Lesson 24

# Android
# Location Based Services

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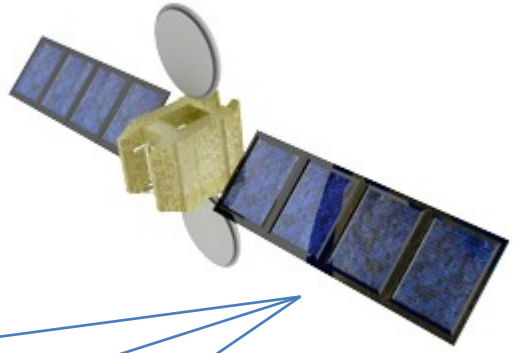
Notes are based on:

Android Developers
http://developer.android.com/index.html

# Location Services

## Introduction

A location-based service (LBS) is an information system driven by the ability of the ‘central’ system to detect the geographical position of the mobile devices.






# Location Services

## Introduction

Location Based Services are used in a variety of situations, such as

*commercial,*
*entertainment,*
*emergency,*
*health,*
*work,*
*personal life, etc.*

**Examples**:

- Locate the nearest bank, restaurant, gas station, hotel, golf course, hospital, police station, etc.

- Provide transportation information on how to go from ‘here’ to ‘there’.

- Social networking is used to locate and reach events, friends and family members.

# Location Services

## How the Global Positioning System (GPS) Works?

Originally created by DOD-USA under the name NAVSTAR (Navigation System for Timing and Ranging) but it is commonly known as **Global Positioning System** (GPS).

The system's backbone consists of 27 Earth-orbiting satellites (24 in operation and 3 in stand-by mode)

Each satellite circles the globe at about 12,000 miles, making *two complete rotations every day.*

The disposition of orbiting satellites is set so that at any time there are at least *four of them in range to any point on earth.*

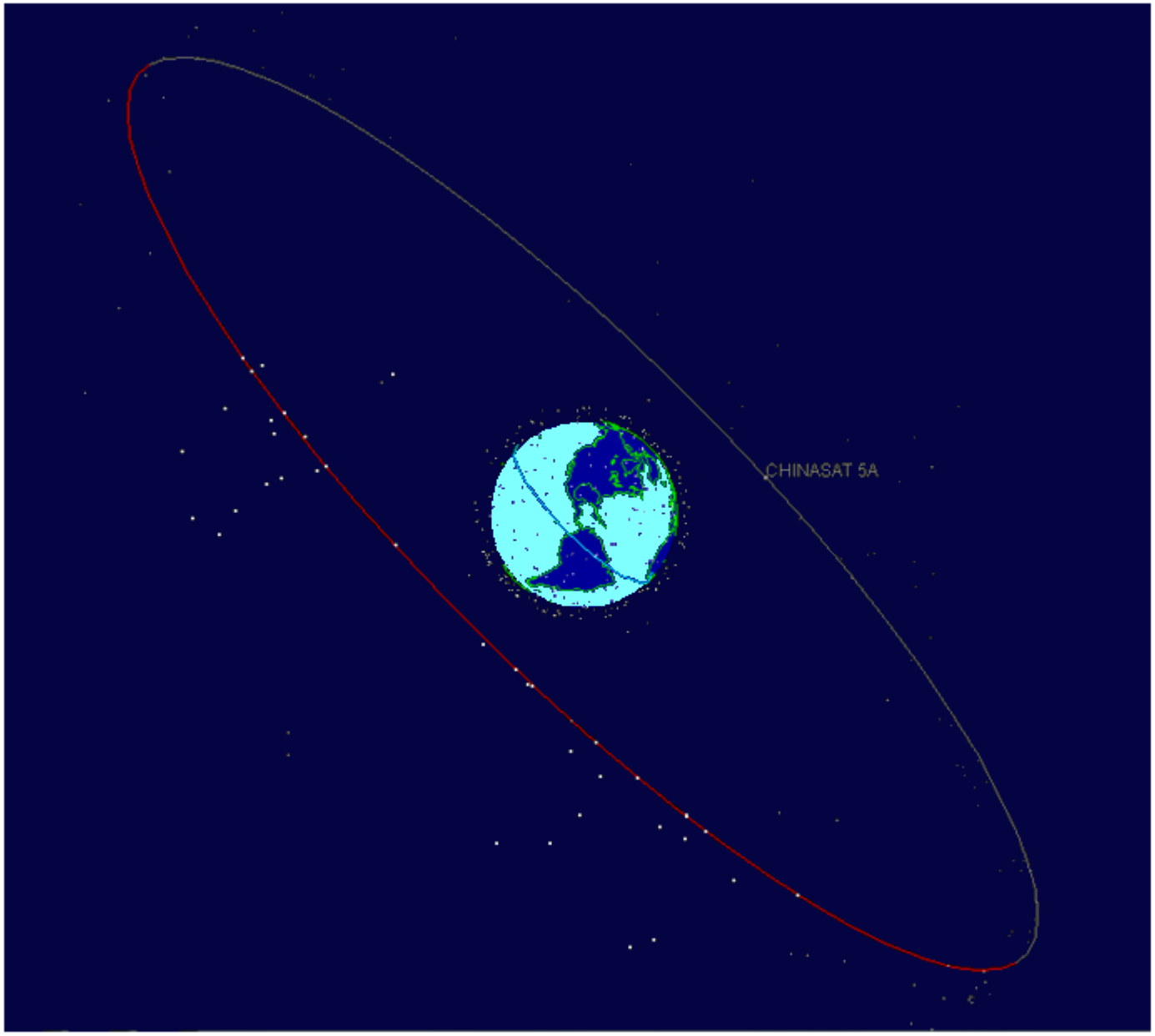
Reference:s http://www.kowoma.de/en/gps/orbits.htm

# Location Services

## How the Global Positioning System (GPS) Works?

The image highlights the orbit of satellite CHINASAT-5A.

See:
NASA
Satellite Tracking
http://science.nasa.gov/realtime/jtrack/3d/JTrack3D.html/



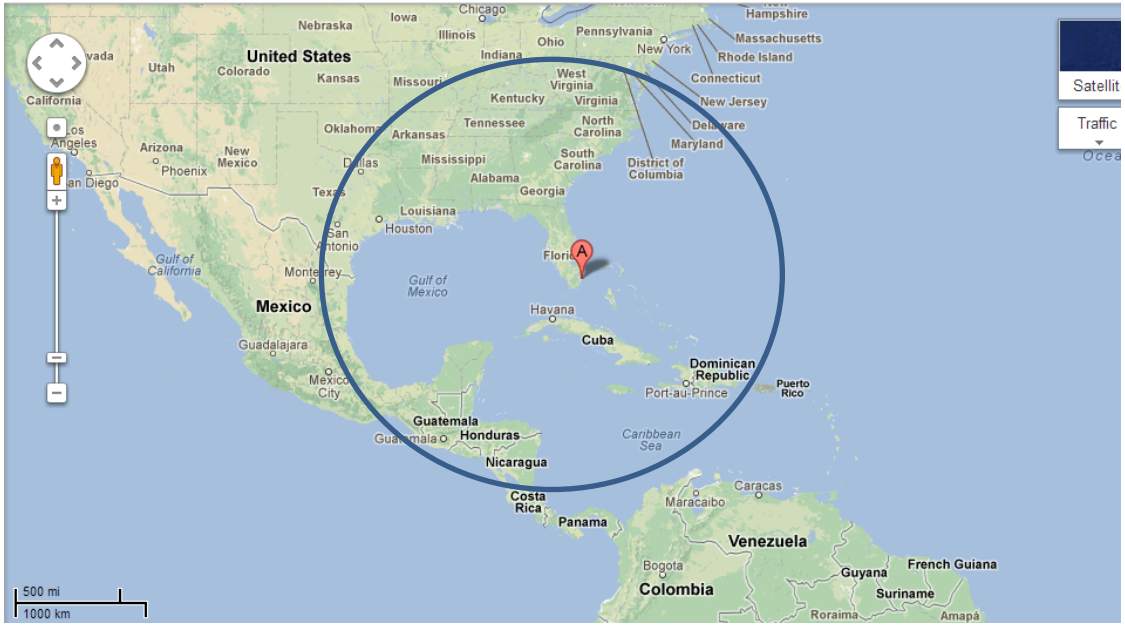
# Location Services

## How the Global Positioning System (GPS) Works?

### 2-D Trilateration

As an example, assume a person is located at the following relative position:

--- Miami 1795 km
--- Caracas 1874 km
--- Bogota 1251 km




**STEP1**

Draw a circle centered in Miami. Scale its radius to 1795 Km.

