



Building Applications with the ArcGIS Runtime SDK for Android

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@agup

Agenda

- Introduction
- Runtime SDK
 - Tools and features
- Maps & Layers
- Tasks
- Editing
- GPS
- Offline Capabilities
- Summary



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SDK Features

Eclipse plug-in

Native ArcGIS Runtime client

Maps (online/offline)

Editing

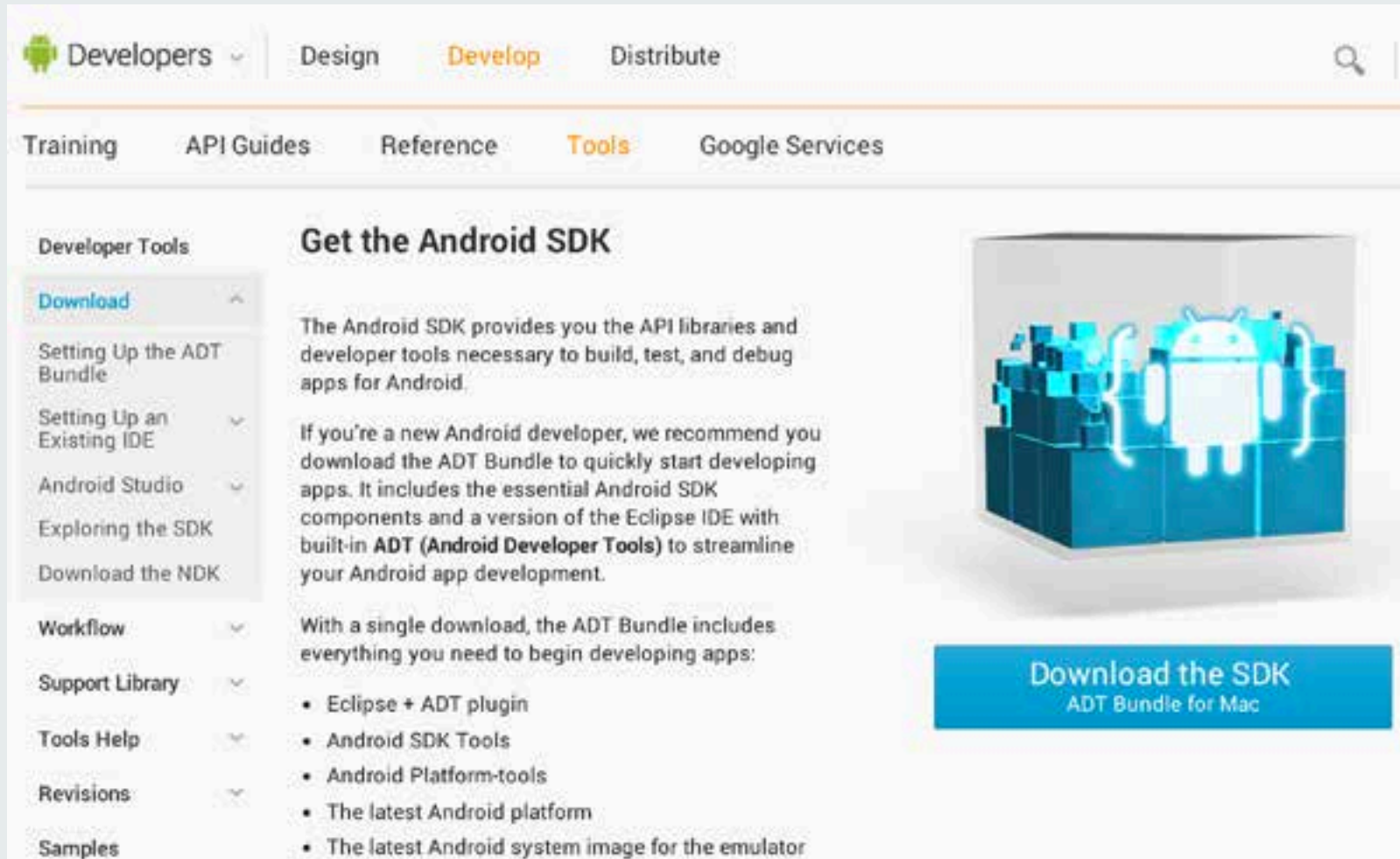
Routing

Data collection

Geoprocessing

And much more!

Android SDK <http://developer.android.com>



The screenshot shows the Android Developer website. At the top, there is a navigation bar with the Android logo, 'Developers', and tabs for 'Design', 'Develop', and 'Distribute'. Below this is another navigation bar with 'Training', 'API Guides', 'Reference', 'Tools', and 'Google Services'. The main content area is titled 'Get the Android SDK'. It features a sidebar on the left with a 'Developer Tools' menu where 'Download' is selected. The main text describes the Android SDK and provides a list of items included in the ADT Bundle. To the right, there is a 3D graphic of the Android robot and a prominent blue button labeled 'Download the SDK' with the subtitle 'ADT Bundle for Mac'.

Developers ▾ | Design | **Develop** | Distribute | 🔍

Training | API Guides | Reference | **Tools** | Google Services

Developer Tools

- Download** ▾
- Setting Up the ADT Bundle
- Setting Up an Existing IDE ▾
- Android Studio ▾
- Exploring the SDK
- Download the NDK

Workflow ▾

Support Library ▾

Tools Help ▾

Revisions ▾

Samples


Get the Android SDK

The Android SDK provides you the API libraries and developer tools necessary to build, test, and debug apps for Android.

