Mobila applikationer och trådlösa nät, HT12

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Lecture 4
Today's topics

- Intents
- BroadcastReceivers
- Introduction to Networking in Android

Configuration changes runtime

- Unless you specify otherwise, a configuration change at runtime will cause your current activity to be destroyed
- Examples:
  - Change in screen orientation
  - Language
  - Input devices, …

  (defined in android.content.res.Configuration)
- If the activity had been in the foreground or visible to the user, a new instance of the activity will be created, and resource values reloaded
- Save UI-state in onPause() or onSaveInstanceState

Handle configuration changes in code

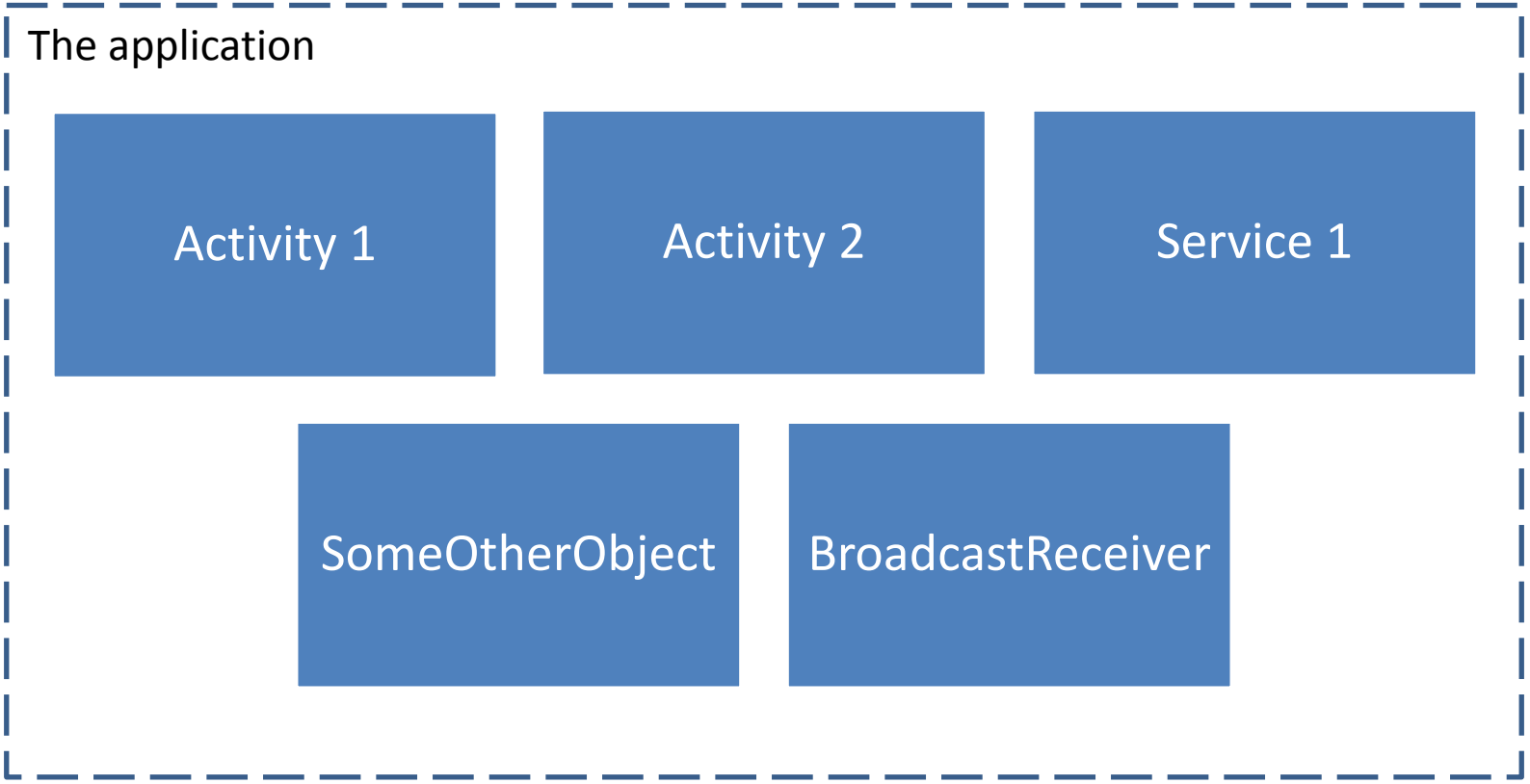
- This surpresses the Activity to be destroyed and restarted
- The application manifest:

```
<activity
    android:label=”. . .”
    android:configChanges=”orientation|keyboardHidden”
/>
```