Observe that n*ot enough information is available for a definitive fix to be made, the person could be anywhere on the blue circle.*

# Location Services

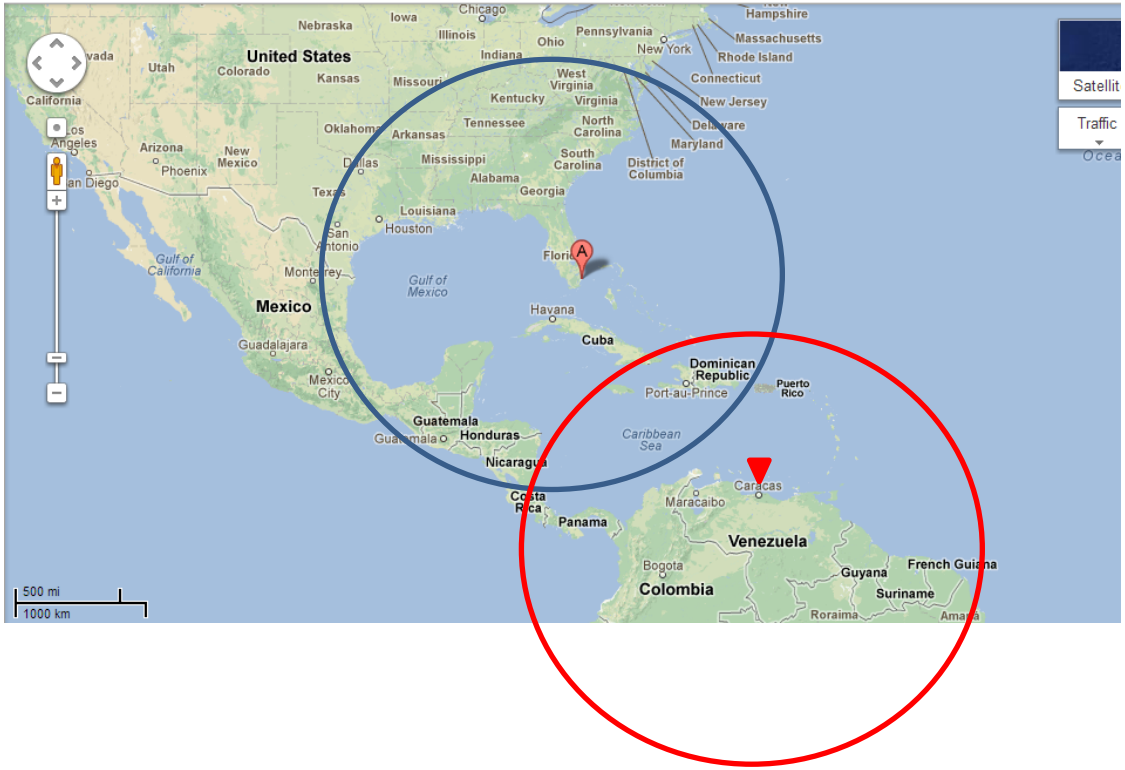
## How the Global Positioning System (GPS) Works?

### 2-D Trilateration

**STEP2**

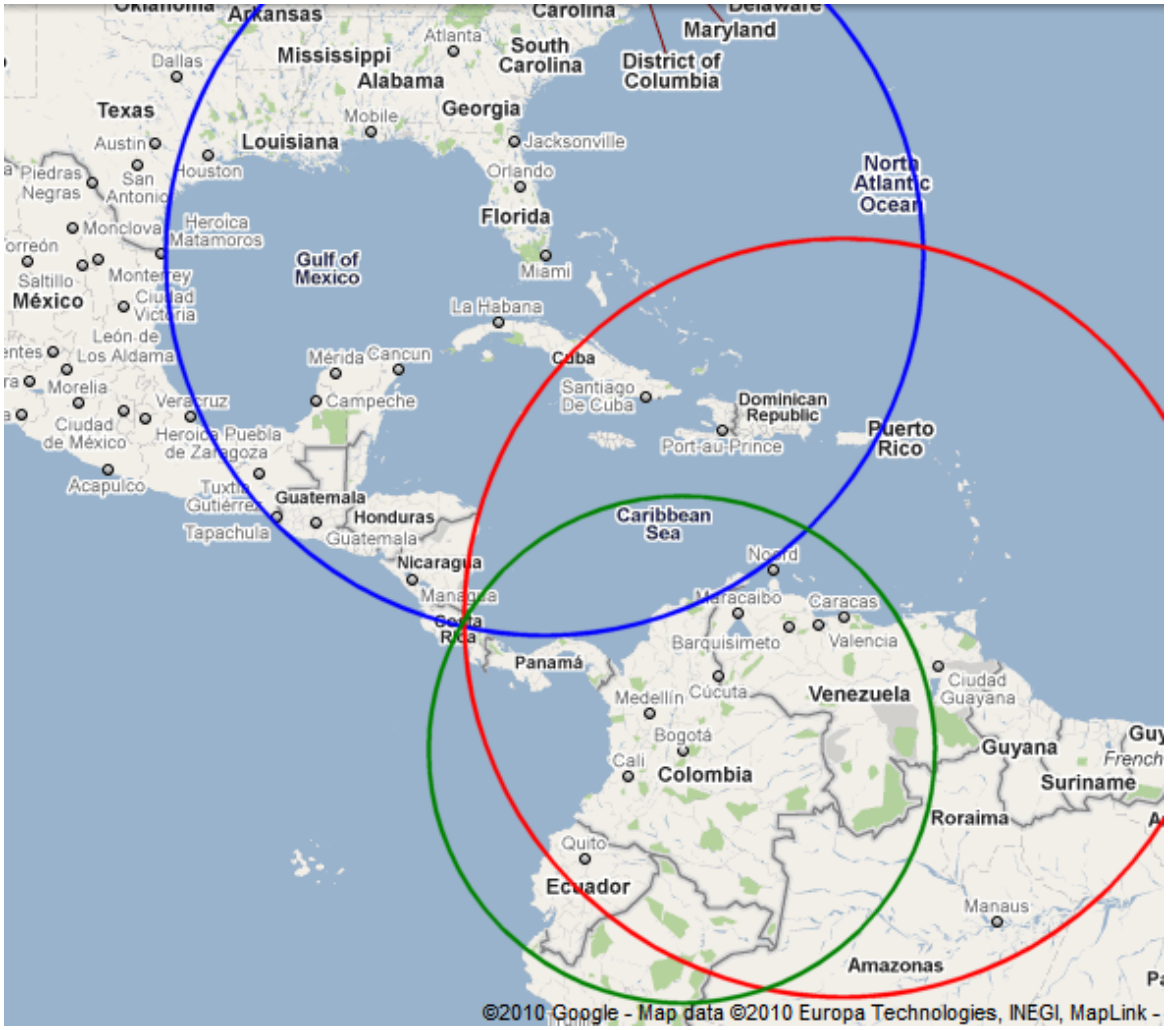
Draw a second circle centered in Caracas, Venezuela.
Scale its radius to 1874 Km.

Two intersection points appear: one on the Caribbean Ocean, an another in Central America.



# Location Services

## How the Global Positioning System (GPS) Works? / Trilateration




--- Miami 1795 km
--- Caracas 1874 km
--- Bogota 1251 km

**STEP3**

Draw a final circle centered in Bogota, Colombia. Set radius to 1251 Km.

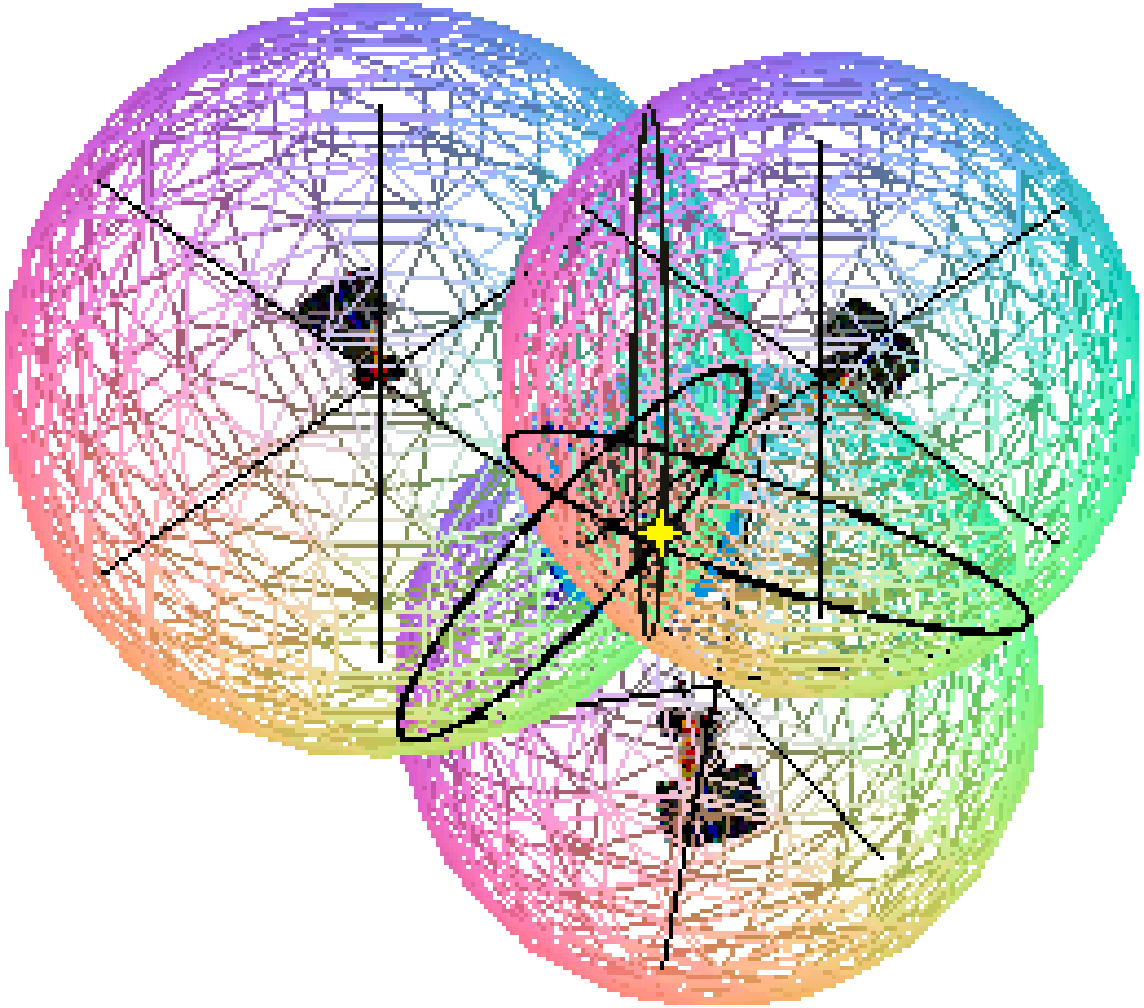
The three circles now intersect on the point over Central America.

