utility classes

### `com.salesforce.androidsdk.app`

Class	Description
<code>SalesforceSDKManager</code>	Abstract subclass of application; you must supply a concrete subclass in your project.
<code>UpgradeManager</code>	Helper class for upgrades
<code>UUIDManager</code>	Helper class for UUID generation

### `com.salesforce.androidsdk.auth`

Class	Description
<code>AccountWatcher</code>	Watcher responsible for cleanup when account is removed from settings application
<code>AuthenticatorService</code>	Service taking care of authentication
<code>HttpAccess</code>	Generic HTTP access layer
<code>LoginServerManager</code>	Manages login hosts
<code>OAuth2</code>	Helper class for common OAuth2 requests

### `com.salesforce.androidsdk.phonegap`

Class	Description
<code>ForcePlugin</code>	Abstract super class for all Salesforce plugins
<code>JavaScriptPluginVersion</code>	Helper class to encapsulate the version reported by the JavaScript code
<code>SalesforceOAuthPlugin</code>	PhoneGap plugin for Salesforce OAuth
<code>SDKInfoPlugin</code>	PhoneGap plugin to get information about the SDK container
<code>TestRunnerPlugin</code>	PhoneGap plugin to run javascript tests in container

**com.salesforce.androidsdk.push**

Class	Description
PushBroadcastReceiver	Internal use class that receives messages from Google Cloud Messaging (GCM)
PushMessaging	Internal use class that handles device registration and unregistration for push notifications, as well as storage and retrieval of registration information
PushNotificationInterface	Public interface implemented by the app to receive and handle push notifications
PushService	Internal use class that registers and unregisters the app with the Salesforce connected app to receive push notifications from the Salesforce organization

**com.salesforce.androidsdk.rest**

Class	Description
ClientManager	Factory of RestClient, kicks off login flow if needed
RestClient	Authenticated client to talk to a Force.com server
RestRequest	Force.com REST request wrapper
RestResponse	REST response wrapper

**com.salesforce.androidsdk.security**

Class	Description
Encryptor	Helper class for encryption/decryption/hash computations
PasscodeManager	Inactivity timeout manager, kicks off passcode screen if needed

**com.salesforce.androidsdk.smartstore.app**

This package is part of the SmartStore library project.

Class	Description
SalesforceSDKManagerWithSmartStore	Super class for all force applications that use the SmartStore (lives in SmartStore library project)
UpgradeManagerWithSmartStore	Upgrade manager for applications that use the SmartStore (lives in SmartStore library project)

**com.salesforce.androidsdk.smartstore.phonegap**

This package is part of the SmartStore library project.

Class	Description
SmartStorePlugin	PhoneGap plugin for SmartStore
StoreCursor	Represents a query cursor

**com.salesforce.androidsdk.smartstore.store**

This package is part of the SmartStore library project.

Class	Description
DBHelper	Helper class to access the database underlying SmartStore
DBOpenHelper	Helper class to manage regular database creation and version management
IndexSpec	Represents an index specification
QuerySpec	Represents a query specification
SmartSqlHelper	Helper class for parsing and running SmartSql
SmartStore	Searchable/secure store for JSON documents

**com.salesforce.androidsdk.ui**

Class	Description
CustomServerUrlEditor	Custom dialog allowing user to pick a different login host
LoginActivity	Login screen
SalesforceActivity	Main activity of native application should extend or duplicate the functionality of this class
OAuthWebviewHelper	Helper class to manage a WebView instance that is going through the OAuth login process
PasscodeActivity	Passcode (PIN) screen
SalesforceDroidGapActivity	Main activity for hybrid applications
SalesforceGapViewClient	WebView client used in hybrid applications
SalesforceR	Class that allows references to resources defined outside the SDK
ServerPickerActivity	Choose login host screen

**com.salesforce.androidsdk.ui.sfhybrid**

Class	Description
SalesforceDroidGapActivity	Defines the main activity for a Cordova-based application
SalesforceGapViewClient	Defines the web view client for a Cordova-based application

**com.salesforce.androidsdk.ui.sfnative**

Class	Description
SalesforceActivity	Main activity of native applications. All native activities are encouraged to extend one of the classes in this package, or else duplicate the functionality of one of these classes.
SalesforceListActivity	Main activity of native applications, based on the Android ListActivity class. All native activities are encouraged to

Class	Description
	extend one of the classes in this package, or else duplicate the functionality of one of these classes.
<code>SalesforceExpandableListActivity</code>	Main activity of native applications, based on the Android <code>ExpandableListActivity</code> class. All native activities are encouraged to extend one of the classes in this package, or else duplicate the functionality of one of these classes.

