

# **IAT359 Mobile Computing**

Fall 2022

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# lecture 5

- Review of starting an Activity for result (new way)
- Data storage options in Android
- Shared preferences
- SQLite Databases for Android

## week 5 check-in

- Quiz 2 today
  - Will be released on Canvas after lecture (2:20PM) and will be open for 24 hours (due Wednesday October 12<sup>th</sup> at 2:20PM)
  - **Must be completed individually**
  - Will cover content from weeks 3 and 4
- Project teams should be formed by TODAY, milestone 1 due on October 18
- Meeting with teams on October 18 during labs
- Assignment 2 due on October 25

# startActivityForResult (deprecated)

Old way:

```
@Override
public void onClick(View v) {
    Intent i = new Intent( packageContext: this, ActivityTwo.class);
    startActivityForResult(i, REQUEST_CODE);
}
```

```
@Override
protected void onActivityResult(int requestCode, int resultCode, Intent data) {
    if (requestCode==REQUEST_CODE) //check that we're processing the response from WordEntry
    {
        if(resultCode==RESULT_OK) //make sure the request was successful
        {
            if ((data.hasExtra( name: "First Name"))&&(data.hasExtra( name: "Last Name"))&&(data.hasExtra( name: "Selected Color")));
            {
                String firstname_entered = data.getExtras().getString( key: "First Name");
                String lastname_entered = data.getExtras().getString( key: "Last Name");
                String color_selected = data.getExtras().getString( key: "Selected Color");
                displayInfo.setText("Welcome " + firstname_entered + " " +lastname_entered);
                displayInfo.setBackgroundColor((Color.parseColor(color_selected)));
            }
        }
    }

    super.onActivityResult(requestCode, resultCode, data);
}
```

# ActivityResultLauncher (new way)

```
@Override
public void onClick(View v) {
    Intent i = new Intent( packageContext: this, ActivityTwo.class);
    getResult.launch(i);
}
```

```
ActivityResultLauncher<Intent> getResult = registerForActivityResult(
    new ActivityResultContracts.StartActivityForResult(),
    new ActivityResultCallback<ActivityResult>() {
        @Override
        public void onActivityResult(ActivityResult result) {
            if (result.getResultCode() == Activity.RESULT_OK) {
                // There are no request codes
                Intent data = result.getData();
                if ((data.hasExtra( name: "First Name"))&&(data.hasExtra( name: "Last Name"))&&(data.hasExtra( name: "Selected Color")));
                {
                    String firstname_entered = data.getExtras().getString( key: "First Name");
                    String lastname_entered = data.getExtras().getString( key: "Last Name");
                    String color_selected = data.getExtras().getString( key: "Selected Color");
                    displayInfo.setText("Welcome " + firstname_entered + " " +lastname_entered);
                    displayInfo.setBackgroundColor((Color.parseColor(color_selected)));
                }
            }
        }
    });
```

# Data Storage Options – Persistent Storage

## **SharedPreferences**

Key-value pairs,  
private data

## **Internal Storage**

Device memory,  
private data

## **External Storage**

Shared external  
storage for public  
data

## **SQLite Database**

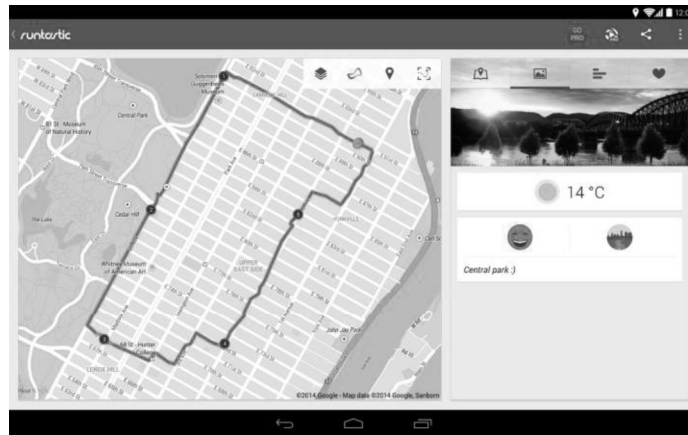
Structured, private  
data

## **Network Connection**

On the web, with  
network server

# SharedPreferences

Primitive data stored as key/ value pairs  
Private to the app



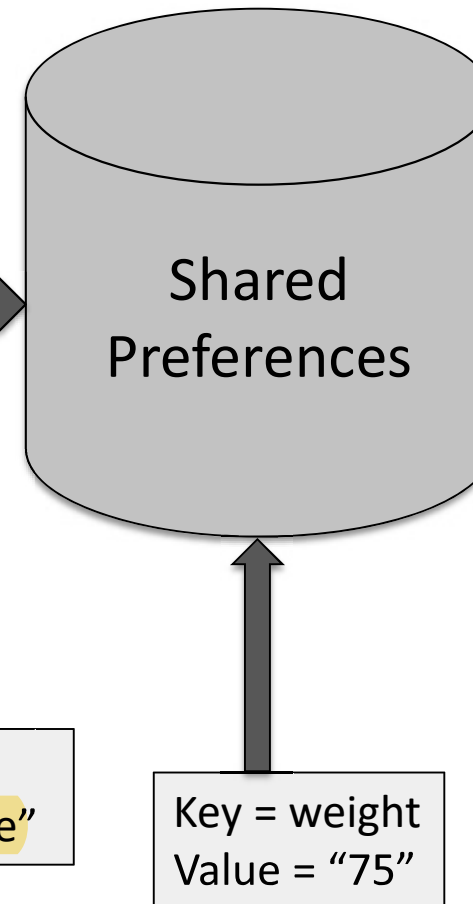
(Runtastic App)

name: runnerDave  
weight: 75 kg

Key / Value pairs

Key = name  
Value = "runnerDave"

