COMP-304
Fall 2018

Review of Lecture 7

- **Content Providers**
  - A **data** store that applications can query, edit, add, and delete.
  - The data can be stored in a **database**, in **files**, or even over a **network**

The format of the query URI is as follows:

<standard_prefix>://<authority>/<data_path>/<id>

content://contacts/people/2

- Creating a Content Provider
  - Create a class that extends the **ContentProvider**
  - Override methods:
    - query
    - getType()
    - insert
    - delete
    - update
    - onCreate
- You can use an SQLite database or other APIs.

Review of Lecture 7

- Use an **UriMatcher** object to parse the content URI that is passed to the content provider through a **ContentResolver**
- **Register your content provider** with Android:
  - modify the AndroidManifest.xml file by adding the <**provider**> element

- **Using the Content Provider**
  - Create and populate ContentValues object
  - Call ContentProvider methods on ContentResolver object:

Uri uri = getContentResolver().**insert**(
Uri.*parse(*
“**content://net.learn2develop.provider.Books/books**”**),**
values);

Location-Based Services

Objectives:

- Develop Android Apps with GPS and Maps capabilities
  - Displaying **Google Maps** in your Android application
  - Displaying **zoom controls** on the map
- Use GPS Features in Your Applications for finding your location, locating your emulator, geocoding locations, mapping locations, mapping intents, mapping views
  - Switching between the **different map views**
  - Retrieving the **address location** touched on the map
  - Performing **geocoding** and **reverse geocoding**

Displaying Maps

- Google Maps is one of the many applications bundled with the Android platform
- You can **embed a map** into your own applications and use it for different purposes
- A Map component in an app.

- A **SupportMapFragment** is the simplest way to place a map in an application.
- It's a wrapper around a view of a map to automatically handle the necessary life cycle needs

Displaying Maps

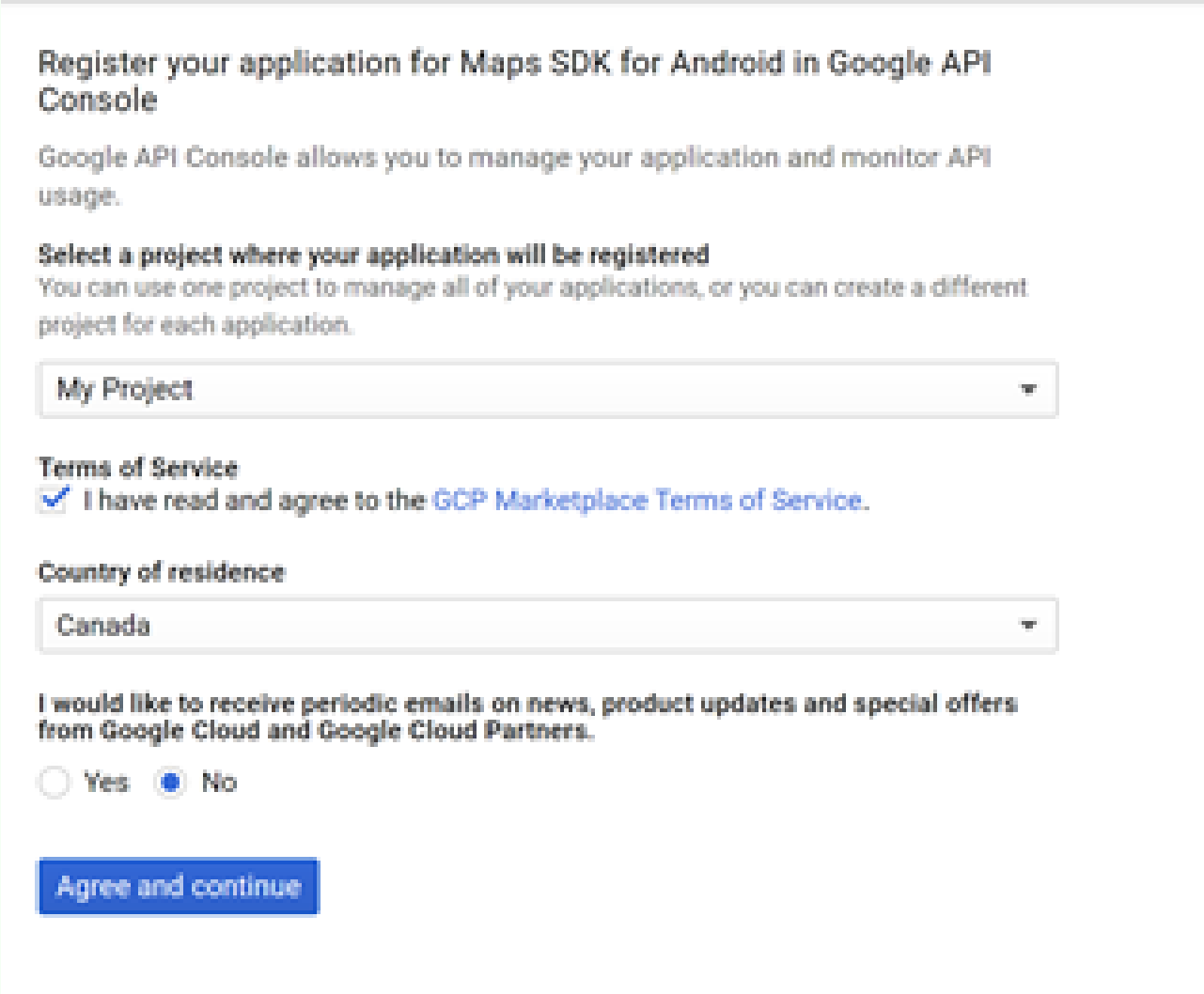
- The steps:
  1. Install and/or update the **Google Play services SDK**