If you're a new Android developer, we recommend you download the ADT Bundle to quickly start developing apps. It includes the essential Android SDK components and a version of the Eclipse IDE with built-in **ADT (Android Developer Tools)** to streamline your Android app development.

With a single download, the ADT Bundle includes everything you need to begin developing apps:

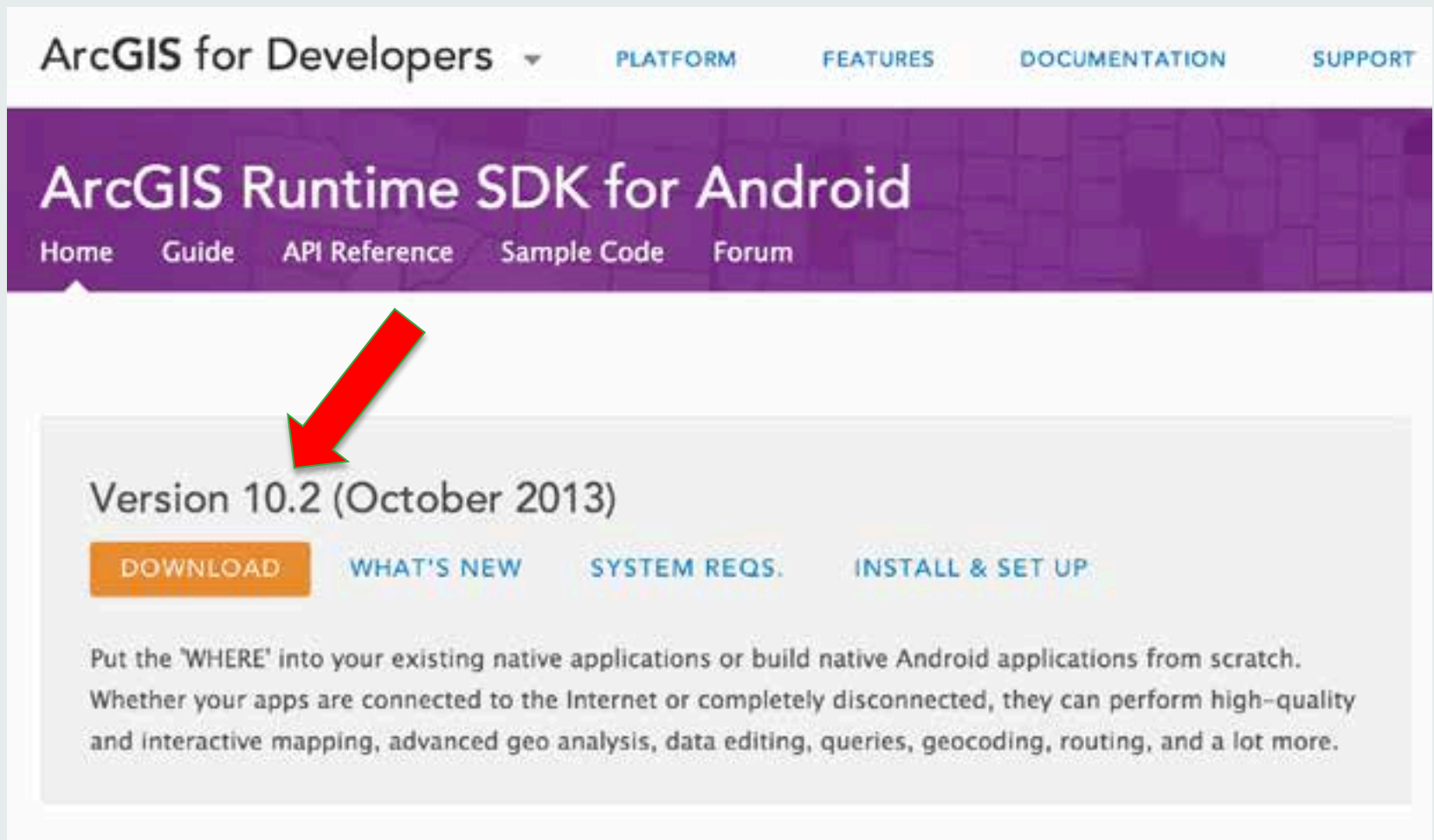
- Eclipse + ADT plugin
- Android SDK Tools
- Android Platform-tools
- The latest Android platform
- The latest Android system image for the emulator



