Esri Developer Summit

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

My contact info…

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SDK Features

Eclipse plug-in

Native ArcGIS Runtime client

Maps (online/offline)

Editing

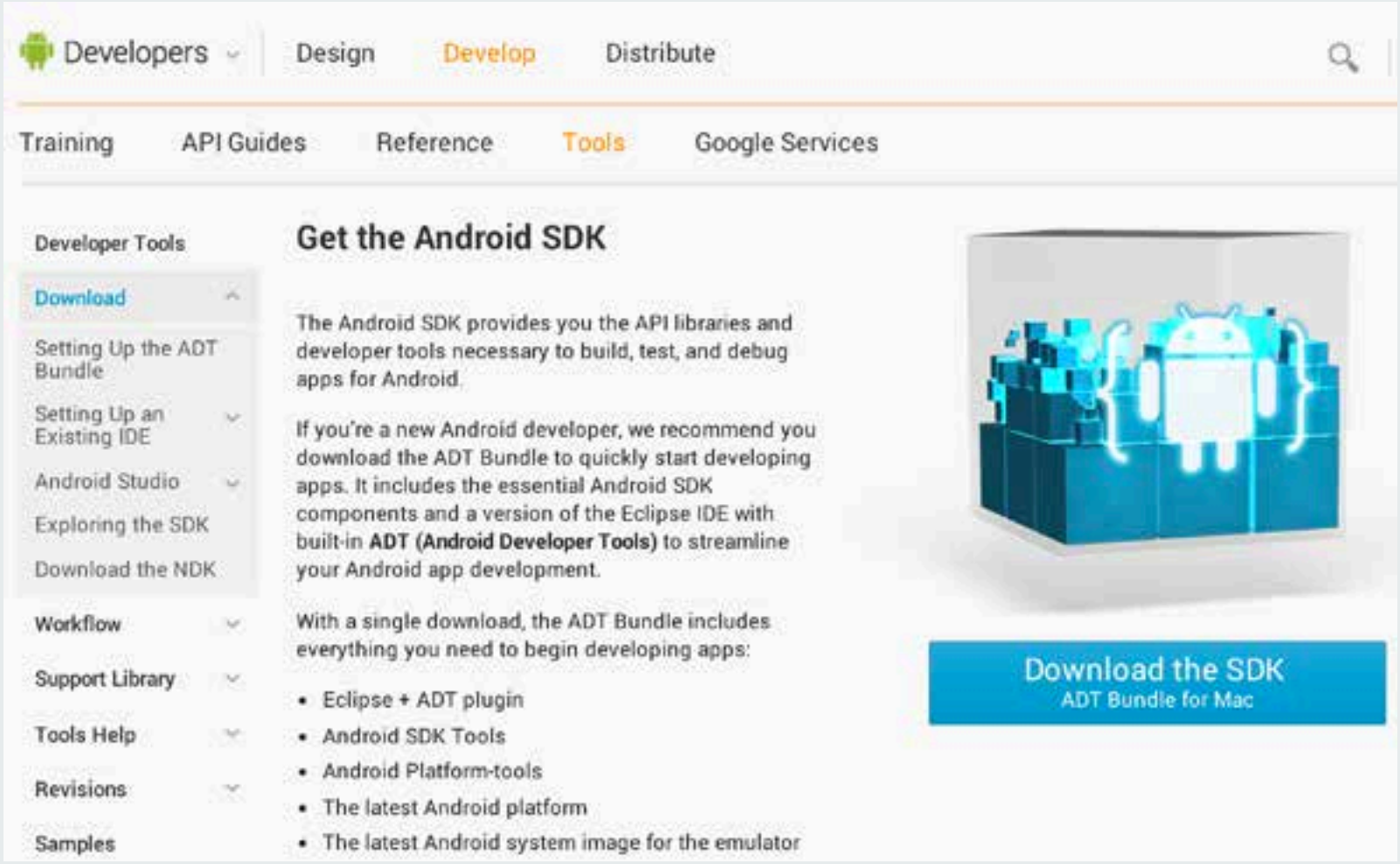
Routing

Data collection

Geoprocessing

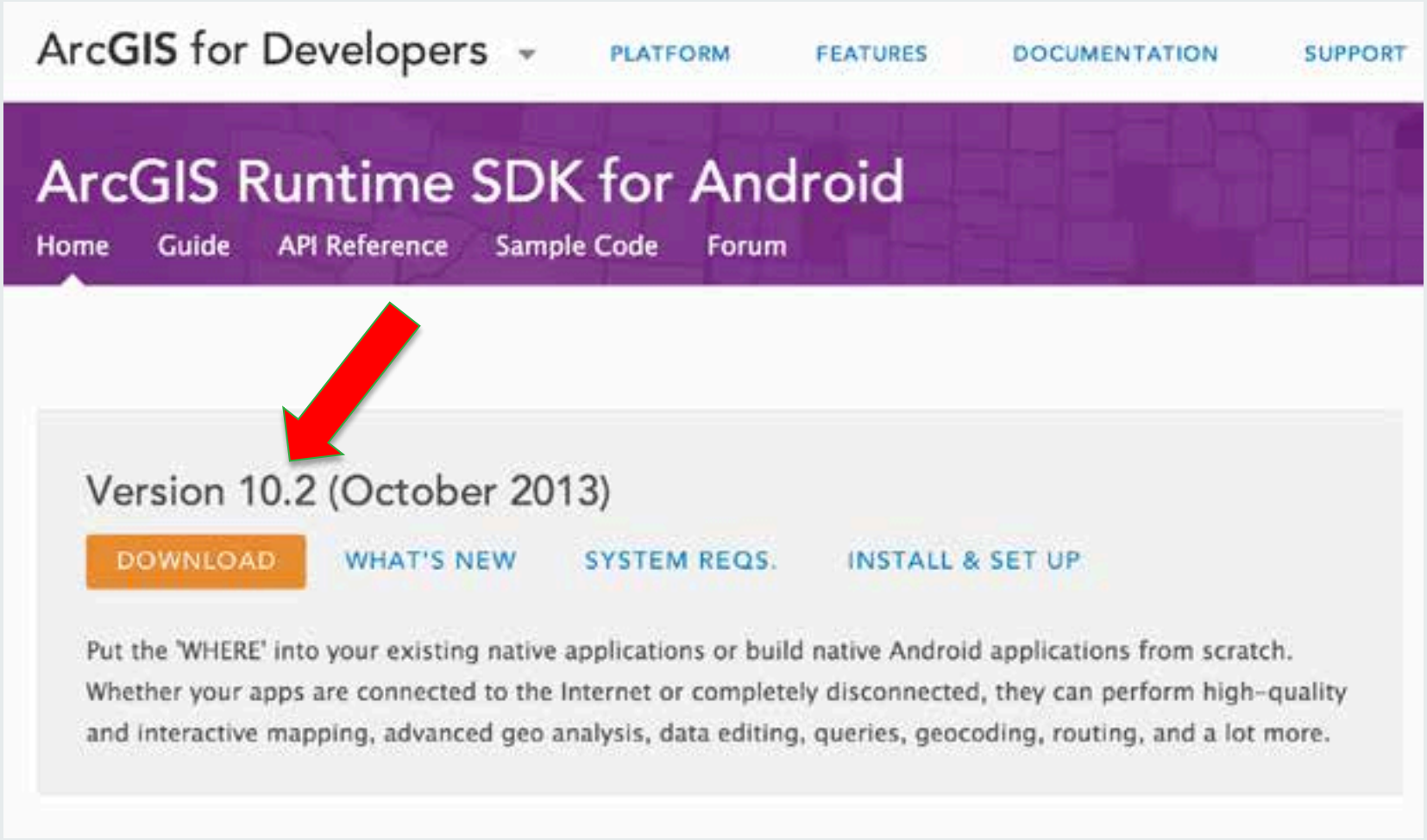
And much more!

