



Programming with Android: Network Operations

Luca Bedogni

Marco Di Felice

Dipartimento di Scienze dell'Informazione

Università di Bologna



Outline

Network operations: *WebView*

Network operations: *WebView* and *WebSettings*

Network operations: *HTTP* Client

Network operations: *HTTP* Requests

Network operations: *HTTP* Responses

Network operations: *Download Manager*

Network operations: *TCP/UDP* Sockets



Android: **WebView Usage**

WebView → A **View** that displays web pages, including simple browsing methods (history, zoom in/out/ search, etc).

Implemented by the WebView class

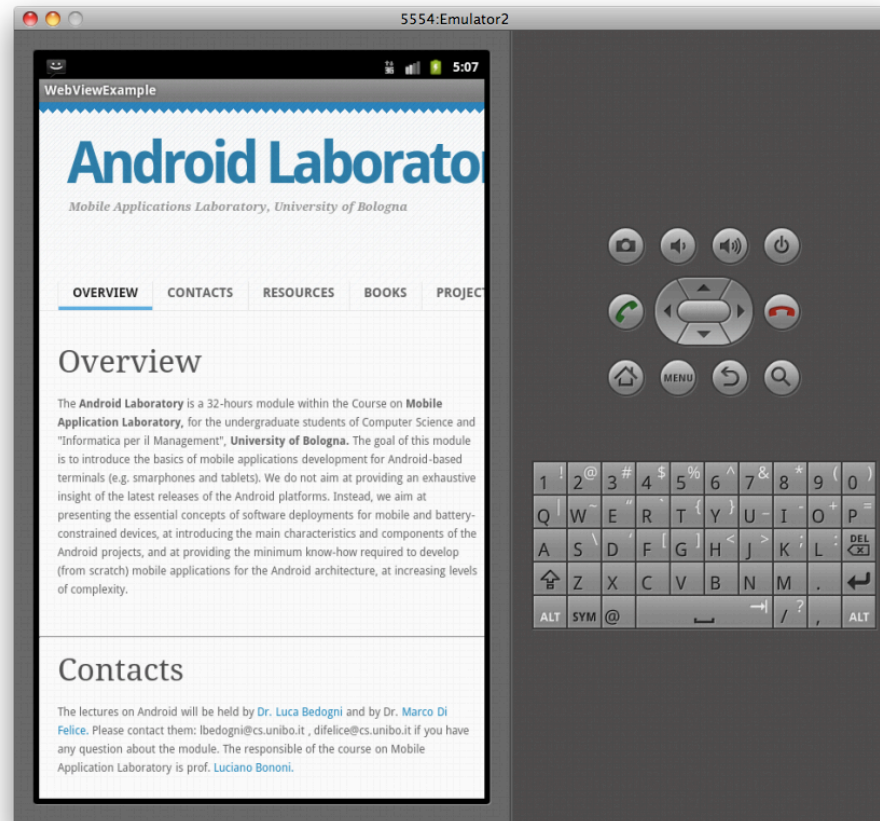
```
public WebView(Context context)
```

Main methods:

- public void **loadUrl**(String url) → load the HTML page at url
- public void **loadData**(String data, String mimeType, String encoding) → load the HTML page contained in data



Android: **WebView Usage**



Luca Bedogni, Marco Di Felice — **Network programming with Android**



Android: **WebView Usage**

By default, the WebView UI does not include any navigation button ...However, **callbacks** methods are defined:

- public void **goBack()**
- public void **goForward()**
- public void **reload()**
- public void **clearHistory()**



Android: **WebView Usage**

It is possible to modify the visualization options of a **WebView** through the **WebSettings** class.

```
public webSettings getSettings()
```

Some options:

- void **setJavaScriptEnabled**(boolean)
- void **setBuildInZoomControls**(boolean)
- void **setDefaultFontSize**(int)



Android: HTTP Classes

HTTP (HyperText Transfer Protocol): Network protocol for exchange/transfer data (hypertext)