Download the SDK
ADT Bundle for Mac

Download the SDK

<https://developers.arcgis.com/en/android/>



ArcGIS for Developers ▾ PLATFORM FEATURES DOCUMENTATION SUPPORT

ArcGIS Runtime SDK for Android

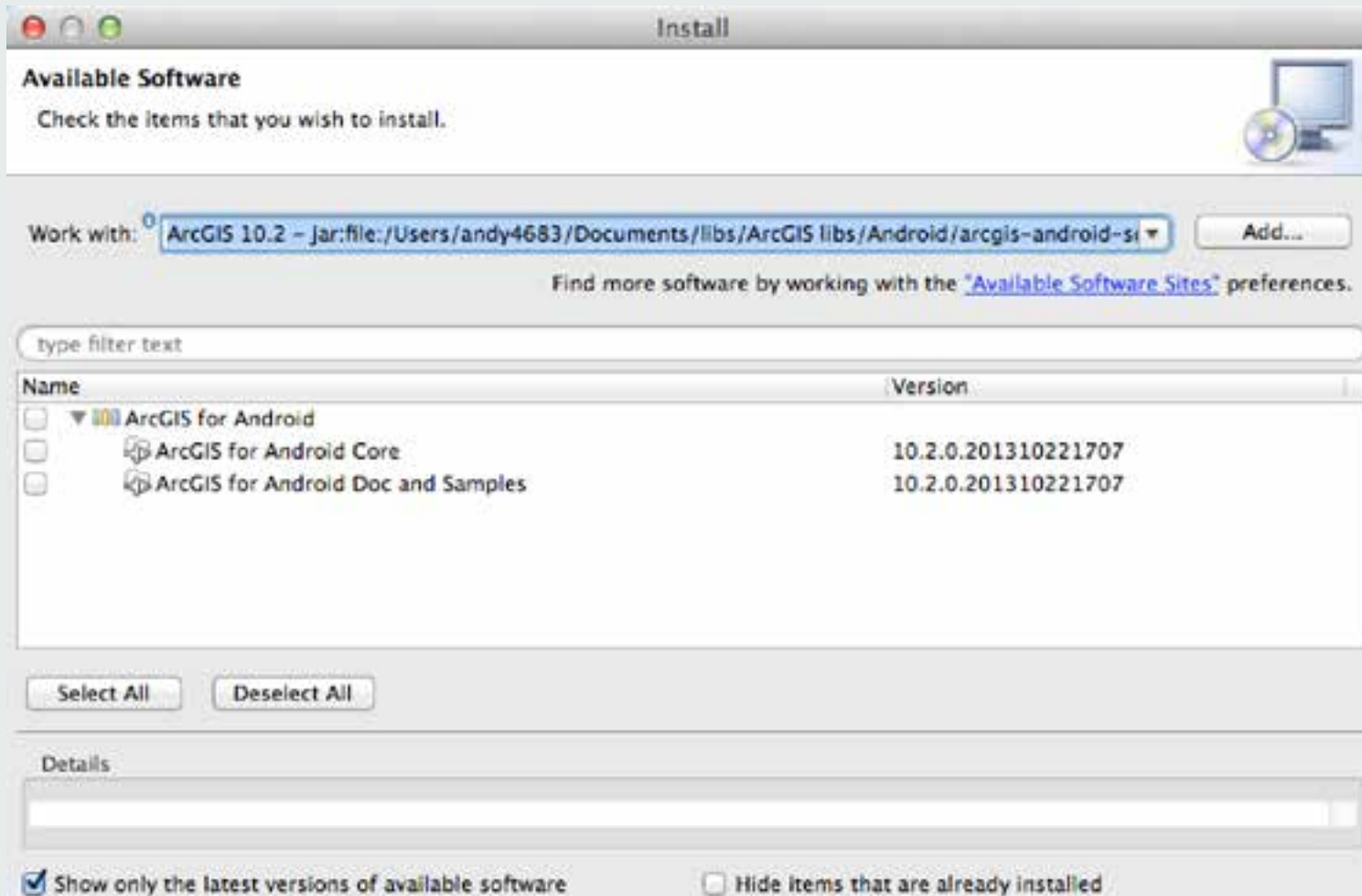
Home Guide API Reference Sample Code Forum

Version 10.2 (October 2013)

DOWNLOAD WHAT'S NEW SYSTEM REQS. INSTALL & SET UP

Put the 'WHERE' into your existing native applications or build native Android applications from scratch. Whether your apps are connected to the Internet or completely disconnected, they can perform high-quality and interactive mapping, advanced geo analysis, data editing, queries, geocoding, routing, and a lot more.

Demo 1 - Installing the SDK



The screenshot shows a window titled "Install" with a standard macOS-style title bar. The window is divided into several sections:

- Available Software:** A header section with the text "Check the items that you wish to install." and a small icon of a computer monitor and CD/DVD.
- Work with:** A dropdown menu currently showing "ArcGIS 10.2 - Jar:file:/Users/andy4683/Documents/libs/ArcGIS libs/Android/arcgis-android-si" and an "Add..." button.
- Filter:** A text input field containing "type filter text".
- Software List:** A table with two columns: "Name" and "Version". It contains three entries, all with checkboxes to their left.