Android SDK http://developer.android.com

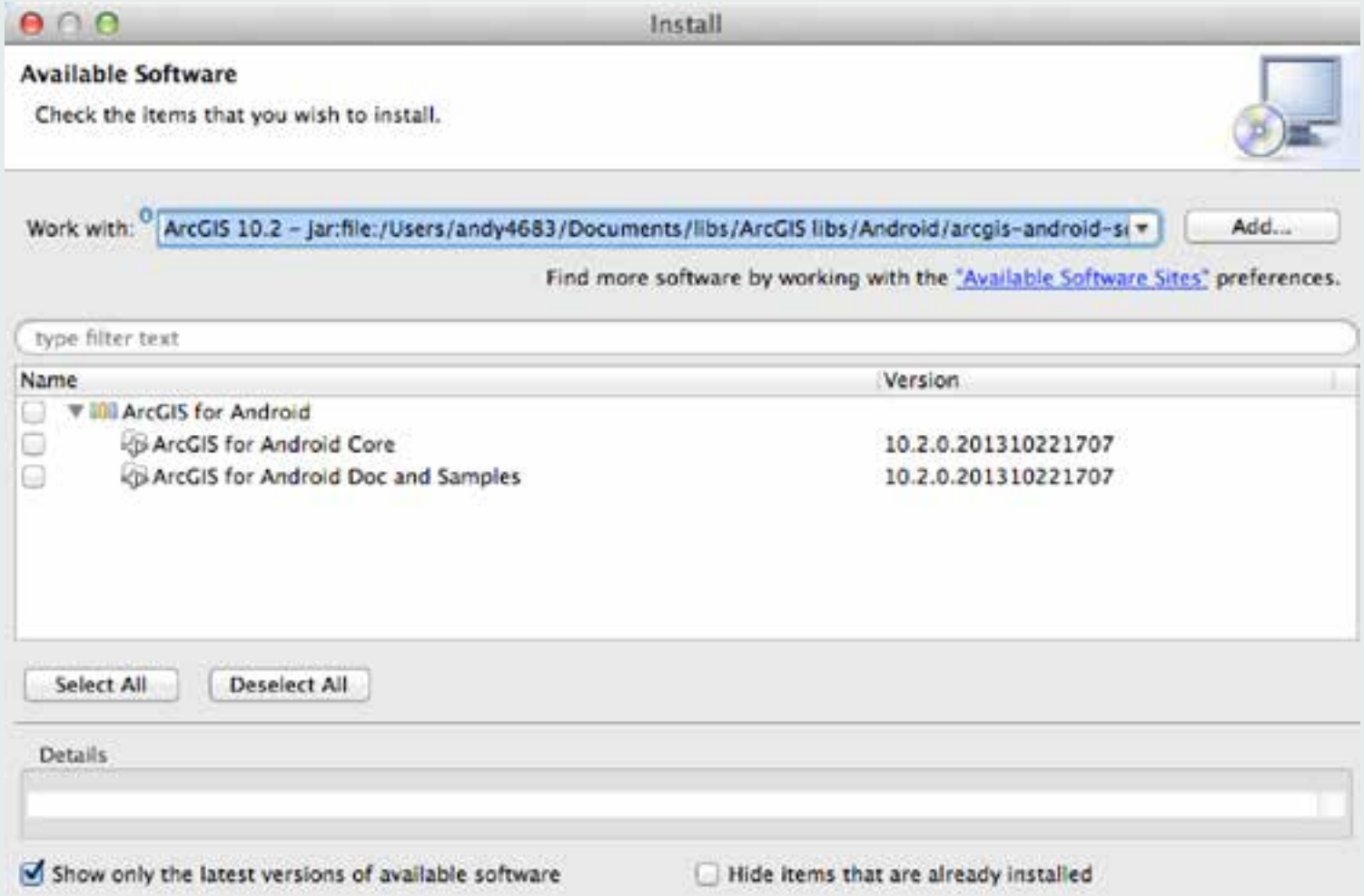


Download the SDK

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

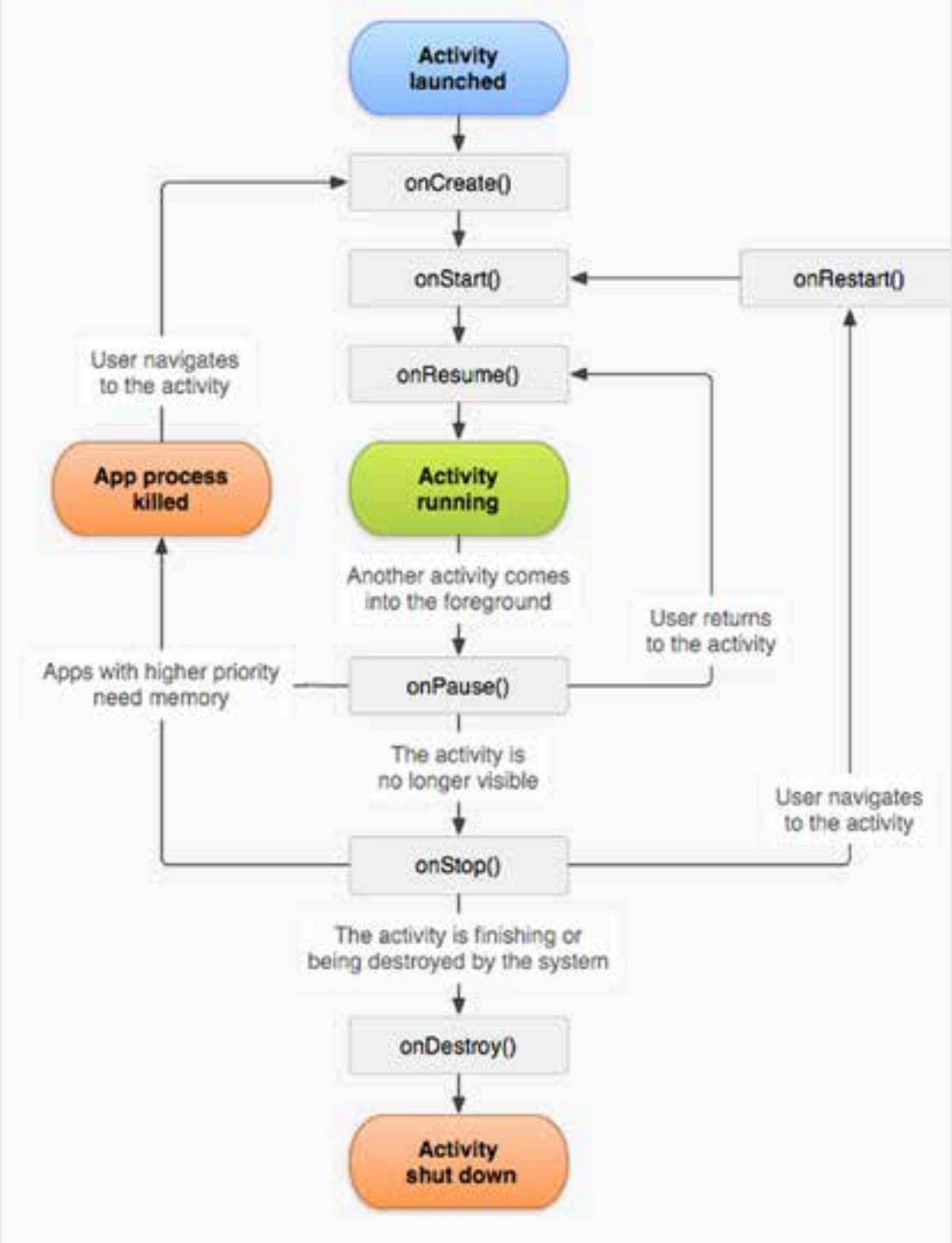


Demo 1 - Installing the SDK



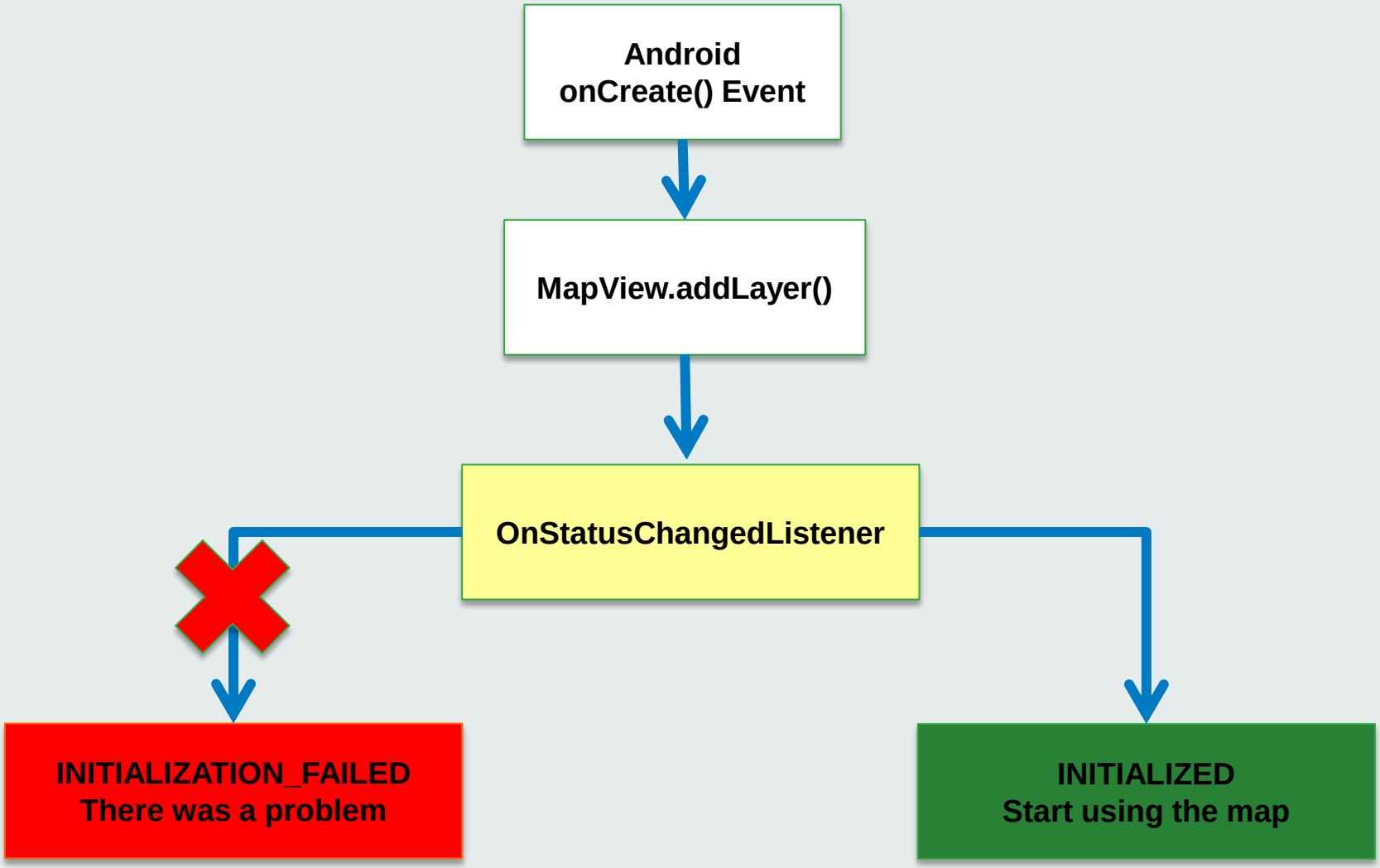
Demo 2- Hello World Sample

Android Application Life Cycle


Activity launched
onCreate()
onStart()
