



# Building Applications with the ArcGIS Runtime SDK for Android

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Esri Developer Summit  
Washington, DC



# Agenda

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



# My contact info...

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<http://www.andygup.net>

# SDK Features

Eclipse plug-in

Native ArcGIS Runtime client

Maps (online/offline)

Editing

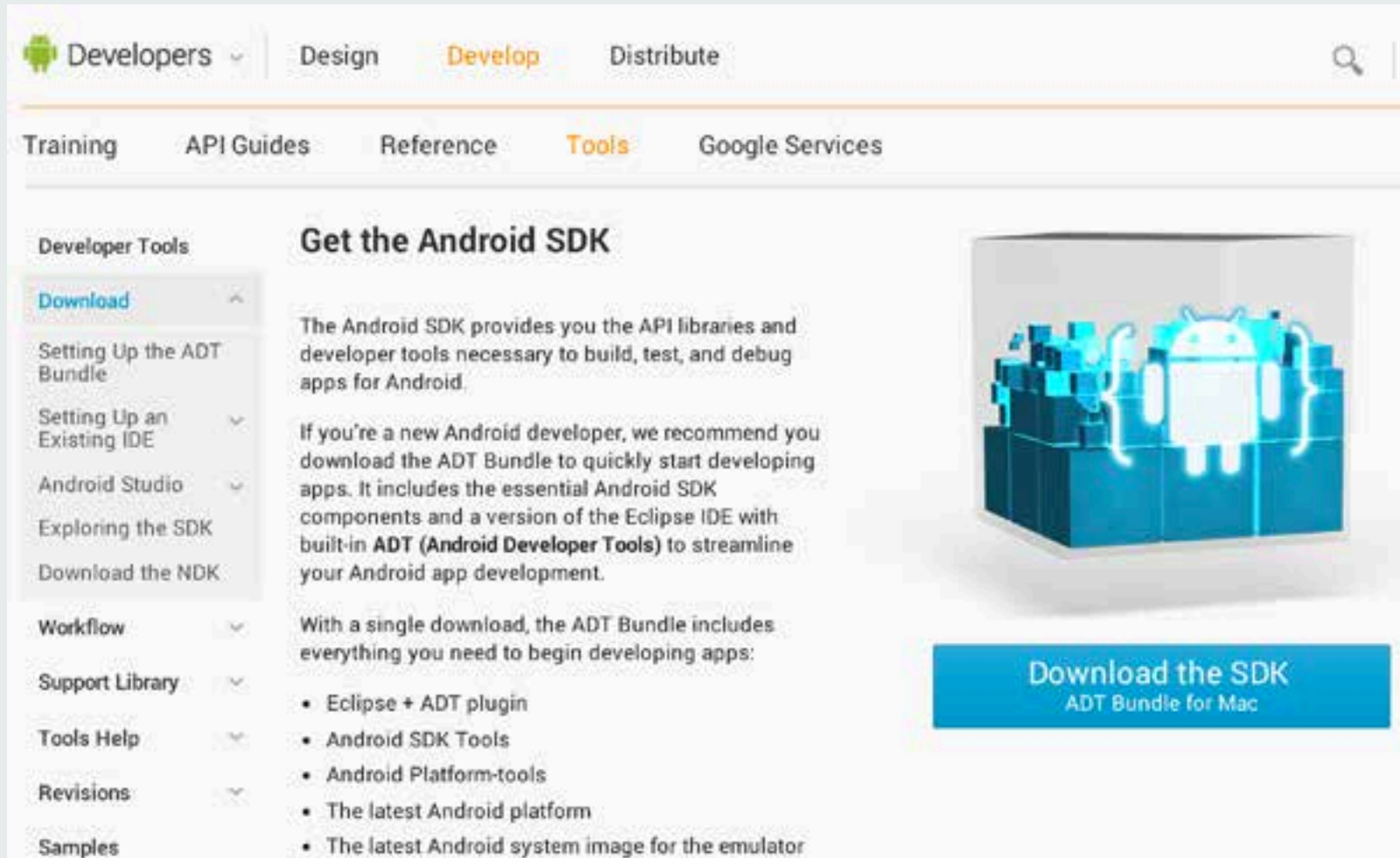
Routing

Data collection

Geoprocessing

And much more!