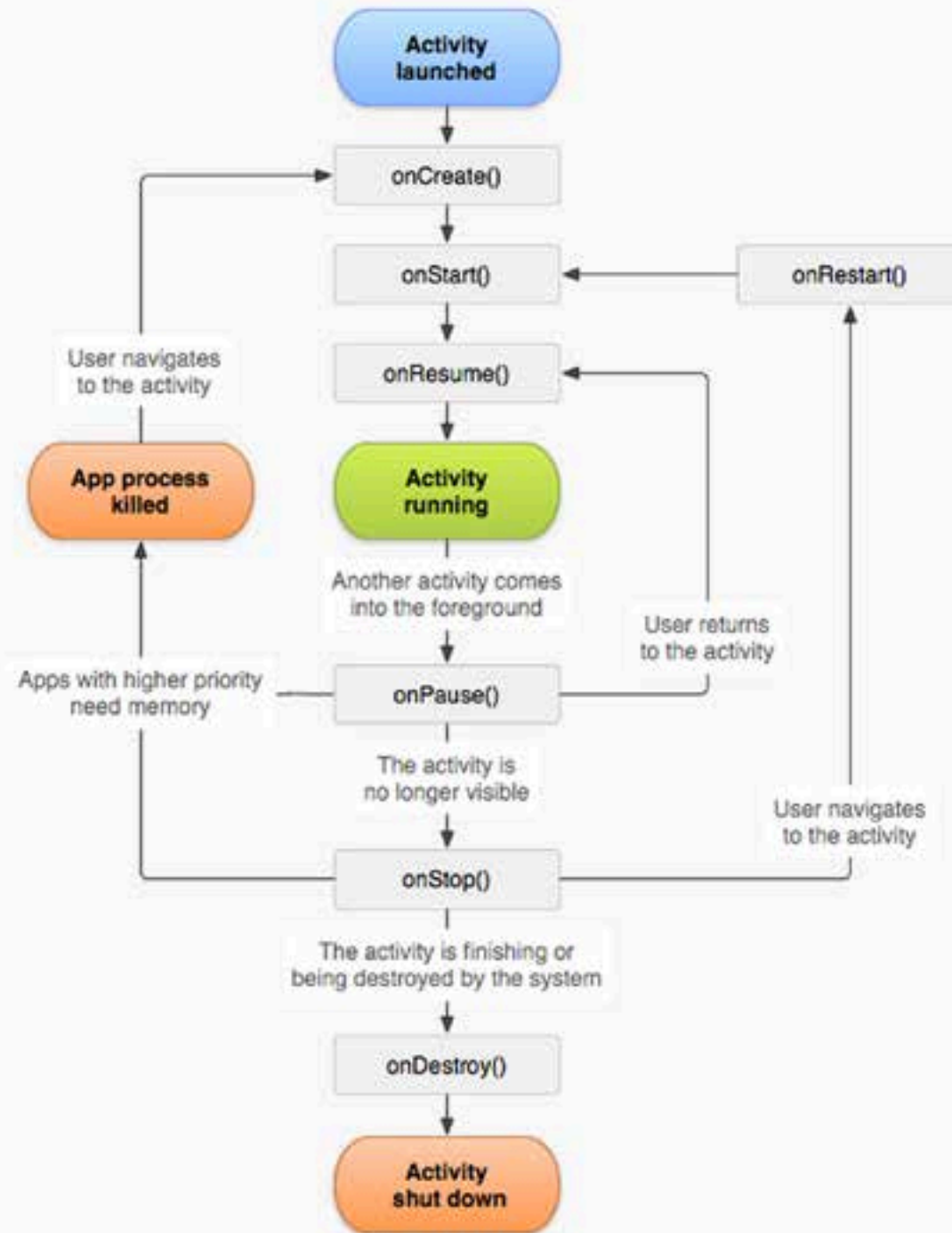
Name	Version
<input type="checkbox"/> ArcGIS for Android	
<input type="checkbox"/> ArcGIS for Android Core	10.2.0.201310221707
<input type="checkbox"/> ArcGIS for Android Doc and Samples	10.2.0.201310221707
- Buttons:** "Select All" and "Deselect All" buttons are located below the software list.
- Details:** A section with a label "Details" and an empty text area below it.
- Options:** Two checkboxes at the bottom: "Show only the latest versions of available software" (checked) and "Hide items that are already installed" (unchecked).

