Lecture – Part B Persistent Data in Android

DT228/3

Dr. Susan McKeever

Choosing data storage for your app

- Files
- Local SQLLite Database
- Remote storage

Pros and cons for each

Complexity of data that can be stored/Ability to query data/ Structure of data/ Storage capacity/Reqmt for internet connection/ Security of data/ Frequency of data changes/ etc

Example: Choosing data storage for your app

A mobile app to allow surveyors to log water table levels in soil; The app will include local maps showing the table levels in the area

- What is your recommendations re persistent data Storage?

- Drawn the technical architecture – including all h/w and s/w components

Example: Choosing data storage for your app –

- Remote storage.. What are the options?
  - Anything that sits on a server that stores data…
  - Formal database e.g. Oracle/ MySQL
  - Google Fusion
  - etc

Doing Database operations

Prone to run time errors

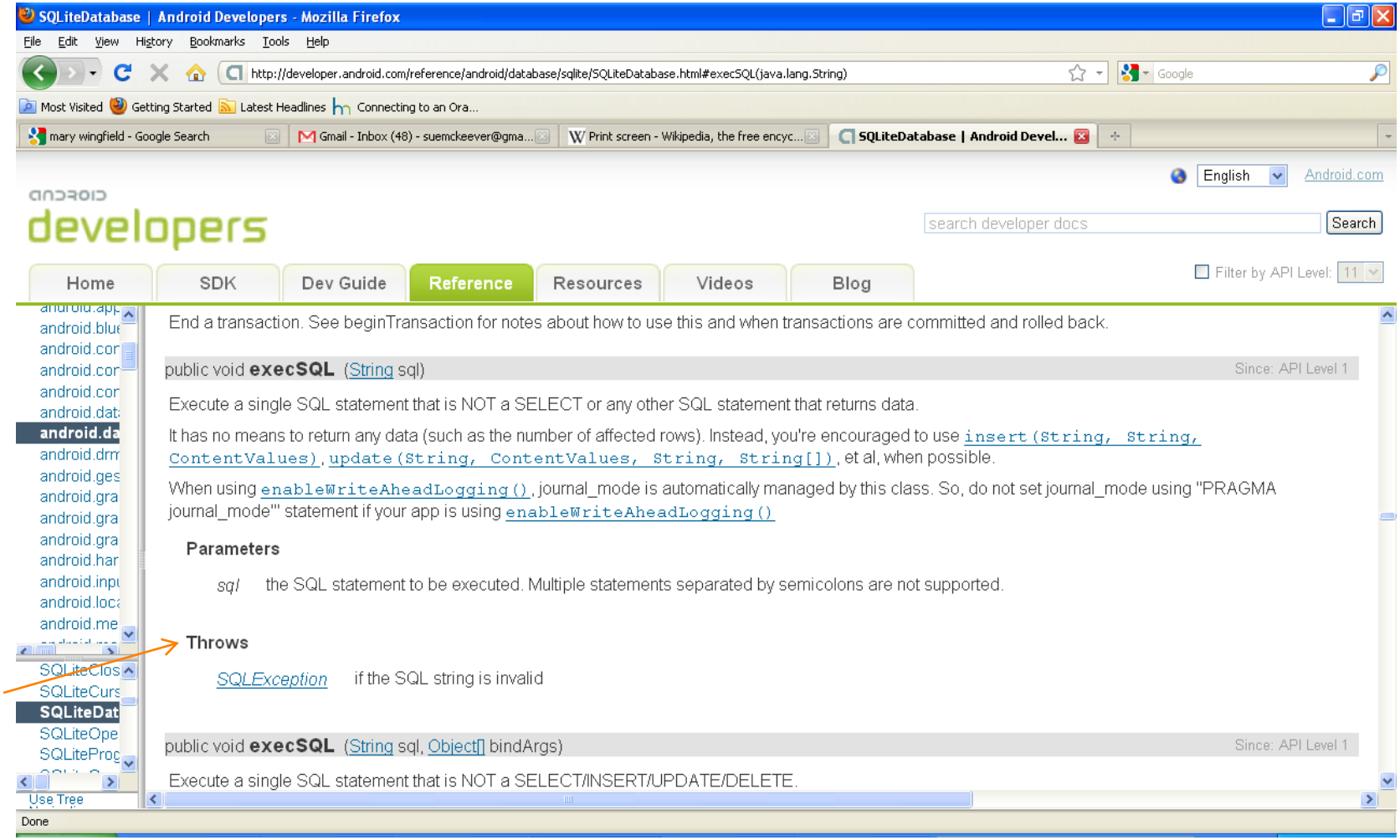
e.g. execSQL().. The SQL statement passed in might be invalid

