The Android platform offers three basic design patterns:

1. Pure Android
   Create a **native Android** app using the SDK and keep the app in the device. Such an app uses Android primitive resources such as widgets, services, activities, fragments, content-providers, notifications, etc.

2. Pure External HTML
   Create a **remote website** and allow Android devices to fetch the external web-pages using the device’s browser.

3. Mixed Mode
   Create an **internal website** hosted in the device. Allow the local HTML-pages (making the app) to interact with local Android resources.
Each approach offers **advantages & disadvantages**. For instance,

- **Option (1)** is richer in GUI and logic controls but is limited to Android devices. Porting the app to other platforms (say Apple’s iOS or Windows Mobile) requires full re-write of all its parts.

- **Option (2)** is the most portable version. Any device with Internet access can interact with the external remote site; however, this model does not use any of the multiple Android’s hardware and software resources (with the exception of its system browser).

- **Option (3)** is an interesting in-between compromise. Solutions based on this approach are—at least in principle—more ‘easily’ transferred from one platform to the other. Current improvements in the HTML5 standard make the strategy even more appealing.
1. **WebViews** use the **WebKit** Open Source Engine (this engine is also present on other systems such as Apple’s IOs - [http://www.webkit.org](http://www.webkit.org))

2. In principle, a WebView is not exactly a regular browser. Although it is used to show webpages, it does not include the common browser’s buttons such as Back, Forward, Reload, etc.

3. The **WebView** class includes (among others) methods to:
   - Load /Reload a page, navigate forward and backward through a history record,
   - Zoom in and out,
   - Use CSS and JavaScript features to provide different styles and images based on the screen's pixel density.
   - Exchange data with the Android device using a JavaScript Interface
   - Perform text searches, capture pictures, load data / stop loading ...
   - Implementing those methods and services could be done in various ways, for instance through Menus, ActionBar, Buttons, etc.
Android’s browser showing a webpage on an HTC phone. Originally www.ebay.com was requested, but redirected to http://m.ebay.com

Android app (Example1A) using an embedded WebView to show the same webpage illustrated on the figure to the left. Image obtained from an HTC phone.
Android **app** (Example1A) running on a tablet. The original requested site **www.ebay.com** is shown as it would be on a ‘normal’ browser running on a laptop/desktop computer (*no redirection*).
Warning! In order for your Activity to access the Internet you must add the `INTERNET` permission to your Android `Manifest` file. For using add-on libraries such as `Google Maps`, you need an explicit `<uses-library...>` clause included in your Manifest.

```xml
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
    package="csu.matos.webview_demo1"
    android:versionCode="1"
    android:versionName="1.0">

    <uses-sdk
        android:minSdkVersion="8"
        android:targetSdkVersion="18"/>

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

    <application android:name="android.permission.INTERNET">
        . . .
        <activity . . .
        </activity>

        <uses-library android:name="com.google.android.maps" />
    </application>

</manifest>
```
Example 1. Populating a WebView

In this example we explore three different ways in which a WebView could be populated:

1. First, our WebView is loaded with an external web-page whose URL is known to us.

2. A second case is shown in which a WebView exposes a set of locally stored HTML pages.

3. A third WebView is used to display an HTML page whose code is dynamically supplied by the app.
Example 1. Populating a WebView

Constructing the example
Eclipse users can find the WebView widget in the Composite pane of the GUI Editor.
WebViews

Example 1. Layout – activity_main.xml

```xml
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:orientation="vertical"
    android:layout_width="match_parent"
    android:layout_height="match_parent">

    <TextView
        android:id="@+id/txtMsg"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:textAppearance="?android:attr/textAppearanceMedium"/>

    <WebView
        android:id="@+id/webView1"
        android:layout_width="match_parent"
        android:layout_height="match_parent"/>

</LinearLayout>
```
Example 1. Option Menu – activity_main_menu.xml

```xml
<menu
    xmlns:android="http://schemas.android.com/apk/res/android">
    <item
        android:id="@+id/back_page"
        android:orderInCategory="100"
        android:showAsAction="never"
        android:title="Back Page"/>
    <item
        android:id="@+id/forward_page"
        android:orderInCategory="110"
        android:showAsAction="never"
        android:title="Forward Page"/>
    <item
        android:id="@+id/reload_page"
        android:orderInCategory="120"
        android:showAsAction="never"
        android:title="Reload Page"/>
    <item
        android:id="@+id/zoom_in"
        android:orderInCategory="130"
        android:showAsAction="never"
        android:title="Zoom In"/>
    <item
        android:id="@+id/zoom_out"
        android:orderInCategory="140"
        android:showAsAction="never"
        android:title="Zoom Out"/>
</menu>
```
Example 1. MainActivity.java

```java
public class MainActivity extends Activity {
    TextView txtMsg;
    WebView webView;

    @Override
    public void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_main);
        txtMsg = (TextView) findViewById(R.id.txtMsg);

        // Try demo1, demo2, or demo3 (please, uncomment one at the time!!!)
        demo1TrySpecificUrl();

        // demo2TryLocallyStoredHtmlPage();
        // demo3TryImmediateHtmlPage();
        // demo4TryRichGoogleMap();

        } // onCreate

    // -------------------------------------------
    // Demo1, Demo2 and Demo3 code goes here...
    // -------------------------------------------

}//MainActivity
```
Example 1. **MainActivity - (Demo1) Show a Remote Page**

```java
@SuppressLint("SetJavaScriptEnabled")
private void demo1TrySpecificUrl() {
    webview = (WebView) findViewById(R.id.webView1);
    webview.getSettings().setJavaScriptEnabled(true);
    //webview.setWebViewClient(new WebViewClient()); //try later
    //set ebay.com as "home server" - go do some shopping
    webview.setWebViewClient(new MyWebViewClient(txtMsg, "ebay.com"));
    webview.loadUrl("http://www.ebay.com");
    //webview.loadUrl("http://www.amazon.com"); //try later
}
```