  1. Create a **Google Maps project**
     - **It creates** google_maps_api.xml file
  2. Get a **Google Maps API key**

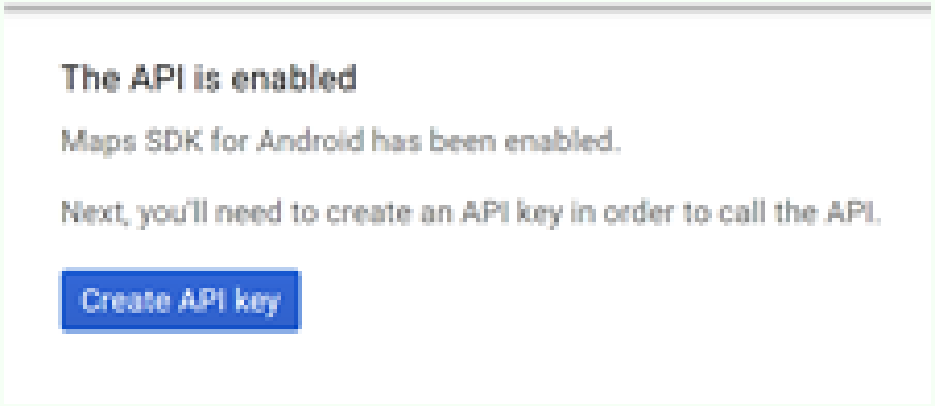
Getting a Maps API Key

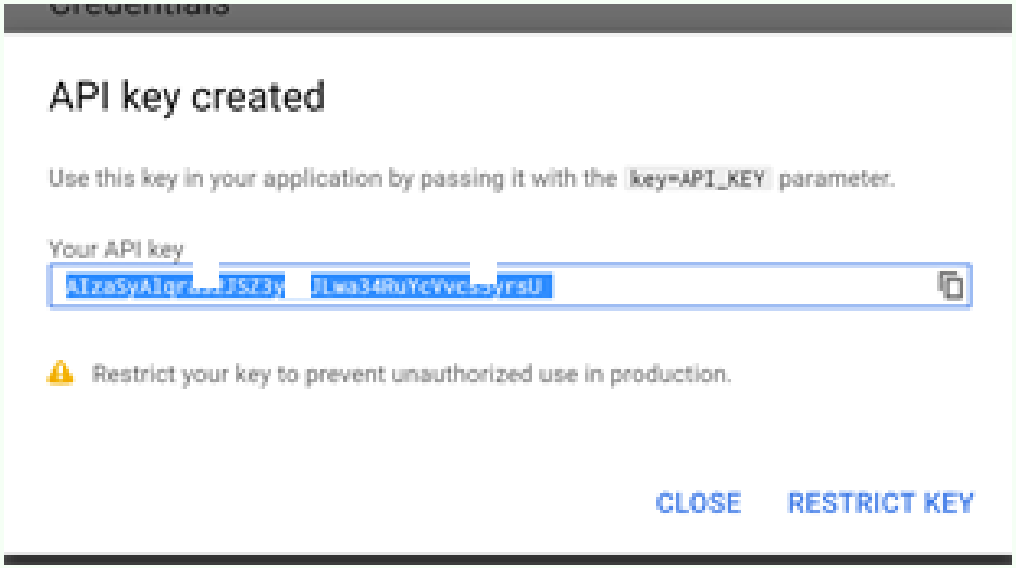
- Use the link provided in the google_maps_api.xml file that Android Studio created for you:
  - Copy the link provided in the google_maps_api.xml file and paste it into your browser.
  - The link takes you to the Google Cloud Platform Console and supplies the required information to the Google Cloud Platform Console via URL parameters, thus reducing the manual input required from you.
- Follow the instructions to **create a new project** on the Google Cloud Platform Console **or select an existing project**.