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



The screenshot shows the top navigation bar of the Android Developer website. The 'Develop' tab is highlighted in orange. Below the navigation bar, the 'Tools' tab is also highlighted in orange. The main content area features a sidebar on the left with a 'Developer Tools' section containing a 'Download' link. The main content area has a heading 'Get the Android SDK' followed by a paragraph describing the SDK and a list of included components. To the right, there is a 3D graphic of the Android robot and a blue button labeled 'Download the SDK 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:

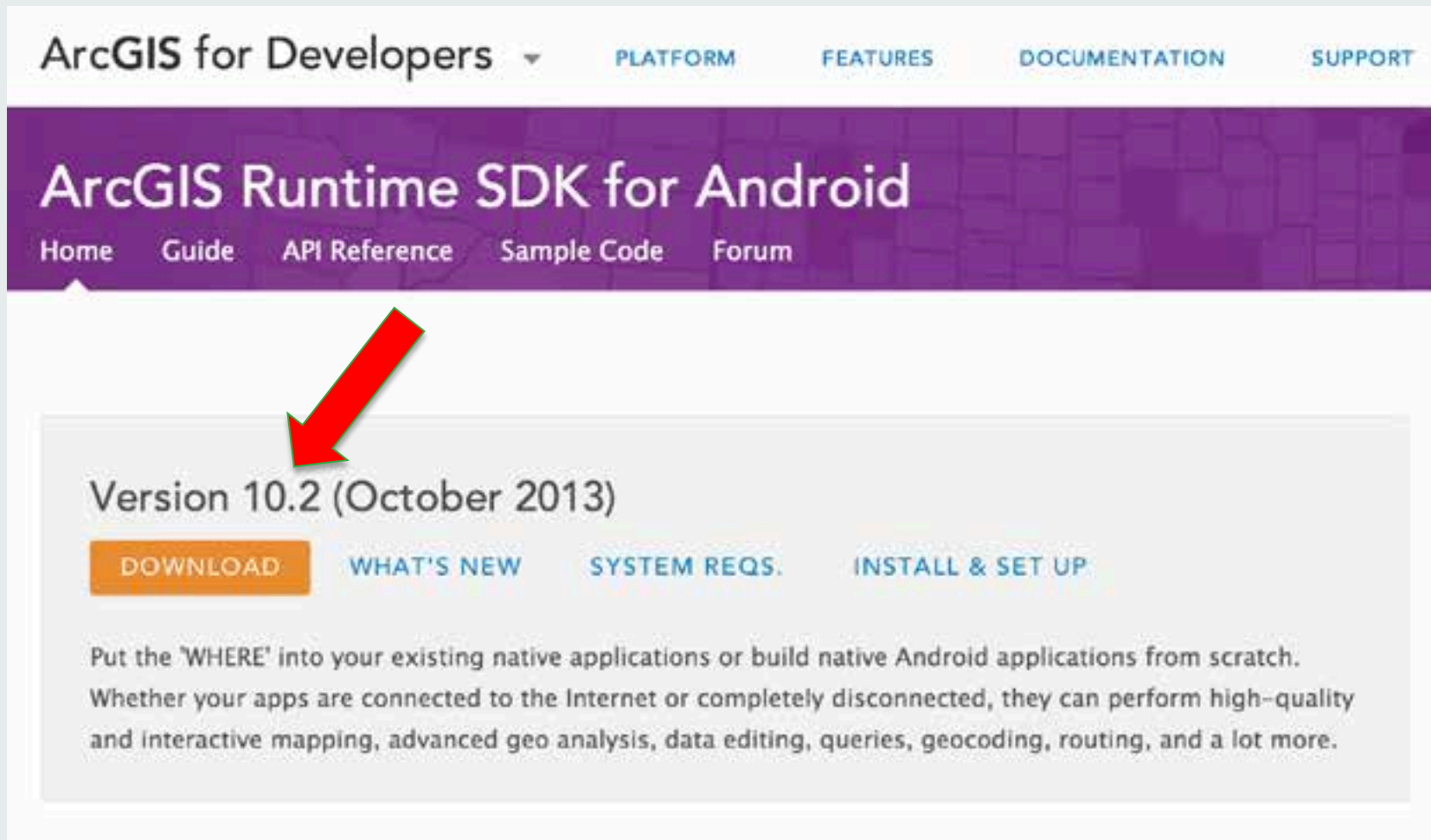
- Eclipse + ADT plugin
- Android SDK Tools
- Android Platform-tools
- The latest Android platform
- The latest Android system image for the emulator



