

CPSC475/575

Persistence

*content adapted from <http://www.cs.utexas.edu/~scottm/cs378/schedule.htm>

Saving Data TEMPORARY

- Ephemeral storage.
 - System kills app – view object state saved
 - You kill app- gone forever
- Techniques
 - Widget has ID system saves state
 - Bundle or Intent (mostly for sending data to new activities or processes)
 - Application object (singleton pattern)

Saving Data TEMPORARY

Application Object (for global data)

```
public class applicationObject extends Application{

    private static final String TAG = "Application";
    private static final int UNINITIALIZED = -1;

    private Integer myInteger;

    public Integer getMyInteger() {
        if (myInteger == null)
            myInteger = new Integer(UNINITIALIZED);
        return myInteger;
    }

    public void setMyInteger(Integer myInt) {
        if (myInteger == null)
            myInteger = new Integer(myInt);
        else
            myInteger = myInt;
        //the above is the same as
        //myInteger = (myInteger == null) ? new Integer(myInt) : myInt;
    }

    @Override
    public void onCreate() {
        super.onCreate();
        Log.e(TAG, "APPLICATION onCreate, myInteger=");
    }
}
```

Finally use in all activities

Create class that
derives from
Application.
Tracks global
data. Could be
authentication
token, database
connection
If multithreaded
synchronize
access

```
<application
    android:name=".applicationObject"
    android:allowBackup="true"
    android:icon="@drawable/ic_launcher"
    android:label="ApplicationObject"
    android:theme="@style/AppTheme" >
    <activity
        android:name=".MainActivity"
        android:label="ApplicationObject" >
```

Define in manifest

```
public class MainActivity extends ActionBarActivity {
    private static final String TAG = "MainActivity";
    TextView myView;
    applicationObject myObject;

    private static final int RES2 = 0;

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_main);
        Log.d(TAG, "MainActivity onCreate");

        myObject = (applicationObject) getApplication();
        myView = (TextView) findViewById(R.id.textView2);
        myView.setText("Application myInteger = " + Integer.toString(myObject.getMyInteger()));
    }

    public void doClickButton2(View view) {
        myObject.setMyInteger(myObject.getMyInteger()+1);
        myView.setText("Application myInteger = " + Integer.toString(myObject.getMyInteger()));
    }
}
```

Saving Data PERMANENT

- Shared Preferences- private data stored in key-value pairs
- Internal Storage - private data on the device
- External Storage – public data on the device
- SQLite Database (we will not do)
- Cloud (we will probably not do)

Shared Preferences

- SharedPreferences Class
- Store and retrieve key-value pairs of data
 - keys are Strings
 - values are Strings, Sets of Strings, boolean, float, int, or long (like a bundle)
- Can save any data this way as long as its Parcelable (Serializable)

Writing to SharedPreferences Recipe

- Obtain SharedPreferences object:
- Call edit() method on object to get a SharedPreferences.Editor object
- Insert data by calling put methods on the SharedPreferences.Editor object (Int, Boolean,String char etc)
- Commit changes

Writing to SharedPreferences

```
private static final String PREF_FILE_NAME = "PrefFile";  
private static final String PASSWORD      = "Password";  
private static final String DEFAULT_PWD   = "Default";
```

} Defaults

```
public void savePref() {
```

```
    //SHAREDPreferences - PERMANENT STORAGE
```

```
    // get a handle to "PrefFile", create if necessary, only this
```

```
    // process has access can have MODE_WORLD_READABLE and MODE_WORLD_WRITEABLE. !
```

```
    SharedPreferences settings = getSharedPreferences("PrefFile", MODE_PRIVATE);
```

← choose file

```
    // can only make changes with editor
```

```
    SharedPreferences.Editor editor = settings.edit();
```

← must edit()

```
    // slap something in it, strings, booleans ints, check the docs
```

```
    editor.putString(PASSWORD, "admin");
```

← save values

```
    //editor.clear();          //removes everything
```

```
    //editor.remove(PASSWORD); //dumps key value pair
```

← can clear all
or delete one

```
    // Commit the edits! You dont call this it aint saved!
```

```
    editor.commit();
```

← must commit

```
}
```

Reading From Shared Preferences

recipe

- Provide key (string) and default value if key is not present
- get Boolean, Float, Int, Long, String, StringSet

Reading from SharedPreferences

```
private static final String PREF_FILE_NAME = "PrefFile";  
private static final String PASSWORD      = "Password";  
private static final String DEFAULT_PWD   = "Default";  
public void getPref(){  
    //SHAREDPreferences - PERMANENT STORAGE  
    // Restore preferences  
    SharedPreferences settings = getSharedPreferences(PREF_FILE_NAME, MODE_PRIVATE);  
    String savedPwd = settings.getString(PASSWORD, DEFAULT_PWD);  
}
```

Defaults

choose file

get value

Shared Preferences File

- Stored as XML
- Stored on emulated device
data/data/<yourpackagename>...

```
<?xml version="1.0" encoding="UTF-8" standalone=""  
<map>  
    <string name="Password">admin</string>  
</map>
```

Internal Storage - Examples

- See 5_Serialization on github

Internal Storage

- Private data stored on device memory
- More like traditional file i/o
- by default files are private to your application
 - other apps cannot access
- files removed when app is uninstalled