Key = weight  
Value = "75"

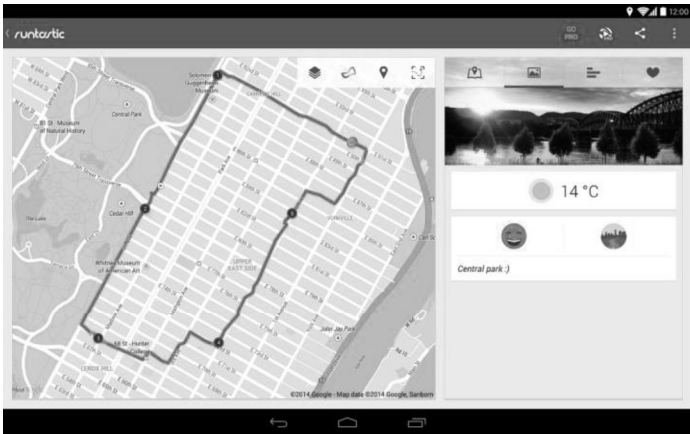


# Android internal and external storage

- **Internal Storage:**
  - Save files directly on the device's internal storage
  - Private files to the app
  - If app is uninstalled, files are removed
- **External storage**
  - Removable storage media (SD card)
  - Non-removable storage
  - Readable by anyone



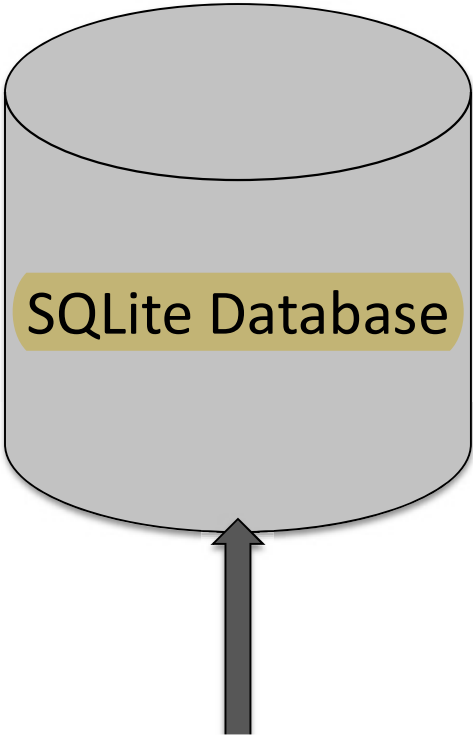
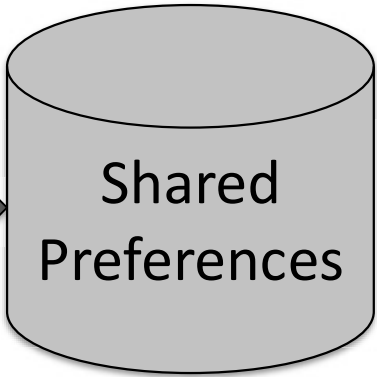
# SQLite Database for Android



(Runtastic App)

name: runnerDave  
weight: 75 kg

Structured data  
Private to the app



Activity ID	Type	Distance	Time	Calories
27	Running	5.2km	00:38:32	348

# Android SharedPreferences

- Simplest way of storing data in Android – XML file
- Key / value pairs

Key	Value
Username	MrSmith
LastName	Smith
FirstName	John
School	SFU

Store the value and use the corresponding key to retrieve the value later

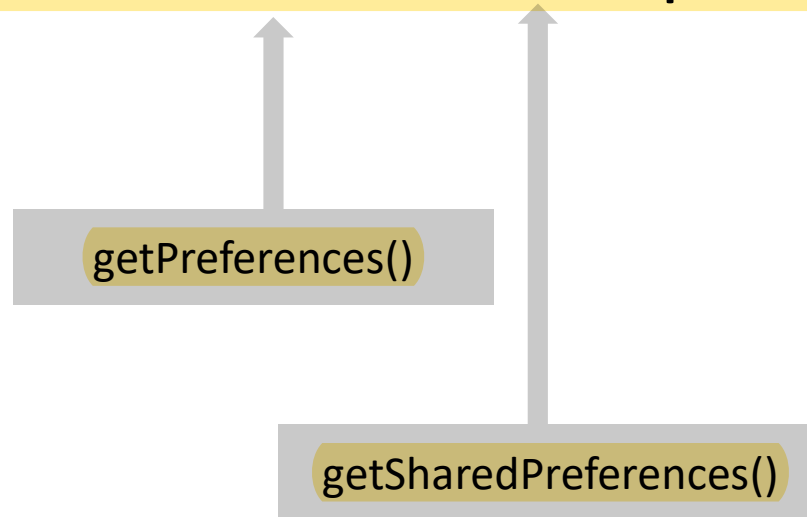
Data stored in XML file in *data/ data/ <package-name>/shared-prefs*

# SharedPreferences – what kind of data

- Username, password, app settings, theme settings, etc
- Only allow primitive data types: **boolean, long, int, float, string**
- Not meant for complex data

# accessing preferences

- An app can have one or more preference files ???



```
public SharedPreferences getPreferences (int mode)
```

```
public abstract SharedPreferences getSharedPreferences (String name, int mode)
```

# mode

MODE\_PRIVATE

- Only your app can access the file

MODE\_WORLD\_READABLE  
(deprecated as of KitKat)

- All apps can read the file **X**

MODE\_WORLD\_WRITEABLE  
(deprecated as of KitKat)