getWriteableDatabase() – the system may have a problem connecting to the database etc

Such methods “throw” exceptions – as seen in the API

Error Handling

- Some SQL methods throw exceptions which your code can catch (and if you don't...?)



Error Handling

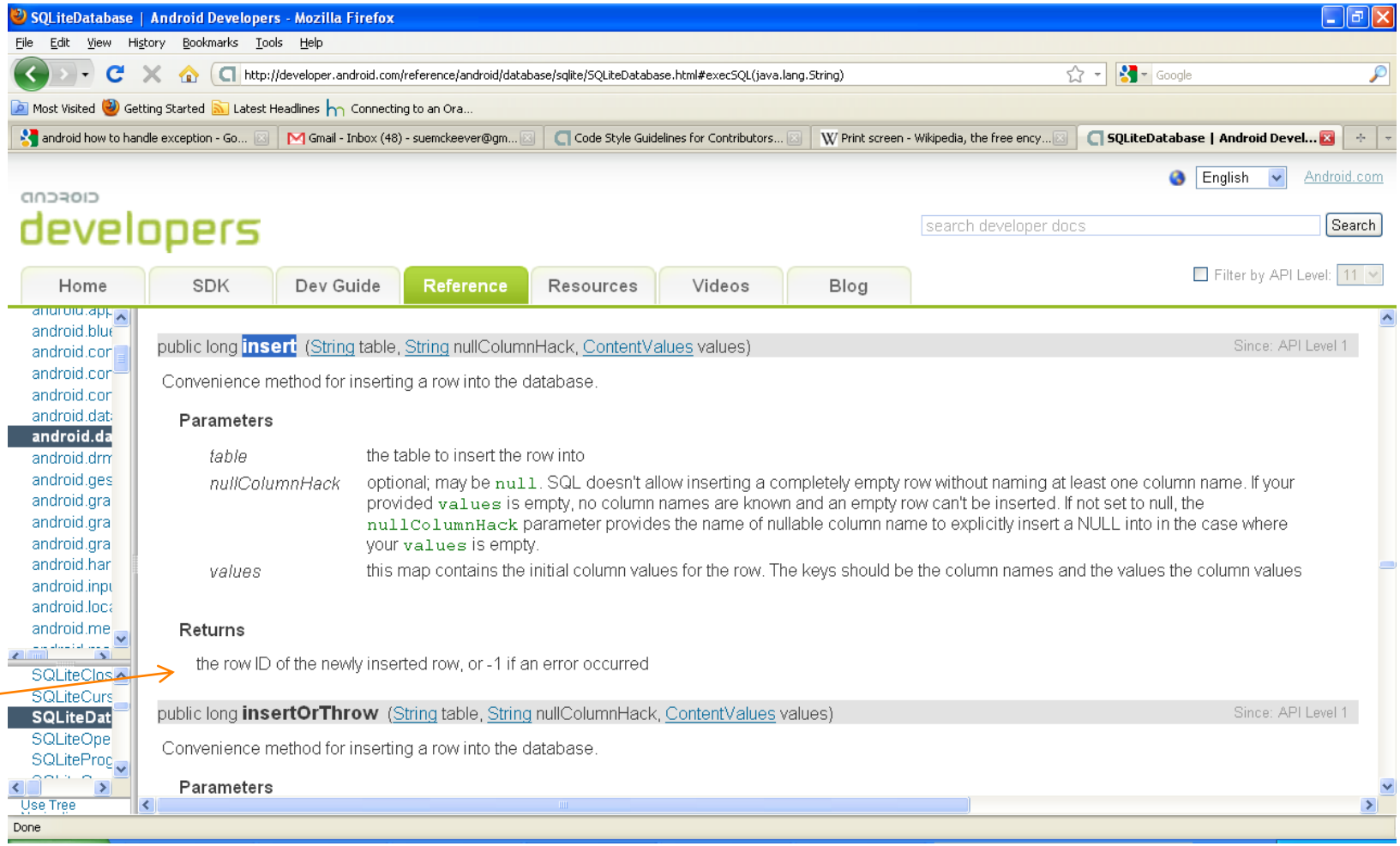
- Some SQL methods throw exceptions which your code can catch

