



Esri International Developer Summit

Palm Springs, CA

Getting Started ArcGIS Runtime SDK for Android

Andy Gup

@agup

Agenda

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



My contact info...

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SDK Features

Eclipse plug-in

Native ArcGIS Runtime client

Maps (online/offline)

Editing

Routing

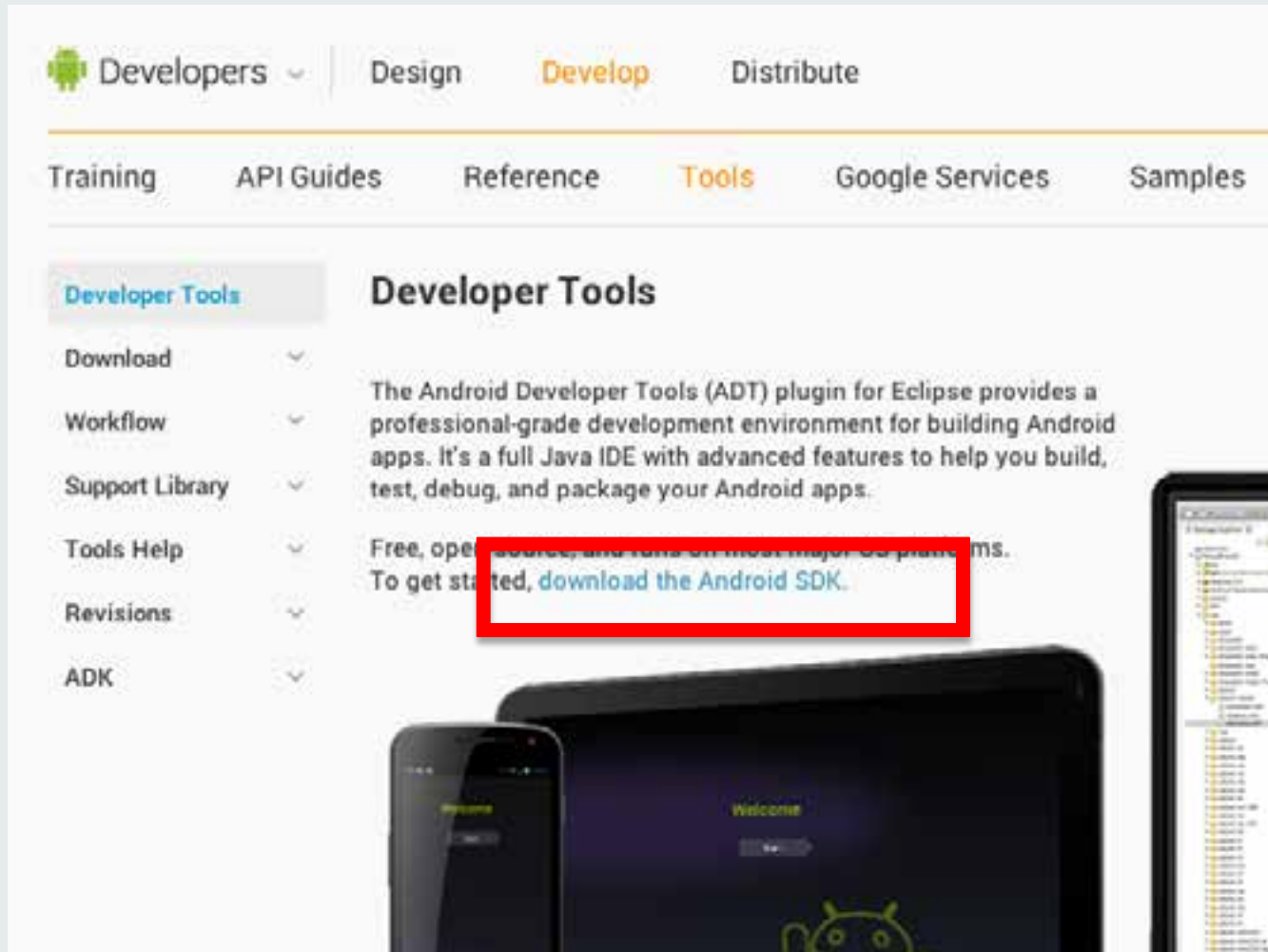
Data collection

Geoprocessing

And much more!

Android SDK

<http://developer.android.com/tools/>



The screenshot shows the 'Developer Tools' section of the Android developer website. The navigation bar includes 'Design', 'Develop', and 'Distribute'. Below it are 'Training', 'API Guides', 'Reference', 'Tools', 'Google Services', and 'Samples'. The 'Developer Tools' section is highlighted, and a red box highlights the text: 'Free, open source, and runs on most major OS platforms. To get started, [download the Android SDK](#).'