Internal Storage - Reading

```
public void doGet(View v) {  
    FileInputStream fis = null;  
    Scanner scanner = null;  
    StringBuilder sb = new StringBuilder();  
    try {  
        fis = openFileInput(FILENAME);  
        scanner = new Scanner(fis);  
        try {  
            while (scanner.hasNextLine()) {  
                sb.append(scanner.nextLine());  
            }  
        } finally {  
            if (fis != null) {  
                try {  
                    fis.close();  
                } catch (IOException e) {  
                    //why bother?  
                }  
            }  
            if (scanner != null) {  
                scanner.close();  
            }  
            et.setText(sb.toString());  
            setFileLoc();  
        }  
    } catch (FileNotFoundException e) {  
        Log.e(TAG, "File not found", e);  
    }  
}
```

Build the string

Close Input Stream

Close scanner

Set the EditText

Internal Storage - Writing

```
public void doSave(View v) {  
    String data = et.getText().toString();  
  
    FileOutputStream fos = null;  
    try {  
        // note that there are many modes you can use  
        fos = openFileOutput(FILENAME, Context.MODE_PRIVATE);  
        try {  
            fos.write(data.getBytes());  
        } finally {  
            fos.close();  
            et.setText("");  
            setFileLoc();  
        }  
    } catch (FileNotFoundException e) {  
        Log.e(TAG, "File not found", e);  
    } catch (IOException e) {  
        Log.e(TAG, "IO problem", e);  
    }  
}
```

Get text from EditText

Private

```
private void setFileLoc() {  
    etLocation.setText(this.getFilesDir().getAbsolutePath());  
    etFileName.setText(FILENAME);  
}
```

External Files - Other Useful Methods

- All of these are inherited from Context
- File getFileDir()
 - get absolute path to filesystem directory when app files are saved
- File getDir(String name, int mode)
 - get and create if necessary a directory for files
- boolean deleteFile(String name)
 - get rid of files, especially cache files
- String[] fileList()
 - get an array of Strings with files associated with Context (application)

Static Files

- If you need / have a file with a lot of data at compile time:
 - save file in project `res/raw` directory
 - can open file using the `openRawResource(int id)` method and pass the `R.raw.id` of file
 - returns an `InputStream` to read from file
 - cannot write to the file

External Storage - Examples

- See 5_Serialization on github

External Storage

- Public data stored on shared external storage
- are world-readable if use
 - [getExternalStoragePublicDirectory\(\)](#)
- are private if use
 - [getExternalFilesDir\(\)](#)

But you need Permission

(for external storage only)

- < uses-permission>, need to use certain device capabilities, such as accessing the Internet, SMS etc

```
><manifest xmlns:android="http://schemas.android.com/apk/res/android"
    package="com.example.demopreferences"
    android:versionCode="1"
    android:versionName="1.0" ><uses-sdk
        android:minSdkVersion="19"
        android:targetSdkVersion="19" />

    <uses-permission android:name="android.permission.READ_EXTERNAL_STORAGE" />
    <uses-permission android:name="android.permission.WRITE_EXTERNAL_STORAGE" />

    <application
```

Checking Media Availability

- `Environment.getExternalStorageState()` determines if media available
 - may be mounted to computer, missing, read-only or in some other state that prevents accessing

Checking Media Availability

```
boolean mExternalStorageAvailable = false;
boolean mExternalStorageWriteable = false;
String state = Environment.getExternalStorageState();

if (Environment.MEDIA_MOUNTED.equals(state)) {
    // We can read and write the media
    mExternalStorageAvailable = mExternalStorageWriteable = true;
} else if (Environment.MEDIA_MOUNTED_READ_ONLY.equals(state)) {
    // We can only read the media
    mExternalStorageAvailable = true;
    mExternalStorageWriteable = false;
} else {
    // Something else is wrong. It may be one of many other states,
    // to know is we can neither read nor write
    mExternalStorageAvailable = mExternalStorageWriteable = false;
}
```

Get state from Environment

available

Read

Cannot Use

External File Directory (private to your app)

- Used only by your app (textures, sounds)
- External files associated with application are deleted when application uninstalled

```
File file = new File(getExternalFilesDir(null), "DemoFile.jpg");
```



If any of the following
DIRECTORY_ALARMS,
DIRECTORY_MUSIC,
DIRECTORY_PICTURES,
Etc
specific subdirectory created

External Shared Files

- Files shared with other apps
- Use public directories on the external storage device
- **Not** deleted when app uninstalled
- `getExternalStoragePublicDirectory(String type)`
- Type is `DIRECTORY_ALARMS`, `DIRECTORY_DCIM` (Digital Camera IMages), `DIRECTORY_DOWNLOADS`, `DIRECTORY_MOVIES`, `DIRECTORY_MUSIC`, `DIRECTORY_NOTIFICATIONS`, `DIRECTORY_PICTURES`, `DIRECTORY_PODCASTS`, `DIRECTORY_RINGTONES`
- System media scanner will categorize your files based on this type

Summary

- Review of temp storage (widget with ID, bundle, application object)
- SharedPreferences
- Internal and External Storage
- Permission intro

Next time - In Class Example

- A calculator that shares its results via email. Illustrates, intents, bundles, preferences.
- See github

Soon - Preference Activity

- An Activity framework to allow user to select and set preferences for your app
- Main Activity can start a preference activity to allow user to set preferences
- Much like the preferences we have done except calls `getDefaultSharedPreferences(this)`
- Boilerplate professional code
- We will do these after we do Fragments