Getting a Maps API Key



Getting a Maps API Key





Adding the API Key to your application

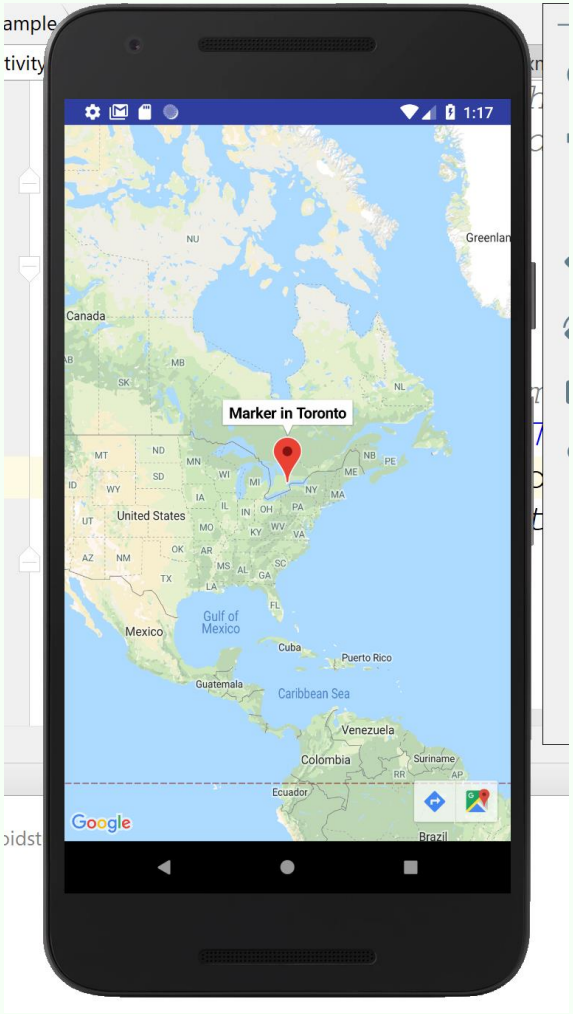
- **To add the key to your application:**
  - In AndroidManifest.xml, add the following element as a child of the <application> element, by inserting it just before the closing tag </application>:

```
<meta-data
    android:name="com.google.android.geo.API_KEY"
    android:value="API_KEY"/>
```

    substituting your API key for *API_KEY*.
  - This element sets the key com.google.android.geo.API_KEY to the value *API_KEY* and makes the API key visible to any **MapFragment** in your application.

Running the app

- Change the Latitude, Longitude to Toronto values
- Run the app



Adding built-in zoom control

- To add a parameter to activity_maps.xml that sets the **uiZoomControls to true**:

```
<fragment xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:map="http://schemas.android.com/apk/res-auto"
    xmlns:tools="http://schemas.android.com/tools"
    android:id="@+id/map"
    android:name="com.google.android.gms.maps.SupportMapFragment“
    map:uiZoomControls="true“
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    tools:context=".MapsActivity" />
```

- You can also programmatically zoom in or out of the map using the animateCamera() method of the **GoogleMap** class.