**Comments**

1. Allow the visited page to execute its **JavaScripts** functions (if any)
2. The extended class **MyWebViewClient** is asked to control page traffic and update the GUI showing the actual URL used by the browser. In our example, only pages from [ebay.com](http://www.ebay.com) are allowed to be shown on the WebView widget. Other sites will be displayed in a separate browser (*more on this class at the end of the example*)
3. The given **URL** is used to initiate the Internet navigation process. Caution, the final page could be different from the original address due to redirection enforced by the remote server. In this example we asked to visit [www.ebay.com](http://www.ebay.com) but ended up at [m.ebay.com](http://m.ebay.com) (when using small screens!).

This app is hard-wired to eBay.com as “home server”
Example 1. MainActivity - (Demo1) Show Remote Page

Web Page To which the app is redirected

Click to navigate forward. Use Menu for other options.
Example 1. MainActivity - (Demo2) Show Local Pages

```java
@SuppressLint("SetJavaScriptEnabled")
private void demo2TryLocallyStoredHtmlPage() {
    webView = (WebView) findViewById(R.id.webView1);
    webView.getSettings().setJavaScriptEnabled(true);

    // a custom WebViewClient could check for url containing the
    // home-base address "file:///android_asset/
    webView.setWebViewClient(new WebViewClient()); //continue using WebViews
    //webView.setWebViewClient(new MyWebViewClient2(this)); //try later
    webView.loadUrl("file:///android_asset/form1_send.html");
}
```

Comments

1. Using a default WebViewClient to control page traffic. By default requested URLs are all –without exception- shown in the WebView (no browsers called). A record of all visited links is kept so forward-backward navigation could be used. In this example the ‘home-server’ address begins with: file:///android_asset/

2. The web-page to be shown is locally stored in the app’s memory space (it could also be on SDcard). In this example, our pages are held in the res/asset/ folder.
Example 1. MainActivity - (Demo2) Show Local Pages

Form1: Sending Data

First Name:
Maria
Last Name:
Macarena

Submit

Form2: Receiving Data

Receiving data from the GET query-string
Spying...Mon Oct 21 2013 19:38:16 GMT-0400 (EDT)
You supplied the following data:
txtFirstName=Maria&txtLastName=Macarena&submit=
Display

Comment: Click on the Submit button to call the second web-page passing form-data (user’s First & Last name)
Example 1. MainActivity - (Demo2) Show Local Pages

```html
<html>
<head>
</head>
<body>

<FORM action="form2_receive.html" id=form1 method=GET name=form1>
   <h1>Form1: Sending Data</h1>
   First Name:
   <br>
   <INPUT id="txtFirstName" name="txtFirstName" value="Maria">
   <br>
   Last Name:
   <br>
   <INPUT id="txtLastName" name="txtLastName" value="Macarena">
   <p>
   <INPUT type="submit" value="Submit" id=submit1 name=submit1>
</FORM>
</body>
</html>

Comments
After pressing Submit the page form2_receive.html will be called. Current form data will be supplied using the HTTP GET method. Therefore the QueryString will include: txtFirstName=Maria&txtLastName=Macarena&submit1=Submit
WebViews

Example 1. form2_receive.html - (Demo2) Show Local Pages

<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN">
<html>
<head>
<br>
<title>Android & Plain HTML Demo</title>
<script language="javascript">

function extracting(variable) {
    var query = window.location.search.substring(1);
    alert(query);
    var personName = getQueryVariable(variable)
    document.getElementById("myMsg").value = personName;
}

function getQueryVariable(variable) {
    var query = window.location.search.substring(1);
    var vars = query.split('&');
    for (var i=0;i<vars.length;i++) {
        var pair = vars[i].split("=");
        if ((pair[0] == variable) || (variable == 0)) {
            return pair[1];
        }
    }
    alert('Query Variable ' + variable + ' not found');
}
</script>
</head>
</html>
Example 1. form2_receive.html – (Demo2) Show Local Pages