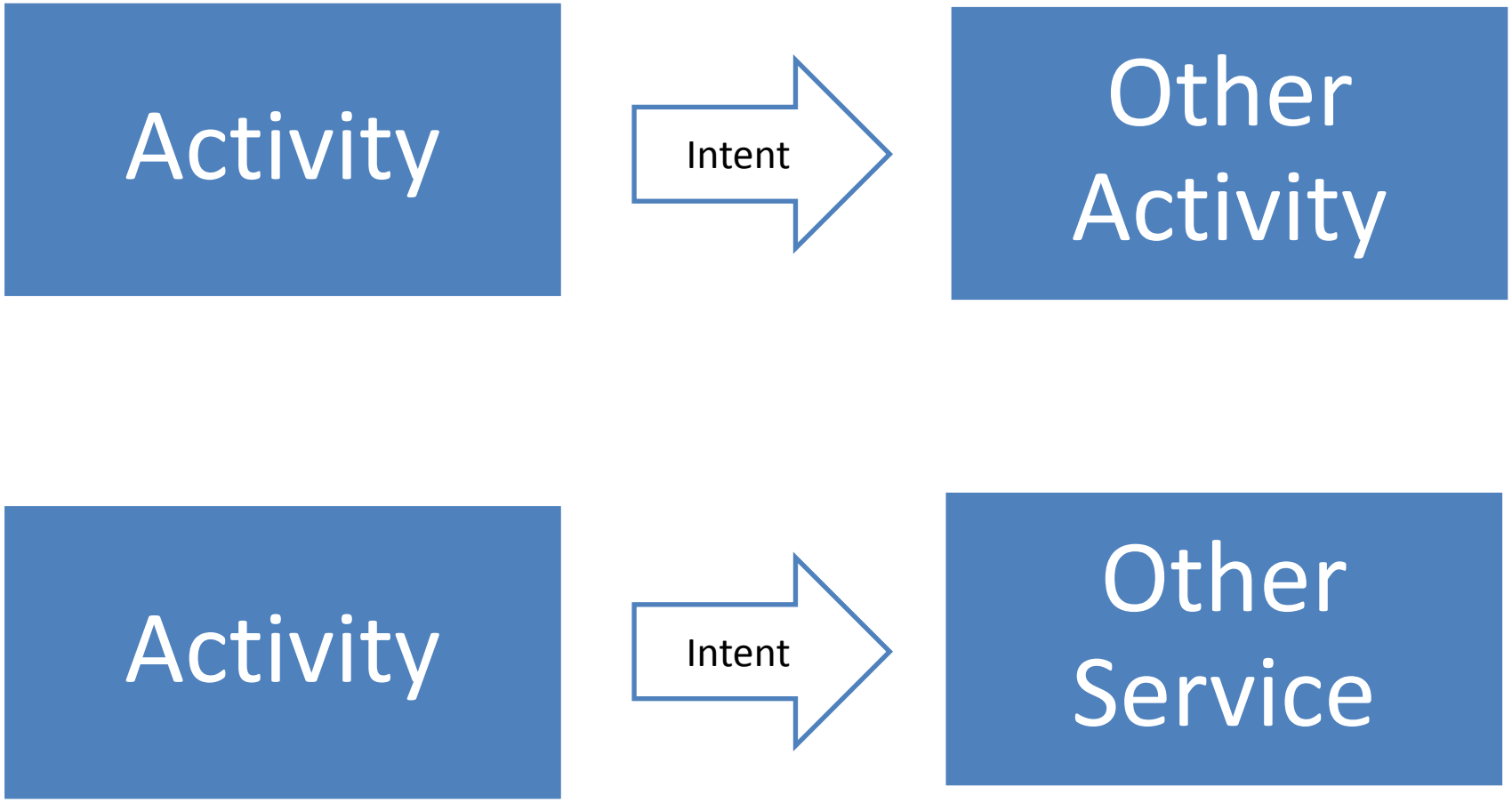
- In the activity:

```
@Override
public void onConfigurationChanged(Configuration newConfig) {
    super. onConfigurationChanged(newConfig);

    // Update any UI based on resource values, they might
    // have changed

    if(newConfig.orientation ==
            Configuration.ORIENTATION_LANDSCAPE) { . . .
```