Developers ▾ | Design **Develop** Distribute

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

Developer Tools

- Download ▾
- Workflow ▾
- Support Library ▾
- Tools Help ▾
- Revisions ▾
- ADK ▾

Developer Tools

The Android Developer Tools (ADT) plugin for Eclipse provides a professional-grade development environment for building Android apps. It's a full Java IDE with advanced features to help you build, test, debug, and package your Android apps.

Free, open source, and runs on most major OS platforms. To get started, [download the Android SDK](#).

Images of a smartphone, a tablet displaying a 'Welcome' screen with the Android logo, and a laptop displaying a code editor are visible at the bottom of the page.

Download the SDK

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

The screenshot shows the ArcGIS Runtime SDK for Android developer page. The header is purple with the title 'ArcGIS Runtime SDK for Android' and a search bar. Below the header are navigation tabs: Home, Guide, API Reference, Sample Code, and Forum. The main content area is white with a light purple background pattern. It features a 'Download' section with a 'DOWNLOAD' button and links for 'Release Notes', 'System Requirements', and 'Deploy and license'. Below this is an 'Install and set up' section with a 'GET STARTED' button. The 'Add a map to your app' section includes a 'CREATE A MAP' button. On the right side, there are three feature highlights: 'Find your way', 'Fast and fluid', and 'Advanced military symbology'. At the bottom right, there is a 'FROM OUR BLOG' section with a link to 'Collector - Disconnected editing and sync'. A 'ANDROID SDK OVERVIEW' button is also present.

ArcGIS Runtime SDK for Android

Home Guide API Reference Sample Code Forum

Search the Android SDK

Download

Current version 10.2 (October 2018)

Get the SDK that lets you build native mapping apps for Android devices! Integrate a wide range of mapping and GIS tasks online or offline, including editing, geocoding, routing, mapping, and data visualization.

[DOWNLOAD](#)

[Release Notes](#) | [System Requirements](#) | [Deploy and license](#)

Install and set up

Instructions are provided to help you install the SDK and set up your development environment.

[GET STARTED](#)

Add a map to your app

This hello world tutorial shows how to create a simple map based application and prepare it for deployment. It provides tips along the way to help you learn how the API works and jump-start your development.

[CREATE A MAP](#)

Find your way

Locate addresses, solve routes, and even provide step-by-step driving directions between any number of locations on the map.

Fast and fluid

Take advantage of the task-based asynchronous pattern to keep your apps responsive and quick.

Advanced military symbology

Use ArcGIS Runtime SDK for Android to easily process messages in MIL-STD-2525C format, from input stream or file, and add them as symbols to your map.

[ANDROID SDK OVERVIEW](#)

From our blog

[Collector - Disconnected editing and sync](#)

Demo 1 - Installing the SDK



Install

Available Software
Check the items that you wish to install.

Work with:

Find more software by working with the ["Available Software Sites"](#) preferences.