```html
<!DOCTYPE html>
<html>
<head>
</head>
<body>
<h1>Form2: Receiving Data</h1>
<p><input TYPE="text" id="myMsg" /></p>
<p><input TYPE="button" value="Display" onclick="extracting('txtFirstName');"></p>
<p>Receiving data from the GET query-string</p>
<script>
    document.write("<p>Spying..." + new Date() );
    document.write("<p>You supplied the following data:");
    var querystring = window.location.search.substring(1);
    document.write("<p><b>" + querystring + "</b>");

    document.write("<p>txtLastName: " + getQueryVariable('txtLastName') );

</script>
</body>
</html>
```
Comments
The Browser-Object-Model (BOM) class Location contains information about the current URL. In particular, the property `window.location.search` returns the query portion of a URL, including the question mark ‘?’. In our example

```
window.location.search is
?txtFirstName=Maria&txtLastName=Macarena&Submit1=Submit
```

Therefore

```
window.location.search.substring(0) is ‘?....’ and
```

```
window.location.search.substring(1) is
txtFirstName=Maria&txtLastName=Macarena&Submit1=Submit
```

You may add *images* to Form1. Add sub-directory /pictures to the assets folder. Refer to a picture using a clause such as:
```
<img src="pictures/picture_name.png" />
```
Example 1. MainActivity - (Demo3) Show Immediate Page

**Playing with Google Maps V2 (Using Coordinates):**
Use your computer to access the following link

```
http://maps.googleapis.com/maps/api/staticmap
?center=41.5020952,-81.6789717
&zoom=14&size=350x450&sensor=false
```

It displays a web page showing a static map centered around the given coordinates (latitude and longitude of Cleveland State University Student’s center)

*We want to reproduce this behavior in our Android app.*

This image was generated using the **Google Maps Image API**. For more information visit **https://developers.google.com/maps/**

For converting street-coordinates see: **http://stevemorse.org/jcal/latlon.php**
Playing with Google Maps V2 (Mapping by Name):
Use your computer to access the following link

http://maps.googleapis.com/maps/api/staticmap
?center=Cleveland+State+University,Ohio
&zoom=15&size=480x700
&maptype=roadmap
&markers=color:green|label:C|41.5020952,-81.6785000
&sensor=false

The URL displays a web page showing a static roadmap of the given location. Reverse geo-location allows us to locate a place by it’s name.

*We want to reproduce this view in our Android app.*

This image was generated using the **Google Maps API**. For more information visit [https://developers.google.com/maps/](https://developers.google.com/maps/)
WebViews

Example 1. MainActivity - (Demo3) Show Immediate Page

```java
@SuppressLint("SetJavaScriptEnabled")
private void demo3TryImmediateHtmlPage() {
    //make a WebView to show a Google Map for given coordinates
    webview = (WebView) findViewById(R.id.webView1);
    webview.getSettings().setJavaScriptEnabled(true);
    webview.setWebViewClient(new WebViewClient());

    String aGoogleMapImage = "<img src="http://maps.googleapis.com/maps/api/
    + "staticmap?center=41.5020952,-81.6789717&"
    + "zoom=14&size=350x450&sensor=false"> ";

    //define an HTML page with code
    String myLocalHtmlPage = "<html>"
    + "<body>"
    + "<h1>Hello, world! </h1>"
    + "<p> Greetings from <b>Cleveland State University</b>";
    + "</p>" + aGoogleMapImage
    + "</body>"
    + "</html>";

    webview.loadData( myLocalHtmlPage, "text/html", "UTF-8" );
}
```
Example 1. MainActivity - (Demo3) Show Immediate Page

Warning!

Make sure your app

1. Has the required **permission** clauses in the **Manifest** file (Internet and com.google.android.map library clauses are needed here)

2. Has been compiled using the Google.APIs library.

3. Your emulator is configured to target a GoogleAPIs environment (such as: [Google APIs (x86 System Image) (API Level 19)](https://example.com))
Example 1. MainActivity - (Demo4) Show Google Map (Again)

Load a WebView with a URL defining a map according to Google Map API V3

```java
@SuppressLint("SetJavaScriptEnabled")
private void demo4TryRichGoogleMap() {
    webview = (WebView) findViewById(R.id.webView1);

    webview.getSettings().setJavaScriptEnabled(true);
    //show only WebViews
    webview.setWebViewClient(new WebViewClient());

    String mapUrl = "https://maps.google.com/maps" + "?q=41.5020952,-81.6789717&t=m&z=13";

    webview.loadUrl(mapUrl);
}
```

This example shows a ‘rich’ Google map with built-in controls for getting directions, zooming, street view, etc. For more information visit the link: https://developers.google.com/maps/documentation/javascript/basics#Mobile
WebViews

Example 1. MainActivity - (Demo4) Show Google Map (Again)

Note:
A subtle difference on the URLs from previous examples

http://maps.google.com/

http://maps.googleapis.com

The V3 API is faster than V2 and is particularly designed with mobile devices on mind. In addition, the V2 API will not receive more special attention (see video https://www.youtube.com/v/zi8at1EmJjA )
Example 1. MainActivity - Menu

