

CPSC475/575

Persistence

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

Administrative

- Check your project before turning it in
- Consider UI usage
- Readings
- Project 2 assigned (tonight!)
- Persistence

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=");  
    }  
}
```

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

Finally use in all activities

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

Singleton

- Do not need for this class
- See <http://stackoverflow.com/questions/16517702/singleton-in-android> for examples

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 - Examples

- See MainActivity.java in app module of Serialization_preferences

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)

Using SharedPreferences

```
//in onCreate (get saved or default value) get a handle to
PREF_FILE_NAME, //create if necessary also
MODE_WORLD_READABLE, MODE_WORLD_WRITEABLE
SharedPreferences settings =
getSharedPreferences(PREF_FILE_NAME,
MODE_PRIVATE);
String savedPwd = settings.getString(PASSWORD, DEFAULT_PWD);
:
//when saving
SharedPreferences settings =
getSharedPreferences(PREF_FILE_NAME,
MODE_PRIVATE);

// can only make changes with editor
SharedPreferences.Editor editor = settings.edit();

// slap something in it, strings, booleans, check the docs
String myString = editTextPwd.getText().toString();
editor.putString(PASSWORD, myString);

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

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

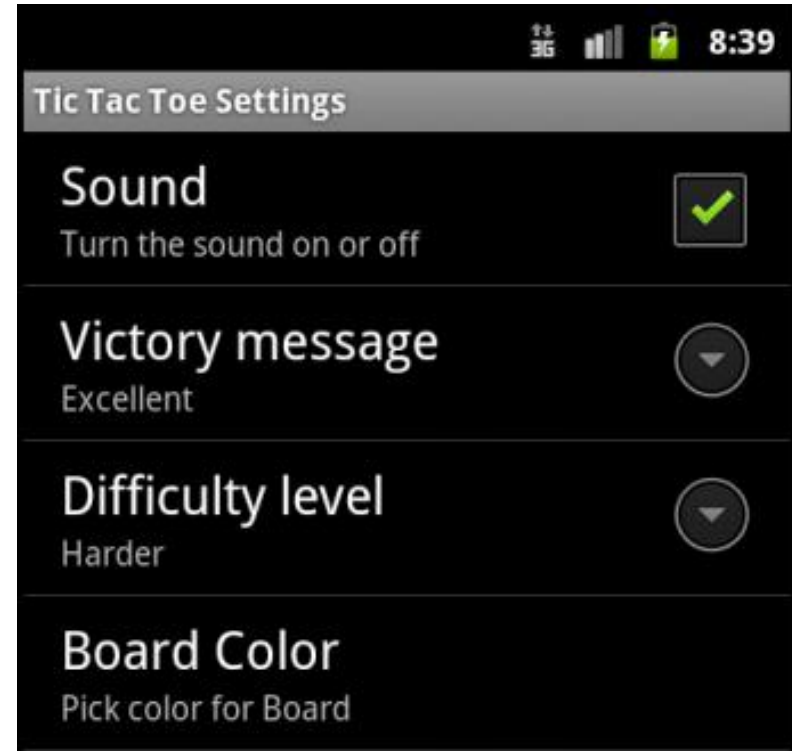
Shared Preferences File

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

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

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



Internal Storage - Examples

- See 5_Serialization

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 getFilesDir()
 - 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)

BTW, application specific 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

External Storage

- Public data stored on shared external storage
 - [getExternalFilesDir\(\)](#)

But you may need Permission

(for external storage only)

It's a dangerous one, but starting in API level 19, this permission is *not* required to read/write files in your application-specific directories returned by

[Context.getExternalFilesDir\(String\)](#)

[Context.getExternalCacheDir\(\)](#)

```
><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

caveat see commonsware explanation on course website

- 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

- SharedPreferences
- Internal and External Storage

Next time - In Class Example

- A calculator that shares its results via email. Illustrates, intents, bundles, preferences.
- See [github](#)

Accessing Files on External Storage

- `getExternalFilesDir(String type)` to obtain a directory (File object) to get directory to save files that are App private
- type is String constant from Environment class
 - `DIRECTORY_ALARMS`,
`DIRECTORY_DCIM` (Digital Camera Images), `DIRECTORY_DOWNLOADS`,
`DIRECTORY_MOVIES`,
`DIRECTORY_MUSIC`,
`DIRECTORY_NOTIFICATIONS`,
`DIRECTORY_PICTURES`,
`DIRECTORY_PODCASTS`,
`DIRECTORY_RINGTONES`