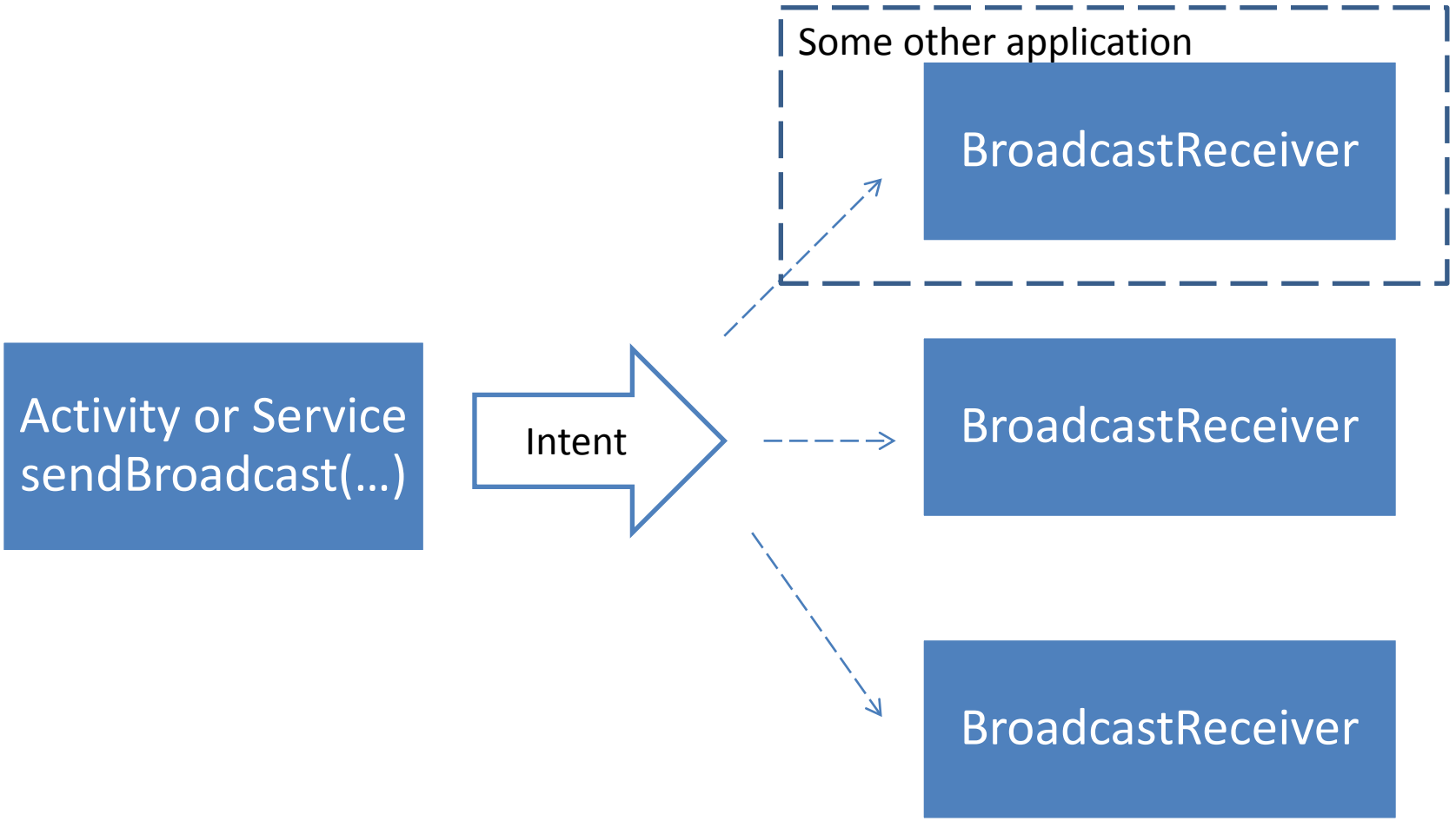
An Android application



Intents – send message or start other component



Broadcast Intents



Intents

- An Intent (meaning aim, purpose, intention) is an *asynchronous* message sent between application components

Intents can be used to

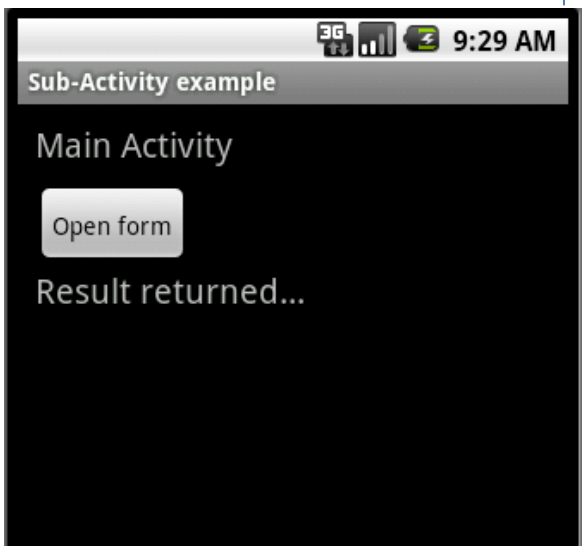
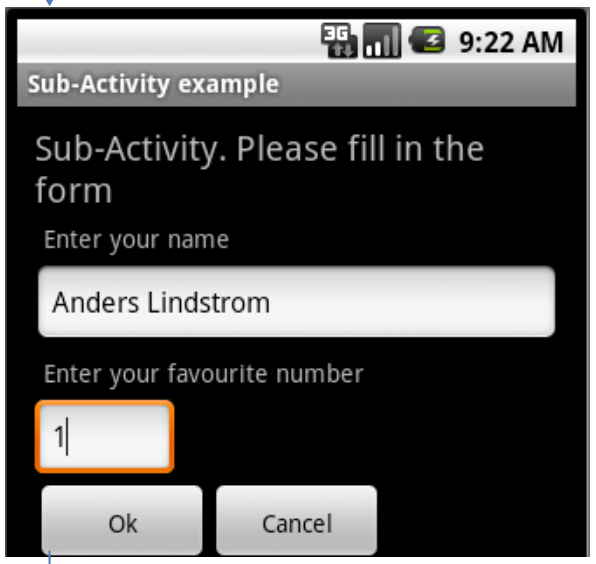
1. Explicitly start a specific Activity or Service (together with some data)
2. Implicitly request that *the best suited* Activity or Service perform an action (together with some data)
3. Broadcast that something has ocurred

Explicit Intents

- To start a new Activity explicitly, call startActivity(intent)

- ```
  Intent intent = new Intent(
      MyCurrentActivity.this,
      MyNextActivity.class);
  startActivity(intent);
  ```

- The new Activity is moved to the top of the Activity stack
- Back button or finish() removes the Activity from the stack
- By default, the application doesn't receive any notification when the newly started Activity finishes!
  ```

Explicit Intents

- All Activities must be registered in the AndroidManifest.xml file

```
<application . . .>
    <activity android:name=".MyMainActivity"
              android:label="@string/app_name">
        <intent-filter>
           <action android:name="android.intent.action.MAIN" />
           <category
               android:name="android.intent.category.LAUNCHER" />
        </intent-filter>
    </activity>