type filter text

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

Details

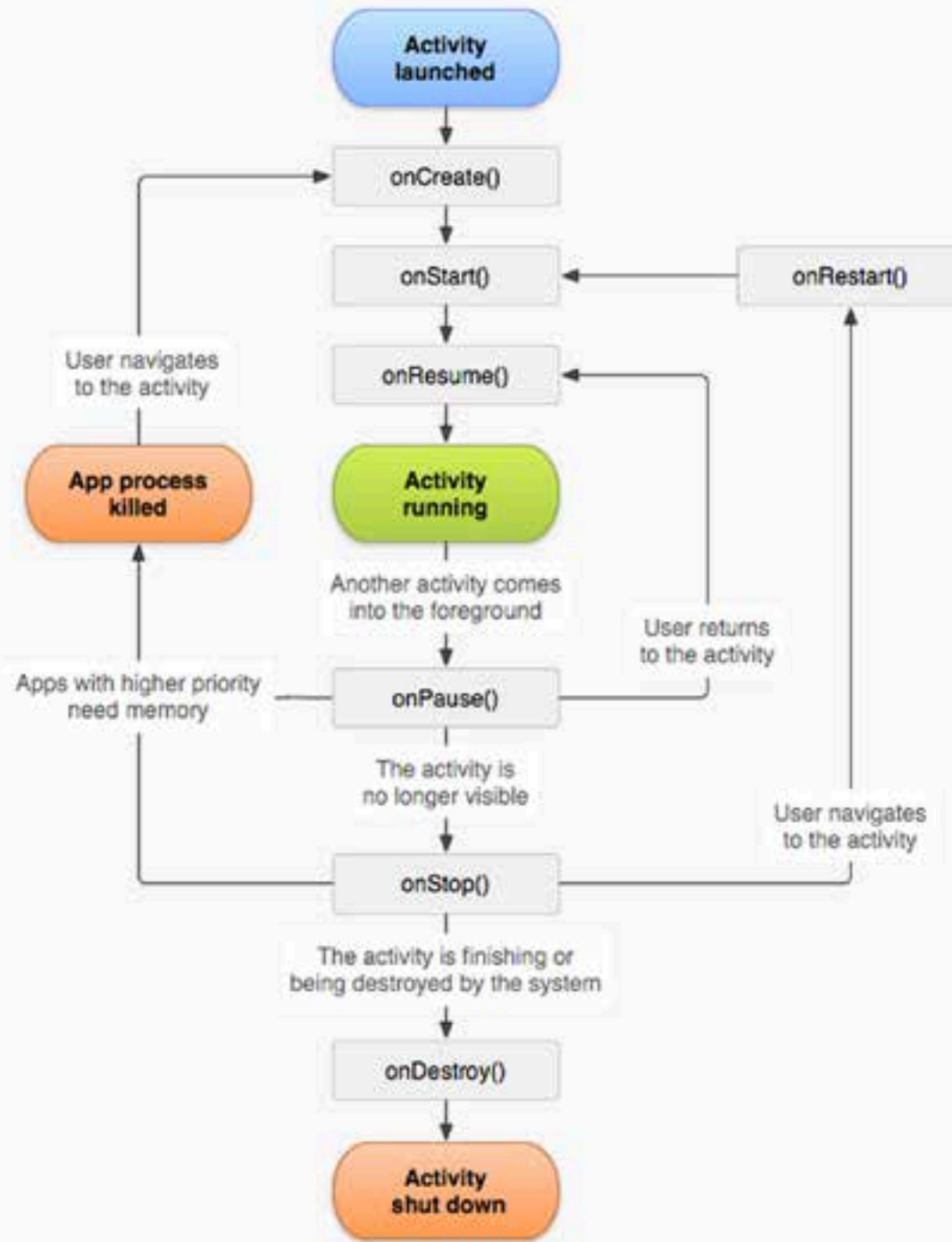
Show only the latest versions of available software Hide items that are already installed