```java
// browser navigation implemented through the option-menu
@Override
public boolean onCreateOptionsMenu(Menu menu) {
    getMenuInflater().inflate(R.menu.activity_main_menu, menu);
    return true;
} // onCreateOptionsMenu

@Override
public boolean onOptionsItemSelected(MenuItem item) {
    String option = item.getTitle().toString();
    if (option.equals("Forward Page"))
        webView.goForward();
    if (option.equals("Back Page"))
        webView.goBack();
    if (option.equals("Reload Page"))
        webView.reload();
    if (option.equals("Zoom In"))
        webView.zoomIn();
    if (option.equals("Zoom Out"))
        webView.zoomOut();
    return true;
} // onOptionsItemSelected

} // class
```
class MyWebViewClient extends WebViewClient {
    // this object keeps a history-log of all visited links
    // and validates url links against a "home-base" server address
    Context context;
    TextView txtMsg;
    String hostServerSuffix; //this is the home-base

    public MyWebViewClient(TextView txtMsg, String hostServerSuffix) {
        this.txtMsg = txtMsg;
        this.hostServerSuffix = hostServerSuffix;
    }

    @Override
    public boolean shouldOverrideUrlLoading(WebView view, String url) {
        context = view.getContext();

        String host = Uri.parse(url).getHost();
        // if 'host' portion extracted above keeps us inside valid
        // base server (hostServerSuffix) then use a WebView to continue
        // navigation, otherwise override navigation by showing requested
        // page inside a full blown-up browser (security issues here...)

        String text = "URL:" + url.toString()
                        + "\n\nHOST:" + host
                        + "\n\nHOME should be:" + hostServerSuffix;
    }
Toast.makeText(context, text, Toast.LENGTH_LONG).show();

if (url.contains(hostServerSuffix)) {
    // do not override navigation (using big web-browser) as long as
    // url points to some page in my defined home-server
    return false;
}
else {
    // The supplied url is not for a page on my 'valid' site,
    // in that case launch another Activity that handles URLs
    Intent intent = new Intent(Intent.ACTION_VIEW, Uri.parse(url));
    context.startActivity(intent);
    return true;
}

@Override
public void onPageStarted(WebView view, String url, Bitmap favicon) {
    // keep user informed - update txtMsg with current URL value
    super.onPageStarted(view, url, favicon);
    txtMsg.setText(url.toString());
}

//MyWebViewClient
What happens if no WebViewClient is supplied by the app?

If a WebViewClient is not provided, the WebView will ask Activity Manager to choose the proper handler for the URL (the first time this happen an App Chooser screen will be displayed showing all candidate apps from which the user may select one).

The image on the right, shows a chooser for the mapping example Demo3. It lists apps registered to show a map, such as: Google-Earth, Google-Maps, And Zillow.

If a WebViewClient is provided it could inspect the given URL values.
- If the current address is ‘acceptable’ it returns FALSE, and the WebView assumes responsibility for displaying the contents of that page,
- otherwise the activity chooses the best way (usually a browser).
Warning - Using JavaScript & Flash Animations

Your Android application **must** explicitly give permission to execute the JavaScript code of visited pages. By default WebViews have Javascript turned off. To activate JavaScripts do this:

```java
webview.getSettings().setJavaScriptEnabled(true);
```

To remove the system’s message warning you on the security risks brought by JS, add to each method enabling JS the following annotation

```java
@SuppressLint("SetJavaScriptEnabled")
```

**Warning:**

Using JavaScript from visited pages creates a security dilemma; while JS is useful it is also dangerous (an attacker can include HTML that executes ‘malevolent’ code). As a rule: you should not allow JS unless you wrote all of the HTML and JavaScript that appears in our WebView (or you trust the visited site).
Warning - Using JavaScript & Flash Animations

The use of plugins is deprecated and will not be supported in the future. Do **not** use the following obsolete statement:

```javascript
webview.getSettings().setPluginState(PluginState.ON);
```

In this example we tried to reach the **Adobe-Flash Download Site**, using the statement:

```javascript
webview.loadUrl("http://get.adobe.com/flashplayer/");
```

Here the resulting image

---

**We're Sorry**

This content requires Adobe Flash Player, which is not supported by your device. This content can be viewed on a desktop computer or on mobile devices that support Flash Player.

Copyright © 2013 Adobe Systems Incorporated. All rights reserved
Commonly Used WebView Methods

The following selected methods supplement the work of a WebView and make it look like a web-browser. These methods could be implemented through an Options-Menu or other GUI solution.

- **reload()** refresh the currently viewed web page
- **goBack()** go back one step in the browser history (use `canGoBack()` to determine if there is any history to trace back)
- **goForward()** go forward one step in the browser history (use `canGoForward()` to determine if there is any history to go forward to)
- **goBackOrForward()** go backwards or forwards in the browser history, where `negative/positive` numbers represent a count of steps to go
- **canGoBackOrForward()** to see if the browser can go backwards or forwards the stated number of steps.
- **clearCache()** clear the browser resource cache
- **clearHistory()** clear the browsing history
- **ZoomIn() , ZoomOut()** magnify control.
WebViews

Mixed Mode – Combining HTML & Android

Why?
• HTML, CSS and JavaScript are very well understood, diffused and proven web-technologies.
• Many developers worldwide already know them.
• HTML-based applications are portable and -to a point- are hardware and software independent
• All mobile platforms (iOS, Android, Windows, Blackberry) support web page technology.
• Android offers through WebViews a simple way to expose HTML pages which are strongly connected to the OS.

How?
• GUI design and part of the business logic could be done with HTML+JS.
• JS supports the notion of a JavaScriptInterface acting as a bridge between the HTML and the Android sides of an app. Hardware and software resources found in the Android device could be presented to the HTML pages in a reasonably simple way.
The **methods** in the interface are invoked by the JavaScript code placed behind the HTML side of the app. The interface methods run on the Android side of the app, using Android resources and data stored in the device.
1. The app displays into a WebView an HTML page stored in the device.

2. The page accepts a person’s name. After clicking the HTML button the page passes the person’s name value to the server.

3. Android contributes to the app by searching its Contacts Database and returning the person’s phone number.

4. A ‘pretty’ Android Toast is used instead of a bland ‘alert’ JS-MessageBox.
WebViews

Example2. Layout activity_main.xml

App’s Structure

```xml
<RelativeLayout
    xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:tools="http://schemas.android.com/tools"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
>
    <WebView
        android:id="@+id/webView1"
        android:layout_width="match_parent"
        android:layout_height="match_parent"
        android:layout_alignParentLeft="true"
    />
</RelativeLayout>
```
public class WebView2 extends Activity {

    @SuppressLint("SetJavaScriptEnabled")
    @Override
    public void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_main);

        WebView webview = (WebView) findViewById(R.id.webView1);
        webview.getSettings().setJavaScriptEnabled(true);

        webview.addJavascriptInterface(new CustomJavaScriptInterface(this), "HtmlAndroidBridge");

        // if the HTML file is in the app's memory space use:
        webview.loadUrl("file:///android_asset/my_local_page1.html");

        // if the HTML files are stored in the SD card, use:
        // webview.loadUrl("file:///sdcard/my_local_webpage1.html");

        // CAUTION: Manifest must include
        // <uses-permission android:name="android.permission.INTERNET"/>
        // <uses-permission android:name="android.permission.READ_EXTERNAL_STORAGE"/>
    }
}
CustomJavaScriptInterface is created as a Java class. An instance of this class is later passed to the JS environment through the statement:

```java
webview.addJavascriptInterface(new CustomJavaScriptInterface(this), "HtmlAndroidBridge");
```

where "HtmlAndroidBridge" is the alias to be used by JS to designate elements in the object.

The JS code behind the HTML pages hosted by the WebView should refer to the methods in the bridge object using the notation