    <activity
        android:name=".MyOtherActivity">
    </activity>
</application>
```

- Example: ExplicitIntent.zip

Implicit Intents

- Intent to perform a task, without specifying an Activity, Service or such
- State the action to perform and, optionally, the data to act upon – a URI
- The Android OS finds the appropriate Activity!
- Native actions: ACTION_DIAL, ACTION_EDIT, ACTION_PICK, *ACTION_VIEW*, ACTION_WEB_SEARCH, ...
- URI's:
  "tel:+4687904813"
  "content://contacts/people",
  "http://google.com",
  . . .

Implicit Intents

- Start a new Activity implicitly

- ```
  Intent intent = new Intent(
      Intent.ACTION_VIEW,
      Uri.parse("content://contacts/people/"));
  startActivity(intent);
  ```

- ```
  if(emergency && !helpInSight) {
      Intent intent = new Intent(
              Intent.ACTION_DIAL,
              Uri.parse("tel:112"));
      startActivity(intent);
  }
  ```

- Need not be a native Activity, third party apps can be registered to support actions (native or new ones)

Returning results, Sub-Activities

Sub-Activity

- E.g. an (sub) Activity for user input (a form)
- Started with *startActivityForResult*
- Triggers an event in the parent Activity on finish
- May return result to the parent Activity
- Returned from the Sub-Activity: Intent with data, request code, result code

Returning results, Sub-Activities

1)
```
startActivityForResult(
        intent,
        requestCode);
```





3) Call back:
```
onActivityResult(
        int requestCode,
        int resultCode,
        Intent result)
{ . . .
```

2)
```
setResult(
        resultCode,
        result);
finish();
```

Returning results, Sub-Activities

- Starting a sub activity from parent Activity:

```
private static final int SHOW_FORM = 0; // Request code(s)
. . .

private class OnStartSubListener implements
View.OnClickListener {
   public void onClick(View v) {
      Intent intent = new
         Intent(MainActivity.this,
         SubActivity.class);
      startActivityForResult(intent, SHOW_FORM);
   }
}
```

Returning results, Sub-Activities

- Call-back implementation in parent Activity:

```
public void onActivityResult(int requestCode,
                             int resultCode, Intent result) {
   super.onActivityResult(requestCode, resultCode, result);

   if(resultCode == Activity.RESULT_OK) {
      switch(requestCode) {
         case SHOW_FORM:
            String name = result.getStringExtra(NAME);
            int number = result.getIntExtra(FAVOURITE_NUMBER, 42);
            // Process result and update view . . .
            break;
         case SHOW_SOMETHING_ELSE:
            // ...
         break;
      }
   . . .
```

Returning results, Sub-Activities

- Returning result from Sub-Activity:

```
private class OnOkClickListener implements View.OnClickListener {
   public void onClick(View v) {
         String name = editName.getText().toString();
         int number =
            Integer.parseInt(editNumber.getText().toString());

         Intent result = new Intent();
         result.putExtra(MainActivity.NAME, name);
         result.putExtra(MainActivity.FAVOURITE_NUMBER, number);

         setResult(Activity.RESULT_OK, result);
         finish();
      }
   }
}
```

- Example code: SubActivity.zip

Intent filters

- To inform the system which implicit intents they can handle, activities, services, and broadcast receivers can have one or more intent filters
- Each filter describes a set of *implicit* intents that the component is willing to *receive*
- An implicit intent is delivered to a component only if it can pass through one of the component's filters
- *An explicit intent is always delivered to its target*, no matter what it contains; the filter is not consulted

Intent filters

- AndroidManifest.xml file with intent-filter

```
<application . . .>
    <activity android:name=".MyMainActivity"
              android:label="@string/app_name">
        <intent-filter>
           <action android:name="android.intent.action.MAIN" />
           <category
               android:name="android.intent.category.LAUNCHER" />
        </intent-filter>
    </activity>

    <activity
        android:name=".MyOtherActivity">
    </activity>
</application>
```

Broadcasting Intents

- Broadcast messages between components with the sendBroadcast(…) method
- This makes it possible to broadcast system wide

- `public static final String SOME_CUSTOM_EVENT = "se.kth.anderslm.SOME_CUSTOM_EVENT";`

- ```
  Intent intent = new Intent(
      SOME_CUSTOM_EVENT);
  intent.putExtra(...);
  context.sendBroadcast(intent);
  ```
  ```

Broadcasting Intents

Native Android broadcast events, examples

- ACTION_TAME/DATE_CHANGED
  ACTION_MEDIA_BUTTON
  ACTION_CAMERA_BUTTON
  ACTION_NEW_OUTGOING_CALL
  ACTION_SCREEN_ON/OFF
  ACTION_TIMEZONE_CHANGED
  ACTION_PACKAGE_ADDED . . .