Demo 2- Hello World Sample

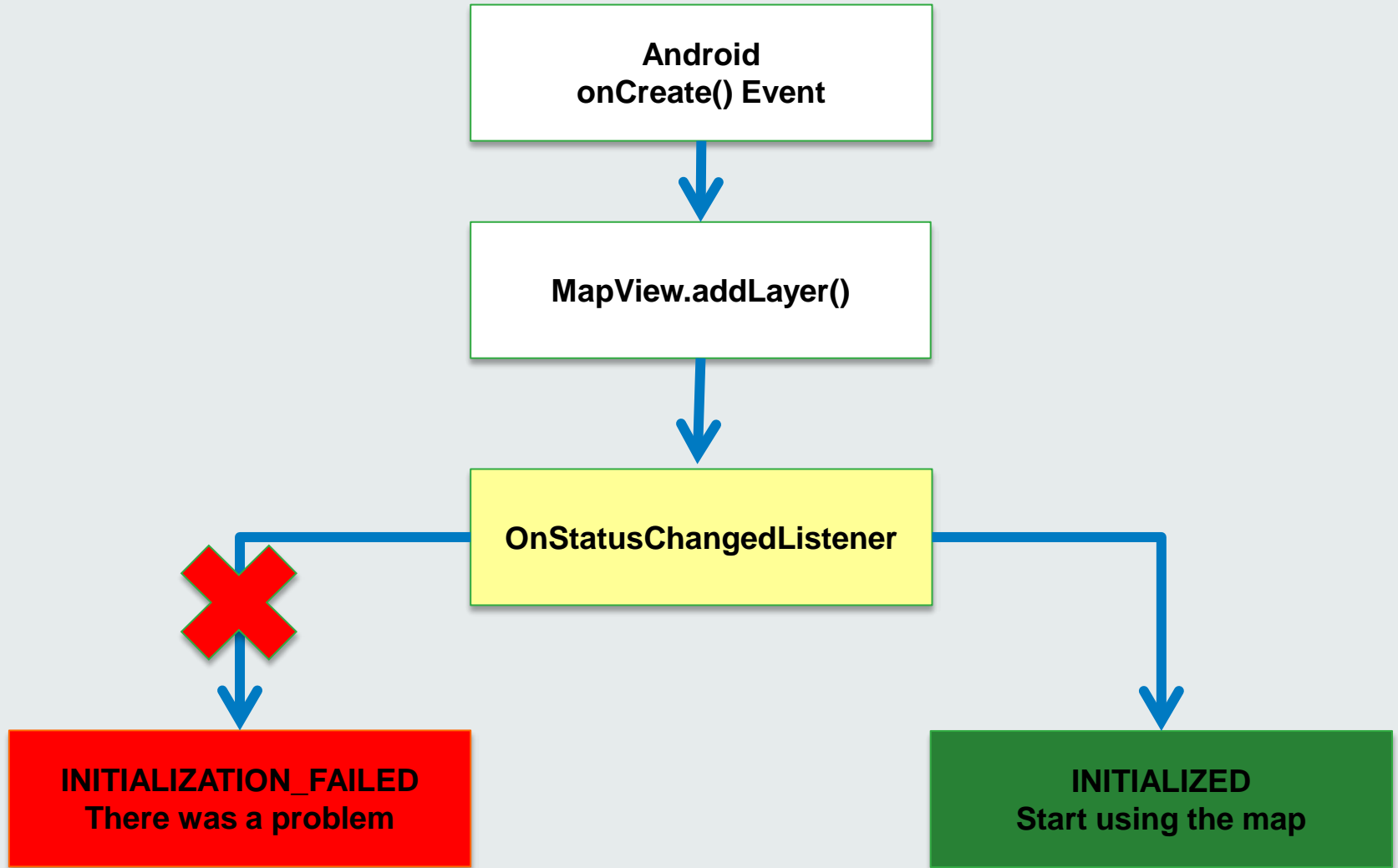


Android Application Life Cycle





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) {
```

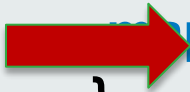
```
        super.onCreate(savedInstanceState);
```

```
        setContentView(R.layout.main);
```

```
        map = (MapView) findViewById(R.id.map);
```

```
    }
```

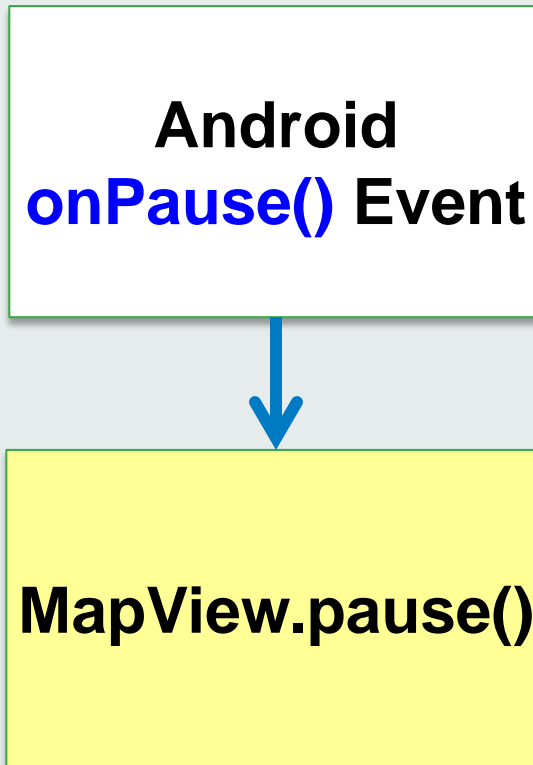
```
}
```



R.id.map == [res/layout/main.xml](#)

```
<com.esri.android.map.MapView  
    android:id="@+id/map"  
    android:layout_width="fill_parent"  
    android:layout_height="fill_parent"  
    mapoptions.MapType="Topo"  
    mapoptions.center="34.056215, -117.195668"  
    mapoptions.ZoomLevel="16" />
```

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...

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 **MapView** events

Available after MapView/Layer initialized

- **Spatial Reference of map**
- **Center of map**
- **Tile information of a tiled layer**

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)  
        {  
             layerButton.setEnabled(true);  
        }  
        if (OnStatusChangeListener.STATUS.INITIALIZATION_FAILED  
            == status){  
            //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)
```

```
        {
```

```
            //TODO
```

```
        }
```

```
        if (OnStatusChangeListener.STATUS.INITIALIZATION_FAILED  
            == status && source == tiledLayer){
```

```
            //Let user know there was a problem
```

```
        }
```

```
    }
```

```
}
```

Status Changed Listener Demo

Listening for **Layer** events

LogCat Console Search

Saved Filters + - [icon]

All messages (no filters) (1)

GPSTester

com.esri.samples.mapeve

listener

	Tag	Text
	samples.mapevent	Test
	samples.mapevent	Test
	samples.mapevent	Test
		BaseMap Layer OnStatusChangeListener = INITIALIZED
		Map OnStatusChangeListener = INITIALIZED
		Map OnStatusChangeListener = LAYER_LOADED

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.