The actual location is: San Jose, Costa Rica.

# Location Services

## 3D-Trilateration

Rather than circles three spheres intersect to define your GPS receiver's location.



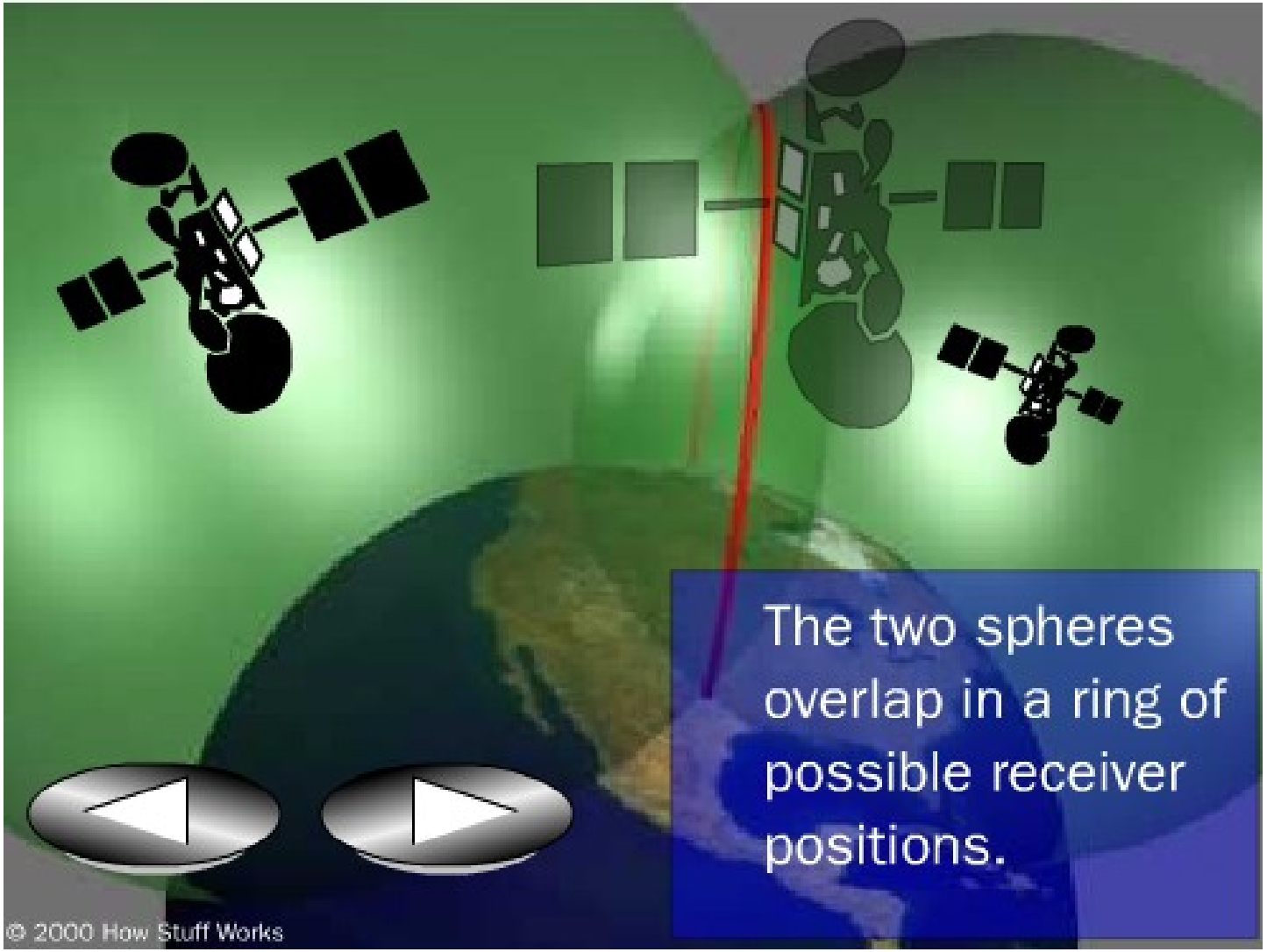
Three spheres

Reference:
http://www.math.tamu.edu/~dallen/physics/gps/gps.htm#references

# Location Services

## 3D-Trilateration

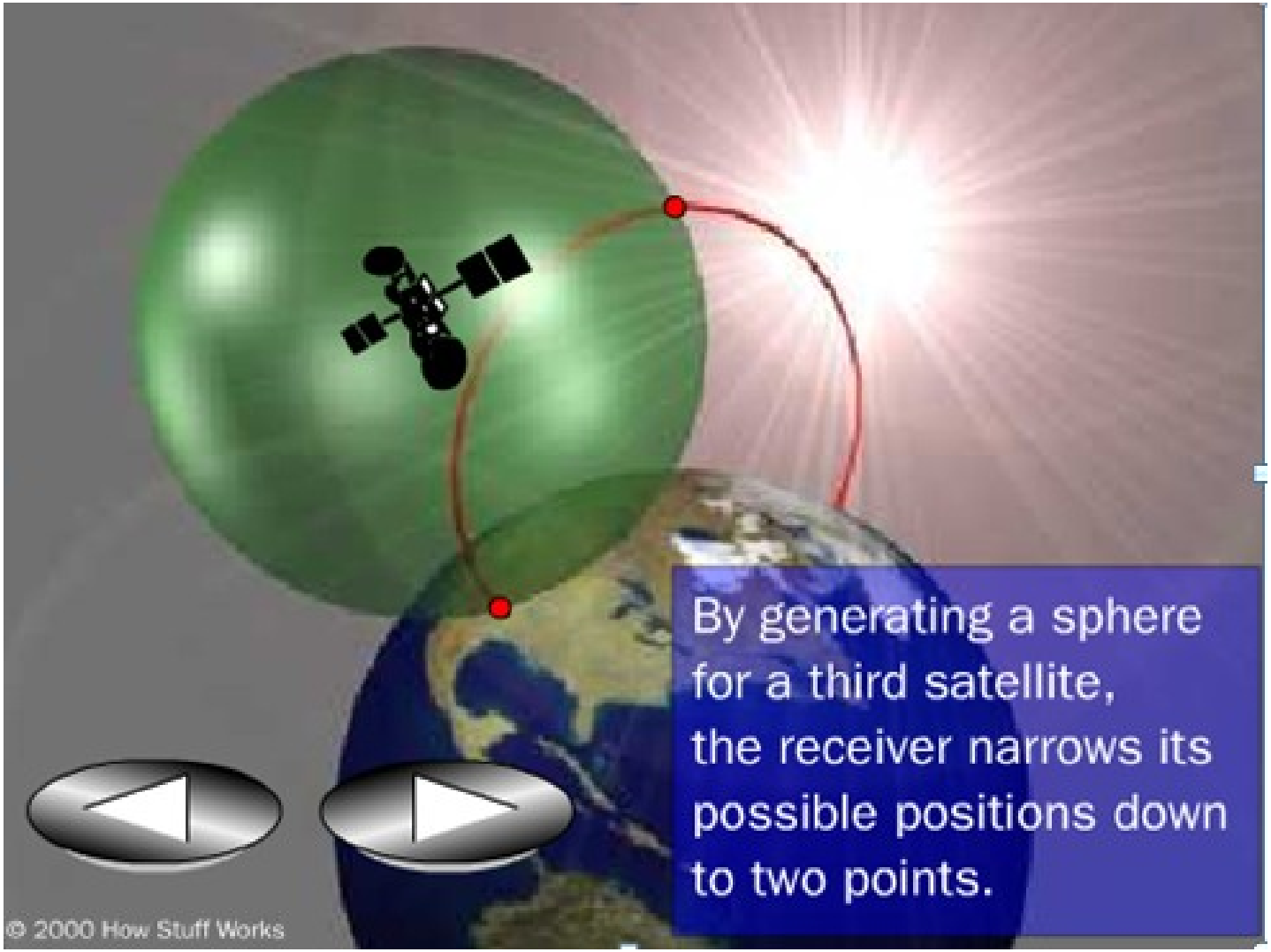
For a visual explanation visit: http://electronics.howstuffworks.com/gadgets/travel/gps.htm



# Location Services

## 3D-Trilateration

For a visual explanation visit: http://electronics.howstuffworks.com/gadgets/travel/gps.htm



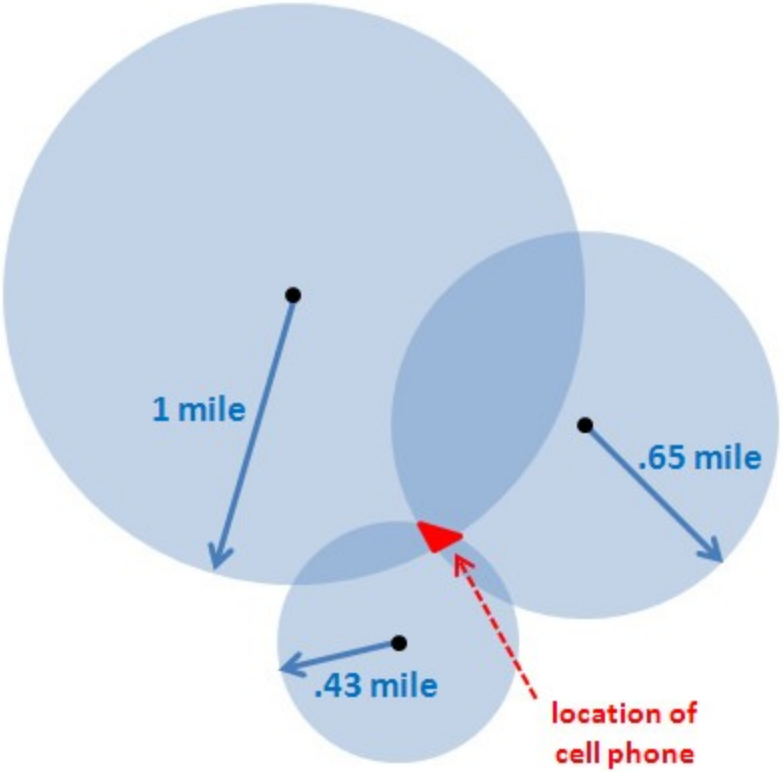
# Location Services

## Cell Tower Triangulation

An alternative method to determine the location of a cell phone is to estimate its distance to three nearby cell towers.