**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

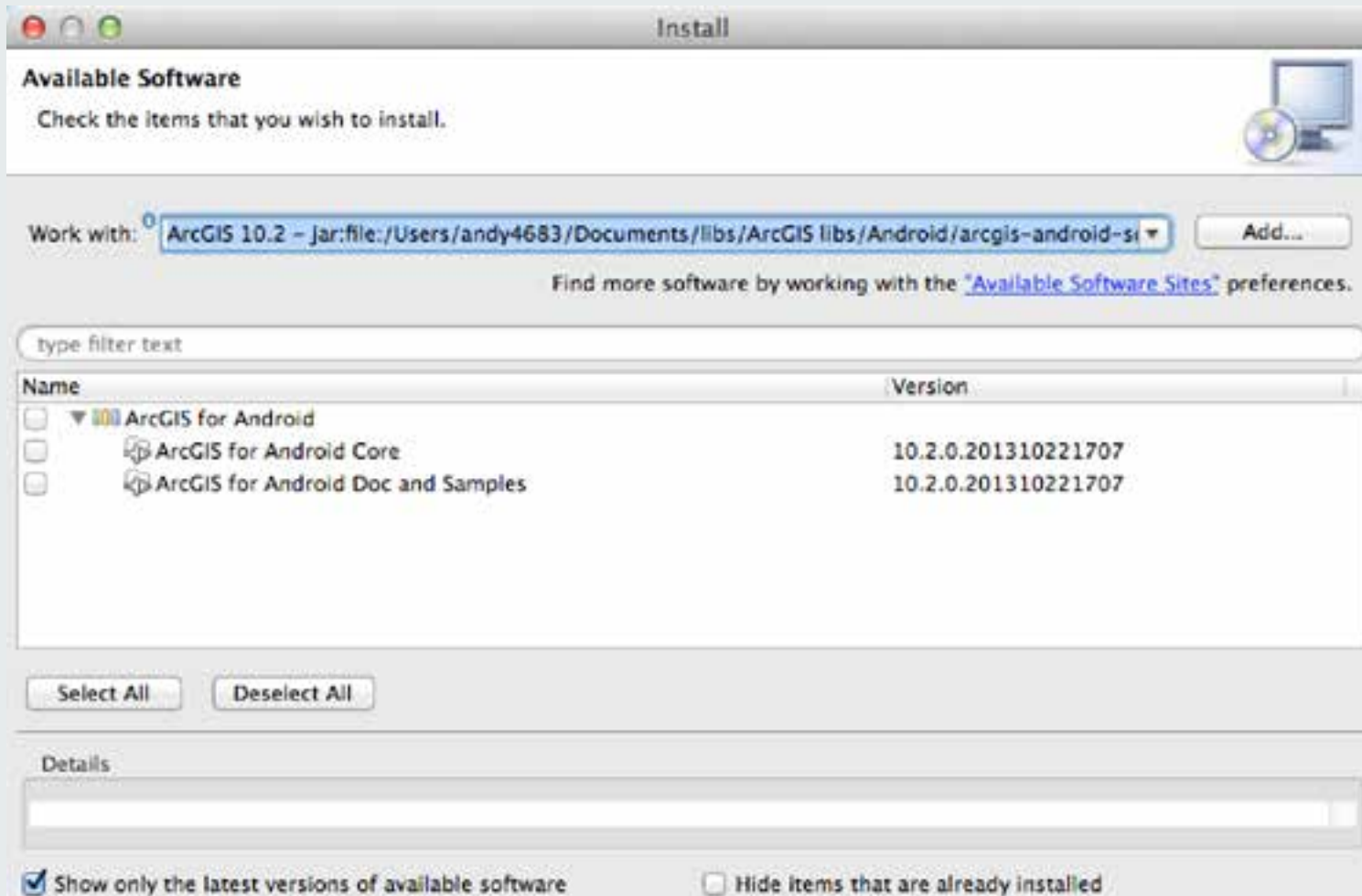
Home Guide API Reference Sample Code Forum