- All apps can write to the file **X**

MODE\_MULTI\_PROCESS

- Multiple processes can modify the same shared preferences file

# why use preferences

User info

- Store user details

Location

- Remember last user location

Updated

- Check when app was last updated

Settings


- Store user settings

First time use

- Check if the user is using the app for the first time

# use SharedPreferences to store data


**1. Get a reference to the SharedPreferences object**  
getPreferences() or getSharedPreferences()



**2. Call the Editor edit()**

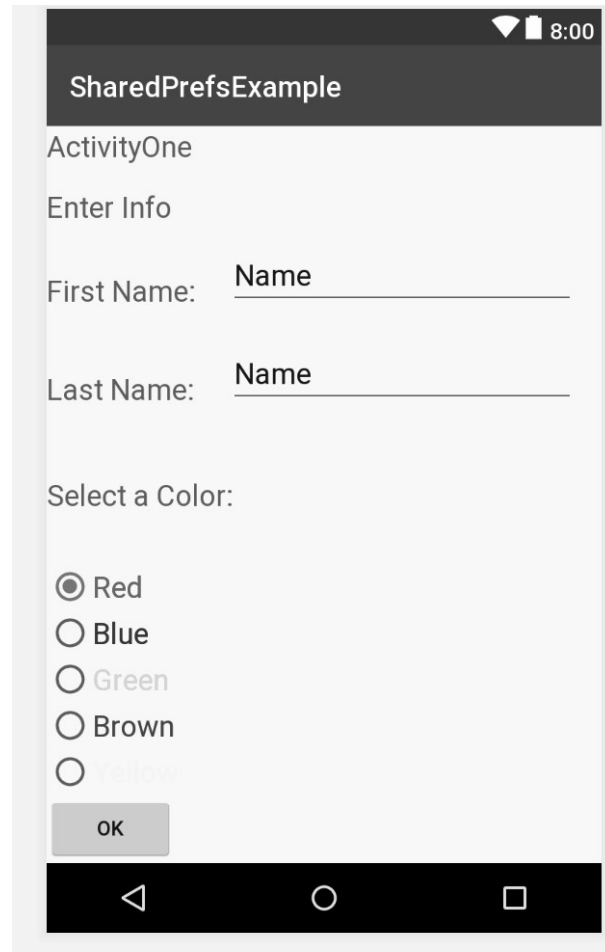


**3. Use the editor to add the data with a key**  
putBoolean(), putString, etc



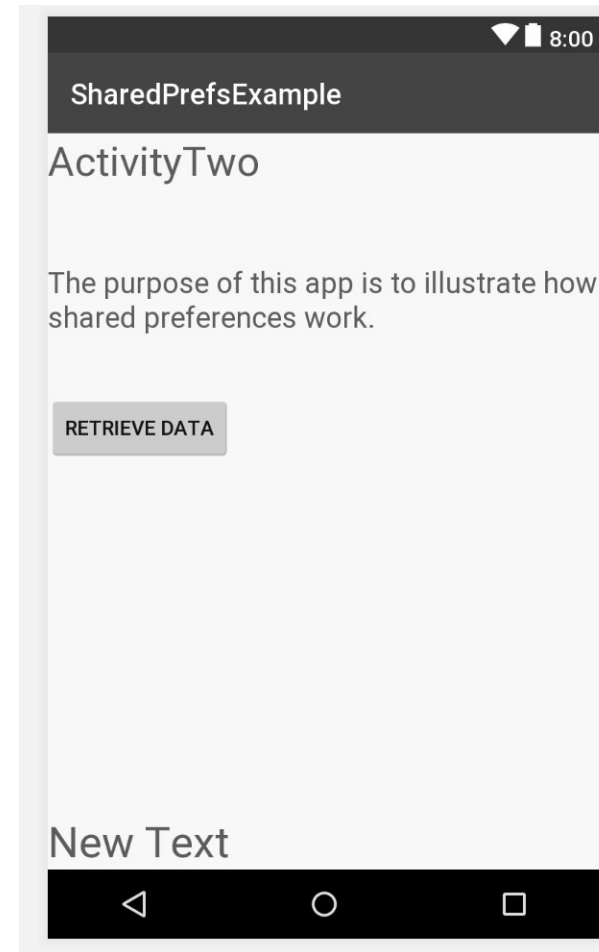
**4. Commit editor changes commit()**

# example using SharedPreferences



The screenshot shows the 'ActivityOne' screen of an app titled 'SharedPreferencesExample'. The status bar at the top indicates a signal strength icon, a battery icon, and the time '8:00'. The app title is in a dark header. Below the header, the text 'ActivityOne' is displayed. The main content area is titled 'Enter Info' and contains two text input fields. The first field is labeled 'First Name:' and the second is labeled 'Last Name:'. Both fields have the text 'Name' entered. Below the input fields, there is a section titled 'Select a Color:' with five radio button options: 'Red' (selected), 'Blue', 'Green', 'Brown', and 'Yellow'. At the bottom of the form is an 'OK' button. The Android navigation bar is visible at the very bottom.