*Distance* of the phone to each antenna could be estimated based upon the *lag time* between the moment the tower sends a *ping* to the phone and receives the answering ping back.

Quite similar to the 2D-Trilateration Method.



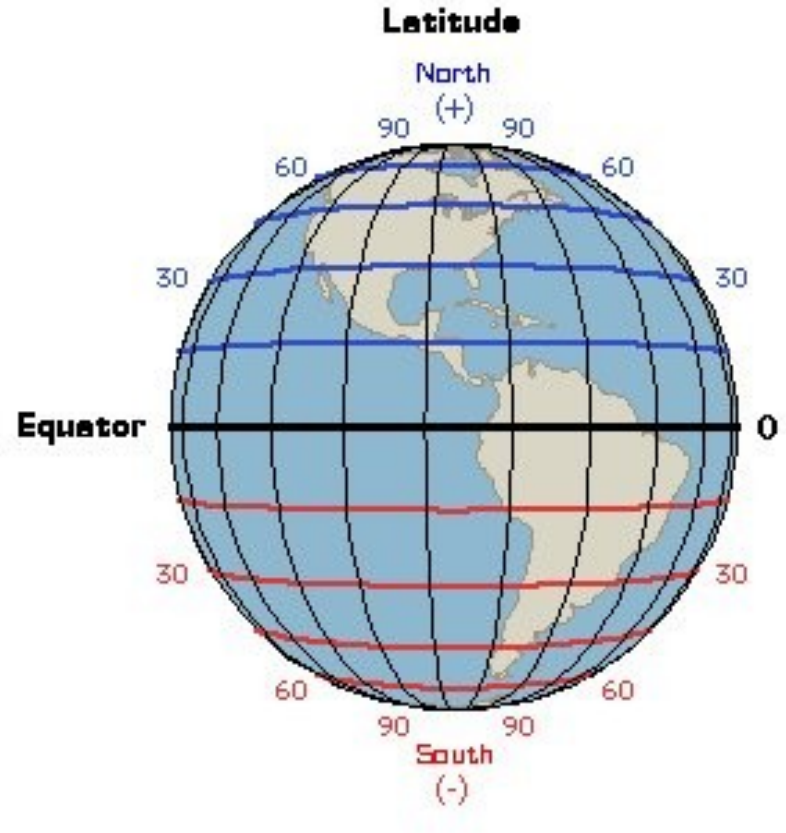

*Triangulation - cell phone detected within a certain radius of each of 3 cell towers – the area where each cell tower overlaps the phone is where it is pinpointed.*

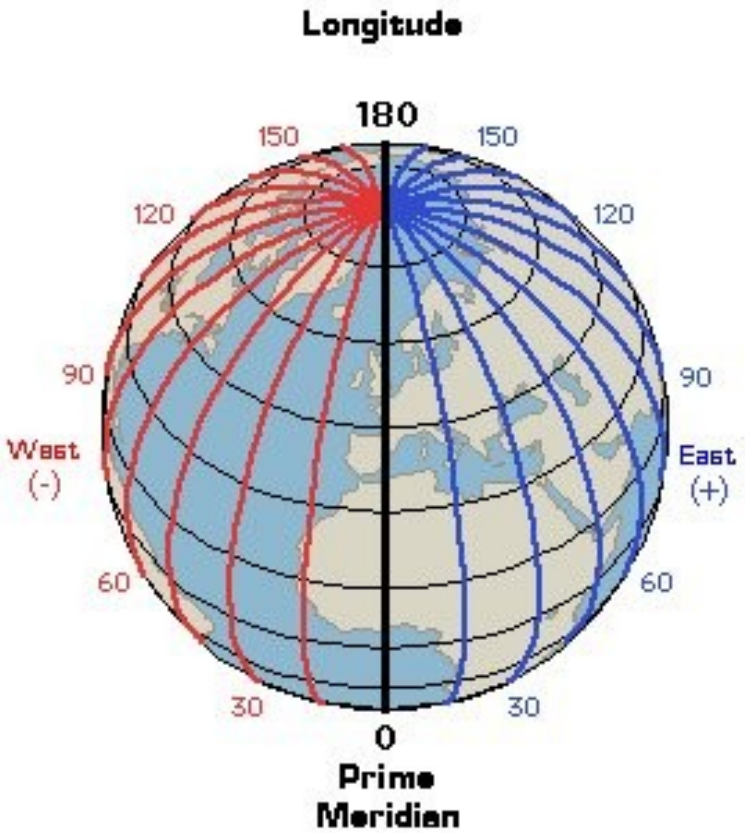
Reference: http://searchengineland.com/cell-phone-triangulation-accuracy-is-all-over-the-map-14790

# Location Services

## Latitude & Longitude

Latitude in GPS-Decimal notation: +90.00000 (North) to -90.000000 (South)
Longitude GPS-Decimal notation: +180.000000 (East) to -180.000000 (West)

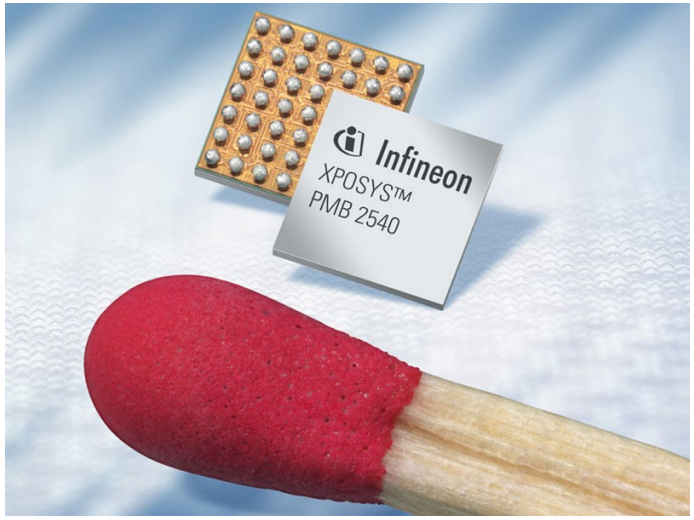


# Location Services

## Android Location Classes

The Android API provides Location data based on a variety of methods including: *Cell Tower Triangulation*, and most commonly *GPS chip readings*.




*GPS is the most common location provider on the Android based phones.*

It offers the most accuracy.

Picture: Epson Infineon GPS (2.8 x 2.9mm)

Reference: http://gizmodo.com/5152146/

# Location Services

## Android Location Classes

| | |
|---|---|
| **Address** | A class representing an Address, i.e, a set of strings describing a location. |
| **Criteria** | A class indicating the application criteria for selecting a location provider. |
| **Geocoder** | A class for handling geocoding. |
| **GpsSatellite** | This class represents the current state of a GPS satellite. |
| **GpsStatus** | This class represents the current state of the GPS engine. |
| **Location** | A class representing a geographic location sensed at a particular time (a "fix"). |
| **LocationManager** | This class provides access to the system location services. |
| **LocationProvider** | An abstract superclass for location providers |

# Location Services

## Android Location Interfaces

| | |
|---|---|
| **GpsStatus.Listener** | Used for receiving notifications when GPS status has changed. |
| **GpsStatus.NmeaListener** | Used for receiving NMEA sentences from the GPS. |
| **LocationListener** | Used for receiving notifications from the *LocationManager* when the location has changed. |

# Location Services

## Location Class

- A class representing a geographic location sensed at a particular time (a "fix").
- A location consists of a latitude and longitude, a UTC timestamp and *optionally* information on altitude, speed, and bearing.
- Information specific to a particular provider or class of providers may be communicated to the application using **getExtras**, which returns a Bundle of *key/value* pairs.
- Each provider will only provide those entries for which information is available.

| **CONSTANTS** | |
|---|---|
| Location.FORMAT_DEGREES | Constant used to specify formatting of a latitude or longitude in the form **[+-]DDD.DDDDD** where D indicates degrees. |
| Location.FORMAT_MINUTES | Constant used to specify formatting of a latitude or longitude in the form "**[+-]DDD:MM.MMMMM**" where D indicates degrees and M indicates minutes of arc (1 minute = 1/60th of a degree). |
| Location.FORMAT_SECONDS | Constant used to specify formatting of a latitude or longitude in the form "**[+-] DDD:MM:SS.SSSSS**" where D indicates degrees, M indicates minutes of arc, and S indicates seconds of arc (1 minute = 1/60th of a degree, 1 second = 1/3600th of a degree). |

# Location Services

## Location Class – Useful Methods

| | |
|---|---|
| static void | distanceBetween (double startLatitude, double startLongitude, double endLatitude, double endLongitude, float[] results)<br>Computes the approximate distance in meters between two locations, and optionally the initial and final bearings of the shortest path between them. |
| float | getAccuracy ()<br>Returns the accuracy of the fix in meters. |
| double | getAltitude ()<br>Returns the altitude of this fix. |
| float | getBearing ()<br>Returns the direction of travel in degrees East of true North. |
| Bundle | getExtras ()<br>Returns additional provider-specific information about the location fix as a Bundle. |
| double | getLatitude ()<br>Returns the latitude of this fix. |
| double | getLongitude ()<br>Returns the longitude of this fix. |
| String | getProvider ()<br>Returns the name of the provider that generated this fix, or null if it is not associated with a provider. |
| float | getSpeed ()<br>Returns the speed of the device over ground in meters/second. |
| long | getTime ()<br>Returns the UTC time of this fix, in milliseconds since January 1, 1970. |

# Location Services

## Location Manager

This class provides access to the system location services.