- ACTION_MEDIA_EJECT
  ACTION_MEDIA_MOUNTED/UNMOUNTED
  ACTION_BATTERY_CHANGED
  ACTION_POWER_CONNECTED/DISCONNECTED

- ACTION_BOOT_COMPLETED
  ACTION_SHUTDOWN

BroadcastReceivers

- A BroadcastReceiver listens to broadcasted Intents

- ```
  public class CameraButtonReceiver
                    extends BroadcastReceiver {
      @Override
      public void onReceive(
            Context context, Intent intent) {
            // To do...
      }
  }
  ```
- Must be registered in the application manifest (or in code)
- Intent Filters are used to specify which Intents the BroadcastReceiver is listening for
  ```

BroadcastReceivers

- Register the BroadcastReceiver in the application manifest or in the source code

- ```
  <receiver
  android:name=".CameraButtonReceiver">
      <intent-filter>
            <action android:name=
      "android.intent.action.CAMERA_BUTTON"/>
      </intent-filter>
  </receiver>
  ```

- Reciviers registered in the manifest file are always active, whether or not the application is running at the moment
  ```

BroadcastReceivers

- Registring a BroadcastReceiver in the source code
- ```
  IntentFilter filter = new IntentFilter (
      "se.kth.anderslm.CameraButtonReceiver");
  CameraButtonReceiver receiver = new
  CameraButtonReceiver();
  registerReceiver(receiver, filter);
  ```
- Reciviers registered in the source code are active only when the corresponding application is running, or until unregistered
- `unRegisterReceiver(receiver);`
- Useful e.g. when using it for updating the UI (unregister when the activity isn't visible or active - in onPause)
  ```

The Application class

- The Application class may be sub-classed to
  - Maintain application state
  - Transfer/share objects between application components
  - Manage and maintain resources used by multiple application components

- Register a custom Application class in the manifest file

```
<application
    android:icon="@drawable/ic_launcher”
    android:name=”CustomApplication” >
    <activity
    ...
</application>
```

- Objects might also be shared between application components using the Singleton Design Pattern

The Application class

- Implement the Application sub-class in a way similar to the Singleton design pattern

- ```
  public class CustomApplication extends Application {

        public static final CustomApplication singleton;
        private SomeSortOfSharedData data;

        public static CustomApplication getInstance() {
                return singleton;
        }

        public final void onCreate() {
                super.onCreate();
                singleton = this;
                // Create other, shared objects
                data = new …;
        }

        public SomeSortOfSharedData getData() { …

        public void setData(…) { …

  }
  ```
  ```

Android Networking

Packages

- java.net: URL, URLConnection, HttpURLConnection, Socket, DatagramSocket…
- java.io: InputStream, OutputStream (and wrapper/filter streams), IOException, …
- java.nio – unblocking IO, channels
- android.bluetooth: BluetoothSocket, BluetoothServerSocket, ...

Android Networking

- Add uses permission to the Android Manifest file, at least android.permission.INTERNET

```
<manifest . . .>
   <application . . .>
       . . .
   </application>
   <uses-permission
       android:name="android.permission.INTERNET">
   </uses-permission>
</manifest>
```

URLConnection

- A connection to a URL for reading or writing
-

```
BufferedInputStream in = null;

try {
  URL url = new
    URL("ftp://mirror.csclub.uwaterloo.ca/index.html");

  URLConnection urlConnection = url.openConnection();

  in = new
    BufferedInputStream(urlConnection.getInputStream());

  readStream(in);
}
finally {
    in.close();
}
```

