Mobile Computing
OVER VIEW NOTES

Storage

Dr. Abraham Campbell
University College Dublin
Abey.campbell@ucd.ie

Four Ways to CRUD* Data

- Preferences
- SQLite
- Plain files
  - Plain files on SD Card
- Network

* - Create Read Update Delete

SharedPreferences Framework

- Provides a mechanism to show, save and manipulate user's preferences
- Supports automatic UI creation
  - Developer declares the type of a user preference => a UI for manipulating these preferences is automatically generated

SharedPreferences Framework

- getPreferences() - Activity-specific
- getSharedPreferences() – Applications specific
- getDefaultSharedPreferences() - shared system preferences

SharedPreferences

- edit()
- remove()
- Clear()
- AND
- commit()

SharedPreferences (committing)

```
SharedPreferences settings =
getSharedPreferences(“myPrefs”, 0);

SharedPreferences.Editor editor = settings.edit();

editor.putString(“username", “Abey”);
editor.commit();
```

SharedPreferences (Restoring)

```
SharedPreferences settings =
getSharedPreferences(“myPrefs”, 0);

  String name = settings.getString((“username",
“Not Stored”););
```

Defining Preferences (Graphical)

```
<PreferenceScreen ...>
<CheckBoxPreference
android:key="checkbox"
android:title="Checkbox Preference"
android:summary="Check it on, check
it off" />
...
```

Adding Preferences

```
public class EditPreferences extends PreferenceActivity
{
        @Override
        public void onCreate(Bundle savedInstanceState)
        {
        super.onCreate(savedInstanceState);
        addPreferencesFromResource(R.xml.preferences);
        }
}
```

Plain Files

- Android has a private storage for each application, which is accessible for both read and write operations
- Also, if a device has external storage (SD Card) and application has appropriate privileges

Plain Files: Available Classes

- General
  - InputStream
  - OutputStream
- Text-Based
  - InputStreamReader
  - OutputStreamWriter
- *Don't forget to close() :-)*
- File paths are NOT accepted!

Working with Plain Files

```
// Example 1
InputStream in = getResources()\
    .openRawResource(R.raw.words);

// Example 2
String FILENAME = "hello_file";
String string = "hello world!";
FileOutputStream fos = openFileOutput(FILENAME, \
          Context.MODE_PRIVATE);
fos.write(string.getBytes());
fos.close();
```

Working with External Storage

- Use

  Environment.getExternalStorageDirectory()

  for root element
- You CAN use file paths there
- External storage is accessible to all applications (with appropriate permissions)

SQLite

- Popular embedded database
- Combines SQL interface & small memory footprint
- Open Source and Public Domain
- Built into Android runtime
- SQL Primer is available at http://www.w3schools.com/web/web_sql.asp

SQLite in Android

- Create & open a DB with subclass of SQLiteOpenHelper()
- Methods needed:
  - Constructor
  - onCreate()
  - onUpgrade()
- Use its instance with getReadableDatabase() or getWriteableDatabase()
- Don't forget to close() :-)

Android's SQLite Cont'd

- db.execSQL("CREATE TABLE constants (_id INTEGER PRIMARY KEY AUTOINCREMENT, title TEXT, valueREAL);");
  - Same for INSERT, UPDATE, DELETE
- Alternatively, use insert(), update(), delete() on SQLiteDatabase object:
  - db.insert("constants", "title", values); constantsCursor.requery();

Android's SQLite Cont'd

- Other methods available:
  - rawQuery() - simply calls your SQL statement
  - query() - lets you construct SQL statement from components with SQLiteQueryBuilder
- Cursors are also available, i.e.
  - getCount(), moveToFirst(), moveToNext(), getColumnNames(), getColumnIndex(),getString(), getInt(), etc.

Android's SQLite Cont'd

- DB inspection is available via adb shell & sqlite3
- SQLite files are available at /data/data/your.app.package/databases/your dbname
- To get DB in and out, use 'adb pull' and 'adb push‘

Network

- Most Android devices have some sort of network connectivity
  - 3G, EDGE, Wifi, etc
- Wide range of connectivity available:
  - Integrated WebKit browser
  - Various built-in and 3rd party API
  - Raw sockets

Network

- Android does not have built-in SOAP or XMLRPC, but has built-in Apache HTTP Components library (http://hc.apache.org)
- HTTP Components basic classes & methods:
  - HttpClient.execute(), HttpRequest (HTTPGet & HTTPPost),ResponseHandler<>

Sending Requests

```
HttpGet getMethod=new HttpGet(url);
try {
ResponseHandler<String> responseHandler =
new BasicResponseHandler();
String responseBody =
client.execute(getMethod,
ResponseHandler);
…
} catch (Throwable t) {
...
```

Parsing Responses

- Data will come back to you mainly in HTML, XML, JSON
- Android has 3 main built-in data parsers:
  - DOM (org.w3c.dom), SAX (org.xml.sax), JSON(org.json)
- Nothing stops you from writing your own :-)
- 3rd party parsers are required for RSS/Atom

Parsing Responses Cont'd

```
...
DocumentBuilder builder = DocumentBuilderFactory.
newInstance().newDocumentBuilder();
Document doc = builder.parse(new InputSource(new
StringReader(raw)));
NodeList elements =
doc.getElementsByTagName("ourelements");
for (int i=0;i<elements.getLength();i++) {
Element elem=(Element)elements.item(i);
...
```

HTTP Components Considerations

- Using HttpClient with SSL is not an easy task due to ambiguity in certificate handling
- HttpClient is single-threaded (so new thread might be needed for each one)
- More info: docs, examples at http://hc.apache.org