Android: data persistence

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Introduction

Introduction

- POO basics: modeling the **domain**
- Modeling domain objects and their interactions
- Data bound with a remote API
- Need of a local database

The native way

The “raw” way

```
private static final String
    SQL_CREATE_ENTRIES =
      "CREATE TABLE REPO (" +
      "_ID INTEGER PRIMARY KEY," +
      "NAME TEXT)";

private static final String
    SQL_DELETE_ENTRIES =
      "DROP TABLE IF EXISTS REPO ";
```

- Subclass SQLiteOpenHelper

```
public class ReposDbHelper extends
    SQLiteOpenHelper {
      public static final int
          DATABASE_VERSION = 1;
      public static final String
          DATABASE_NAME = "repos.db";

      public ReposDbHelper(Context
          context) {
        super(context, DATABASE_NAME,
            null, DATABASE_VERSION);
    }
```

```
    //...
    public void onCreate(SQLiteDatabase
        db) {
        db.execSQL(SQL_CREATE_ENTRIES);
    }

    public void onUpgrade(SQLiteDatabase
        db, int oldVersion, int
        newVersion) {
        db.execSQL(SQL_DELETE_ENTRIES);
        onCreate(db);
    }
}
```

- Get an instance of `SQLiteOpenHelper`

```
final ReposDbHelper loDbHelper =
new ReposDbHelper(getContext());
```

- Put Information into a Database

```
final SQLiteDatabase loDB =
   loDbHelper.getWritableDatabase();

final ContentValues loValues = new
   ContentValues();
loValues.put("name", "a sample name");

final long llNewRowId =
   db.insert("REPO", null, loValues);
```

- Read Information from a Database

```
final SQLiteDatabase loDB =
   loDbHelper.getReadableDatabase();

final String[] lasProjection = { "_id",
   "name" };

final String lsSelection = "NAME = ?";
final String[] lasSelectionArgs = { "a
   sample name" };

final String lsSortOrder = "NAME DESC";
```

```
final Cursor loCursor = loDB.query(
    "REPO",
    lasProjection,
    lsSelection,
    lasSelectionArgs,
    null,
    null,
    lsSortOrder);
loCursor.moveToFirst();

final long llItemId = loCursor.getLong(
    loCursor.getColumnIndexOrThrow("_ID")
);
```

The ContentProvider way

- Provide a `ContentProvider` subclass dedicated to the application

```
public class RepoProvider extends
   ContentProvider {
}
```

- Define a specific `UriMatcher` and configure available URI

```
public class RepoProvider extends
    ContentProvider {
      private static final UriMatcher
          sUriMatcher =
            new
              UriMatcher(UriMatcher.NO_MATCH);
}
```

```
static {
  sUriMatcher.addURI("fr.test.app.provider",
     "repo", 1);
  sUriMatcher.addURI("fr.test.app.provider",
     "repo/#", 2);
}
```

- Override various CRUD methods

```
public Cursor query(
    Uri uri,
    String[] projection,
    String selection,
    String[] selectionArgs,
    String sortOrder) {
    //...
```

```
//...
switch (sUriMatcher.match(uri)) {
    case 2:
        selection = selection + "_ID = "
           + uri.getLastPathSegment();
        break;
    default:
        //...
}
```

- Use it through a `ContentResolver` instance

```
mCursor = getContentResolver().query(
    "fr.test.app.provider/repo/2",
    mProjection,
    mSelectionClause,
    mSelectionArgs,
    mSortOrder);
```

- Refer to the **open-sourced Google's iosched application**

Async management

- Perform CRUD operations outside of the main thread

Query data using Loader

- To query the `ContentProvider` in an `Activity`, make it implementing `LoaderManager.LoaderCallbacks<Cursor>`

```
public class ReposListActivity
    extends FragmentActivity
    implements
       LoaderManager.LoaderCallbacks<Cursor>
       {
}
```

- Start loading data with a loader identifier

```
getLoaderManager()
    .initLoader(LOADER_REPOS, null,
      this);
```

- Implement `LoaderCallbacks...`

- ...to create the CursorLoader

```
@Override
public Loader<Cursor> onCreateLoader(
  int id, Bundle bundle) {
  if(id == LOADER_REPOS) {
    return new CursorLoader(
      this,
      "fr.test.app.provider/repo",
      mProjection,
      null, null, null);
  }
  //...
}
```