- Put this code into try/catch unless your code is robust enough to never hit the error

```
try
{
        // Code that
        execSQL……
}
catch (SQLException e)
{
        // whatever you want to happen e.g.
        Log.e("Error executing SQL…",
        e.toString());
}
finally
{ … }
```

Error Handling

- The RETURN values from SQL methods give useful info too...



Opening/connecting to the database -

- We used `getWriteableDatabase()` from the SQLLiteopenHelper class
- API definition:

public synchronized SQLiteDatabase getWritableDatabase ()

Create and/or open a database that will be used for reading and writing. The first time this is called, the database will be opened and onCreate(SQLiteDatabase), onUpgrade(SQLiteDatabase, int, int) and/or onOpen(SQLiteDatabase) will be called. Once opened successfully, the database is cached, so you can call this method every time you need to write to the database. (Make sure to call close() when you no longer need the database.) Errors such as bad permissions or a full disk may cause this method to fail, but future attempts may succeed if the problem is fixed.
Database upgrade may take a long time, **you should not call this method from the application main thread**, including from ContentProvider.onCreate().

Returns
•a read/write database object valid until close() is called

Throws
SQLLiteException if the database cannot be opened for writing

Opening/connecting to the database

- getWriteableDatabase() to connect to the database
- Can take a long time..
  - E.g. if Database upgrade is involved
- For slow operations (such as this) consider use of threads.
- Subclass a class called **`AsyncTask`**
  - Asynchronous (background).. Versus synchronous (wait)
  - (like comparing email versus phone call..)..
  - Must override the doInBackGround() method– which runs on a separate thread
  - Put the “slow” comands in to your own `AsyncTask`

Opening/connecting to the database - Asynchronous Task

..

```
private class MyLongTask extends AsyncTask
{
    @Override
    protected Object doInBackground(final Object... objects)
    {
      try
      {
          openHelperRef.getWritableDatabase();

       }
      catch (etc
```

- Put your slow tasks in it's own asyncTask class – (subclassed)
- Use the **doInBackGround()** method to execute the code.. (above)
- Then… instantiate this class from your activity that needs it..
- `new MyLongTask().execute();`

Remember your SQL…

SELECT
INSERT
UPDATE
DELETE

SQL for selects

Getting Data from a Database

The Select statement:

```
SELECT column_1 [ , column_N ]
FROM table_name
[ WHERE column_1 = 'search term' ];
```

Example:

```
SELECT * FROM tasks;
```

SQL for Updates

Saving Data to a Database

The Update statement:

```
UPDATE table
SET column_1 = ‘new value’
[ , column_N = 1 ]
[ WHERE id = 1 ];
```