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.setOutputSR(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);  
            }  
        }  
    }  
}
```

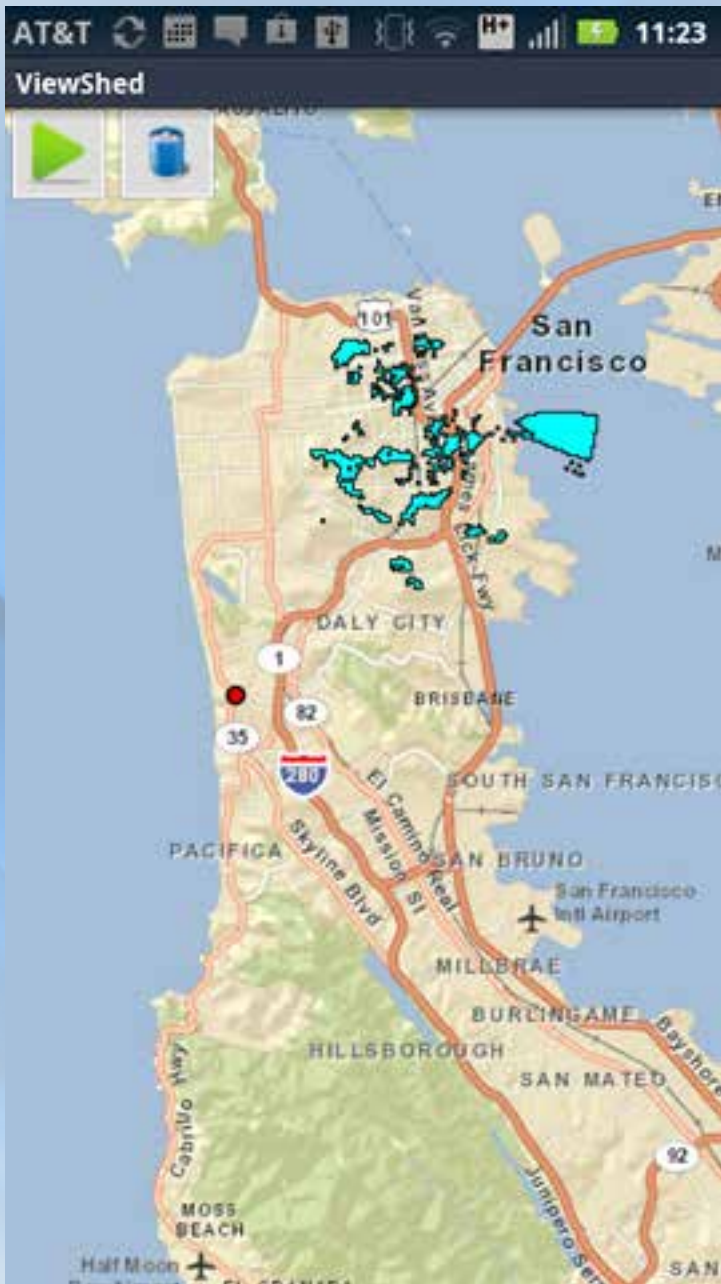
Geoprocessing Example – Step 4

```
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<GPPParameter>();
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  
    }  
});
```

AT&T [Icons] 2:21

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

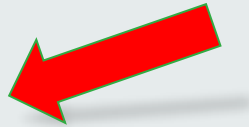
Webmaps

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

```
_locDisplayMgr = map.getLocationDisplayManager();  
_locDisplayMgr.setLocationListener(new LocationListener(){  
    //TODO  
});  
_locDisplayMgr.start();
```



GPS/Location **Start**

Map and layers must be loaded

Then auto center and/or draw GPS graphic

Configure LocationDisplayManager

```
boolean _mapLoaded = false;
```

```
LocationDisplayManager Idm = map.getLocationDisplayManager();
```

```
Idm.setAutoPanMode(AutoPanMode.OFF);
```

```
Idm.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 (status == STATUS.INITIALIZED) {
```