ActivityOne

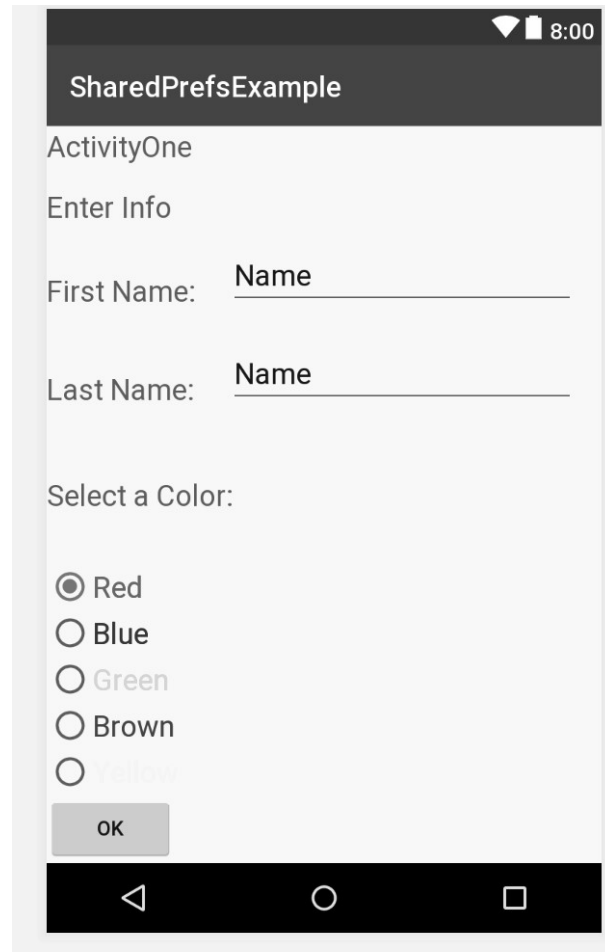


The screenshot shows the 'ActivityTwo' screen of the same app. The status bar and app title are identical to the first screen. The text 'ActivityTwo' is displayed. The main content area contains a paragraph of text: 'The purpose of this app is to illustrate how shared preferences work.' Below this text is a button labeled 'RETRIEVE DATA'. At the bottom of the screen, there is a text input field labeled 'New Text'. The Android navigation bar is visible at the very bottom.

ActivityTwo



# ActivityOne

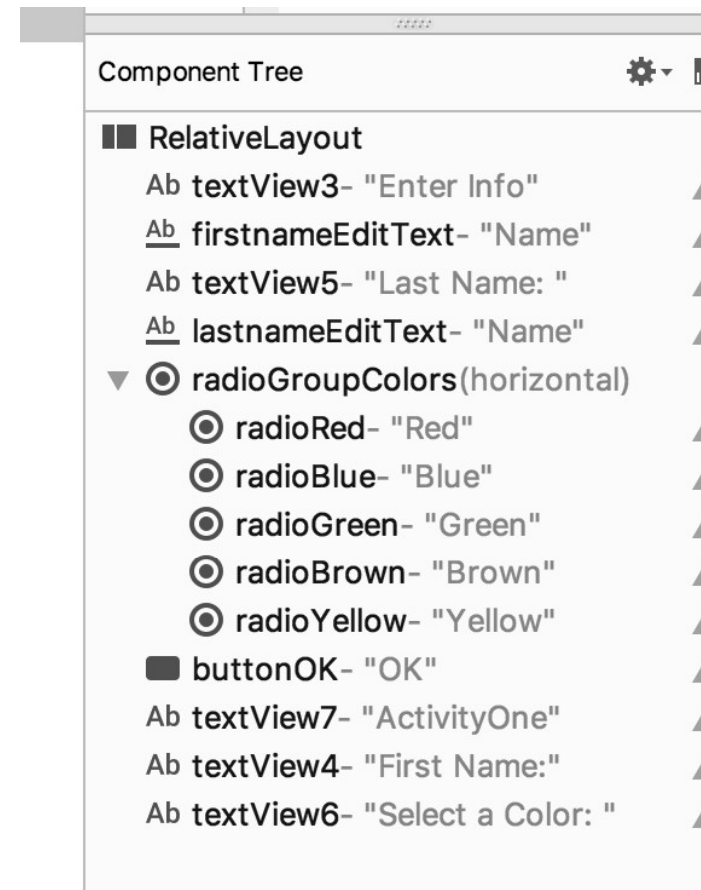


The screenshot shows a mobile application interface titled "SharedPrefsExample". Below the title bar, the text "ActivityOne" is displayed. The main content area contains the following elements:

- A label "Enter Info" followed by two text input fields. The first is labeled "First Name:" and the second is labeled "Last Name:". Both fields contain the text "Name".
- A label "Select a Color:" followed by a vertical list of five radio buttons with corresponding color names: "Red", "Blue", "Green", "Brown", and "Yellow". The "Red" radio button is selected.
- An "OK" button at the bottom of the form.

The bottom of the screen shows a standard Android navigation bar with back, home, and recent apps icons.

ActivityOne



# ActivityOne – get references to UI elements

```
@Override
protected void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.activity_activity_one);

    okButton = (Button)findViewById(R.id.buttonOK);
    okButton.setOnClickListener(this);
    firstNameEditText = (EditText)findViewById(R.id.firstnameEditText);
    lastNameEditText = (EditText)findViewById(R.id.lastnameEditText);
    colorButton = (RadioGroup) findViewById(R.id.radioGroupColors);
    colorButton.setOnCheckedChangeListener(this);
}
```

# saving the data to SharedPreferences

- We have to save the names and color
- Notice the 4 steps in the code below:

```
@Override
public void onClick(View v) {
    firstName = firstNameEditText.getText().toString();
    lastName = lastNameEditText.getText().toString();
    Toast.makeText(this, firstName + lastName + color, Toast.LENGTH_SHORT).show();

    Intent i = new Intent (this, ActivityTwo.class);

    SharedPreferences sharedPrefs = getSharedPreferences("MyData", Context.MODE_PRIVATE);
    SharedPreferences.Editor editor = sharedPrefs.edit();
    editor.putString("firstName", firstName);
    editor.putString("lastName", lastName);
    editor.putString("selectedColor", color);
    Toast.makeText(this, "First, last names and color saved to Preferences", Toast.LENGTH_LONG).show();
    editor.commit();

    startActivity(i);
}
```