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



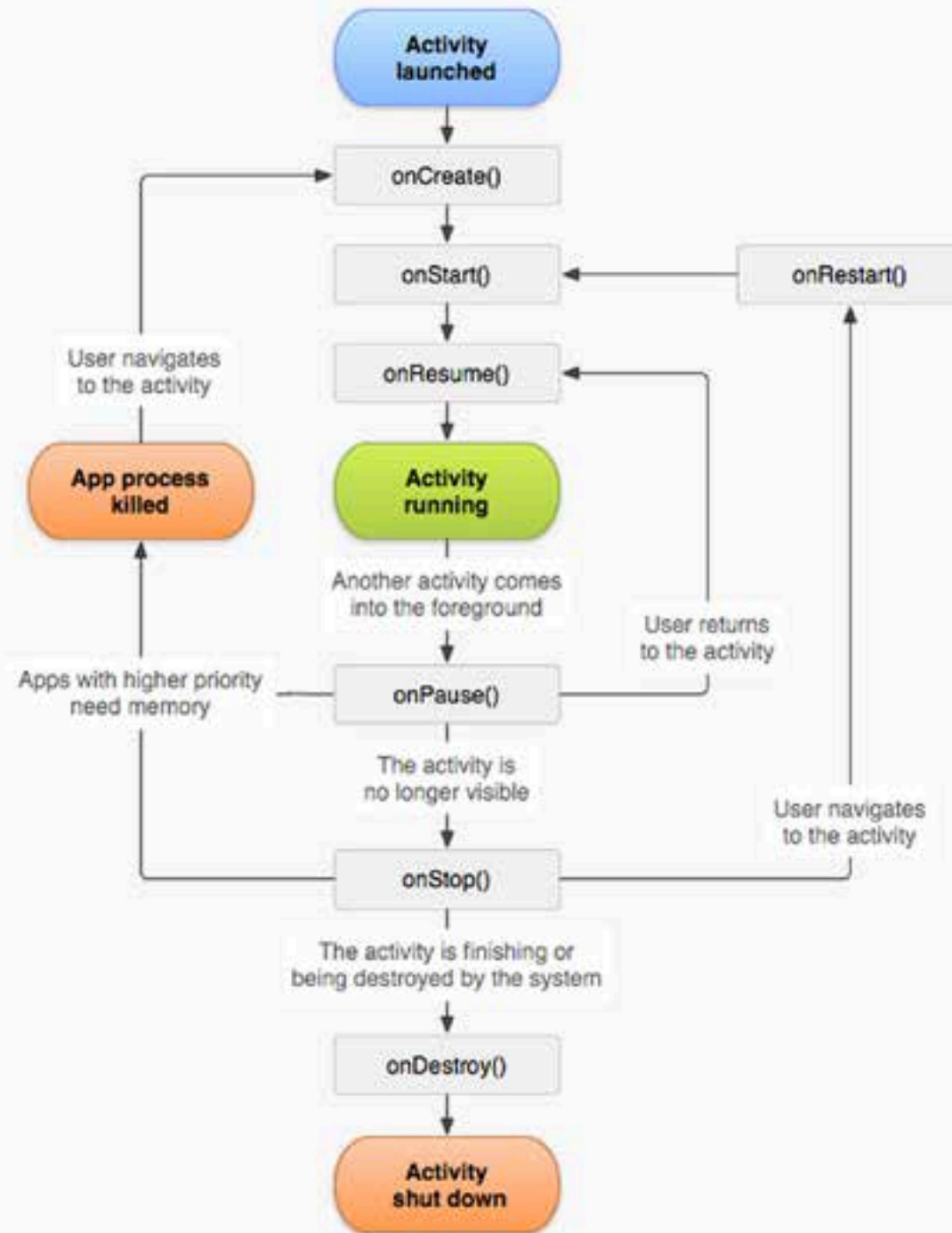
# Demo 2- Hello World Sample





# Android Application Life Cycle

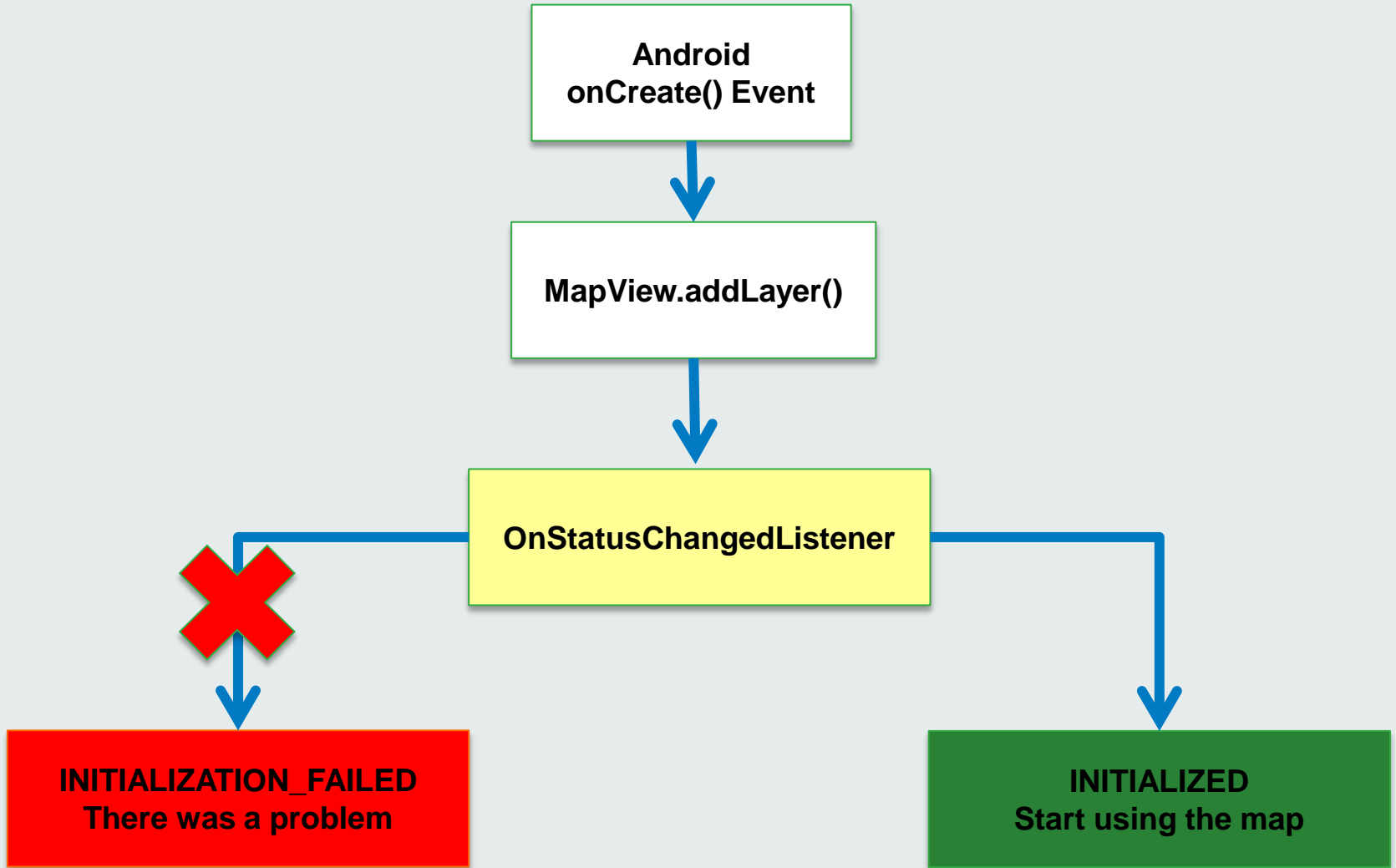




# ArcGIS Map Life Cycle




# Map initialization



# Starting up a map

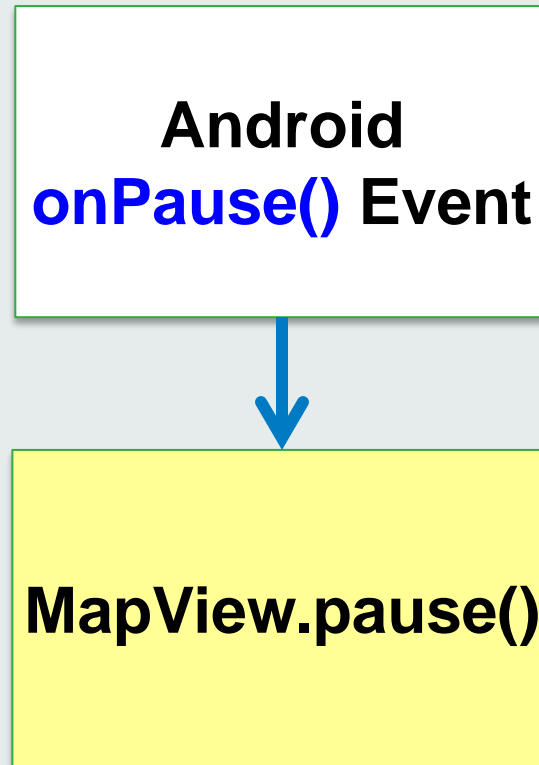
```
public class HelloWorld extends Activity {  
  
    MapView map = null;  
  
    /** Called when the activity is first created. */  
    public void onCreate(Bundle savedInstanceState) {  
        super.onCreate(savedInstanceState);  
        setContentView(R.layout.main);  