```javascript
HtmlAndroidBridge.methodName(args)
```

HTML pages could be stored in either the application’s memory space or the larger SD card.
public class CustomJavaScriptInterface {
    private Context context;

    CustomJavaScriptInterface(Context context) {
        // remember the application's context
        this.context = context;
    }

    @JavascriptInterface
    public void showToast(String toastMsg) {
        // instead of dull JavaScript alert() use flashy Toasts
        Toast.makeText(context, toastMsg, Toast.LENGTH_SHORT).show();
    }

    @JavascriptInterface
    public String getPhoneNumber(String person) {
        // accept a person's name and fake that you are
        // searching the Android's Contacts Database
        person = person.toLowerCase();
        if (person.equals("jose cuervo"))
            return "555-1111";
        else if (person.equals("waldo"))
            return "555-2222";
        else
            return "555-3333";
    }
}
Comments

1. The public method `showToast(string)` is called by JS code to briefly display an arbitrary message on top of the HTML page held by the WebView. Observe that `Toast` is an Android object not an HTML resource.

2. The method `getPhoneNumber(string)` is used to pretend that an Android search into the Contact’s database is taking place. For simplicity we have chosen to limit the number of contacts to only three people. However, in the appendix you will find a more appropriate solution. Databases and Content Providers are studied later in the course.
Example 2. HTML – my_local_page1.html

<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN">
<html>
<head>
<title>Android GetPhone Demo</title>
<script language="javascript">
    function setPerson(nameValue) {
        // move nameValue to input box - reset phone
        document.getElementById("guiName").value = nameValue;
        document.getElementById("guiPhone").value = "";
    }

    function askAndroidToFindPhone() {
        // call Android, ask it to find the person’s phone number
        var person = document.getElementById("guiName").value;
        HtmlAndroidBridge.showToast('Android is busy - Searching phones... ' + person);
        document.getElementById("guiPhone").value =
            HtmlAndroidBridge.getPhoneNumber(person);
    }
</script>
<style type="text/css">
    .style1 {
        color: #008000;
        font-family: Arial, Helvetica, sans-serif;
    }
</style>
</head>
Dos Amigos: HTML & Android

Click here to set name to 'Jose Cuervo'

Click here to set name to 'Waldo'

or just type any person's name

Person's name

Ask Android to Find Person's Phone Number

Phone Number
Comments

1. The HTML page assembles a visual interface exposing among others an input TextBox for the user to enter a person’s name. Clicking a button activates a search for the person’s phone number.

2. Like in any common HTML page the tag `<script language="javascript">` is used to add code-behind support. JS scripts can occasionally implement all of the business-logic associated to the app; however the typical case is that most solutions are obtained by collaboration.

3. The shared object `HtmlAndroidBridge` allows JS code-behind to call Android methods. This is needed whenever JS wants to reach hardware and software resources that are available in the Android powered device (observe that JS has no direct access to them).

4. Notice how HTML pages can be enhanced using CSS specifications.
In the next Android app example we will add mapping services obtained from **Google Maps JavaScript API V3**. This API brings new features to mapping operations. It extends the capabilities shown in Example1-Demo3 and Demo4 in which Google maps are requested by a browser or WebView as part of an URL.

**Why?**

**Advantages offered by Android**

1. Access to native hardware & software resources on the device (such as fine location services, contact list, music, pictures, etc)
2. ‘Easy’ placement of the finished app in the Android Market.
3. Good tools for rapid development using the Android SDK and Eclipse.

**Advantages offered by Google Maps Service**

1. Rapid versioning of the server-held software. This eliminates the requirement to download and install frequent Android-app updates.
2. More frequent feature additions and bug fixes from Google.
3. Cross-platform compatibility: Using the Maps API allows you to create a single map that runs on multiple platforms.
What do we want?

- Map a given location using **Google Maps JavaScript API V3**. ([https://developers.google.com/maps/documentation/javascript/](https://developers.google.com/maps/documentation/javascript/))
- The map is expected to show its most current and updated features.
- The mapping effort should be the same but the final product must adapt itself to the current hardware powered by Android.

How to do it?

- First, use your desktop and a browser to prototype the map. Write a simple HTML document that shows an image obtained from calling Google Maps API with the appropriate geo-coding information.
- Next, create an Android app that displays a **WebView**.
- Load the **HTML+JS** page design above, into the WebView (Done!)
What is Exactly Google Maps JavaScript API V3?

- The **Google Maps Javascript API** is a free service that lets you embed Google Maps in your own web pages.

- It is especially designed to be faster and more applicable to mobile devices (as well as traditional desktop browser applications).

- The API provides a number of utilities for manipulating maps (just like on the [http://maps.google.com](http://maps.google.com) web page) and adding content to the map through a variety of services, allowing you to create rich maps applications on your website/app.

Link: [https://developers.google.com/maps/documentation/javascript/](https://developers.google.com/maps/documentation/javascript/)
Example 3. Embedding Existing Web Technology in Android

Map on a Windows Browser
The image below shows a Google Map created with the API V3. It’s centered around “Cleveland State University, Ohio” (IE Explorer on a Windows machine)

Link: https://developers.google.com/maps/documentation/javascript/basics?csw=1
WebViews

Example 3. Embedding Existing Web Technology in Android

Map on an Android Device
The image shows the same Google map depicted in the previous page (‘Cleveland State University, Ohio’).

This time the image comes from an Android emulator running an app that uses a WebView to show the HTML page.

As in the previous page, the map includes scrolling, zooming, road & satellite modes, as well as street view capabilities.
Example 3. HTML + Javascript + API V3