### `com.salesforce.androidsdk.util`

Class	Description
<code>BaseActivityInstrumentationTestCase</code>	Super class for activity test classes
<code>EventsListenerQueue</code>	Class to track activity events using a queue, allowing for tests to wait for certain events to turn up
<code>EventsObservable</code>	Used to register and receive events generated by the SDK (used primarily in tests)
<code>EventsObserver</code>	Observer of SDK events
<code>SalesforceSDKManagerInstrumentationTestCase</code>	Super class for tests of an application using the Salesforce Mobile SDK
<code>HybridInstrumentationTestCase</code>	Super class for tests of hybrid application
<code>JSTestCase</code>	Super class to run tests written in JavaScript
<code>JUnitReportTestRunner</code>	Test runner that runs tests using a time run cap
<code>LogUtil</code>	Helper methods for logging
<code>NativeInstrumentationTestCase</code>	Super class for tests of native application
<code>TimeLimitedTestRunner</code>	Test runner that limits the lifetime of the test run

## Libraries

Libraries are under `/libs`.

Library Name	Description
<code>cordova-2.3.0.jar</code>	Open source mobile development framework; used in hybrid applications (*)
<code>sqlcipher.jar</code>	Open source extension to <code>SQLite</code> that provides transparent 256-bit AES encryption of database files (**)
<code>x86/*.so</code>	Native libraries required by <code>sqlcipher</code> on Intel-based devices
<code>armeabi/*.so</code>	Native libraries required by <code>sqlcipher</code> on ARM-based devices (**)
<code>commons-code.jar, guava-r09.jar</code>	Java libraries required by <code>sqlcipher</code>

(\*) denotes files required for hybrid application.



(\*\*) denotes files required for SmartStore.

## Resources

Resources are under /res.

### drawable-hdpi

File	Use
sf__edit_icon.png	Server picker screen
sf__highlight_glare.png	Login screen
sf__icon.png	Application icon

### drawable-ldpi

File	Use
sf__icon.png	Application icon

### drawable-mdpi

File	Use
sf__edit_icon.png	Server picker screen
sf__highlight_glare.png	Login screen
sf__ic_refresh_sync_anim0.png	Application icon
sf__icon.png	Application icon

### drawable

File	Use
sf__header_bg.png	Login screen
sf__progress_spinner.xml	Login screen
sf__toolbar_background.xml	Login screen

### drawable-xlarge

File	Use
sf__header_bg.png	Login screen (tablet)
sf__header_drop_shadow.xml	Login screen (tablet)
sf__header_left_border.xml	Login screen (tablet)
sf__header_refresh.png	Login screen (tablet)
sf__header_refresh_press.png	Login screen (tablet)

File	Use
sf__header_refresh_states.xml	Login screen (tablet)
sf__header_right_border.xml	Login screen (tablet)
sf__login_content_header.xml	Login screen (tablet)
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)

### layout

File	Use
sf__custom_server_url.xml	Server picker screen
sf__login.xml	Login screen
sf__passcode.xml	Pin screen
sf__server_picker.xml	Server picker screen (deprecated)
sf__server_picker_list.xml	Server picker screen

### layout-land

File	Use
sf__passcode.xml	PIN screen

### layout-xlarge

File	Use
sf__header_bottom.xml	Header (tablet)
sf__header_separator.xml	Header (tablet)
sf__login.xml	Login screen (tablet)
sf__login_header.xml	Login screen (tablet)
sf__passcode.xml	PIN screen (tablet)
sf__server_picker.xml	Server picker screen (tablet)

File	Use
sf__server_picker_header.xml	Server picker screen (tablet)

**menu**

File	Use
sf__clear_custom_url.xml	Add connection dialog
sf__login.xml	Login menu (phone)

**values**

File	Use
bootconfig.xml	Connected app configuration settings
sf__colors.xml	Colors
sf__dimens.xml	Dimensions
sf__strings.xml	SDK strings
sf__style.xml	Styles
strings.xml	Other strings (app name)

**values-xlarge**

File	Use
sf__colors.xml	Colors (tablet)
sf__dimens.xml	Dimensions (tablet)
styles.xml	Styles (tablet)

**xml**

File	Use
authenticator.xml	Preferences for account used by application
config.xml	Plugin configuration file for PhoneGap. Required for hybrid.
servers.xml	Server configuration.

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