## Android - Cloudant NoSQL DB API

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#### Overview

This tutorial shows how to apply technology available in IBM MobileFirst Platform Foundation to store data for Android mobile applications. By using Cloudant NoSQL DB APIs, you can complete specific database operations, such as creating, reading, updating, deleting, and synchronizing data between local and remote databases. This tutorial provides a basic overview of these APIs and explains how to configure and run the sample, in the following topics:

- Using the IMFData SDK
- · Creating local data stores
- · Creating remote data stores
- · Setting user permissions for remote stores
- Modeling data for Android applications
- · Creating and updating data
- Supporting synchronization and offline storage
- Running the Android sample
- Obtaining and configuring the required SDKs
- · BlueList application flow

## **Using the IMFData SDK**

After the IMFData SDK is installed, you can begin to initialize and use the SDK in your native Android application.

// Initialize the IMFDataManager

DataManager manager = DataManager.initialize(context, new URL(CLOUDANT\_PROXY\_URL));

The value for cloudantProxyUrl is the URL of the MobileFirst Data Proxy which was configured during installation. The URL includes the IP address, host, and context root that you have defined.

For example: http://localhost:10080/imf-data-proxy.

In the native Android sample that comes with this tutorial, the value for the cloudantProxyUrl is set in the bluelist.properties file.

# **Creating local data stores**

You can create a Store object to allow your application to access a local database, which can be used even when the application is offline.

```
// Using reference to IMFDataManager that you initialized above, create a local store using a bolts task
String name = "todosdb";
// Create local store
Task<Store> storeTask = manager.localStore(name);
storeTask.continueWith(new Continuation<Store, Void>() {
    @Override
    public Void then(Task<Store> task) throws Exception {
        if(task.isFaulted()){
            // Handle error
        }else{
            // Newly created store
            Store localStore = task.getResult();
        }
        return null;
    }
};
```

## **Creating remote data stores**

You can also create a Store object to allow your application to access a remote database.

```
// Create remote store
String name = "todosdb";
// Using reference to IMFDataManager that you initialized above, create a remote store using a bolts task
Task<Store> storeTask = manager.remoteStore(name);
storeTask.continueWith(new Continuation<Store, Void>() {
     @Override
     public Void then(Task<Store> task) throws Exception {
        if (task.isFaulted()){
            // Handle error
        }else{
            // Newly created store
            Store remoteStore = task.getResult();
        }
        return null;
    }
}
```

# Setting user permissions for remote stores

You can set specific permissions for users to access remote stores.

```
// Using reference to IMFDataManager that you initialized above, set the user permissions for the remote store
Task<Boolean> permissionsTask = manager.setCurrentUserPermissions(DataManager.DB_ACCESS_GROUP_MEMBERS
, "todosdb");
permissionsTask.continueWith(new Continuation<Boolean, Object>() {
    @Override
    public Object then(Task<Boolean> task) throws Exception {
        if(task.isFaulted()){
            // Handle error
        }else{
            // setting permissions was successful
        }
        return null;
    }
});
```

**Note:** In the sample, the user is authenticated via OAuth. OAuth has been configured through adapter-based authentication. You can find further instructions on setting up access with OAuth capabilities and the MobileFirst Data Proxy in configuring OAuth security (https://www-

01.ibm.com/support/knowledgecenter/SSHS8R\_7.0.0/com.ibm.worklight.dev.doc/cloud/data/t\_data\_cloudantsec.html%23oauth), in the user documentation.

## **Modeling data for Android applications**

In Android applications, you can use the DataObjectMapper class to map native objects to JSON document format. When you create a data store with the DataManager API, you can create a new DataObjectMapper to set on the Store object.

```
localStore.setMapper(new DataObjectMapper());
```

In the sample, a custom TodoItem class allows you to store custom data as objects in our application. When creating a custom DataObjectMapper class, make sure that it meets the following requirements:

- Conform to the IMFDataObject protocol.
- Have the IMFDataObject protocol metadata property set on the class interface.
- Implements DataObject.