Demo 2- Hello World Sample



Android Application Life Cycle

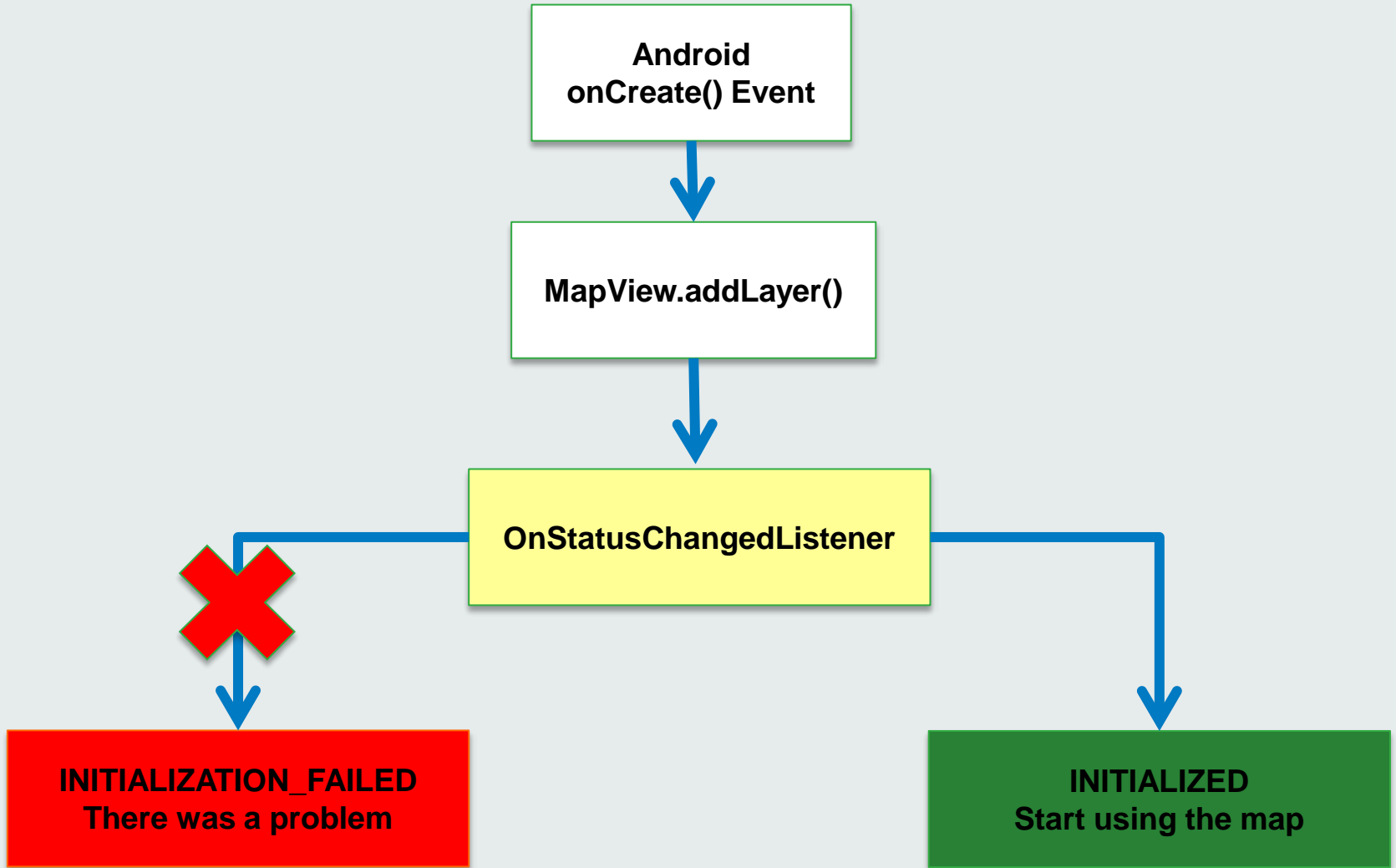




ArcGIS Map Life Cycle




Map initialization



MapView class

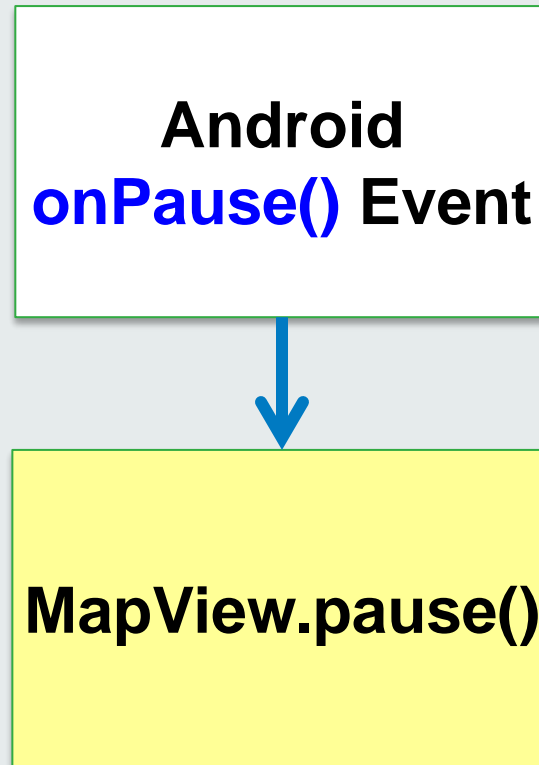
```
public class HelloWorld extends Activity {  
  
    MapView map = null;  
  
    /** Called when the activity is first created. */  
    public void onCreate(Bundle savedInstanceState) {  
        super.onCreate(savedInstanceState);  
        setContentView(R.layout.main);  
        map = (MapView) findViewById(R.id.map);  
    }  
}
```



Map Layout - `res/layout/main.xml`

```
<com.esri.android.map.MapView  
    android:id="@+id/map"  
    android:layout_height="fill_parent"  
    android:layout_width="fill_parent"  
/>
```

Minimize the map app



Re-open the map app

Android
onResume() Event



```
graph TD; A[Android onResume() Event] --> B[MapView.unpause()];
```

MapView.unpause()

onPause and onResume Events

```
@Override  
protected void onPause() {  
    super.onPause();  
    mMapView.pause();  
}
```

```
@Override  
protected void onResume() {  
    super.onResume();  
    mMapView.unpause();  
}
```

Adding layers to your map

Web Maps

Tiled Map Service

Dynamic Maps Service

Feature Layer

Graphics Layer

Image Layer

And more layers...

CSV

Offline Tiles

WMS

KML

Open Street Map

Adding map layers

```
map = new MapView(this);  
map.addLayer(new ArcGISTiledMapServiceLayer(  
    "http://mapservice/ArcGIS/rest/services/..."));  
setContentView(map);
```

Listening for **MapView** events

`OnStatusChangeListener.STATUS.INITIALIZED`

`OnStatusChangeListener.STATUS.INITIALIZATION_FAILED`

`OnStatusChangeListener.STATUS.LAYER_LOADED`

`OnStatusChangeListener.STATUS.LAYER_LOADING_FAILED`

Listening for **Map** events

```
map.setOnStatusChangeListener(new OnStatusChangeListener() {  
    private static final long serialVersionUID = 1L;  
  
    public void onStatusChanged(Object source, STATUS status) {  
        if (OnStatusChangeListener.STATUS.INITIALIZED == status  
            && source == map) {  
            map.addLayer(someFeatureLayer);  
        }  
        if (OnStatusChangeListener.STATUS.INITIALIZATION_FAILED  
            == status && source == map){  
            //Let user know there was a problem  
        }  
    }  
}
```