        map = (MapView)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



R.id.map == [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();
    if(mMapView != null){
        mMapView.pause();
    }
}
```

```
@Override
protected void onResume() {
    super.onResume();
    if(mMapView != null){
        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

```
// Always set these before adding layer
```

```
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  
        }  
    }  
}
```

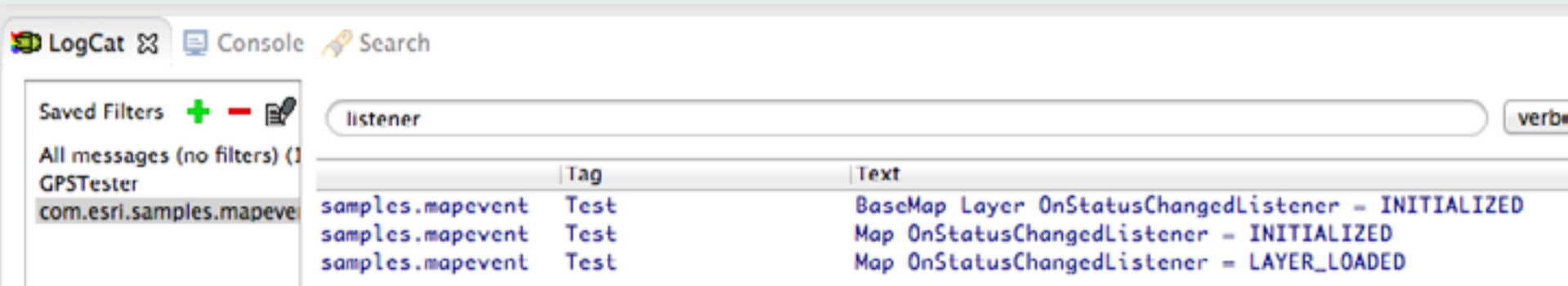
# Listening for **Layer** events