#### Todoltem implementation (TodoItem.java)

```
public class Todoltem implements DataObject {
  private Metadata metadata = null;
  private String name;
  private Integer priority;
  // NOTE: If you use a constructor with arguments, you will need to supply an empty constructor for the mapper to function
  public TodoItem(){
     this.name = "";
     this.priority = 0;
  public TodoItem(String name, Integer priority){
     this.name = name;
     this.priority = priority;
  }
  @Override
  public Metadata getMetadata() {
     return metadata:
  @Override
  public void setMetadata(Metadata metadata) {
     this.metadata = metadata;
  }
}
```

You must then register the class and data type with the <code>DataObjectMapper</code>. In the sample, the <code>DataStoreManager</code> instance does that after the store is created.

```
//using the existing store with mapper localStore.getMapper().setDataTypeForClassName("TodoItem", TodoItem.class.getCanonicalName());
```

## Creating and updating data

Using the same operation, you can save new objects and save changes to existing objects in the local data store.

#### Creating, saving, and updating Todo Items

```
// You can create a new Todoltem to save here, or you can use an existing object from the localStore that you have made ch
anges to
Todoltem todoltem = new Todoltem("Buy Groceries", 2);
// Use an existing store
Store store = localStore;
// Save automobile to store
Task<Object> saveTask = store.save(automobile);
saveTask.continueWith(new Continuation<Object, Void>() {
  @Override
  public Void then(Task<Object> task) throws Exception {
     if (task.isFaulted()) {
       // save was not successful, task.getError() contains the error
     } else {
       // use the result
       TodoItem savedTodoItem = (TodoItem) task.getResult();
       // Manipulate new item/add to your Ul/whatever else you're doing with your data
     return null;
  }
});
```

**Note:** When saving an object, it is good practice to use the new object that is returned by the task.getResult() method, to avoid errors caused by stale objects and to maintain a consistent experience.

### **Deleting data**

To delete an object in a data store, pass the object to the LocalStore.delete(objecttodelete) method.

```
// Use an existing store and Todoltem
Store store = localStore;
// Pass the Item you'd like to delete from the local Data Store as the parameter
Todoltem todoltem = existingTodoltem;
// Delete the Todoltem from the store
Task<String> deleteTask = store.delete(todoItem);
deleteTask.continueWith(new Continuation<String, Void>() {
  @Override
  public Void then(Task<String> task) throws Exception {
     if (task.isFaulted()) {
       // delete was not successful, task.getError() contains the error
     } else {
       // use the result
       String deletedTodoItemId = task.getResult();
     return null;
  }
});
```

#### Querying data

You can query for objects that have an object mapper. To run a query for objects, create a Cloudant query with the query filters on data type. Run the query against a Store object. For more information about query and related operations, see the topics about querying, in the user documentation.

## Supporting synchronization and offline storage

By using the data manager API, you can synchronize data between local storage on the device and remote store instances.

#### **Pull replication**

When pull replication runs, the local database within the mobile device is updated with what exists in the remote database.

```
// Use an existing store
Store store = localStore;
// create a pull replication task
// name is the database name of the store being replicated
Task<PullReplication> pullTask = manager.pullReplicationForStore(store.getName());
pullTask.continueWith(new Continuation<PullReplication, Object>() {
  @Override
  public Object then(Task<PullReplication> task) throws Exception {
     if(task.isFaulted()){
        // Handle error
     }else{
        // Start the replication
        PullReplication pull = task.getResult();
        Replicator replicator = ReplicatorFactory.oneway(pull);
        replicator.start();
     return null;
});
```

### **Push replication**

When push replication runs, the data from the local database within the mobile device is sent to the remote database.

```
// Use an existing store
Store store = localStore;
// create a push replication task
// name is the database name of the store being replicated
Task<PushReplication> pushTask = manager.pushReplicationForStore(store.getName());
pushTask.continueWith(new Continuation<PushReplication, Object>() {
  @Override
  public Object then(Task<PushReplication> task) throws Exception {
     if(task.isFaulted()){
        // Handle error
     }else{
        // Start the replication
        PushReplication push = task.getResult();
        Replicator replicator = ReplicatorFactory.oneway(push);
       replicator.start();
     return null;
  }
});
```

**Note:** The code snippets above might be different from the code that you can see in the sample. These snippets have been created to give the clearest and most understandable outline of the APIs and how they are used. For the sample to be easier to use, all the implementation for the above operations can be found in <code>DataStoreManager</code> and <code>MainActivity</code>.