Example:

```
UPDATE tasks
SET complete = ‘true’
WHERE id = 1;
```

SQL for inserts

Adding Data to a Database

The Insert statement:

```
INSERT INTO table (column_1 [ , column_N ])
VALUES (value_1 [ , value_2 ]);
```

Example:

```
INSERT INTO tasks (name, complete)
VALUES ( 'Get Milk', 'false' );
```

SQL for deletes

Removing Data from a Database

The Delete statement:

```
DELETE FROM table
[ WHERE id = 1 ];
```

Example:

```
DELETE FROM tasks
WHERE id = 1;
```

QUERIES – How to call the SELECT

rawQuery()

Simplest
Pass in the SQL SELECT statement directly
Ok for simple queries (e.g. Always have same columns returned)

```
myCursor = db.rawQuery("SELECT _ID, name, city  " +
                "FROM people WHERE  name = " +
                        personName, null)
```

(Or better – just put your SQL statement into a string variable and pass that in: `db.rawQuery(varSql, null)`

QUERIES – How to call the SELECT

query()

Query method builds up the SQL statement from a bunch of parameters

More flexible than rawQuery() ...
See overleaf

SQLiteQueryBuilder

Provides a way to "build" queries – see the API

Look at these in the API if rawQuery() doesn't meet what you need...

Query() example

query()

Query method builds up the SQL statement from a bunch of parameters e.g.

```
public Cursor getAllPeople()
    {
        return db.query(DATABASE_TABLE, new String[] {
                KEY_ROWID,
                KEY_FIRSTNAME,
                KEY_SURNAME,
                    KEY_CITY},
                    null,
                    null,
                    null,
                    null,
                    null);
    }
```

Cursors

Query results

- Whatever rows are *returned comes back in a* ***Cursor***
- To view the row(s), need to navigate around the cursor.
- API supplies various methods for moving along the rows of the cursor

  e.g.

  ```
  moveToFirst()
  moveToNext()
  isAfterLast()
  ```

Cursor - methods detail from the API

Public boolean `moveToFirst()`

Move the cursor to the first row.
This method will return false if the cursor is empty.

Returns
whether the move succeeded.

Etc

Cursor - iterating through rows..

See Code snippet..

- Return the cursor from the query....

- **IF you want to do something individually with the rows … need to iterate through the rows in the cursor**

    - Go to the first record
    - Move to the next…
    - Till you hit the last one..
    - Same logic for Android.. Web... Java... etc

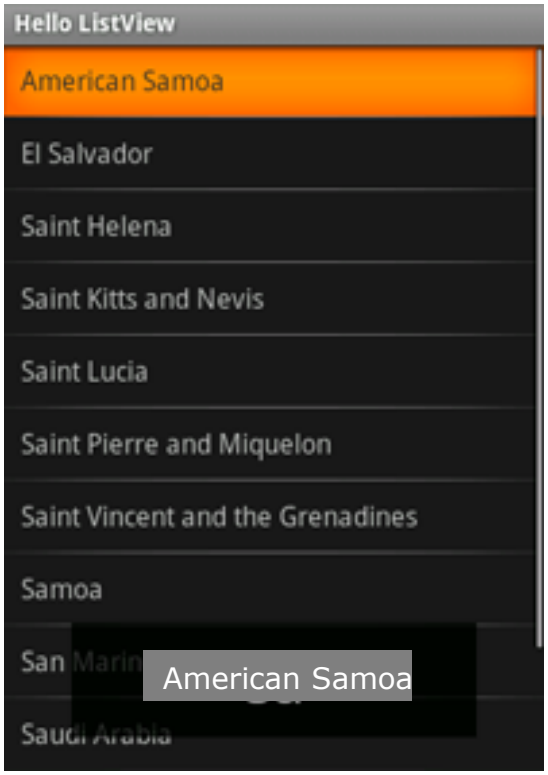
- Extract values out of the cursor using getString(index), getInt(index) etc. Where index is the column position in the cursor

Cursor - Displaying database rows on a list

Usually.. Want to display back query results into a list....