# ActivityTwo: retrieve the data from SharedPreferences

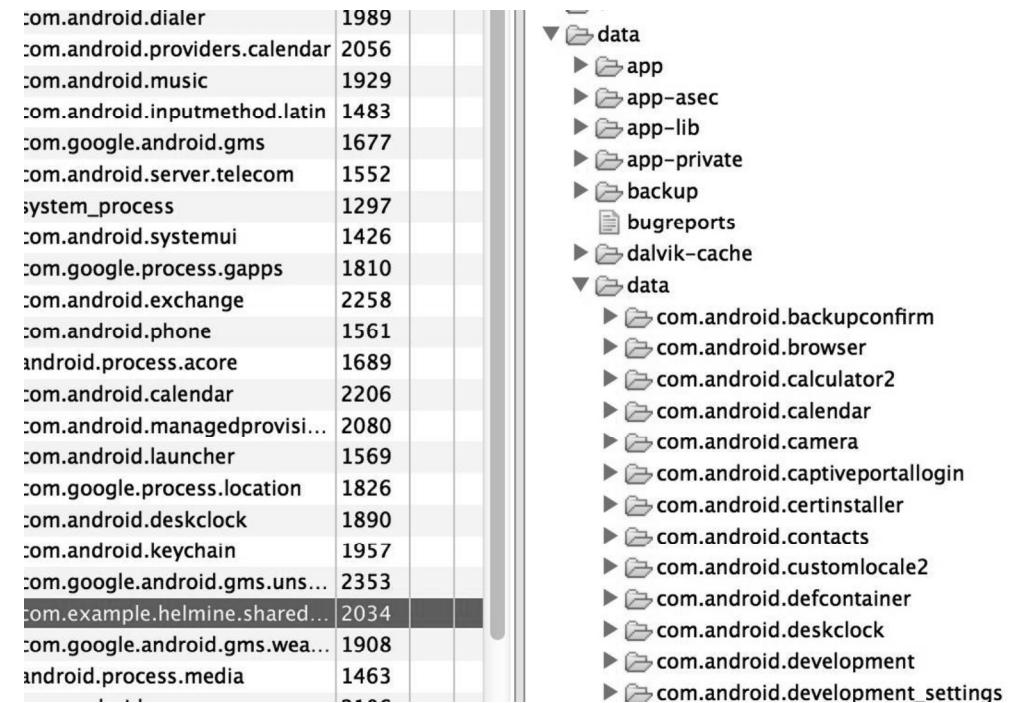
```
@Override
public void onClick(View v) {

    SharedPreferences sharedPrefs = getSharedPreferences("MyData", Context.MODE_PRIVATE);
    String firstName = sharedPrefs.getString("firstName", DEFAULT);
    String lastName = sharedPrefs.getString("lastName", DEFAULT);
    String colorSelected = sharedPrefs.getString("selectedColor", DEFAULT);

    displayInfo.setText("Welcome " + firstName + " " + lastName);
    displayInfo.setBackgroundColor((Color.parseColor(colorSelected)));
}
```

# the SharedPreferences file

- Device File Explorer
- Find the proper package name
- SharedPreferences file is in *data/data/<package-name>/shared-prefs*



# the SharedPreferences file

- Pull the file from the device
- Save it in a location of your choice, then open it



```
AndroidManifest.xml x MyData.xml x
<?xml version='1.0' encoding='utf-8' standalone='yes' ?>
<map>
  <string name="firstName">maria</string>
  <string name="lastName">lastname</string>
  <string name="selectedColor">#00ff00</string>
</map>
|
```

# question

What is the main difference between Shared Preferences and onSaveInstanceState?

# question

Why is Shared Preferences better suited to storing simple data (rather than complex data)?