Request/Response Communication Model

MAIN COMMANDS

- HEAD
- GET
- POST
- PUT
- DELETE
- TRACE
- CONNECT



Android: **HTTP Classes**

- **HttpClient** → Interface for an HTTP client
- **HttpRequest** → Interface for an HTTP request
- **HttpResponse** → Interface for an HTTP response
- **ResponseHandler<T>** → Handler that creates an object <T> from an HTTP Response
- **HttpContext** → Context of the HTTP Request (request+response+data)



Android: HTTP Classes

- **HttpClient** → Interface for an HTTP client
(DefaultHttpClient → implementation of an HttpClient)

```
HttpClient client=new DefaultHttpClient();
```

Main method:

The public method **execute(...)** performs an HTTP request, and allows to process an HTTP reply from the HTTP server.

One of the signature of **execute()**

```
abstract<T> T execute(HttpUriRequest request,  
ResponseHandler <T> responseHandler)
```



Android: **HTTP** Classes

➤ **HttpRequest** → Interface for an HTTP request

Two implementations:

HttpGet → implements the **GET** HTTP method

```
HttpGet request=new HttpGet(String address);
```

```
HttpGet request=new HttpGet(URI address);
```

HttpPost → Implements the **POST** HTTP method



Android: HTTP Classes

- **ResponseHandler <T>** → Interface for creating an object <T> from an `HttpResponse`, obtained after having executed an `HttpRequest`.

Method to override

```
public abstract T handleResponse (HttpResponse res)
```

Generally, <T> is a `String` (HTML code) ...



Android: HTTP Classes

- **HttpPost** → Implements the **POST** HTTP method

```
HttpPost request=new HttpPost(String address);
```

```
HttpPost request=new HttpPost(URI address);
```

Encapsulating a parameter ...

```
List<NameValuePair> par=new ArrayList<NameValuePair>()  
par.add(new BasicNameValuePair("name","Marco"));  
HttpEntity postEntity=new UrlEncodedFormEntity(par);  
request.setEntity(postEntity);
```



Android: HTTP Classes

Basic HttpClient Request-Response Application ...

```
HttpClient client=new DefaultHttpClient();
HttpGet request=new HttpGet();
request.setURI("http://www.cs.unibo.it");
try {
    client.execute(request, responseHandler);
} catch (ClientProtocolException e) {
    e.printStackTrace();
} catch (IOException e) {
    e.printStackTrace();
}
```



Android: HTTP Classes

Basic HttpClient Request-Response Application ...

```
class MyResponseHandler implements ResponseHandler<String> {
    @Override
    public String handleResponse(HttpResponse response) {
        InputStream content=response.getEntity().getContent();
        byte[] buffer=new byte[1024];
        int numRead=0;
        ByteArrayOutputStream stream=new ByteArrayOutputStream();
        while ((numRead=content.read(buffer))!=-1)
            stream.write(buffer, 0, numRead);
        content.close();
        String result=new String(stream.toByteArray());
        return result;
    }
}
```



Android: **Download Manager**

DownloadManager → System service that handles long-run HTTP downloads.

- The client can specify the file to be downloaded through an **URI** (path).
- Download is conducted in **background** (with retries)
- Broadcast Intent action is sent to notify when the download completes.

```
DownloadManager dm=(DownloadManager) getSystemService  
(DOWNLOAD_SERVICE);
```



Android: Download Manager

- The Request class is used to specify a download request to the Download Manager.

```
Request request=new DownloadManager.Request(Uri.parse(address));
```

Main methods of the **DownloadManager**

- long **enqueue**(DownloadManager.Request)
- Cursor **query**(DownloadManager.Query)
- ParcelFileDescriptor **openDownloadedFile**(long)



Android: **TCP/IP Communication**

TCP/UDP Communication → Android applications can use `java.net.Socket` facilities.

➤ Use socket-based programming like in Java ...

Class **DatagramSocket** → UDP Socket

Classes **Socket/ServerSocket** → TCP socket

Read/Write on Sockets through **InputStream/OutputStream**