<ListView> for XML Layout

Row.XML (maybe)



SimpleCursorAdaptor

An Adapter for supplying the list

A cursor of database rows for feeding into the adaptor

SimpleCursorAdaptor -

See In Class example

- An off the shelf Adapter from the Android API (such as SimpleCursorAdapter means you don't have to navigate the individual result (cursor) rows..
  - Just use the cursor object as a parameter when instantiating the adapter you're going to use

SimpleCursorAdaptor -

VERY similar to previous ArrayAdaptor example – Except..it needs:

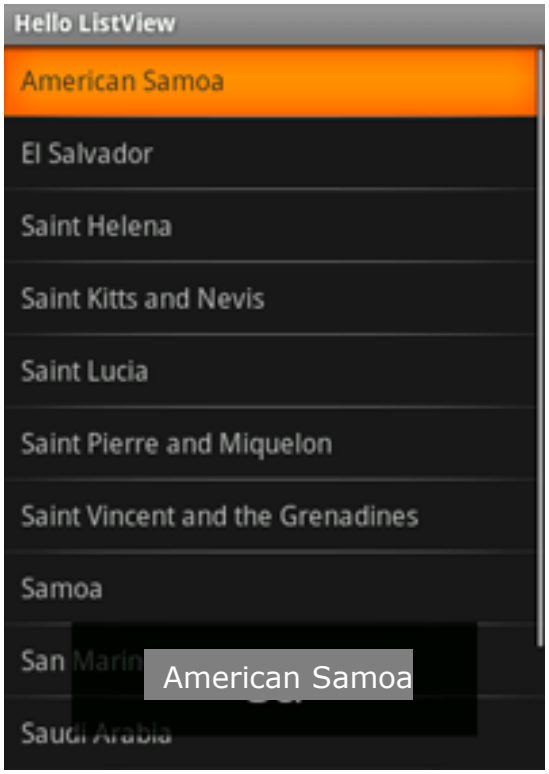
1. a cursor passed in as database source (instead of array)
2. The columns to display from the cursor
3. The textviews to display (the columns)in the layout

```
// the desired columns to be bound
(2) String[] columns = new String[] {"surname", "city"};

// the XML defined views which the data will be bound to
(3) int[] rowIDs = new int [] {R.id.surname_entry,
R.id.city_entry};

// create the adapter using the cursor pointing to the desired
data as well as the layout information
 SimpleCursorAdapter mAdapter = new SimpleCursorAdapter(this,
R.layout.row, myCursor, columns, to);
                    (1)      (2)    (3)
```

Displaying a list from a dB



A cursor adaptor to take the data from a query to a list.. DONE

Then..

How to “do something” when an on the list is clicked? Where does code go?

Responding to list clicks (when populated from a dB)

`OnListItemClicked()` method as before

- Automatically called in a ListActivity when an item is clicked..
- Usually want to find the contents of the row that was clicked
- If the data your want is in the cursor – use the position parameters to retrieve it.

`e.g.`

```
public void onListItemClick(ListView parent, View v, int position,
                                    long id)
{
   super.onListItemClick(l, v, position, id); // always 1st line
   cursor = (Cursor) mAdapter.getItem(position);
    // retrieve the 2nd column which contains a name..
   String myName =   cursor.getString(1);
   // add code to do whatever I want when an item is clicked..etc
```

Putting it all together e.g.

- Data entry screen to “add” something
- List of “things”
- Click on a list to display details of a thing

What classes do you need?

What you've learnt about dBs

How to use the SQLLiteOpenHelper class
How to use inserts, updates, deletes
ContentValues()
Error handling
Asynchronous tasks for opening/connecting
How to do queries – and use cursors..
How to use populate a list using
    SimpleCursorAdaptor
How to get at the list row clicked..
How to view a SQLLite database