```
            _mapLoaded = true;
```

```
        }
```

```
    }
```

```
}
```

Listen for LocationService Updates

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

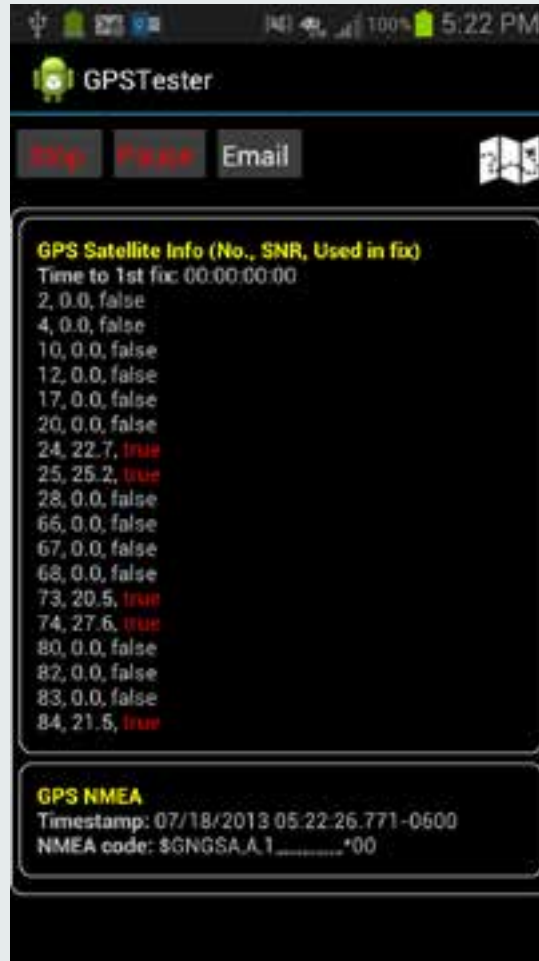
LocationService Life Cycle

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

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


Android GPS Test Tool

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



Demo GPS



Offline

Editing

Routing

Mapping

Uses a local geodatabase

Synchronize Edits via FeatureService

ArcGIS Runtime SDK for Android

Home

Guide

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Sample Code

Forum

Analysis

Cloud & Portal

Display Information

Edit Data

Local Data

Create Local JSON Features

Create Local Runtime Geodatabase

Local Tile Layer

Export Tile Cache

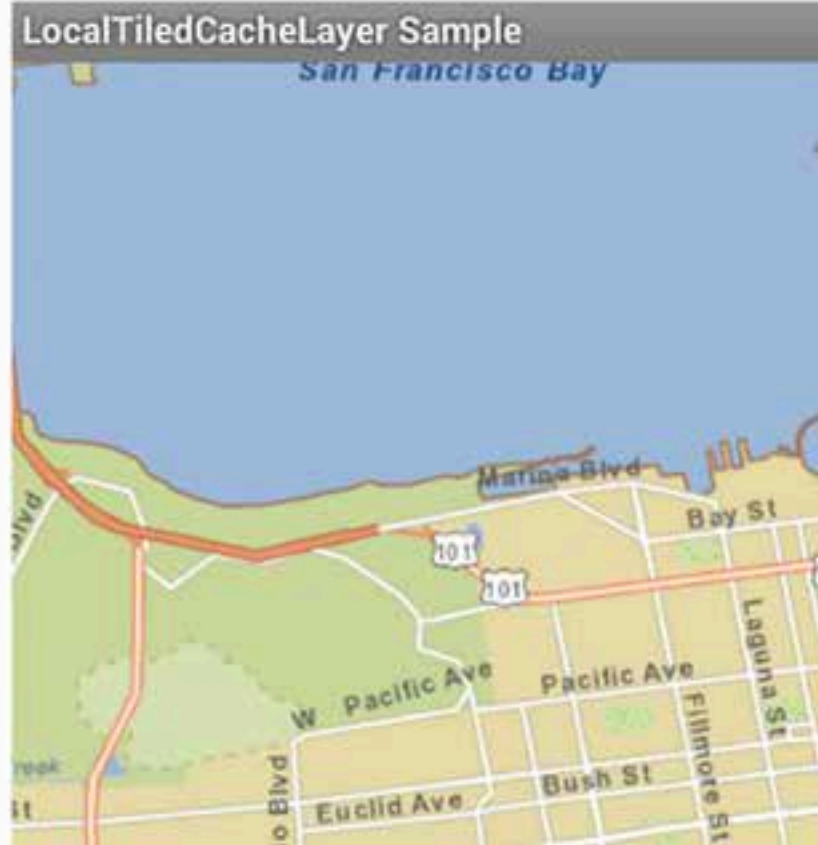
Maps

Routing & Navigation

Search

Local Tile Layer

DOWNLOAD SAMPLE PROJECT



Local Tile Layer

```
@Override
public void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.main);
    map = (MapView) findViewById(R.id.map);

    // change the path to reflect the directory where your compact cache or tpk resides on disk.
    localTileLayer = new ArcGISLocalTiledLayer(Environment.getExternalStorageDirectory().getAbsolutePath()
        + "/ArcGIS/samples/localtilelayer/<CacheName>/Layers");
    map.addLayer(localTileLayer);
}
}
```

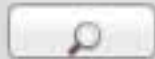
ArcGIS Online Sample for Android

Create an ArcGIS Online sample project for Android

Filter samples:

All Android SDKs

All Categories



OfflineEditor

Offline Routing And Geocoding

Export Tile Cache

Previous 5

Next 5

Project Name:



< Back

Next >

Cancel

Finish

Debugging

- [Genymotion](#) emulator – excellent!
- Use the Android Debug Bridge (ADB) and Logcat