onRestart()
onResume()
User navigates to the activity
App process killed
Activity running
Another activity comes into the foreground
User returns to the activity
Apps with higher priority need memory
onPause()
The activity is no longer visible
User navigates to the activity
onStop()
The activity is finishing or being destroyed by the system
onDestroy()
Activity shut down

ArcGIS Map Life Cycle

Map initialization



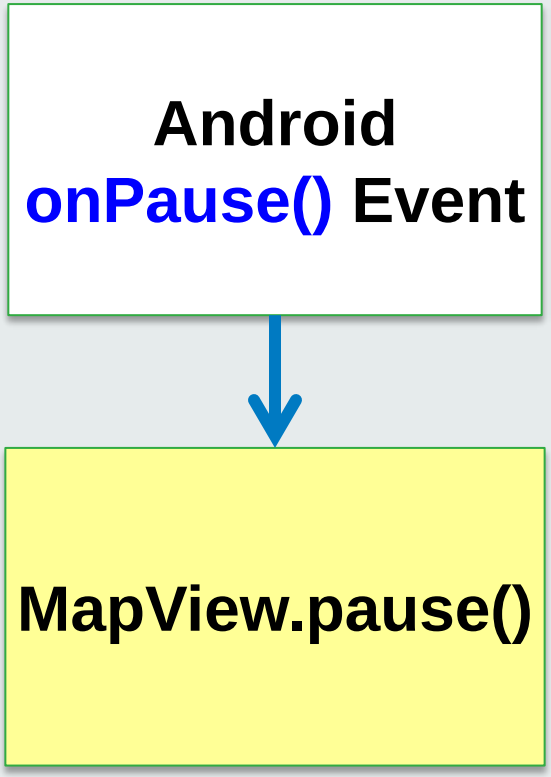
MapView class

```
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);
    }
}
```

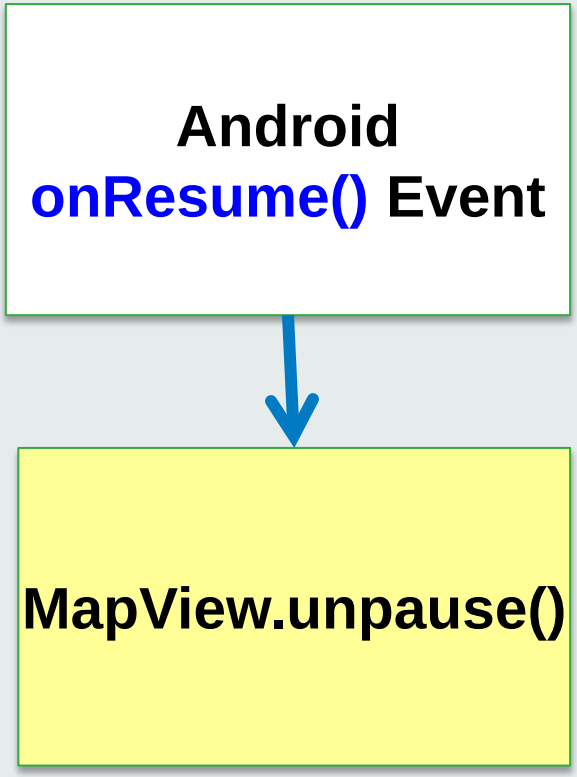
Map Layout - res/layout/main.xml

```
<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



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