These services allow applications

1. To *obtain periodic updates of the device's geographical location*,

2. or to fire an application-specified **Intent** when the *device enters the proximity of a given geographical location*.

You do not instantiate this class directly; instead, retrieve it through

Context.getSystemService (Context.LOCATION_SERVICE)

# Location Services

## Location Manager – Useful Methods

| | |
|---|---|
| void | addProximityAlert (double latitude, double longitude, float radius, long expiration, PendingIntent intent)<br>Sets a proximity alert for the location given by the position (latitude, longitude) and the given radius. |
| String | getBestProvider (Criteria criteria, boolean enabledOnly)<br>Returns the name of the provider that best meets the given criteria. |
| GpsStatus | getGpsStatus (GpsStatus status)<br>Retrieves information about the current status of the GPS engine. |
| Location | getLastKnownLocation (String provider)<br>Returns a Location indicating the data from the last known location fix obtained from the given provider. |
| LocationProvider | getProvider (String name)<br>Returns information associated with the location provider of the given name, or null if no provider exists by that name. |
| List<String> | getProviders (Criteria criteria, boolean enabledOnly)<br>Returns a list of the names of LocationProviders that satisfy the given criteria, or null if none do. |
| void | requestLocationUpdates (String provider, long minTime, float minDistance, PendingIntent intent)<br>Registers the current activity to be notified periodically by the named provider. |
| void | requestLocationUpdates (String provider, long minTime, float minDistance, LocationListener listener)<br>Registers the current activity to be notified periodically by the named provider. |
| void | setTestProviderStatus (String provider, int status, Bundle extras, long updateTime)<br>Sets mock status values for the given provider. |

# Location Services

## LocationListener Class

Used for receiving notifications from the **LocationManager** when the *location has changed*.

These methods are called if the **LocationListener** has been *registered* with the location manager service using the method:

**requestLocationUpdates** (Provider, minTime, minDistance, LocationListener)

# Location Services

## LocationListener Class – Useful Methods

| | |
|---|---|
| abstract void | onLocationChanged (Location location)<br><br>Called when the location has changed. |
| abstract void | onProviderDisabled (String provider)<br><br>Called when the provider is disabled by the user. |
| abstract void | onProviderEnabled (String provider)<br><br>Called when the provider is enabled by the user. |
| abstract void | onStatusChanged (String provider, int status, Bundle extras)<br><br>Called when the provider status changes. |

# Location Services

## LocationProvider Class

**Constants**:

LocationProvider.AVAILABLE
LocationProvider.OUT_OF_SERVICE
LocationProvider.TEMPORARILY_UNAVAILABLE

| Public Methods | |
|---|---|
| abstract int | getAccuracy()<br>Returns a constant describing horizontal accuracy of this provider. |
| String | getName()<br>Returns the name of this provider. |
| abstract int | getPowerRequirement()<br>Returns the power requirement for this provider. |
| abstract boolean | hasMonetaryCost()<br>true if the use of this provider may result in a monetary charge to the user, false if use is free. |
| boolean | meetsCriteria(Criteria criteria)<br>Returns true if this provider meets the given criteria, false otherwise. |
| abstract boolean | requiresCell()<br>true access to a cellular network (to make use of cell tower IDs) is needed, false otherwise. |
| abstract boolean | requiresNetwork()<br>true if the provider requires access to a data network (e.g., the Internet), false otherwise. |
| abstract boolean | requiresSatellite()<br>true if access to a satellite-based positioning system (e.g., GPS) is needed, false otherwise. |
| abstract boolean | supportsAltitude()<br>Returns true if the provider is able to provide altitude information, false otherwise. |
| abstract boolean | supportsBearing()<br>Returns true if the provider is able to provide bearing information, false otherwise. |
| abstract boolean | supportsSpeed()<br>Returns true if the provider is able to provide speed information, false otherwise. |

# Location Services

## LocationProvider Class

An *abstract superclass* for location providers.

A location provider *supplies periodic reports on the geographical location of the device.*

Each provider has a set of criteria under which it may be used; for example,
some providers require GPS hardware and visibility to a number of satellites;
others require the use of the cellular radio,
or access to a specific carrier's network,
or access to the internet.

They may also have *different battery consumption* characteristics or *monetary costs* to the user.

The **Criteria** class allows providers to be selected based on user-specified criteria.

# Location Services

## Example – Obtain Location Coordinates

In this example we request **GPS** services and display *latitude* and *longitude* values on the UI. Additionally we deliver an SMS with this information.

### Notes

1. Observe the *GPS chip is not a synchronous device* that will immediately respond to a "*give me a GPS reading*" call.

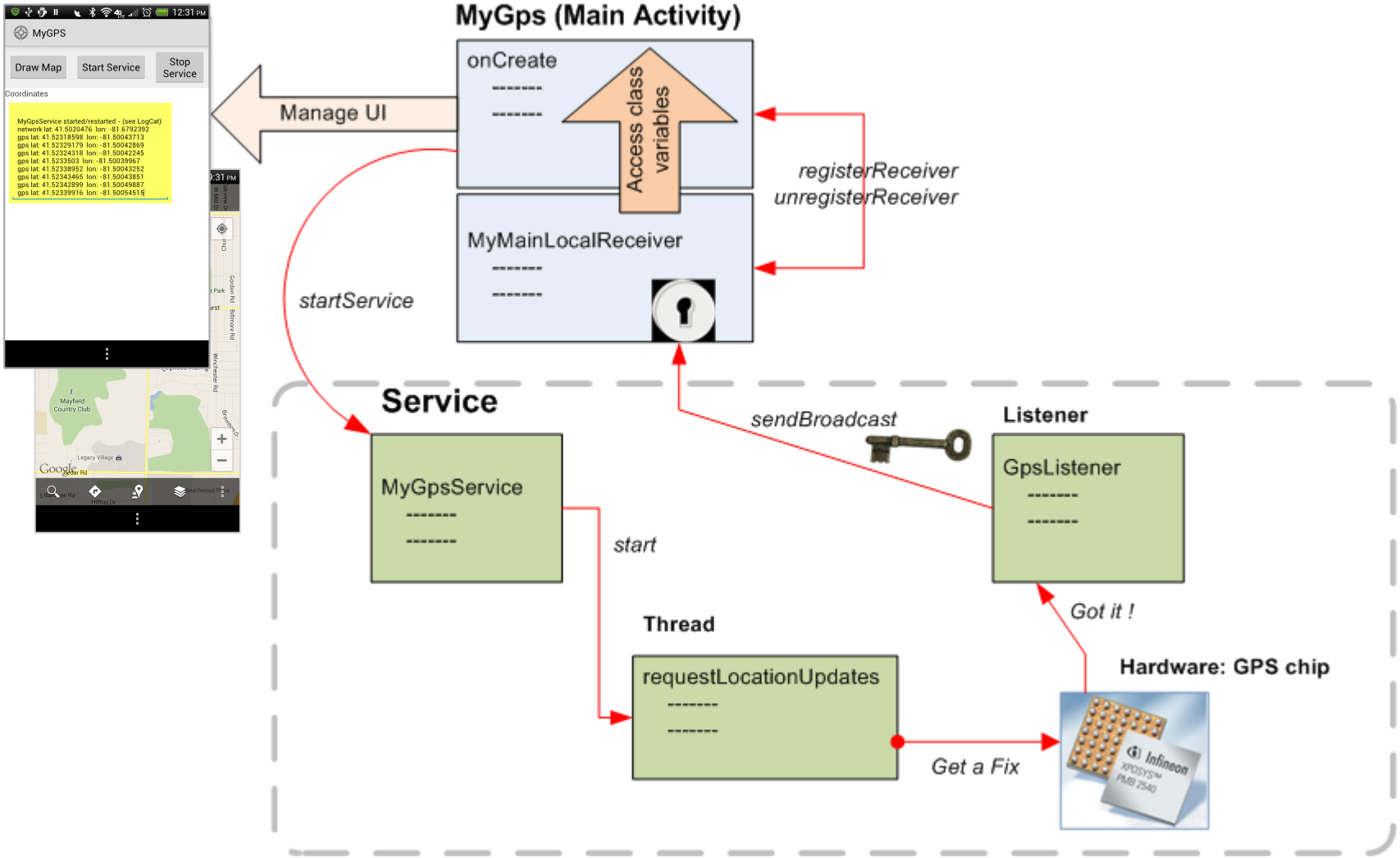
1. In order to engineer a **good solution** that takes into account the potential delays in obtaining location data we place the UI in the main activity and the request for location call in a background service.

2. Remember the service runs in the same process space as the main activity, therefore for the sake of responsiveness we must place the logic for location data request in a separate parallel **thread**.

3. A thread (unlike an Activity) **needs** the presence of a **Looper** control to manage IPC message sending. This implies and additional *Looper.prepare* and *Looper.loop* methods surrounding the *locationUpdate* method.