HttpURLConnection

- Used to send and receive data over the web. Data may be of any type and length (here: downloading an image from the net, Networking1.zip)

```
HttpURLConnection http = null;
InputStream istream = null;
try {
   URL text = new URL(urlStr);
   http = (HttpURLConnection) text.openConnection();
   istream = http.getInputStream();
   Bitmap bmImg = BitmapFactory.decodeStream(istream);
   imageView.setImageBitmap(bmImg);
}
finally {
   if(istream != null) istream.close();
   if(http != null) http.disconnect();
}
```

HttpURLConnection

- Reading from a HttpURLConnection, saving to file (Networking2.zip)

```
try {
   URL text = new URL(urlStr);
   http = (HttpURLConnection) text.openConnection();

   istream = http.getInputStream();
   byte[] buffer = new byte[1024];
   fos = this.openFileOutput (fileName, Activity.MODE_PRIVATE);

   int readSize = 0;
   while (readSize != -1) {
      readSize = istream.read(buffer);
      if (readSize > 0) {
         fos.write(buffer, 0, readSize);
      }
   }
```

XML

- Extensible Markup Language (XML) is a set of rules for encoding documents in machine-readable form
- Meta-data
- Widely used for the representation of arbitrary data structures, for example in web services
- An element can contain:
  - other elements
  - text
  - *attributes*

  (or a mix of all of the above...)

XML

```
<bookstore>
    <book category="WEB">
        <title>Learning XML</title>
        <author>Erik T. Ray</author>
        <year>2003</year>
        <price>39.95</price>
    </book>
    <book>
        . . .
    </book>
</bookstore>
```

Parsing XML

- Slogan: ”Don’t Superize Me”
- Model parser – Reads the entire document and stores it as a tree-structure
  Android: DocumentBuilder
- Push parser - Set up callbacks, the SAX component *pushes* document events to you
  Android: org.xml.sax
- Pull parser – *Pull* data from the document using the pull parser component
  Android: XMLPullParser
- Pull/Push reads only the parts of the document needed

Parsing XML (pull parser)

- ```
  XmlPullParser parser =
  XmlPullParserFactory.newInstance().newPullParser()
  parser.setInput(inputStream, encoding);
  ```

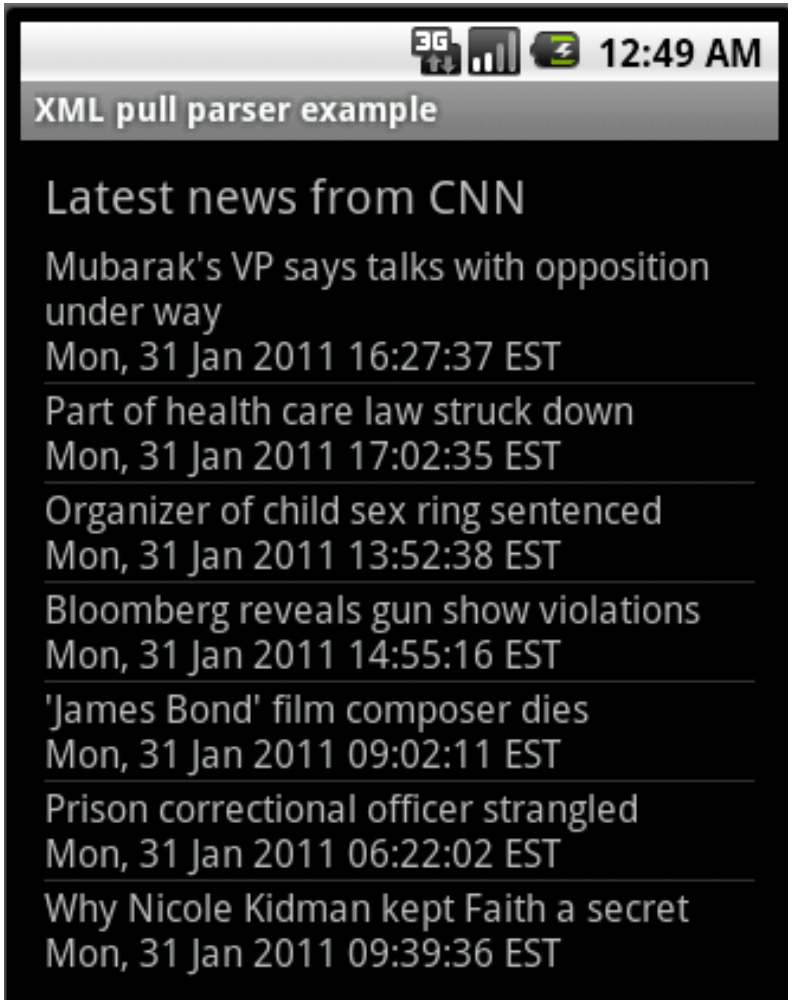
- ```
  int parseEvent = parser.next()
  ```