```
OnStatusChangedListener.STATUS.INITIALIZED

OnStatusChangedListener.STATUS.INITIALIZATION_FAILED

OnStatusChangedListener.STATUS.LAYER_LOADED

OnStatusChangedListener.STATUS.LAYER_LOADING_FAILED
```

Listening for Map events

```
map.setOnStatusChangedListener(new OnStatusChangedListener() {

    private static final long serialVersionUID = 1L;

    public void onStatusChanged(Object source, STATUS status) {
       if (OnStatusChangedListener.STATUS.INITIALIZED == status
            && source == map) {
          map.addLayer(someFeatureLayer);
       }
       if (OnStatusChangedListener.STATUS.INITIALIZATION_FAILED
             == status && source == map){
          //Let user know there was a problem
       }
    }
}
```

Listening for Layer events

```
tiledLayer.setOnStatusChangedListener(new
OnStatusChangedListener() {

    private static final long serialVersionUID = 1L;

    public void onStatusChanged(Object source, STATUS status) {
       if (OnStatusChangedListener.STATUS.INITIALIZED == status
            && source == tiledLayer) {
            //TODO
       }
      if (OnStatusChangedListener.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

Microsoft Clip art

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<GPParameter>,
    Void, GPParameter[]> {

    GPParameter[] outParams = null;