# Location Services

## Example – Obtain Location from GPS



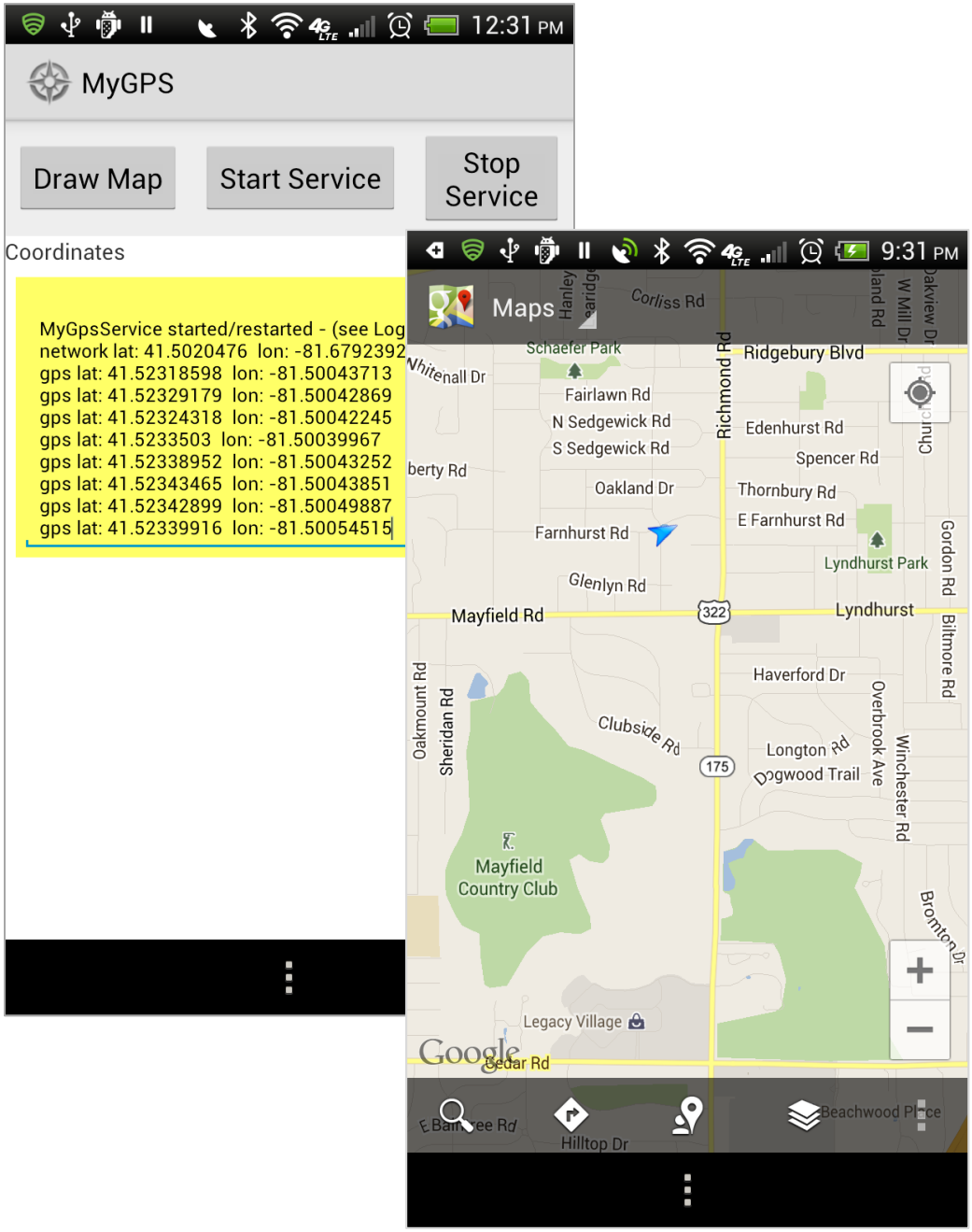
# Location Services

## Example.

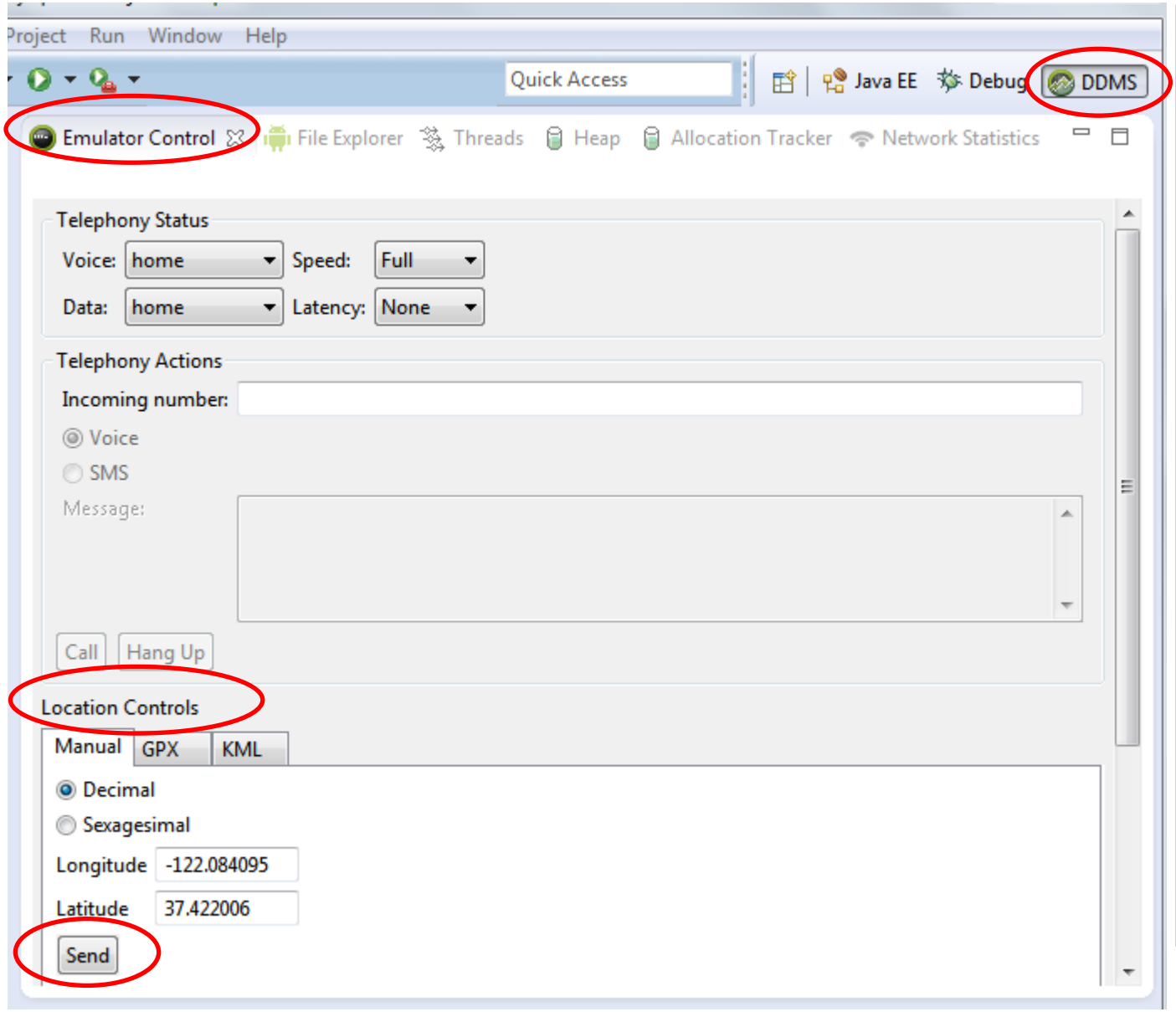
## Obtaining & Mapping a Location Using Its Coordinates

In this example we create a background service to gather location data from various sources (Network, GPS chip, wi-fi, …)

The user may invoke an Intent to show a Google Map depicting the location



# Example – Mapping and Sharing a Location.




## GPS Emulation

Use the **DDMS** > **Emulator Control** panel to enter test data reflecting *Latitude* and *Longitude*.

Select emulator 5554.

On panel "**Location Controls**" enter coordinates.

Press the '**Send**' button to transmit the data.

# Location Services

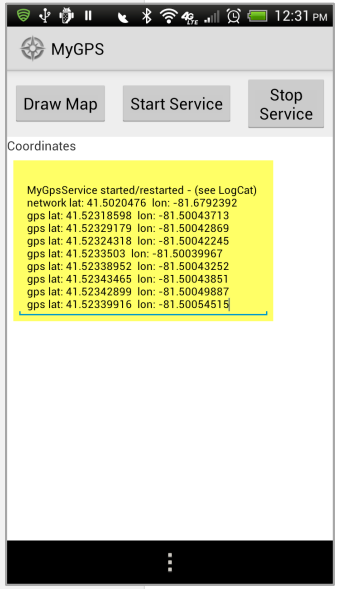
## Example – Obtain Location Coordinates – Layout 1 of 2

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

    <LinearLayout
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:background="#ffeeeeee" >

        <Button
            android:id="@+id/btnDrawMap"
            android:layout_width="wrap_content"
            android:layout_height="wrap_content"
            android:layout_gravity="center"
            android:layout_margin="6dp"
            android:text="Draw Map" />

        <Button
            android:id="@+id/btnStartService"
            android:layout_width="wrap_content"
            android:layout_height="wrap_content"
            android:layout_gravity="center"
            android:layout_margin="6dp"
            android:text="Start Service" />
```



# Location Services

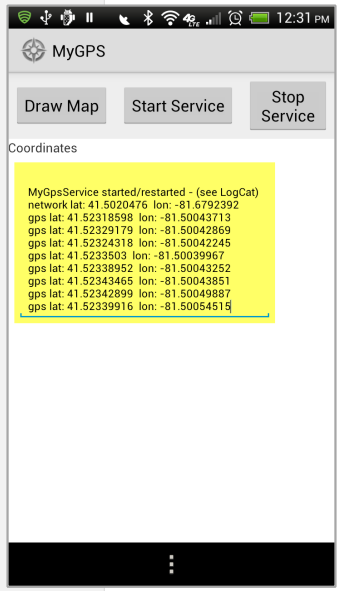
## Example – Obtain Location Coordinates – Layout 2 of 3