```html
<!DOCTYPE html>
<html>
<head>
<meta name="viewport" content="initial-scale=1.0, user-scalable=no" />
<style type="text/css">
html { height: 100% }
body { height: 100%; margin: 0px; padding: 0px }
#map_canvas { height: 100% }
</style>
<script type="text/javascript">
    function initialize() {
        var latlng = new google.maps.LatLng(41.5020952, -81.6789717);
        var myOptions = {
            zoom: 15,
            center: latlng,
            mapTypeId: google.maps.MapTypeId.ROADMAP
        };
        var map = new google.maps.Map(document.getElementById("map_canvas"), myOptions);
    }
</script>
</head>
<body onload="initialize()">
    <div id="map_canvas" style="width:100%; height:100%"></div>
</body>
</html>
```

This HTML page uses a JavaScript function to set a Google Map around a specific set of coordinates (CSU Student Center).
WebViews

Example 3. Embedding Existing Web Technology in Android

Comments

google_map.html is the HTML page responsible for drawing the Google Map.

1. The `<style>` tag sets the entire screen (100% height, width) as the canvas on which the map is to be drawn.

2. The first `<script>` fragment calls an API method to draw a map. Observe that no actual location is supplied (the map is not displayed yet).

3. The `Initialize` JS function sets mapping arguments. Map is to be centered around the supplied latitude and longitude. ROADMAP mode (other options are SATELLITE and TRAFFIC), as well as zooming factor (15 out of 21) are requested.

4. When the HTML page is loaded the `Initialize` function is called and the map is created.
### WebViews

#### Example 3. Embedding Existing Web Technology in Android

Using Google JavaScript Maps API V3

**Putting the pieces together:**

1. Place a **WebView** in the activity_main.xml file
2. Copy the previous HTML page in the **assets** folder
3. Add **Internet** and **maps permission** to the app’s manifest
4. Done

```xml
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout
    xmlns:android="http://schemas.android.com/apk/res/android"
    android:orientation="horizontal"
    android:layout_width="match_parent"
    android:layout_height="match_parent">

    <WebView
        android:id="@+id/webview"
        android:layout_width="match_parent"
        android:layout_height="match_parent"/>
</LinearLayout>
```
public class MainActivity extends Activity {
    WebView webview;

    @ SuppressLint("SetJavaScriptEnabled")
    @Override
    public void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_main);

        // load into WebView local HTML page defining mapping operation
        webview = (WebView) findViewById(R.id.webview);
        webview.getSettings().setJavaScriptEnabled(true);

        webview.loadUrl("file:///android_asset/google_map.html");

    }//onCreate

}//class

The Android side of the app loads an HTML page and does no more work. The app’s intelligence is written in the HTML + JS page(s).
Using Google JavaScript Maps API V3 (using *real* locations)

This experience combines the two previous examples:

- Android’s GPS hardware finds the actual location of the device.
- A JavaScript Bridge-Object passes the *real* location data to an HTML webpage.
- The page contains a JavaScript function to draw a map centered on the given coordinates.

Latitude and longitude detected by the device’s GPS chip. Image taken from an Android phone.
Example 4. Cross-Platform Collaboration

App Structure

LAYOUT - activity_main.xml

```xml
<?xml version="1.0" encoding="utf-8"?>

<LinearLayout
    xmlns:android="http://schemas.android.com/apk/res/android"
    android:orientation="horizontal"
    android:layout_width="match_parent"
    android:layout_height="match_parent">

    <WebView
        android:id="@+id/webview"
        android:layout_width="fill_parent"
        android:layout_height="fill_parent"/>

</LinearLayout>
```

This example is based on:
http://code.google.com/apis/maps/articles/android_v3.html
http://code.google.com/apis/maps/documentation/javascript/overlays.html#MarkerAnimations
http://gmaps-samples.googlecode.com/svn/trunk/articles-android-webmap
public class MainActivity extends Activity implements LocationListener {
    // a LocationListener could use GPS, Cell-ID, and WiFi to establish
    // a user's location. Deciding which to use is based on choices
    // including factors such as accuracy, speed, and battery-efficiency.

    private WebView webView;
    LocationManager locationManager;
    MyLocationBridge locationBridge = new MyLocationBridge();

    @Override
    protected void onDestroy() {
        super.onDestroy();
        // cut location service requests
        locationManager.removeUpdates(this);
    }

    private void getLocation() {
        locationManager = (LocationManager) getSystemService(Context.LOCATION_SERVICE);
        Criteria criteria = new Criteria();
        // criteria.setAccuracy(Criteria.ACCURACY_FINE); // use GPS(you should be outside)
        criteria.setAccuracy(Criteria.ACCURACY_COARSE); // cell towers, wifi
        String provider = locationManager.getBestProvider(criteria, true);

        // In order to make sure the device is getting the location, request
        // updates [wakeup after changes of: 5 sec. or 10 meter]
        locationManager.requestLocationUpdates(provider, 5, 10, this);
        locationBridge.setNewLocation(locationManager.getLastKnownLocation(provider));
    }
}
```java
@Override
public void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.activity_main);
    getLocation();
    setupWebView();
    this.setRequestedOrientation(ActivityInfo.SCREEN_ORIENTATION_PORTRAIT);
}

//onCreate
// Set up the webview object and load the page's URL
@SuppressLint("SetJavaScriptEnabled")
private void setupWebView() {
    final String centerMapURL = "javascript:centerAt(" + locationBridge.getLatitude() + "," + locationBridge.getLongitude() + ");"