```
 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



# Listening for **Layer** events



The screenshot shows the LogCat window in Android Studio. The search filter is set to 'listener'. The log messages are as follows:

Package	Tag	Text
com.esri.samples.mapevent	Test	BaseMap Layer OnStatusChangeListener - INITIALIZED
com.esri.samples.mapevent	Test	Map OnStatusChangeListener - INITIALIZED
com.esri.samples.mapevent	Test	Map OnStatusChangeListener - LAYER_LOADED

# Map touch events - **MapOnTouchListener**

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

# 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);  
    }  
});
```

# Listening for custom touch events

```
class MyTouchListener extends MapOnTouchListener {  
    public MyTouchListener(Context arg0, MapView arg1) {  
        super(arg0, arg1);  
    }  
  
    public boolean onDragPointerMove(MotionEvent from, MotionEvent to) {  
        . . .  
        . . .  
        return super.onDragPointerUp(from, to);  
    }  
}
```

# 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);  
            }  
        }  
    }  
}
```

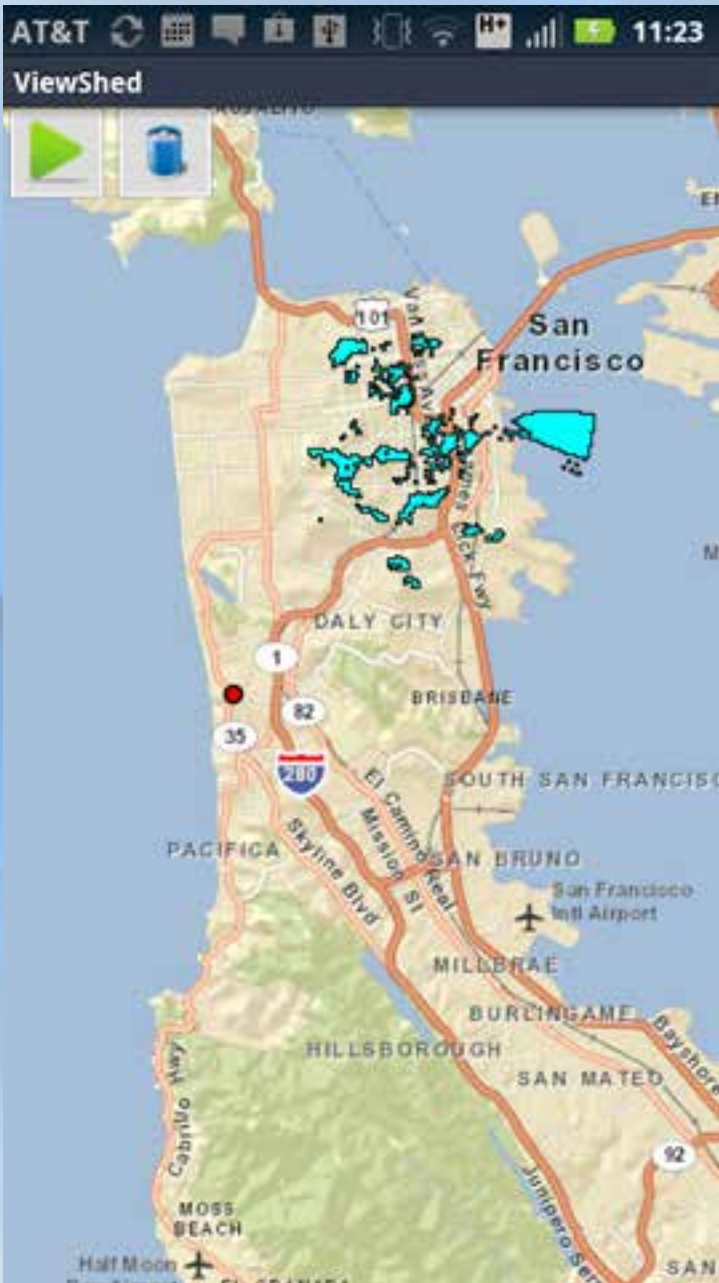
# Geoprocessing Example – Step 4

```
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 and layers must be loaded

Then 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

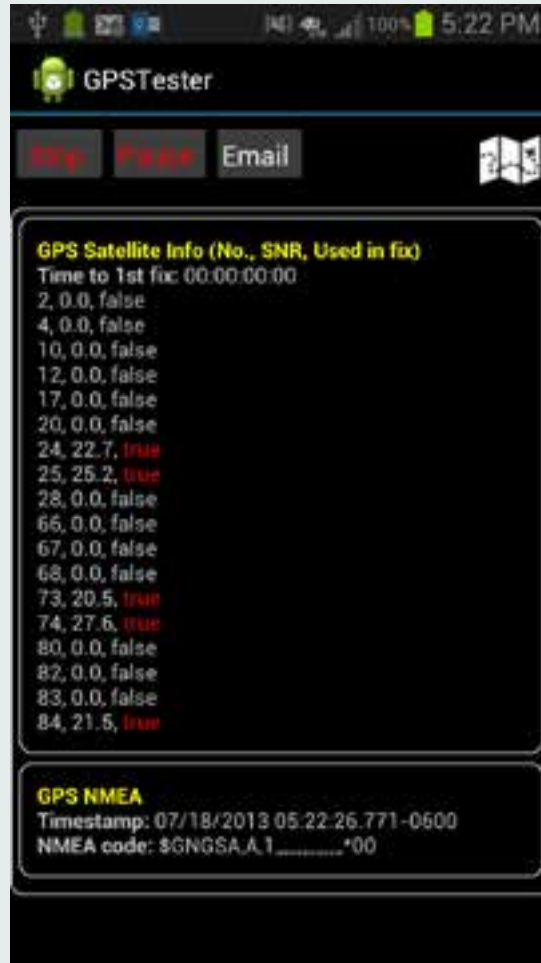
```
@Override
protected void onPause() {
    super.onPause();
    locationService.stop();
}
```

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