Programmatically zoom in or out

```
public boolean onKeyDown(int keyCode, KeyEvent event) {
    switch (keyCode) {
        case KeyEvent.KEYCODE_3:
            mMap.animateCamera(CameraUpdateFactory.zoomIn());
            break;
        case KeyEvent.KEYCODE_1:
            mMap.animateCamera(CameraUpdateFactory.zoomOut());
            break;
    }
    return super.onKeyDown(keyCode, event);
}
```

Changing Views

- By default, Google Maps is displayed in ***map view***, which is basically drawings of streets and places of interest.
- You can also set Google Maps to display in ***satellite view*** using the setMapType() method of the **GoogleMap** class:

```
    public void onMapReady(GoogleMap googleMap) {
        mMap = googleMap;

        // Add a marker in Sydney and move the camera
        LatLng sydney = new LatLng(-34, 151);
        mMap.addMarker(new MarkerOptions().position(sydney).title(
"Marker in Sydney"));

          mMap.moveCamera(CameraUpdateFactory.newLatLng(sydney));
          mMap.setMapType(GoogleMap.MAP_TYPE_SATELLITE);
      }
```

Getting the Location That Was Touched

- To get the latitude and longitude of a point on the Google Map that was touched, you must set a onMapClickListener:

```
mMap.setOnMapClickListener(new GoogleMap.OnMapClickListener()
{
@Override
public void onMapClick(LatLng point) {
Log.d("DEBUG","Map clicked [" + point.latitude +
" / " + point.longitude + "]");
}
});
}
```

Reverse Geocoding

- Google Maps in Android supports **reverse geocoding** via the **Geocoder** class.
- The following code snippet shows how you can **retrieve the address of a location just touched** using the getFromLocation() method:

```
Geocoder geoCoder = new Geocoder(getBaseContext(), Locale.getDefault());
try {
List<Address> addresses = geoCoder.getFromLocation(point.latitude,point.longitude,1);
String add = "";
if (addresses.size() > 0)
{
for (int i=0; i<addresses.get(0).getMaxAddressLineIndex();i++)
add += addresses.get(0).getAddressLine(i) + "\n";
}
Toast.makeText(getBaseContext(), add, Toast.LENGTH_SHORT).show();
}
catch (IOException e) { e.printStackTrace();}
}
```

Geocoding

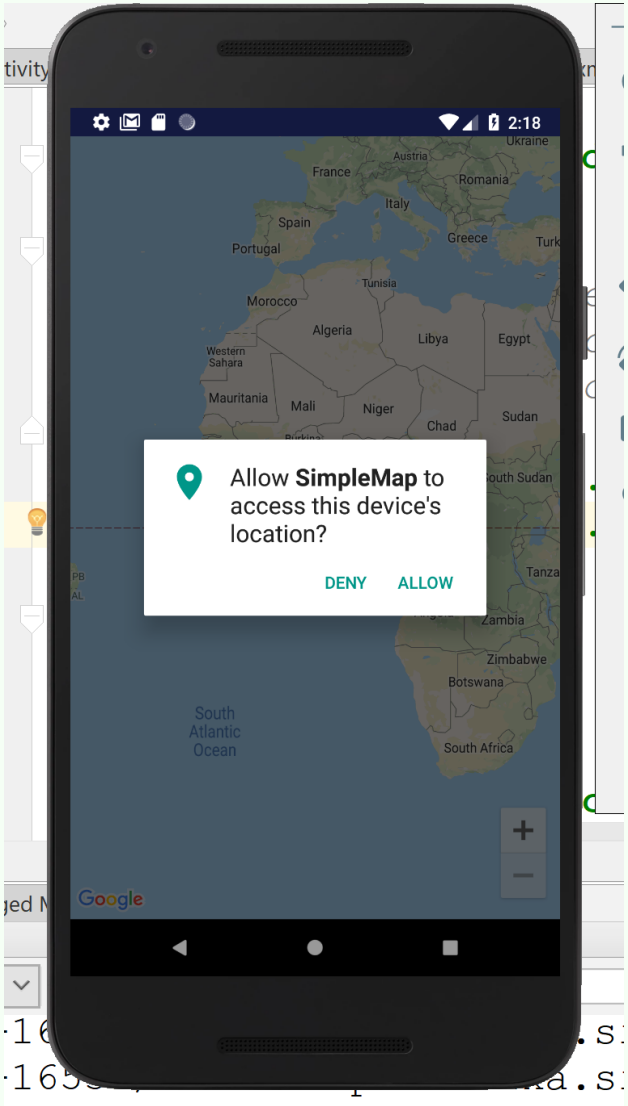
- If you know the address of a location but want to know its **latitude and longitude**, you can do so via **geocoding**.
  - You can use the Geocoder class for this purpose.
- The following code shows how you can find the exact location of the Empire State Building by using the getFromLocationName() method:

```
Geocoder geoCoder = new Geocoder(getBaseContext(), Locale.getDefault());
try {
List<Address> addresses = geoCoder.getFromLocationName("empire state building", 5);
if (addresses.size() > 0) {
LatLng p = new LatLng((int) (addresses.get(0).getLatitude()),
(int) (addresses.get(0).getLongitude()));
mMap.moveCamera(CameraUpdateFactory.newLatLng(p));
}
} catch (IOException e) {e.printStackTrace();}
```