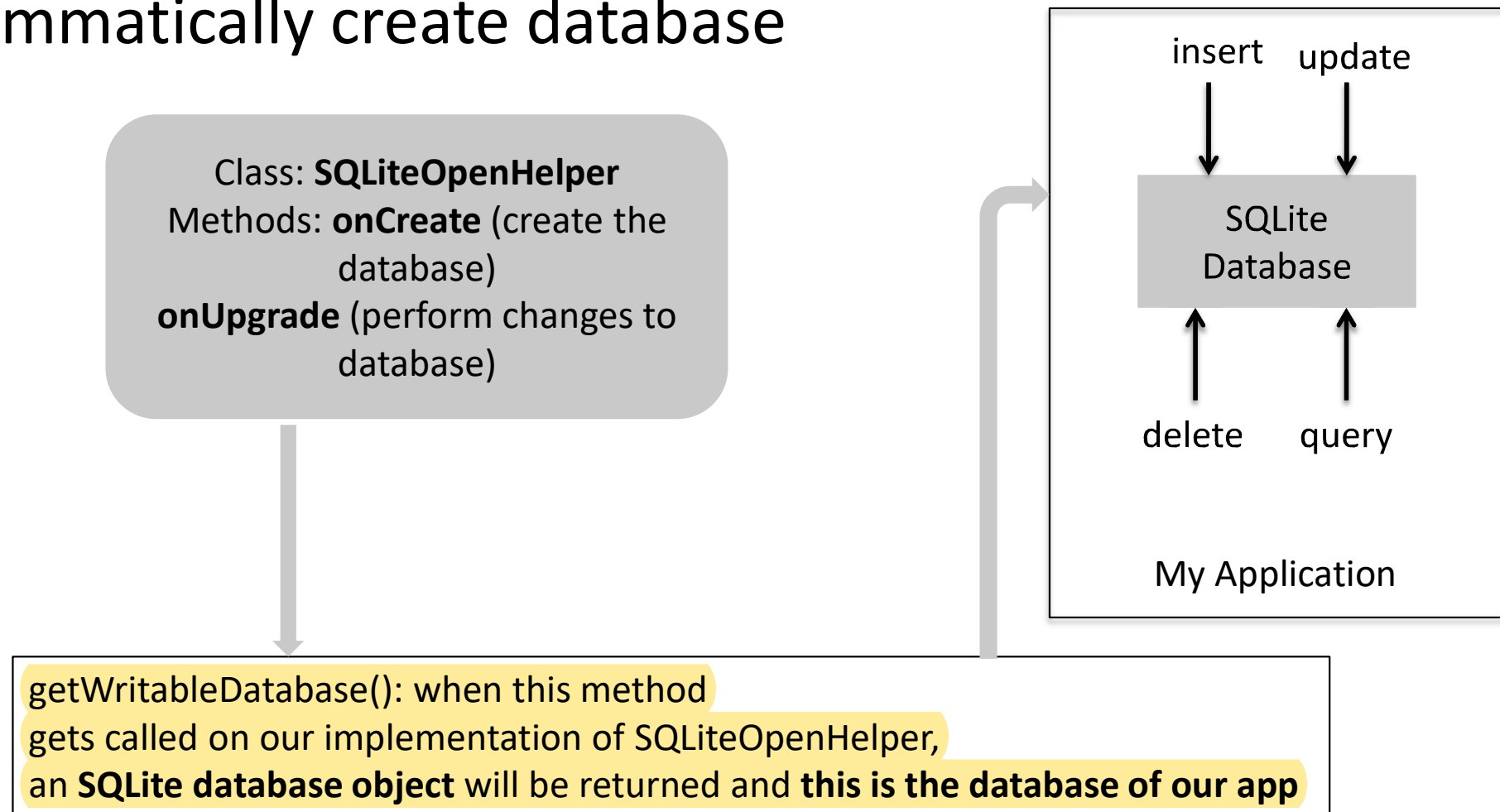


# SQLite Databases for Android

- **SQLite**: language for managing data in relational databases
- Apps have their private SQLite databases
  - The database of an app is accessible by any class in the app, but not by other apps
- */data/data/<package-name>/database folder*
- App database
  - Self-contained
  - Transaction-based
  - No server

# process

- Programmatically create database



# creating an SQLite database schema

- Programmatically create database

**1. Define schema** – database name, version, table names, column names



**2. Create the database** – queries to create the database



**3. Execute queries** – insert, update, delete operations

# step 1: define schema

Plant Database

PLANTSTABLE

_id	Name
1	Lavender
2	Rosemary
3	Hibiscus

Notes:

- **\_id** is the primary key
- It identifies a row uniquely
- underscore: Android convention for primary keys

```
private static final String DATABASE_NAME = "plantdatabase";
```

```
private static final String TABLE_NAME = "PLANTSTABLE";
```

```
private static final String UID = "_id";
```

```
private static final String NAME = "Name";
```

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

Constant  
fields, do not  
change values  
within our app

## Step 2: create the database – SQLiteOpenHelper

- Subclass of SQLiteOpenHelper
  - Implement onCreate() and onUpgrade()
- SQLiteOpenHelper class:
  - Opens the database if it exists
  - Creates the database if it does not exist
  - Updates the database as necessary

# SQLiteOpenHelper - methods

- **onCreate()** – this method is called when the database is first created
  - Creation of tables
  - Initial data inside of tables
- **onUpgrade()** – this method is called whenever the database is updated
  - Drop, add tables
  - Anything that updates the database structure

# SQLiteDatabase class

- An object representing the database that we have just created
- Method: **public void execSQL(String sql)**
  - Executes a single SQL statement
  - Notice that the method returns void – this is an indication to what type of SQL statements this method can execute

# example application

- 1. Create the SQLite Database schema

```
public class HelperClass extends SQLiteOpenHelper{
    private static final String DATABASE_NAME = "plantdatabase";
    private static final String TABLE_NAME = "PLANTSTABLE";
    private static final String UID = "_id";
    private static final String NAME = "Name";
    private static final int DATABASE_VERSION = 1;

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

    @Override
    public void onCreate(SQLiteDatabase db) {
    }

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



# onCreate() method

- Statement to create database:

_id	Name
1	Lavender
2	Rosemary
3	Hibiscus

```
CREATE TABLE PLANTSTABLE(_id INTEGER PRIMARY KEY  
AUTOINCREMENT, Name VARCHAR(255));
```

This can also be written as:

```
private static final String CREATE_TABLE =  
" CREATE TABLE " +TABLE_NAME+ " (" +UID+ " INTEGER PRIMARY KEY AUTOINCREMENT, " +NAME+ " VARCHAR(255));";
```

# onCreate() method

```
public class HelperClass extends SQLiteOpenHelper{
    private Context context;
    private static final String DATABASE_NAME = "plantdatabase";
    private static final String TABLE_NAME = "PLANTSTABLE";
    private static final String UID = "_id";
    private static final String NAME = "Name";
    private static final int DATABASE_VERSION = 1;
    private static final String CREATE_TABLE =
        " CREATE TABLE " +TABLE_NAME+ " (" +UID+ " INTEGER PRIMARY KEY AUTOINCREMENT, " +NAME+ " VARCHAR(255));";

    @Override
    public void onCreate(SQLiteDatabase db) {
        try {
            db.execSQL(CREATE_TABLE);
        } catch (SQLException e) {
            Toast.makeText(context, "exception onCreate() db", Toast.LENGTH_LONG).show();
        }
    }
}
```

# onUpgrade() method

- In this method we can do anything that will change the database schema
  - Modify the table
  - Delete the table
  - Add, delete columns
  - Drop table

# onUpgrade() method

- Example: drop table query

```
private static final String DROP_TABLE = "DROP TABLE IF EXISTS " +TABLE_NAME;
```

---

```
@Override  
public void onUpgrade(SQLiteDatabase db, int oldVersion, int newVersion) {  
    try {  
        db.execSQL(DROP_TABLE);  
        onCreate(db);  
    } catch (SQLException e) {  
        Toast.makeText(context, "exception onUpgrade() db", Toast.LENGTH_LONG).show();  
    }  
}
```

# sample code: main activity

- Create an object of the HelperClass
- Then, run the app to see what happens