Listening for **Layer** events

```
 tiledLayer.setOnStatusChangeListener(new  
onStatusChangeListener() {  
  
    private static final long serialVersionUID = 1L;  
  
    public void onStatusChanged(Object source, STATUS status) {  
        if (OnStatusChangeListener.STATUS.INITIALIZED == status  
            && source == tiledLayer) {  
            //TODO  
        }  
        if (OnStatusChangeListener.STATUS.INITIALIZATION_FAILED  
            == status && source == tiledLayer){  
            //Let user know there was a problem  
        }  
    }  
}
```

Status Changed Listener Demo

Map touch events - **MapOnTouchListener**

Public Methods	
boolean	onDoubleTap (MotionEvent point) Notified when a single-pointer-double-tap gesture occurs.
boolean	onDragPointerMove (MotionEvent from, MotionEvent to) Notified when a part of a single touch drag gesture event occurs.
boolean	onDragPointerUp (MotionEvent from, MotionEvent to) Notified when a part of a single-touch-drag gesture event occurs.
void	onLongPress (MotionEvent point) Notified when a long-press gesture occurs.
void	onMultiPointersSingleTap (MotionEvent event) Notified when a two-pointers-single-tap gesture occurs.
boolean	onPinchPointersDown (MotionEvent event) Notified when a part of a pinch gesture occurs.
boolean	onPinchPointersMove (MotionEvent event) Notified when a part of a pinch gesture occurs.
boolean	onPinchPointersUp (MotionEvent event) Notified when a part of a pinch gesture occurs.
boolean	onSingleTap (MotionEvent point) Notified when a single-pointer-single-tap gesture occurs.
boolean	onTouch (View v, MotionEvent event) Called when a touch event is dispatched to a view.

```
class MyTouchListener extends MapOnTouchListener {
```

```
    Graphic g;
```

```
    // first point clicked on the map
```

```
    Point p0 = null;
```

```
    int uid = -1;
```

```
    public MyTouchListener(Context arg0, MapView arg1) {  
        super(arg0, arg1);  
    }
```

```
    public boolean onDragPointerMove(MotionEvent from, MotionEvent to) {  
        if (uid == -1) { // first time  
            g = new Graphic(null, sfs);  
            p0 = map.toMapPoint(from.getX(), from.getY());  
            uid = gLayer.addGraphic(g);  
  
            } else {  
  
                . . .  
            }  
        return true;  
    }  
}
```

Listening for map touch events

```
map.setOnSingleTapListener(new OnSingleTapListener() {  
    private static final long serialVersionUID = 1L;  
  
    public void onSingleTap(float x, float y) {  
        Point point = map.toMapPoint(x, y);  
        final Graphic graphic = new Graphic(point,  
_pictureSymbol);  
        graphicsLayer.addGraphic(graphic);  
    }  
});
```

Switching between touch listeners

```
/**
 * Sets the DEFAULT MapOnTouchListener
 */
public void setDefaultTouchListener(){
    MapOnTouchListener ml =
        new MapOnTouchListener(getContext(), map);
    map.setOnTouchListener(ml);
}

/**
 * Set the MyTouchListener to override various user touch events.
 */
public void setDrawTouchListener(){
    _myTouchListener = new MyTouchListener(getContext(), map);
    map.setOnTouchListener(_myTouchListener);
}

/**
 * Remove DEFAULT MapOnTouchListener
 */
map.setOnTouchListener(null);
```



Touch listeners demo

Tasks

All ArcGIS Tasks are `AsyncTask`

- Geocode
- GeoProcessing
- Routing
- Identify
- Query

Performance and the UI Thread

AsyncTask – runs in background

Handler() – bound to creation thread

ExecutorService – manage multiple **AsyncTasks**

Threads

Geoprocessing Example – Step 1

```
class ViewShedQuery extends AsyncTask<ArrayList<GPPParameter>,
    Void, GPPParameter[]> {

    GPPParameter[] outParams = null;

    @Override
    protected void onPostExecute(GPPParameter[] result) {
        //TODO
    }

    @Override
    protected GPPParameter[] doInBackground(
        ArrayList<GPPParameter>... params1) {
        //TODO
    }
}
```


Geoprocessing Example – Step 2

@Override

```
protected GPPParameter[] doInBackground(  
    ArrayList<GPPParameter>... params1) {  
  
    gp = new Geoprocessor(_gpEndPoint);  
    gp.setOutSR(map.getSpatialReference());  
  
    try {  
        GPResultResource rr = gp.execute(params1[0]);  
        outParams = rr.getOutputParameters();  
    } catch (Exception e) {  
        e.printStackTrace();  
    }  
    return outParams;  
}
```

Geoprocessing Example – Step 3

@Override

```
protected void onPostExecute(GPParameter[] result) {  
    if (result == null)  
        return;  
    for (int i = 0; i < outParams.length; i++) {  
        if (result[i] instanceof GPFeatureRecordSetLayer) {  
  
            GPFeatureRecordSetLayer fsl =  
                (GPFeatureRecordSetLayer) result[i];  
  
            for (Graphic feature : fsl.getGraphics()) {  
                Graphic g = new Graphic(feature.getGeometry(),  
                    new SimpleFillSymbol(Color.CYAN)  
                );  
  
                gLayer.addGraphic(g);  
            }  
        }  
    }  
}
```