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

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

Geoprocessing Example – Step 2

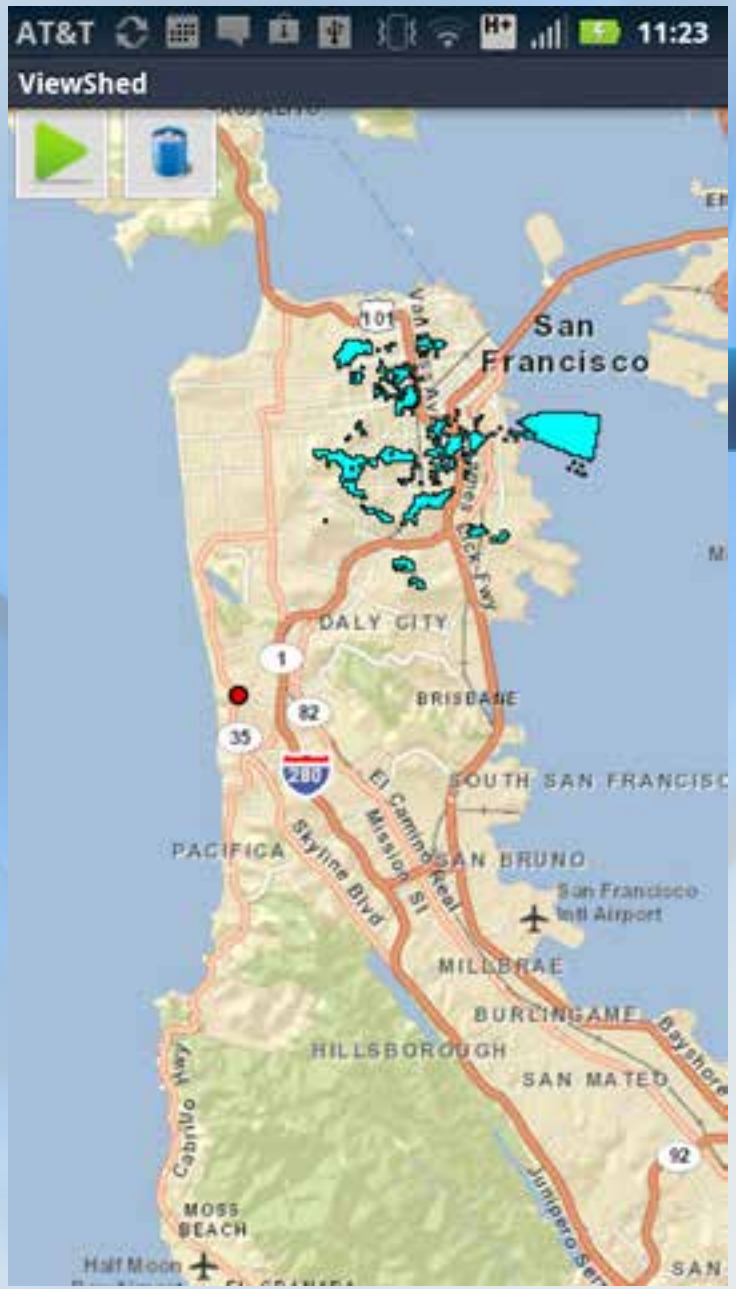
```
@Override
protected GPParameter[] doInBackground(
    ArrayList<GPParameter>... params1) {

    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

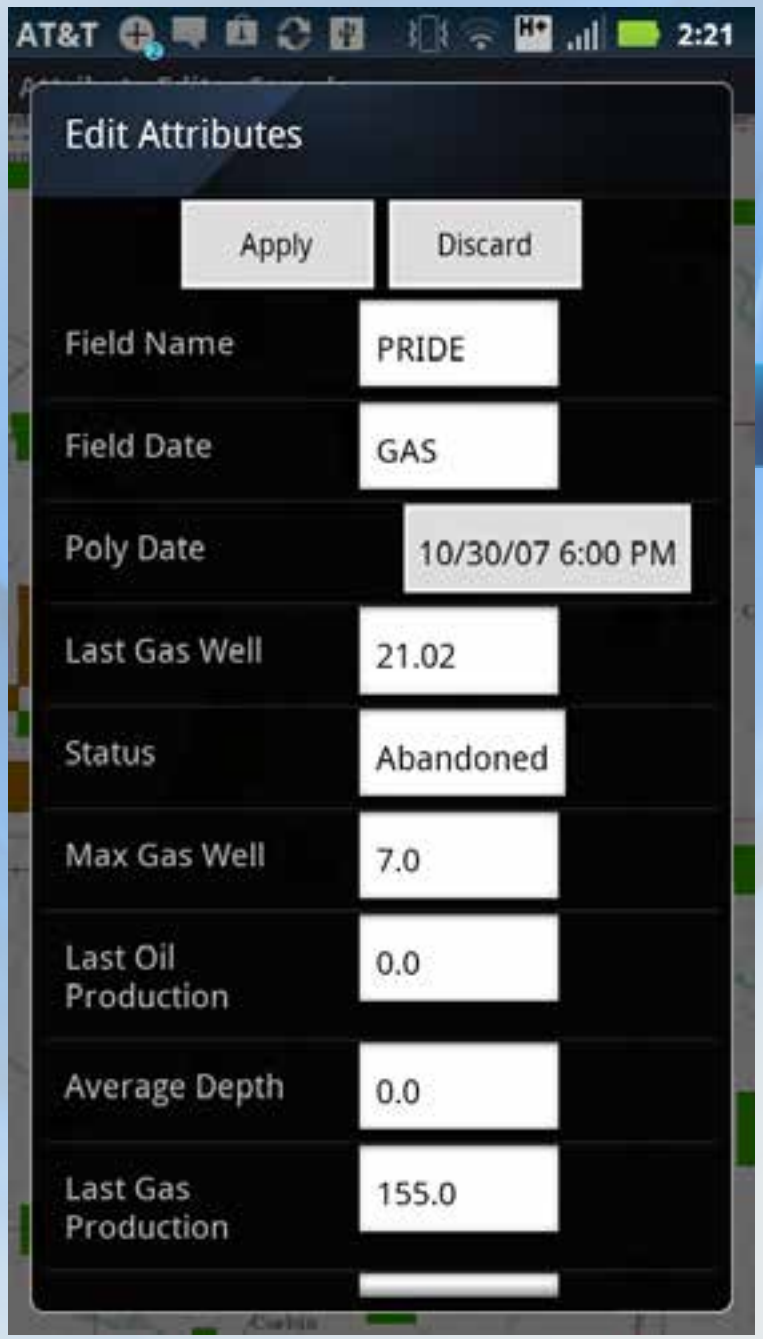
Editing Feature Layers – data integrity

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
    }
);
```



AttributeEditor demo

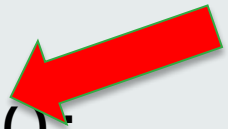
Webmaps

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.setOnStatusChangedListener(new OnStatusChangedListener() {
    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