    // set up the webview to show location results
    webview = (WebView) findViewById(R.id.webview);
    webview.getSettings().setJavaScriptEnabled(true);
    webview.addJavascriptInterface(locationBridge, "locationBridge");
    webview.loadUrl("file:///android_asset/google_map2.html");
    // Wait for the page to load then send the location information
    webview.setWebViewClient(new WebViewClient() {
        @Override
        public void onPageFinished(WebView view, String url) {
            webview.loadUrl(centerMapURL);
        }
    });
} //setUpWebView
```
@Override
public void onLocationChanged(Location location) {
    String lat = String.valueOf(location.getLatitude());
    String lon = String.valueOf(location.getLongitude());
    Toast.makeText(getApplicationContext(), lat + "\n" + lon, 1).show();
    locationBridge.setNewLocation(location);
}

@Override
public void onProviderDisabled(String provider) {
    // needed by Interface. Not used
}

@Override
public void onProviderEnabled(String provider) {
    // needed by Interface. Not used
}

@Override
public void onStatusChanged(String provider, int status, Bundle extras) {
    // needed by Interface. Not used
}

} //class
// An object of type "MyLocationBridge" will be used to pass data back and forth between the Android app and the JS code behind the HTML page.

```java
public class MyLocationBridge {
    private Location mostRecentLocation;

    @JavascriptInterface
    public void setNewLocation(Location newCoordinates){
        mostRecentLocation = newCoordinates;
    }

    @JavascriptInterface
    public double getLatitude() {
        if (mostRecentLocation == null) return (0);
        else return mostRecentLocation.getLatitude();
    }

    @JavascriptInterface
    public double getLongitude() {
        if (mostRecentLocation == null) return (0);
        else return mostRecentLocation.getLongitude();
    }
}
```

}// MyLocationFinder
<!DOCTYPE html>
<html>
<head>
<meta name="viewport" content="initial-scale=1.0, user-scalable=no" />

<meta http-equiv="content-type" content="text/html; charset=UTF-8"/>

<title>Google Maps JavaScript API v3 Example: Marker Simple</title>

<style type="text/css">
  html { height: 100% }
  body { height: 100%; margin: 0px; padding: 0px }
  #map_canvas { height: 100% }
</style>

<script type="text/javascript" src="http://maps.google.com/maps/api/js?sensor=false">
</script>
Example 4. google_map2.html

```html
<script type="text/javascript">
function initialize() {
    // get latitude and longitude from the JavaScripInterface
    var myLatlng = new google.maps.LatLng( locationBridge.getLatitude(),
                                          locationBridge.getLongitude());

    var myOptions = {
        zoom: 17,
        center: myLatlng,
        mapTypeId: google.maps.MapTypeId.ROADMAP
    }

    var map = new google.maps.Map(document.getElementById("map_canvas"),
                                  myOptions);

    var marker = new google.maps.Marker({
        position: myLatlng,
        map: map
    });
}
</script>

</body>
<body onload="initialize()">
    <div id="map_canvas"></div>
</body>
</html>
```
Example 4. Testing App with the Emulator Control

WebViews
Questions?
**APPENDIX A.  A List of suggested material on Android and Web Technologies**

**Oracle Mobile Application Framework**
How to build mobile apps for Android and iOS using Java-based Oracle MAF Platform

**Intel App Framework**
http://app-framework-software.intel.com/
JavaScript Library for Mobile HTML5 Multi-Platform Development

**Performance Tips for Geo API** (55 min video – explains why G-maps V3 API was created)
https://www.youtube.com/v/zI8at1EmJjA

**Google Maps Developers Documentation**
https://developers.google.com/maps/documentation/

**Google Maps JavaScript API V3 Tutorial**
http://code.google.com/apis/maps/documentation/javascript/tutorial.html

**Building Web Apps in WebView**
How to embed web pages into your Android application using WebView and bind JavaScript to Android APIs.

**Debugging Web Apps**
How to debug web apps using JavaScript Console APIs.

**Best Practices for Web Apps**
Practices you should follow in order to provide an effective web application on Android-powered devices.
public String findPhoneNumber(String searchName) {
    // look for first contact entry partially matching searchName

    String name = "n.a.";
    String number = "n.a.";
    // define an iterator to traverse the contact book
    Cursor phones = getContentResolver().query(
        ContactsContract.CommonDataKinds.Phone.CONTENT_URI,
        null, null, null, null);

    while (phones.moveToNext()) {
        String NAME = ContactsContract.CommonDataKinds.Phone.DISPLAY_NAME;
        name = phones.getString(phones.getColumnIndex(NAME));
        String NUMBER = ContactsContract.CommonDataKinds.Phone.NUMBER;
        number = phones.getString(phones.getColumnIndex(NUMBER));

        if (name.toLowerCase().contains(searchName.toLowerCase())) {
            return number; // a good match, phone number found
        }
    }
    // Not found
    return "n.a.";
} // findPhoneNumber

APPENDIX B. A realistic (although very inefficient!!!) function to search for a phone number using the user’s Contact-Book

Add to Manifest
<uses-permission android:name="android.permission.READ_CONTACTS"/>

8 - 65