# Android GPS Test Tool

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



# Demo GPS



# Offline (BETA) at v10.2

Add, Update, Delete

Requires a local geodatabase

Synchronize Edits via FeatureService

# ArcGIS Runtime SDK for Android

[Home](#) [Guide](#) [API Reference](#) [Sample Code](#) [Forum](#)

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.



## ArcGIS Online Sample for Android

Create an ArcGIS Online sample project for Android

Filter samples:

All Android SDKs

All Categories



OfflineRoutingAndGeocoding - BETA

OfflineEditor - BETA

Previous 5

Next 5

Project Name:



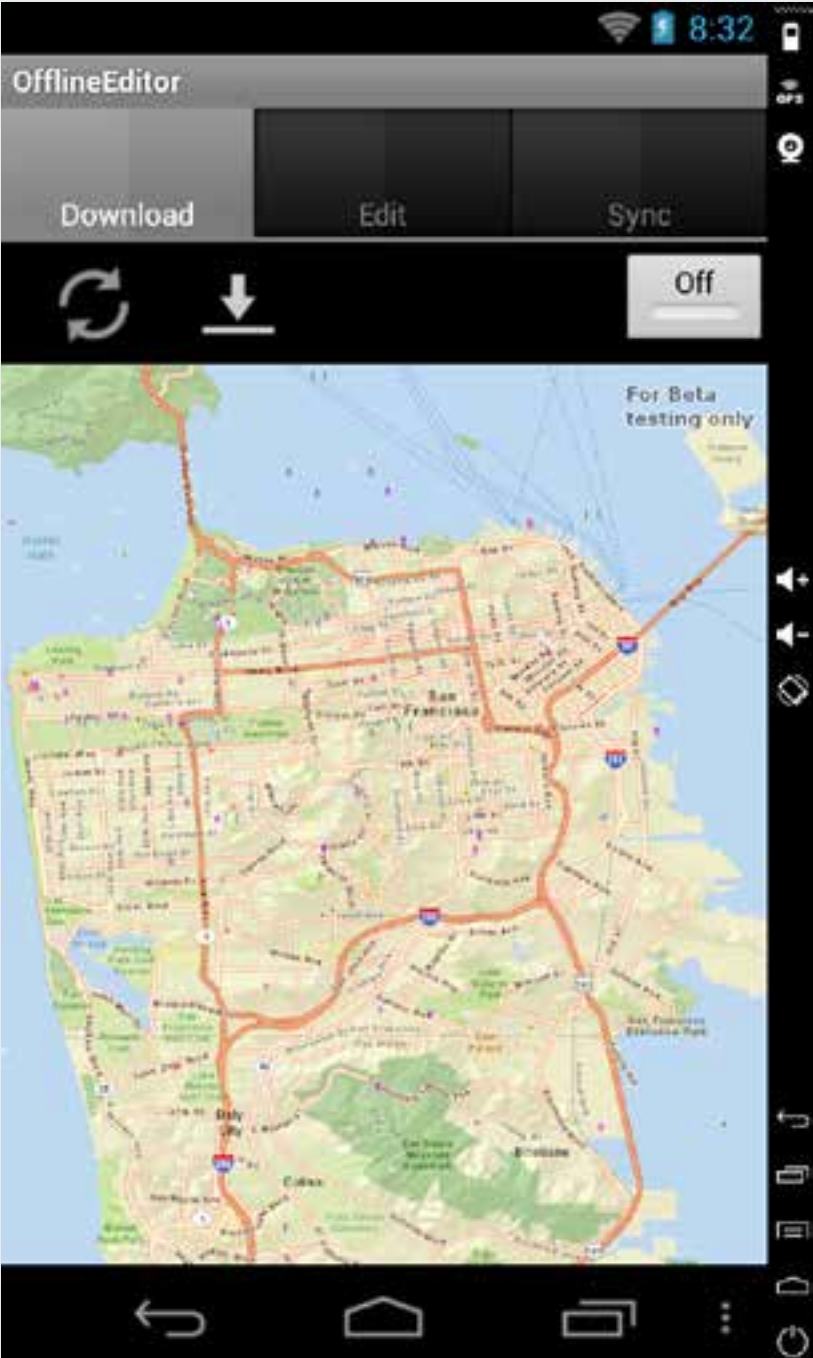
< Back

Next >

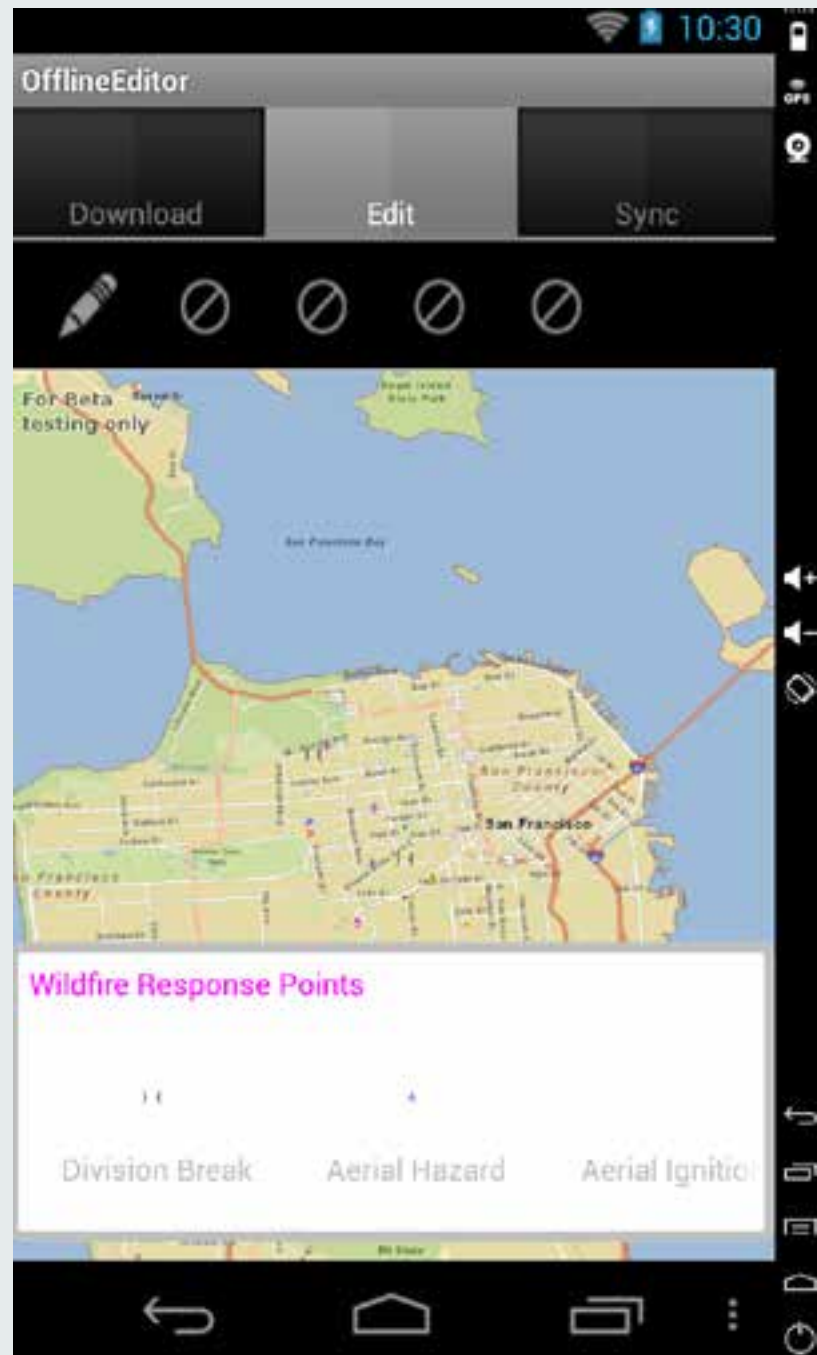
Cancel

Finish

# Offline (BETA)



# Offline (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.