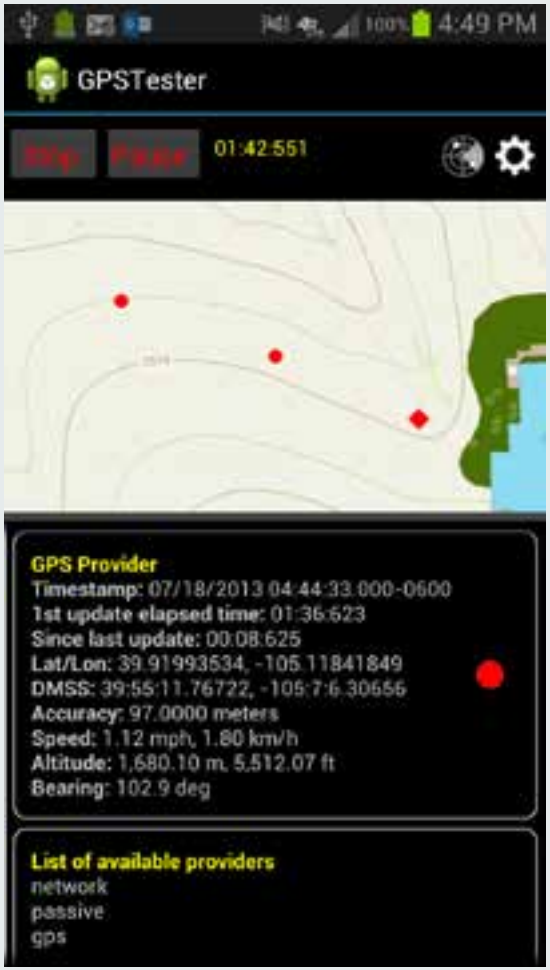
```
@Override
protected void onPause() {
    super.onPause();
     locationService.stop();
}

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

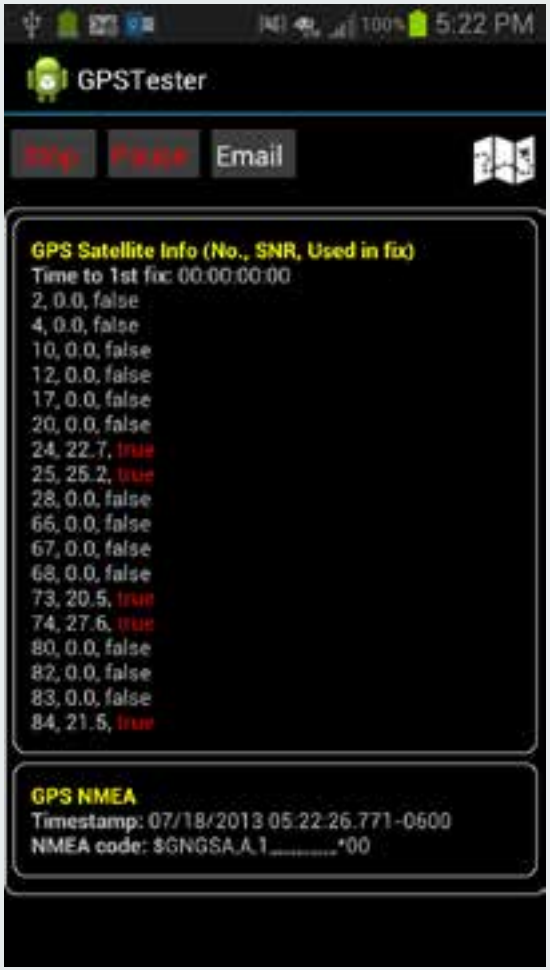
Demo GPS

Microsoft Clip art

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

Create an offline map BETA

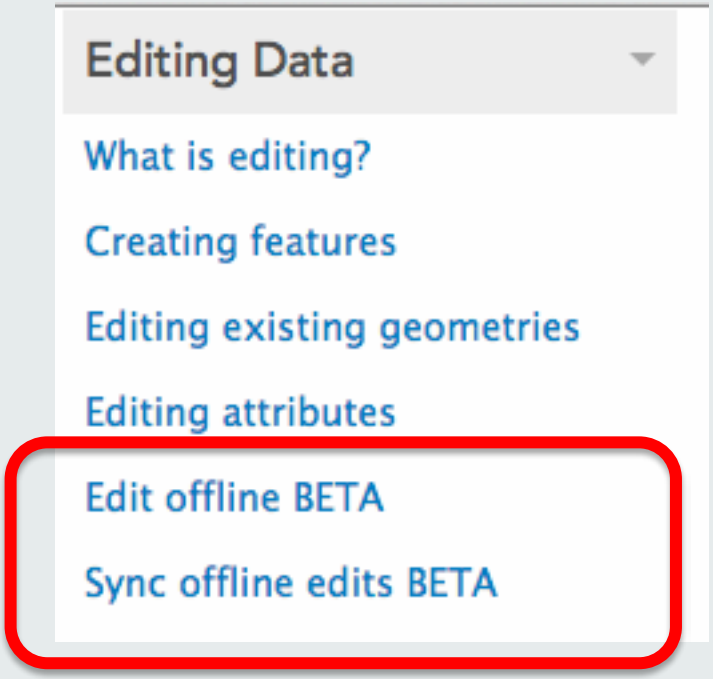
You can provide offline maps to users so they can be productive when their connectivity is poor or non-existent.

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). Includ tables, and attachments of features.
- Sync edits when online again (upload their edits and/or pull down only t service based.
- Perform blazing fast searches for locations (geocode and reverse geocod Find a route.

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

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.