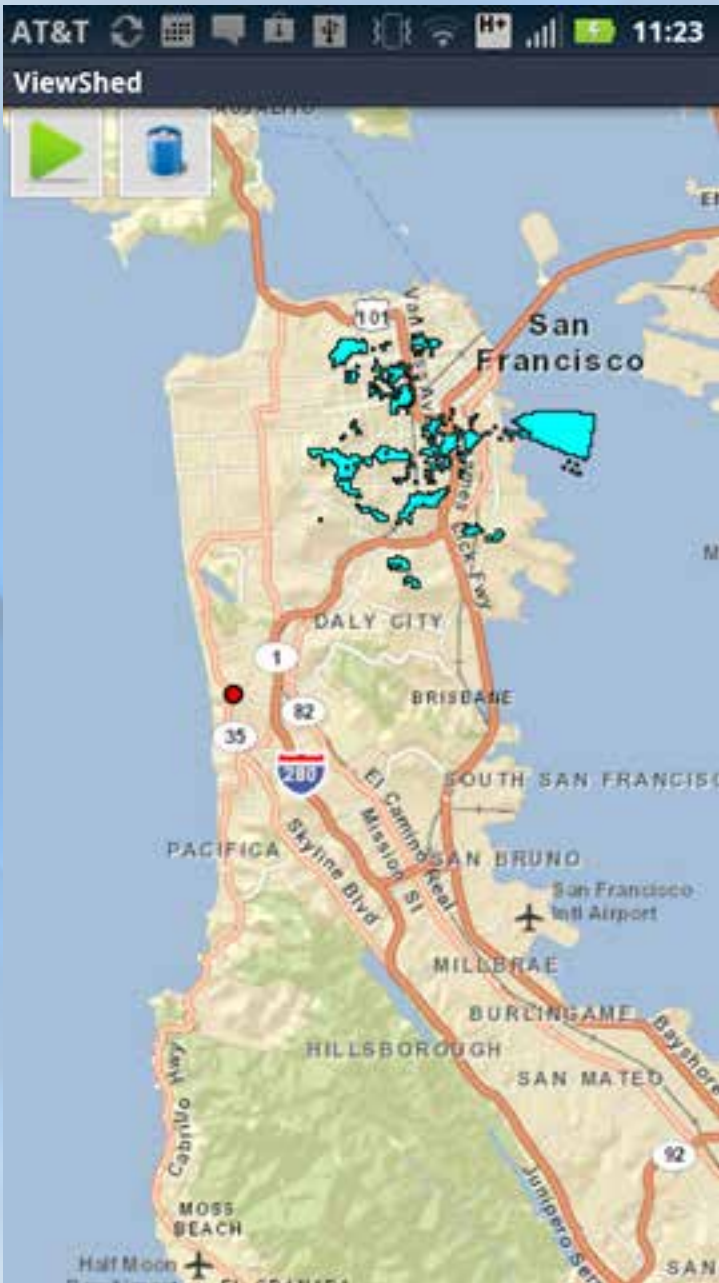
Geoprocessing Example – Step 4

```
GPFeatureRecordSetLayer gpf = new GPFeatureRecordSetLayer("xyz");
gpf.setSpatialReference(map.getSpatialReference());
gpf.setGeometryType(Geometry.Type.Point);
// 1st input parameter - Add the point selected by the user
Graphic f = new Graphic(mappoint, new SimpleMarkerSymbol(...));
gpf.addGraphic(f);

// Second input parameter
GPLinearUnit gpl = new GPLinearUnit("Viewshed_Distance");
gpl.setUnits("esriMeters");
gpl.setDistance(8046.72);

// Add params
params = new ArrayList<GPParameter>();
params.add(gpf);
params.add(gpl);

new ViewshedQuery().execute(params);
```



Geoprocessing demo

Editing Feature Layers

`ArcGISFeatureLayer.applyEdits()`

- Asynchronous
- Create new feature
- Delete features
- Edit existing geometries
- Edit attributes

Editing Feature Layers - Online

Immediate over-the-air sync (requires internet!)

Adding

Deleting

Updating

Editing Feature Layers – data integrity

Features must confirm to layer specification

- Geometry type
- Accuracy
- Topology rules



Editing Feature Layers

```
featureLayer.applyEdits(new Graphic[] { graphic },  
    null, null, new CallbackListener<FeatureEditResult[][]>() {  
  
    public void onError(Throwable error) {  
        // TODO implement error code  
    }  
  
    public void onCallback(FeatureEditResult[][] editResult) {  
        //update UI  
    }  
  
});
```


Edit Attributes

Apply

Discard

Field Name

PRIDE

Field Date

GAS

Poly Date

10/30/07 6:00 PM

Last Gas Well

21.02

Status

Abandoned

Max Gas Well

7.0

Last Oil
Production

0.0

Average Depth

0.0

Last Gas
Production

155.0

AttributeEditor demo


Webmaps

Uses a different pattern than tiled maps:

```
map = new MapView(  
    getApplicationContext(),  
    "http://www.arcgis.com/home/item.html?id=81d22543..",  
    "userName",  
    "password"  
);  
  
setContentview(map);
```