```
public class MainActivity extends Activity {
```

```
    HelperClass helper;
```

---

```
@Override
```

```
protected void onCreate(Bundle savedInstanceState) {  
    super.onCreate(savedInstanceState);  
    setContentView(R.layout.activity_main);  
    helper = new HelperClass(this);  
}
```

# nothing happens!!!

- Why??
- IMPORTANT: the database gets created only when there is an attempt to access it for the first time
  - Since there was no access to our database, the database was not created
  - This means that onCreate() and onUpgrade() methods have not been called
  - We have to call the method **getWritableDatabase()** – **returns a database object**

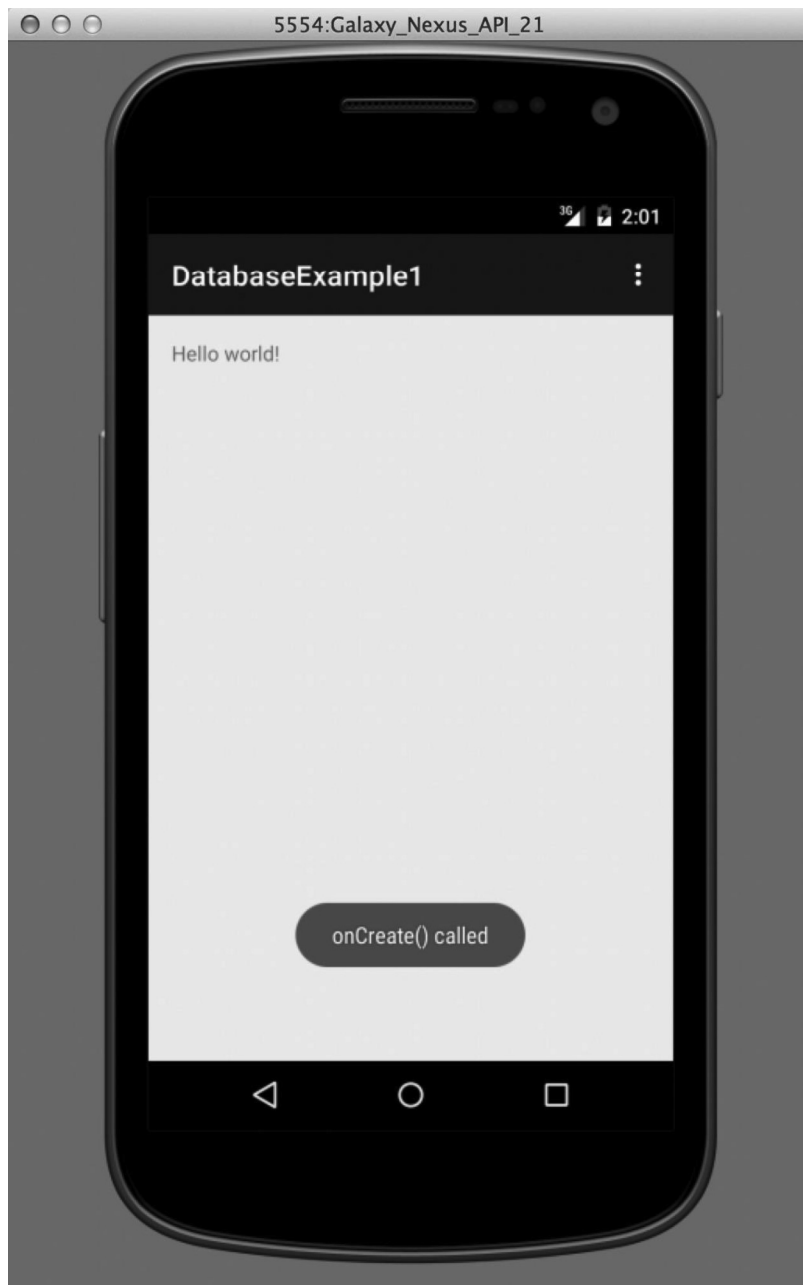
# Accessing the database