- Event codes:
  ```
  XmlPullParser.START_DOCUMENT, END_DOCUMENT,
  START_TAG, END_TAG, TEXT, …
  ```

- Getting attributes:
  ```
  int n = parser.getAttributeCount();
  String attributeName = parser.getAttributeName(i);
  String value = parser.getAttributeValue(i);
  ```

Parsing XML, example

- RSS (Really Simple Syndication or Rich Site Summary) is an XML-based format for sharing and distributing Web content, such as news headlines
- Example: CNN news RSS, http://rss.cnn.com/rss/cnn_topstories.rss



Parsing XML, example

```
<?xml version="1.0" encoding="ISO-8859-1" ?>
<rss version="2.0">
<channel>
    <title>CNN.com</title>
    <link>http://edition.cnn.com/?eref=edition</link>
    <description>CNN.com delivers up-to-the-minute news.</description>
    <item>
        <title> Mubarak's VP says talks with opposition under way</title>
        <link> http://rss.cnn.com/~r/rss/cnn_topstories/~3/xXT6mhyGJWI/index.html</link>
        <description> Talks between opposition parties and Egyptian Vice. . .</description>
        <pubDate> Mon, 31 Jan 2011 16:27:37 EST</pubDate>
    </item>
    <item>
        <title>Why Nicole Kidman kept Faith a secret</title>
        <link>. . .
    </item>
    </channel>
</rss>
```

Parsing XML

```
private void updateNews() throws Exception {
   HttpURLConnection http = null;
   InputStream xmlStream = null;
   try {
            URL url = new URL(cnnUrl);
            http = (HttpURLConnection) url.openConnection();
            RSSParser parser = new RSSParser();
            parser.parse(http.getInputStream(), newsItems);
            adapter.notifyDataSetChanged();
   }
   finally {
        if(xmlStream != null) xmlStream.close();
        if(http != null) http.disconnect();
   }
}
```

Parsing XML, the parser class

```
XmlPullParser parser =
   XmlPullParserFactory.newInstance().newPullParser();
parser.setInput(inputStream, encoding);

int parseEvent = parser.getEventType();
while(parseEvent != XmlPullParser.END_DOCUMENT) {
   switch(parseEvent) {
   case XmlPullParser.START_DOCUMENT: . . .
   case XmlPullParser.START_TAG:
        String tagName = parser.getName();
        if(tagName.equalsIgnoreCase(ITEM)) {
               parseItem();
        }
        break;
   case XmlPullParser.END_TAG: . . .
   }
   parseEvent = parser.next();
}
```

Parsing XML, the parser class

```
private void parseItem() throws IOException, XmlPullParserException {
    int parseEvent;
    String name, item = "";
    // Continue until end of </item>
    do {
    parseEvent = parser.next();
    name = parser.getName();
    if(parseEvent == XmlPullParser.START_TAG) {
        if(name.equalsIgnoreCase(TITLE)) {
            item += parser.nextText() + "\n";
        }
        else if(name.equalsIgnoreCase(PUBDATE)) {
            item += parser.nextText();
        }
    }
    } while(parseEvent != XmlPullParser.END_TAG || !name.equals(ITEM));

    itemList.add(item);
}
```

Parsing XML

- Example with push parser, SAX, in Meier chapter 5: Creating an Earthquake viewer