```
        <Button
            android:id="@+id/btnStopService"
            android:layout_width="wrap_content"
            android:layout_height="wrap_content"
            android:layout_gravity="center"
            android:layout_margin="6dp"
            android:text="Stop Service" />
    </LinearLayout>

    <TextView
        android:id="@+id/txtTopLine"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:text="Coordinates"
        android:textAppearance="?android:attr/textAppearanceSmall" />

    <ScrollView
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:layout_margin="7dp"
        android:background="#ffffff66" >

        <LinearLayout
            android:layout_width="match_parent"
            android:layout_height="wrap_content" >
```



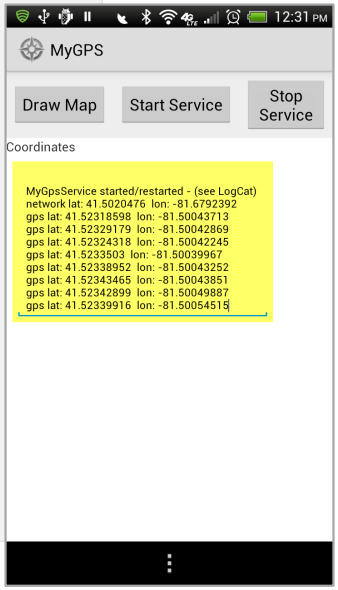
# Location Services

## Example – Obtain Location Coordinates – Layout 3 of 3

```
            <TextView
                android:id="@+id/txtMsg"
                android:layout_width="0dip"
                android:layout_height="wrap_content"
                android:layout_margin="3dp"
                android:textSize="12sp" />
        </LinearLayout>

    </ScrollView>

</LinearLayout>
```



# Location Services

## Example – Obtain Location Coordinates - Manifest

```
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
    package="cis493.mappinggps"
    android:versionCode="1"    android:versionName="1.0" >
    <uses-sdk android:minSdkVersion="8" />
    <uses-permission android:name="android.permission.INTERNET" />
    <uses-permission android:name="android.permission.ACCESS_FINE_LOCATION" />
    <application
        android:icon="@drawable/ic_menu_compass"
        android:label="@string/app_name"
        android:theme="@android:style/Theme.Holo.Light" >
        <activity
            android:name=".MyGPS"
            android:configChanges="orientation"
            android:label="@string/app_name"
            android:screenOrientation="portrait" >
            <intent-filter>
                <action android:name="android.intent.action.MAIN" />
                <category android:name="android.intent.category.LAUNCHER" />
            </intent-filter>
        </activity>
        <service android:name="MyGpsService" >
        </service>
    </application>
</manifest>
```

# Location Services

## Example – Obtain Coordinates - Main Activity: MyGps 1

```
// Request GPS location, show lat & long, optionally draw a map
package cis493.mappinggps;
import . . .

public class MyGPS extends Activity implements OnClickListener {
    TextView txtMsg;
    Button btnStopService;
    Button btnDrawGoogleMap;
    TextView txtTopMsg;

    ComponentName service;
    Intent intentMyService;
    BroadcastReceiver receiver;
    String GPS_FILTER = "cis470.action.GPS_LOCATION";
    double latitude;
    double longitude;
    String provider;

    @Override
    public void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.main);

        txtMsg = (TextView) findViewById(R.id.txtMsg);
        txtTopMsg = (TextView) findViewById(R.id.txtTopLine);
        findViewById(R.id.btnStopService).setOnClickListener(this);
        findViewById(R.id.btnStartService).setOnClickListener(this);
        findViewById(R.id.btnDrawMap).setOnClickListener(this);
```

# Location Services

## Example – Obtain Coordinates - Main Activity: MyGps 2

```
        getMyLocationServiceStarted();

      // register & define filter for local listener
        IntentFilter myLocationFilter = new IntentFilter(GPS_FILTER);
      receiver = new MyMainLocalReceiver();
      registerReceiver(receiver, myLocationFilter);
    }//onCreate
    // ////////////////////////////////////////////////////////////////
    public void getMyLocationServiceStarted(){
        // get background service started
        txtMsg.append("\nMyGpsService started/restarted - (see LogCat)");
        intentMyService = new Intent(this, MyGpsService.class);
        service = startService(intentMyService);
    }
    ////////////////////////////////////////////////////////////////////
    @Override
  protected void onDestroy() {
      super.onDestroy();
      try {
         stopService(intentMyService);
         unregisterReceiver(receiver);
      } catch (Exception e) {
         Log.e ("MAIN-DESTROY>>>", e.getMessage() );
      }
      Log.e ("MAIN-DESTROY>>>" , "Adios" );
  }// onDestroy
```

# Location Services

## Example – Obtain Coordinates - Main Activity: MyGps 3

```
// local RECEIVER
private class MyMainLocalReceiver extends BroadcastReceiver {
   @Override
   public void onReceive(Context localContext, Intent intentFilteredResponse) {
      latitude = intentFilteredResponse.getDoubleExtra("latitude",-1);
      longitude = intentFilteredResponse.getDoubleExtra("longitude",-1);
       provider = intentFilteredResponse.getStringExtra("provider");

      Log.e ("MAIN>>>",  Double.toString(latitude));
      Log.e ("MAIN>>>",  Double.toString(longitude));
      Log.e ("MAIN>>>",  provider);

      String msg = provider
              + " lat: " + Double.toString(latitude) + " "
                 + " lon: " + Double.toString(longitude);

      txtMsg.append("\n" + msg);

   }
}//MyMainLocalReceiver
```

# Location Services

## Example – Obtain Coordinates - Main Activity: MyGps 4

```
   public void drawGoogleMap(double latitude, double longitude){

//    // this looks good on a big screen
//    String myGeoCode = "https://maps.google.com/maps?q="
//                + latitude
//                + ","
//                + longitude
//                + "(You are here!)&iwloc=A&hl=en";

      // this looks better on a small screen
      String myGeoCode = "geo:" + latitude
                    + "," + longitude
                    + "?z=15";

      Intent intentViewMap = new Intent(Intent.ACTION_VIEW,
              Uri.parse(myGeoCode));

      startActivity(intentViewMap);
   }
```

## Example – Obtain Coordinates - Main Activity: MyGps 5

```
    @Override
    public void onClick(View v) {
       // stop service
       if ( v.getId() == R.id.btnStopService ) {
          try {
             stopService(new Intent(intentMyService) );
             txtMsg.setText("After stopping Service: " +
                           service.getClassName());
             btnStopService.setText("Finished");
             btnStopService.setClickable(false);
          } catch (Exception e) {
             e.printStackTrace();
          }
       // draw a Google map with given coordinates
       } else if (v.getId() == R.id.btnDrawMap ){
          drawGoogleMap(latitude, longitude);
       // re-start service
       }  else if (v.getId() == R.id.btnStartService ){
          getMyLocationServiceStarted();
       }

    }

}//MyGPS
```

# Example – Obtain Coordinates – MyGpsService 1

```
// This is the GPS service. Requests location updates
// in a parallel thread. sends broadcast using filter.

package cis493.mappinggps;
Import . . .
public class MyGpsService extends Service {

   String GPS_FILTER = "cis470.action.GPS_LOCATION";
   Thread serviceThread;
   LocationManager lm;
   GPSListener myLocationListener;
   boolean isRunning = true;

   @Override
   public IBinder onBind(Intent arg0) {
      return null;
   }

   @Override
   public void onCreate() {
      super.onCreate();
   }
```

# Example – Obtain Coordinates – MyGpsService 2

```
@Override
public void onStart(Intent intent, int startId) {

   Log.e("<<MyGpsService-onStart>>", "I am alive-GPS!");

   // we place the slow work of the service in a back thread
   serviceThread = new Thread(new Runnable() {
      public void run() {
         getGPSFix_Version1(); // coarse: network based
         getGPSFix_Version2(); // fine: gps-chip based
      }// run
   });

   serviceThread.start();      // get the thread going

}// onStart
```

# Location Services

## Example – Obtain Coordinates – MyGpsService



```
public void getGPSFix_Version1() {
      // Get a location as soon as possible
       LocationManager locationManager = (LocationManager)
                                    getSystemService(Context.LOCATION_SERVICE);
       // work with best available provider
       Criteria criteria = new Criteria();
       String provider = locationManager.getBestProvider(criteria, false);
       Location location = locationManager.getLastKnownLocation(provider);

       if ( location != null ){
         // capture location data sent by current provider
         double latitude = location.getLatitude();
         double longitude = location.getLongitude();

         // assemble data bundle to be broadcasted
         Intent intentFilteredResponse = new Intent(GPS_FILTER);
         intentFilteredResponse.putExtra("latitude", latitude);
         intentFilteredResponse.putExtra("longitude", longitude);
         intentFilteredResponse.putExtra("provider", provider);
         Log.e(">>GPS_Service<<", provider + " =>Lat:" + latitude
              + " lon:" + longitude);

         // send the location data out
         sendBroadcast(intentFilteredResponse);
       }
}
```

# Example – Obtain Coordinates – MyGpsService



```
public void getGPSFix_Version2() {
   try {
      // using: GPS_PROVIDER
      // more accuracy but needs to see the sky for satellite fixing
      Looper.prepare();
      lm = (LocationManager) getSystemService(Context.LOCATION_SERVICE);