- ... and deal with result

```
@Override
public void
   onLoadFinished(Loader<Cursor> loader,
   Cursor cursor) {
     if(loader.getId() == LOADER_REPOS){
         // ...
     }
}
```

- See also: AsyncQueryHandler

The ORM way

The well-known: ORMLite

- Declare your model using ORMLite annotations

```
@DatabaseTable(tableName = "REPO")
public class RepoEntity {
    @DatabaseField(columnName = "_ID",
       generatedId = true)
    public long _id;

    @DatabaseField
    public String name;
}
```

- declare the corresponding DAO

```
public class DAORepo extends
   BaseDaoImpl<RepoEntity, Long> {

    public DAORepo(ConnectionSource cs)
        throws SQLException {
        this(cs, RepoEntity.class);
    }

    //...
}
```

- subclass OrmLiteSqliteOpenHelper

```
public class DatabaseHelperTest
  extends OrmLiteSqliteOpenHelper {

  private static final String
    DATABASE_NAME = "test.db";

  private static final int
    DATABASE_VERSION = 1;
  //...
```

```
//...
public DatabaseHelperTest(
  Context context) {

  super(context,
    DATABASE_NAME,
    null,
    DATABASE_VERSION,
    R.raw.ormlite_config);
}
//...
```

```
//...
@Override
public void onCreate(SQLiteDatabase db,
   ConnectionSource cs) {
  TableUtils.createTable(cs,
     RepoEntity.class);
}

@Override
public void onUpgrade(SQLiteDatabase db,
   ConnectionSource cs, int oldVersion,
   int newVersion) {
  //...
}
```

- get the requested DAO

```
DatabaseHelperTest helper = //...

ConnectionSource cs =
   helper.getConnectionSource();

DatabaseTableConfig<RepoEntity>
   tableConfig =
  DatabaseTableConfigUtil.fromClass(cs,
     RepoEntity.class);

DAORepo dao = new DAORepo(cs,
   tableConfig);
```

- perform CRUD operations

```
// create

RepoEntity repo =
  new RepoEntity("a sample name");

dao.create(repo);
```

```
// read

List<RepoEntity> repos =
    dao.queryBuilder()
        .where()
        .eq("name", "a sample name")
        .query();
```

- Performance: orm-gap gradle plugin

```
buildscript {
  repositories {
    mavenCentral()
  }
  dependencies {
    classpath
       'com.github.stephanenicolas.ormgap'
      + ':ormgap-plugin:1.0.0-SNAPSHOT'
  }
}

apply plugin: 'ormgap'
```

- generate an ORMLite configuration file that boosts DAOs creations
- to use this file

```
public RepoDatabaseHelper(Context
    context) {
      super(context,
        DATABASE_NAME,
        null,
        DATABASE_VERSION,
        R.raw.ormlite_config);
}
```

The attractive way: requery

- Object mapping
- SQL generator
- RxJava and Java 8 support
- No reflection, compile-time processing and generation
- Relationships support
- Callback method (`@PostLoad`)
- Custom type converters

- Define object mapping

```
@Entity
abstract class Repo {
    @Key @Generated
    int id;

    String name;
}
```

- Easy to perform SQL queries

```
Result<Repo> repos = data
  .select(Repo.class)
  .where(Repo.NAME.lower().like("%sample%"))
  .orderBy(Repo.ID.desc())
  .get();
```

Async management: RxJava

- Get a specific instance of `SingleEntityStore`

```
DatabaseSource dbSource =
  new DatabaseSource(context,
     Models.DEFAULT, "test.db", 1);

Configuration conf =
   dbSource.getConfiguration();

SingleEntityStore<Persistable> data =
  RxSupport.toReactiveStore(new
     EntityDataStore<>(conf));
```

- and use it the RX way

```
data.select(RepoEntity.class)
    .get()
    .subscribeOn(Schedulers.newThread())
    .subscribe(/*...*/)
```

Conclusion

Conclusion

- Personal assessment of each way

	ContentProvider	ORMLite	requery
setup	-	+	+
performance	+	-	+
readability	-	+	+
maintainability	-	+	+