## **Running the Android sample**

Make sure that you have properly configured and started the following instances:

- MobileFirst Server with CloudantAuthenticationAdapter and AndroidBlueList Native API deployed
- Cloudant Data Local Layer Edition

MobileFirst Data Proxy Server configured against MobileFirst Server and the Cloudant Data Layer Local Edition

## Obtaining and configuring the required SDKs

Make sure that you have correctly installed and set up Gradle. If you have not done so, complete the following:

- 1. Download the current Gradle distribution from www.Gradle.org.
- 2. When importing the sample, select a build.gradle file.

  Android Studio then prompts you for a GRADLE\_HOME variable.
- 3. Point to the Gradle distribution that you just downloaded.
- 4. After the project is open, check and update the following items:
  - In the bluelist.properties file, set the cloudantProxyUrl to your MobileFirst Data Proxy Server location.
  - In the wlclient.properties file, make sure to check and update the values to match the MobileFirst Server instance that you have deployed.

Now, you can run the sample on the simulators provided by Android or a supported Android device.

## **BlueList application flow**

When the application starts, the <code>DataStoreManager</code> instance initiates the connection to the MobileFirst Server instance and creates and registers the <code>BlueListChallengeHandler</code> instance.

```
WLClient client = WLClient.createInstance(context);
client.registerChallengeHandler(blueListChallengeHandler)
;
```

For simplicity, the sample silently logs in a user by calling CloudantAuthenticationAdapter with correct user name and password parameters. This is completed in the BlueListChallengeHandler.

```
@Override
public void handleChallenge(WLResponse wlResponse) {
   Object[] parameters = new Object[]{UserName,UserPassword};
   WLProcedureInvocationData invocationData = new WLProcedureInvocationData(AdapterName, "submitAuthentication")
;
   invocationData.setParameters(parameters);
   WLRequestOptions options = new WLRequestOptions();
   options.setTimeout(30000);
   submitAdapterAuthentication(invocationData, options);
}
```

After authentication, the database is configured in the DataStoreManager init method. This database configuration consists of the following steps:

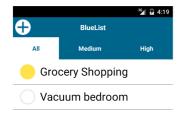
- Initializing the SDK
- Creating the local and remote databases
- Setting permissions for the user that was created
- Setting the replicatorFactory, pullReplication, and pushReplication
- Registering the TodoItem class and data type with the DataObjectMapper

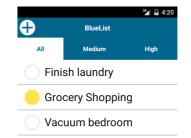
**Note:** For simplicity, the database name that is created is currently set to the variable DBName in the DataStoreManager, but you can change this name in the bluelist.properties file.

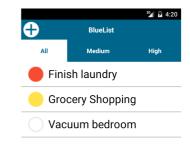
The MainActivity class provides functions for creating, updating, deleting, and listing items, and functions for push and pull replication.

After completing initialization, the application does an initial pull from the remote database. The user can now create, update, and modify list items in the application, and modify the corresponding priority (red = high, yellow = medium, white = low). By design, the application starts synchronization only when the user manually pulls down the list. On pull down, the application

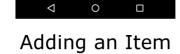
first completes a pull replication from the remote database to the local. After this operation has completed, push replication occurs, which sends any updated local data to the remote database. The local and remote databases are then synchronized.



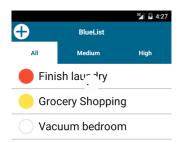


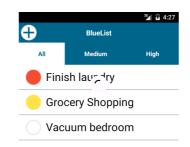


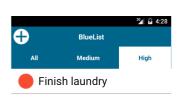


















Push Replication



**Pull Replication**