      // This listener will catch and disseminate location updates
      myLocationListener = new GPSListener();

      // define update frequency for GPS readings
      long minTime = 0; // best time: 5*60*1000 (5min)
      float minDistance = 5; // 5 meters

      // request GPS updates
      lm.requestLocationUpdates(LocationManager.GPS_PROVIDER,
                                minTime,
                                minDistance,
                                myLocationListener);
      Looper.loop();

   } catch (Exception e) {
      e.printStackTrace();
   }

}
```

# Example – Obtain Coordinates – MyGpsService



```
@Override
public void onDestroy() {
   super.onDestroy();
   Log.e("<<MyGpsService-onDestroy>>", "I am dead-GPS");
   try {
      lm.removeUpdates(myLocationListener);
      isRunning = false;
   } catch (Exception e) {
      Toast.makeText(getApplicationContext(), e.getMessage(), 1).show();
   }
}// onDestroy

// /////////////////////////////////////////////////////////////////
private class GPSListener implements LocationListener {
   public void onLocationChanged(Location location) {
      // capture location data sent by current provider
      double latitude = location.getLatitude();
      double longitude = location.getLongitude();
      // assemble data bundle to be broadcasted
      Intent myFilteredResponse = new Intent(GPS_FILTER);
      myFilteredResponse.putExtra("latitude", latitude);
      myFilteredResponse.putExtra("longitude", longitude);
      myFilteredResponse.putExtra("provider", location.getProvider());
      Log.e(">>GPS_Service<<", "Lat:" + latitude + " lon:" + longitude);
      // send the location data out
      sendBroadcast(myFilteredResponse);
   }
```

## Example – Obtain Coordinates – MyGpsService 5

```
      public void onProviderDisabled(String provider) {

      }

      public void onProviderEnabled(String provider) {

      }

      public void onStatusChanged(String provider, int status, Bundle extras) {

      }
   };// GPSListener class



}// MyGpsService
```

# Location Services

**JARGON:**

**Bearing**

is the angle (East-ward) between a line connecting two points (source, destination) and a north-south line, or *meridian.*

## NMEA (National Marine Electronics Association)

The NMEA 2000 standard contains the requirements for the minimum implementation of a serial-data communications network to interconnect marine electronic equipment onboard vessels. Equipment designed to this standard will have the ability to share data, including commands and status, with other compatible equipment over a single signaling channel.
Reference: http://www.nmea.org/content/nmea_standards/white_papers.asp

## UTC - Coordinated Universal Time

Is a time standard based on *International Atomic Time* (TAI) with leap seconds added at irregular intervals to compensate for the Earth's slowing rotation.
Visit: http://www.time.gov/timezone.cgi?Eastern/d/-5/java

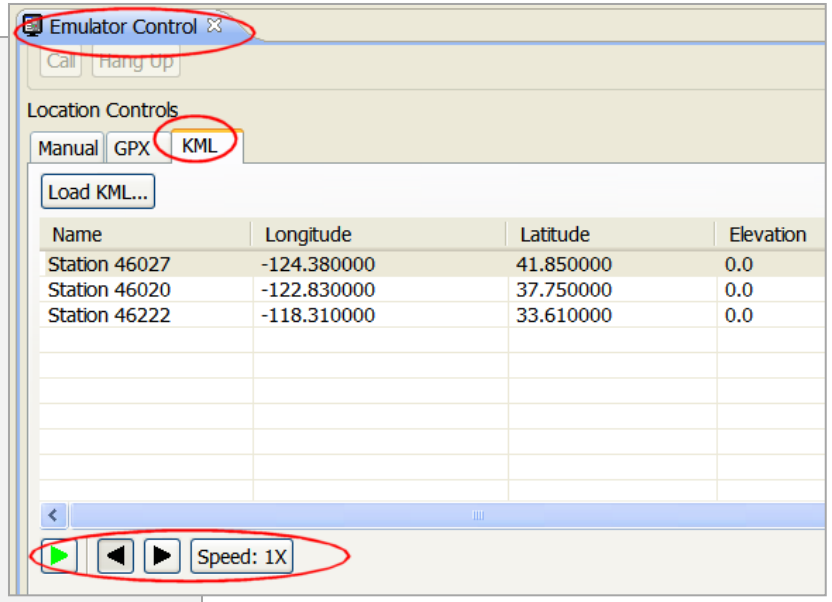
# Location Services

**Keyhole Markup Language**

Use Eclipse's **DDMS** > **Emulator Control** > **KML** tab to provide location data to your emulator using a KML file.

**Example:** File *my_location_data.kml* contains the following set of placemarks

```
<?xml version="1.0" encoding="UTF-8"?>
<kml xmlns="http://earth.google.com/kml/2.2">
<Placemark>
        <name>Station 46027</name>
        <description>Off the coast of Lake Earl</description>
        <Point>
        <coordinates>-124.38,41.85,0</coordinates>
        </Point>
</Placemark>
<Placemark>
        <name>Station 46020</name>
        <description>Outside the Golden Gate</description>
        <Point>
        <coordinates>-122.83,37.75,0</coordinates>
        </Point>
</Placemark>
<Placemark>
        <name>Station 46222</name>
        <description>San Pedro Channel</description>
        <Point>
        <coordinates>-118.31,33.61,0</coordinates>
        </Point>
</Placemark>
</kml>
```




Example taken from:
Unlocking Android by F. Ableson et al.
Manning Publications 2009,
ISBN 978-1-933988-67-

# Location Services

## Appendix: Skyhook Location Services

(Excerpts taken from www.skyhookwireless.com)

Skyhook's Core Engine is a software-only location system that quickly determines device location with 10 to 20 meter accuracy.

A mobile device with Skyhook's Core Engine collects raw data from each of the location sources (GPS, towers, wi-fi).

The Skyhook client then sends this data to the Location Server and a single location estimate is returned.

The client is optimized so that it communicates with the Location Server only when the location cannot be determined locally.

This behavior minimizes the user's data cost while maximizing battery life

# Location Services

**Appendix: Skyhook Location Services**

www.skyhookwireless.com

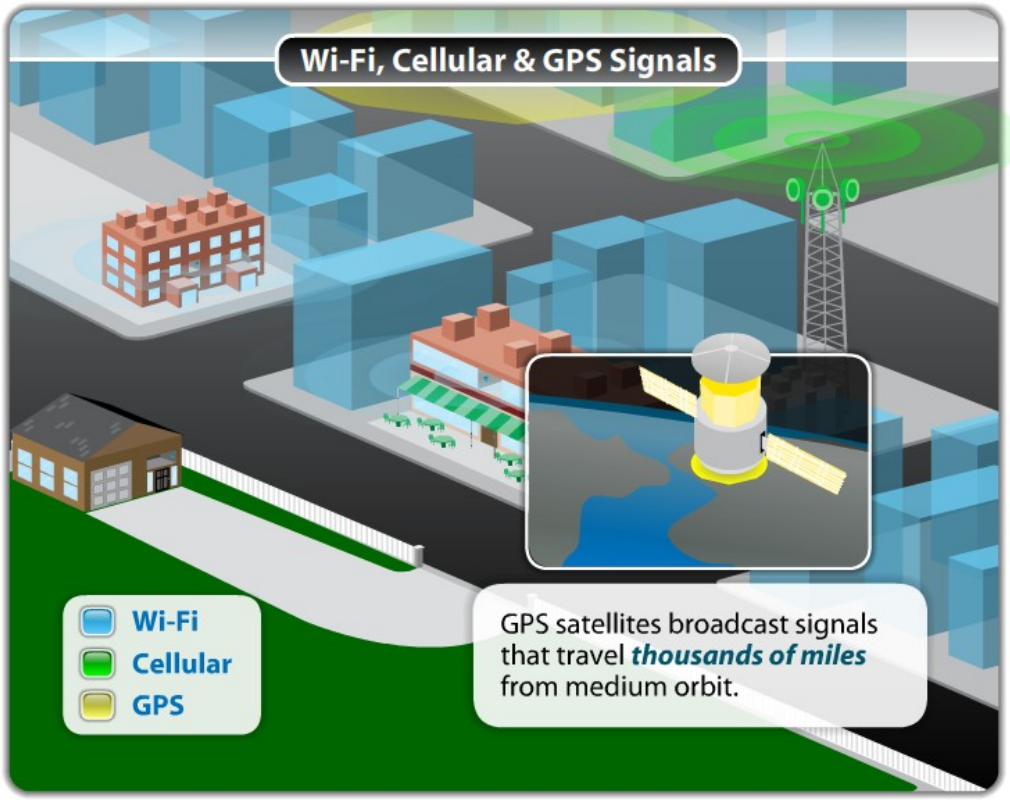
"Skyhook's is a software-only location system that determines device location with 10 to 20 meter accuracy."

Skyhook's raw data comes from :

- **Wi-Fi access points,**
- GPS satellites and
- cell towers

Supported platforms include:

- Android
- Linux
- Mac OS X
- Windows



# Location Services

**Appendix: Skyhook Location Services** www.skyhookwireless.com

**PROS:**

- Promises to work well in confined physical spaces (such as very developed urban areas)
- Better battery life (no need for constant GPS-chip readings)

**CONS:**

- Poor documentation available (Dec 2012)
- Unreliable at times (you may get very inaccurate fixes, or none at all)
- Not appropriate for rural areas, current coverage focuses mostly on USA and European cities.
- Vulnerable to spoofing location attacks (the attacker could convince the device to be in a false location. See http://www.syssec.ch/press/location-spoofing-attacks-on-the-iphone-and-ipod )

# Location Services

**Appendix: Skyhook Location Services** www.skyhookwireless.com

**Coverage Area** (Dec 2012)