```
Log.d("Tag", "string message");
```

Application	Tag	Text
com.agup.gps	GPSTester	Startup: GPS enabled true. GPS prefs true. Network not enabled.
com.agup.gps	GPSTester	Startup: check your GPS and network settings.
com.agup.gps	test	backend

Github



Maps-app Template:

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

Android Quick Start Sample:

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

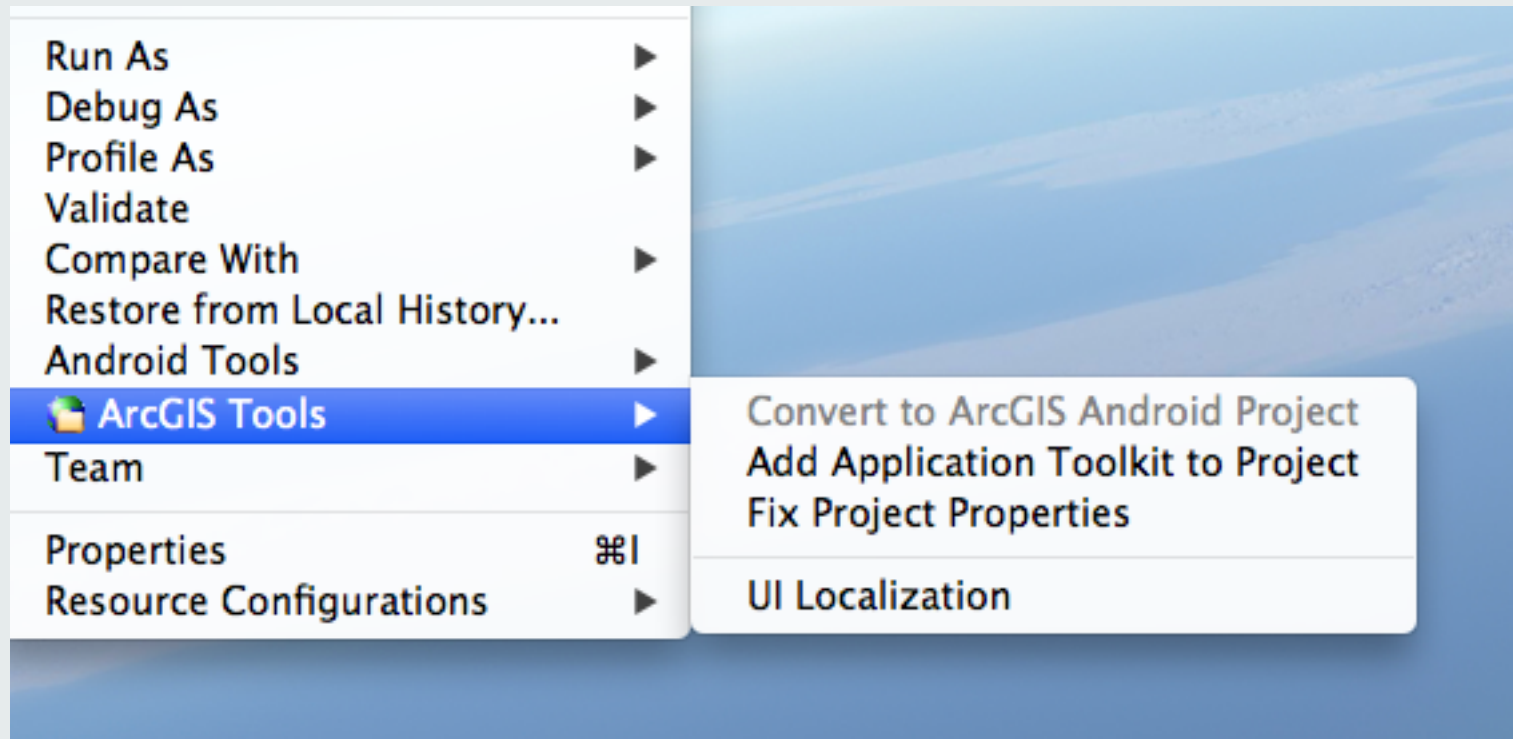
Android GPS Test Tool:

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

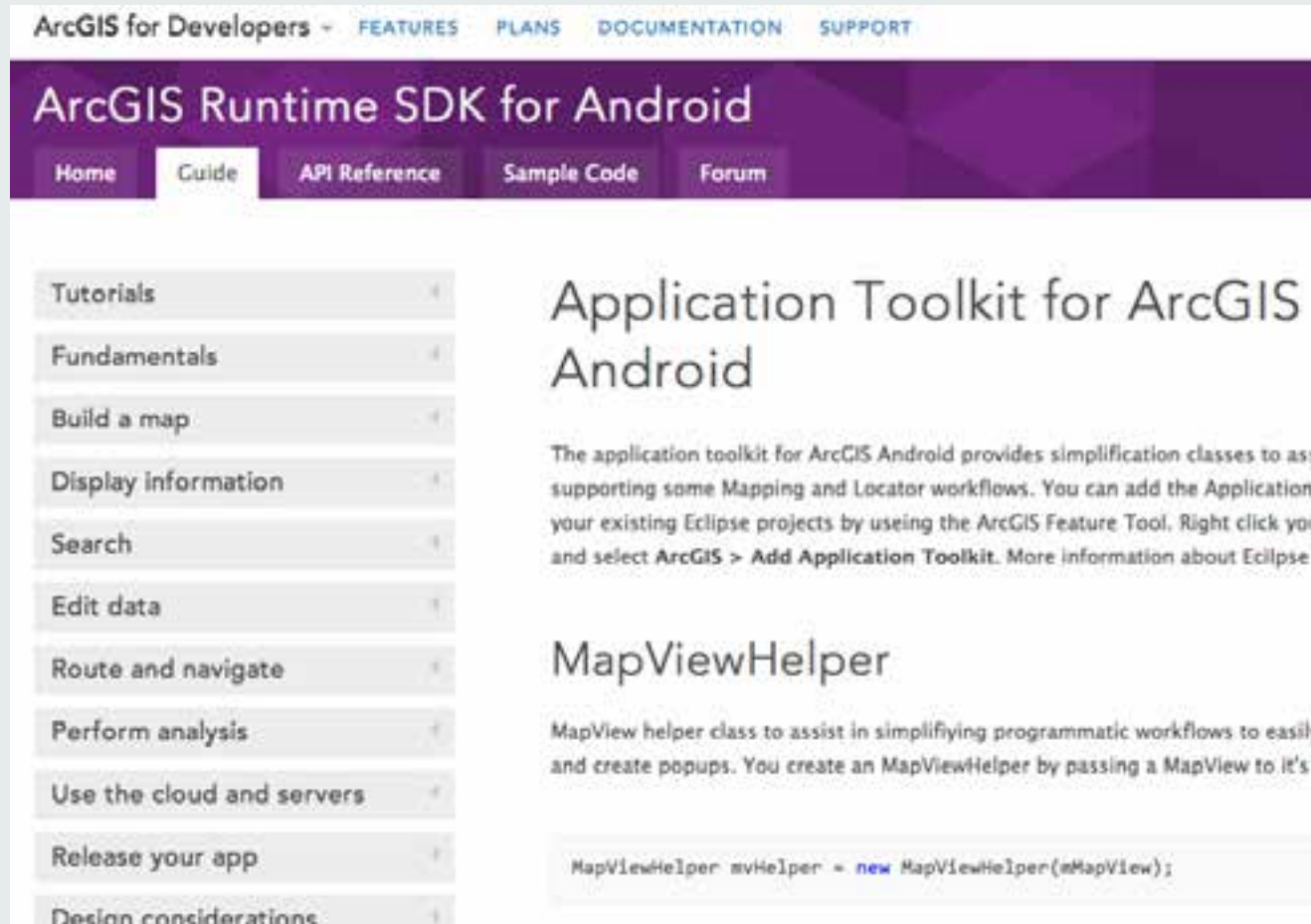
Blog posts on Android GPS

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

Application Toolkit



Application Toolkit



ArcGIS for Developers - FEATURES PLANS DOCUMENTATION SUPPORT

ArcGIS Runtime SDK for Android

Home Guide API Reference Sample Code Forum

- Tutorials
- Fundamentals
- Build a map
- Display information
- Search
- Edit data
- Route and navigate
- Perform analysis
- Use the cloud and servers
- Release your app
- Design considerations

Application Toolkit for ArcGIS Android

The application toolkit for ArcGIS Android provides simplification classes to assist in supporting some Mapping and Locator workflows. You can add the Application Toolkit to your existing Eclipse projects by using the ArcGIS Feature Tool. Right click your project and select ArcGIS > Add Application Toolkit. More information about Eclipse IDE

MapViewHelper

MapView helper class to assist in simplifying programmatic workflows to easily create popups. You create an MapViewHelper by passing a MapView to its constructor.

```
MapViewHelper mvHelper = new MapViewHelper(mMapView);
```

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Understanding our world.