GPS Location

```
_locationService = map.getLocationService();  
_locationService.setAutoPan(true);  
_locationService.setLocationListener(new LocationListener(){  
    //TODO  
});  
_locationService.start();
```



GPS/Location **Start**

Map + layer(s) MUST be loaded first

Start LocationManager and/or
LocationService

Auto center and/or draw GPS graphic

Configure LocationService

```
boolean mapLoaded = false;
```

```
LocationService ls = map.getLocationService();
```

```
ls.setAutoPan(false);
```

```
ls.setLocationListener(new LocationListener() {  
    public void onLocationChanged(Location loc) {  
        if(mapLoaded == true){  
            //Do something  
        }  
    }  
})
```



```
map.setOnStatusChangeListener(new OnStatusChangeListener() {  
    public void onStatusChanged(Object source, STATUS status) {  
        if (source == map && status == STATUS.INITIALIZED) {  
            mapLoaded = true;  
        }  
    }  
})
```

Listen for LocationService Updates

```
ls.setLocationListener(new LocationListener() {  
    public void onLocationChanged(Location loc) {  
        if(loc != null){  
            if(loc.hasAccuracy() && mapLoaded == true){  
                //TODO Handle update  
            }  
        }  
    }  
}
```

LocationService Life Cycle

```
@Override
protected void onPause() {
    super.onPause();
    locationService.stop();
}
```

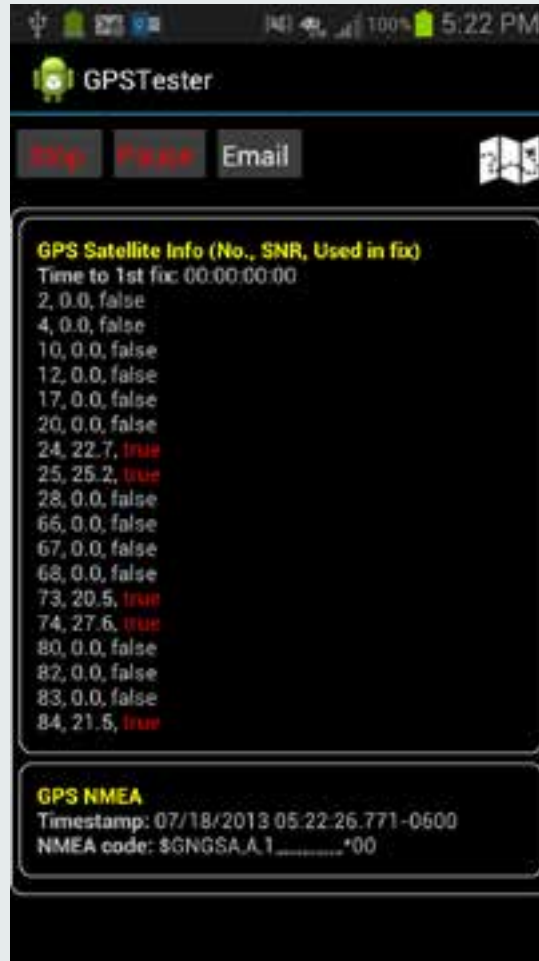
```
@Override
protected void onResume() {
    super.onResume();
    if(map.isLoaded() == true) {
        locationService.start();
    }
}
```

Demo GPS



Android GPS Test Tool

<https://github.com/Esri/android-gps-test-tool>



Offline (BETA) at v10.2

Add, Update, Delete

Requires a local geodatabase

Synchronize Edits via FeatureService

Tutorials

Fundamentals

Build a Map

Displaying Information

Search

Editing Data

[What is editing?](#)

[Creating features](#)

[Editing existing geometries](#)

[Editing attributes](#)

[Edit offline BETA](#)


[Sync offline edits BETA](#)

Create an offline map BETA

You can provide offline maps to users so they can be productive when their connectivity is poor or non-existent.

With ArcGIS Runtime, users can perform the following tasks offline:

- View basemaps (also known as tiled maps or tile caches).
- Edit operational data (also known as feature data and vector data). Includes tables, and attachments of features.
- [Sync edits](#) when online again (upload their edits and/or pull down only the service based).
- Perform blazing fast searches for locations (geocode and reverse geocode). [Find a route.](#)

 **License:** Offline editing functionality is currently in beta. After the beta period, license your application at the Standard level.

Offline (BETA)

Editing Data ▼

- What is editing?
- Creating features
- Editing existing geometries
- Editing attributes
- Edit offline BETA**
- Sync offline edits BETA**

Upcoming Release

- Android Studio support
- IntelliJ Support
- Routing Helper

Tips-and-tricks

- Test using a phone and tablet vs. Emulator
- [Genymotion](#) emulator – excellent!
- Android Help: <http://developer.android.com/>
- Android Help -> [User Interface Best Practices](#)
- Which Android version? [Know your users!](#)
- Troubleshooting ArcGIS? Use the Android Debug Bridge (ADB) and Logcat

Github



Android Quick Start Sample:

<https://github.com/esri/quickstart-map-android>

Maps-app Template:

<https://github.com/Esri/maps-app-android>

Android GPS Test Tool:

<https://github.com/Esri/android-gps-test-tool>

Blog posts on Android GPS

<http://www.andygup.net/android-gps/>

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Understanding our world.