```
SQLiteDatabase myDatabase = helper.getWritableDatabase();
```

getWritableDatabase() will return an SQLite database object.

The returned object is a reference to the database that we just created.

Next: run the code again

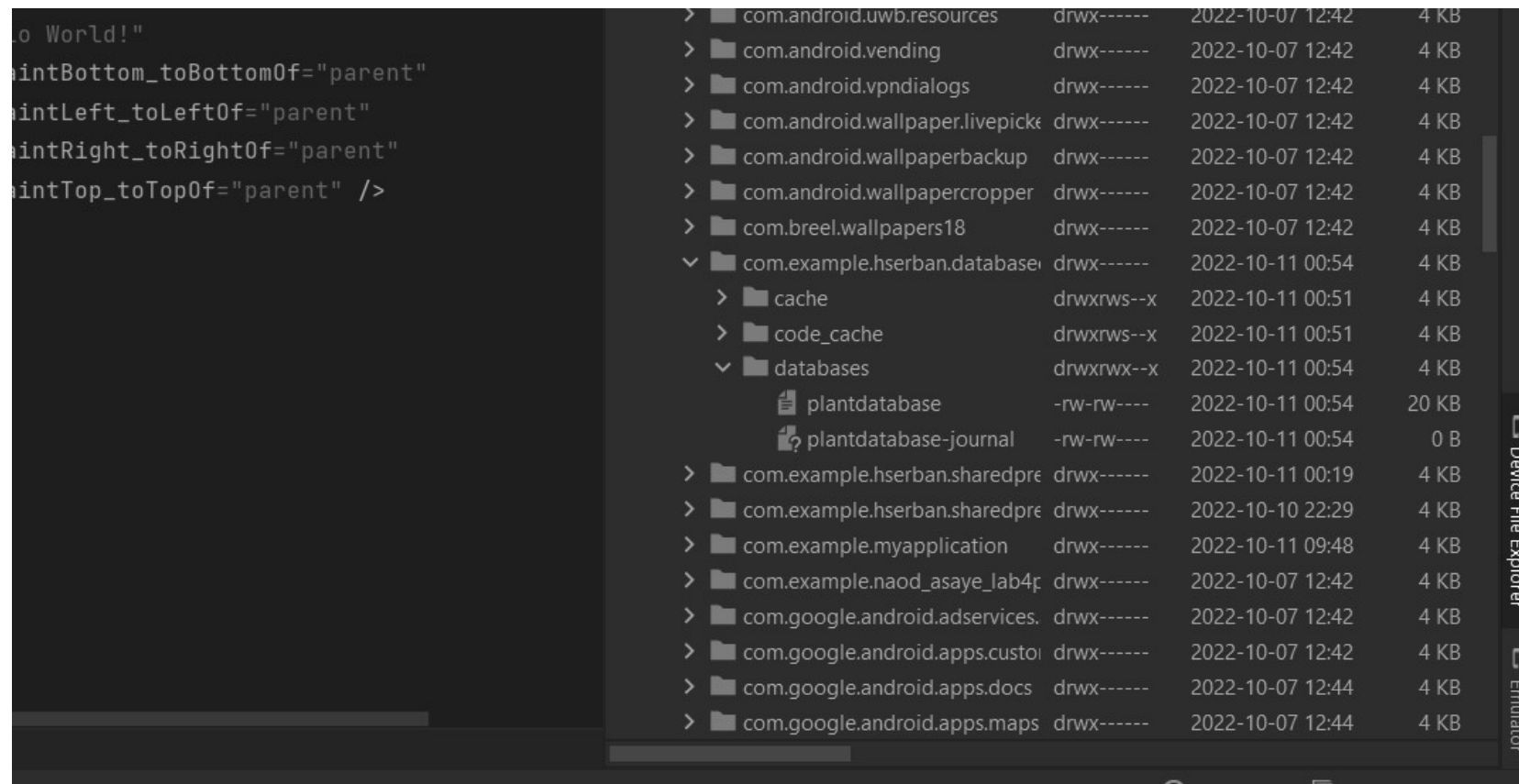


onCreate() called because the database was accessed for the first time and this triggered the database creation



# viewing the database file

- Device File Explorer



# what about onUpgrade?

- When is onUpgrade() called? It is called when a change in the database schema takes place.
- The database exists already, let's modify it by adding one new column: the type of the plant

```
private static final String TYPE = "Type";
```

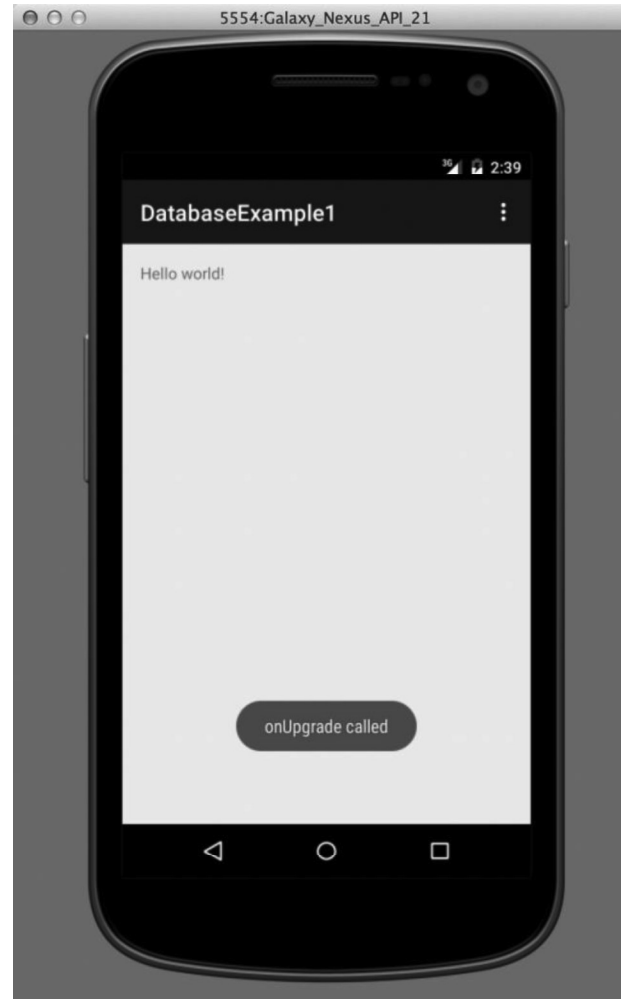
- We also have to change the CREATE TABLE: (only the change is shown below):

```
AUTOINCREMENT, " +NAME+ " VARCHAR(255), " +TYPE+ " VARCHAR(255));";
```

- Database version: this also needs to be changed, because we have changed the structure of the database

```
private static final int DATABASE_VERSION = 2;
```

# outcome



# question

- Why do we need to call `getWritableDatabase()`?

# question

- What does the Helper class do?

# summary of today's class

- Data storage options in Android
  - Shared Preferences (simple, primitive data)
  - Internal and External Storage (not discussed)
  - SQLite Databases (complex, structured data)
- Shared preferences
  - when to use this storage method
  - How to store and retrieve data from SharedPreferences
- SQLite Databases for Android
  - Defining the schema, creating the database
  - We will continue this topic next week

# resources

- Saving Data - <http://developer.android.com/training/basics/data-storage/index.html>
- Using Databases - <https://developer.android.com/training/data-storage/sqlite>
- SQLite official site - <https://www.sqlite.org/index.html>
- SQLite Query Language - <https://www.sqlite.org/lang.html>