Getting Location Data

- Mobile devices are commonly equipped with **GPS receivers**.
- Because of the many satellites orbiting the earth, you can **use a GPS receiver to find your location easily**.
- However, GPS requires a clear sky to work and hence **does not always work indoors** or where satellites can't penetrate (such as a tunnel through a mountain).
- Another effective way to locate your position is through *cell tower triangulation*.
  - When a mobile phone is switched on, it is constantly in contact with base stations surrounding it.
  - By knowing the **identity of cell towers, it is possible to translate this information into a physical location** through the use of various databases containing the cell towers' identities and their exact geographical locations.

Getting Location Data



Getting Location Data

- In Android, location-based services are provided by the **LocationManager** class, located in the **android.location** package.
- Using the LocationManager class, your application can:
  - obtain **periodic updates** of the device's geographical locations
  - **fire an intent** when it enters the proximity of a certain location.

Getting Location Data

- In the MapsActivity.java file, you first check for permission to use the Coarse Locations.
- Then you obtain a reference to the LocationManager class using the getSystemService() method.
- You do this in the onCreate() method of the activity:

```
//---use the LocationManager class to obtain locations data
lm = (LocationManager)
getSystemService(Context.LOCATION_SERVICE);
locationListener = new MyLocationListener();
```

Getting Location Data

- Next, you create an instance of the MyLocationListener class, which you define later in the class.
- The MyLocationListener class implements the LocationListener abstract class.
- You need to **override four met**hods in this implementation:
  1. onLocationChanged(Location location) - Called when the location has changed
  2. onProviderDisabled(String provider) - Called when the provider is disabled by the user
  3. onProviderEnabled(String provider) - Called when the provider is enabled by the user
  4. onStatusChanged(String provider, int status, Bundle extras) - Called when the provider status changes

Getting Location Data

- In this example, you're more interested in **what happens when a location changes**, so you write your code in the onLocationChanged() method.
- Specifically, when a location changes, you **display a small dialog on the screen showing the new location information**: latitude and longitude.
- You show this dialog using the Toast class:

```
public void onLocationChanged(Location loc) {
if (loc != null) {
Toast.makeText(getBaseContext(),
"Location changed : Lat: " + loc.getLatitude() +" Lng: " + loc.getLongitude(),
Toast.LENGTH_SHORT).show();
LatLng p = new LatLng((int) (loc.getLatitude()),(int) (loc.getLongitude()));
mMap.moveCamera(CameraUpdateFactory.newLatLng(p));
mMap.animateCamera(CameraUpdateFactory.zoomTo(7));
}
}
```

Getting Location Data

- To be notified whenever there is a change in location, you needed to **register a request for location changes** so that your program can be notified periodically.
- You do this via the requestLocationUpdates() method:

```
if(permissionGranted) {
lm.requestLocationUpdates(LocationManager.GPS_PROVIDER, 0, 0, locationListener);
}
```

Getting Location Data

- The requestLocationUpdates() method takes four arguments:

1. provider - The name of the provider with which you register.
   - In this case, you are using GPS to obtain your geographical location data.
2. minTime - The minimum time interval for notifications, in milliseconds. 0 indicates that you want to be continually informed of location changes.
3. minDistance - The minimum distance interval for notifications, in meters. 0 indicates that you want to be continually informed of location changes.
4. listener - An object whose onLocationChanged() method will be called for each location update

Getting Location Data

- Finally, in the onPause() method, you **remove the listener when the activity is destroyed or goes into the background** (so that the application no longer listens for changes in location, thereby saving the battery of the device).
- You do that using the removeUpdates() method:

Getting Location Data

```
@Override
public void onPause() {
super.onPause();
//---remove the location listener---
if (ActivityCompat.checkSelfPermission(this,
android.Manifest.permission.ACCESS_FINE_LOCATION)
!= PackageManager.PERMISSION_GRANTED && ActivityCompat.checkSelfPermission(
this, android.Manifest.permission.ACCESS_COARSE_LOCATION)
!= PackageManager.PERMISSION_GRANTED) {
ActivityCompat.requestPermissions(this,
new String[]{android.Manifest.permission.ACCESS_COARSE_LOCATION},
REQUEST_COURSE_ACCESS);
return;
}else{
permissionGranted = true;
}
if(permissionGranted) {
lm.removeUpdates(locationListener); // remove the listener
}
}
```

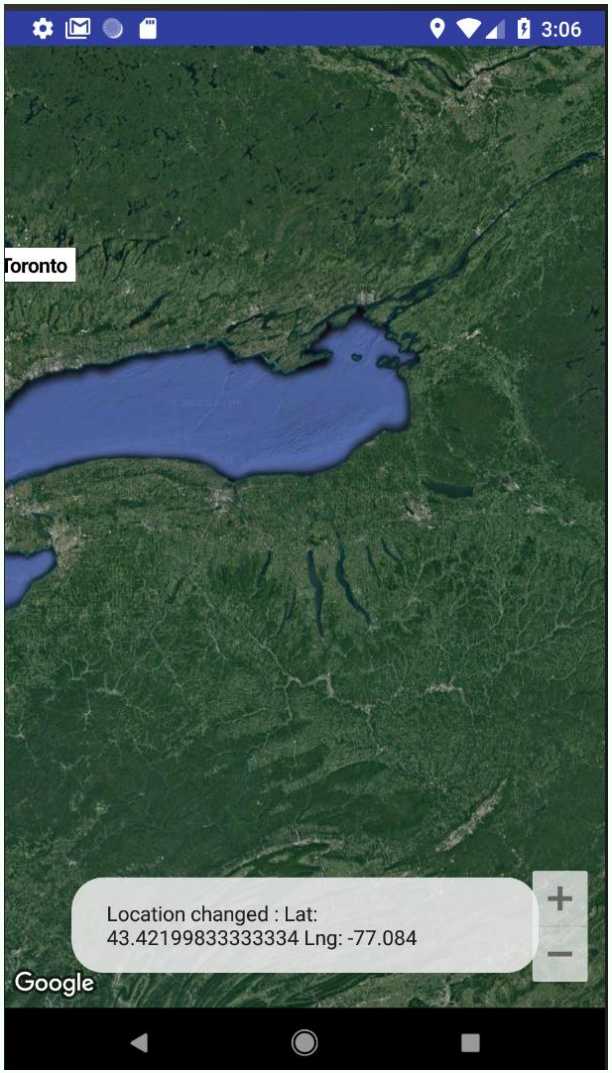
Getting Location Data

- You can combine both the GPS location provider with the network location provider within your application:

```
@Override
public void onResume() {
super.onResume();
//---request for location updates---
lm.requestLocationUpdates(
LocationManager.GPS_PROVIDER, 0, 0, locationListener);
//---request for location updates---
lm.requestLocationUpdates(
LocationManager.NETWORK_PROVIDER, 0, 0,
locationListener);
}
```

- To simulate GPS data received by the Android emulator, you use the Location Controls tool on the right-hand side of the emulator.

Getting GPS Location Data



Getting Location Data

- However, this will cause your application to receive two different sets of coordinates, as both the GPS provider and the NETWORK provider will try to get your location using their own methods (GPS versus Wi-Fi and cell ID triangulation).
- Hence, it is important that you **monitor the status of the two providers in your device and use the appropriate one**.
- You can **check the status of the two providers by implementing the following three methods** of the MyLocationListener class:

Getting Location Data

```
//---called when the provider is disabled---
public void onProviderDisabled(String provider) {
Toast.makeText(getBaseContext(), provider + " disabled",
Toast.LENGTH_SHORT).show();
}
//---called when the provider is enabled---
public void onProviderEnabled(String provider) {
Toast.makeText(getBaseContext(), provider + " enabled", Toast.LENGTH_SHORT).show();
}
//---called when there is a change in the provider status---
public void onStatusChanged(String provider, int status, Bundle extras) {
        String statusString = "";
        switch (status) {
                case android.location.LocationProvider.AVAILABLE:
                  statusString = "available";
                case android.location.LocationProvider.OUT_OF_SERVICE:
                  statusString = "out of service";
                case android.location.LocationProvider.TEMPORARILY_UNAVAILABLE:
                  statusString = "temporarily unavailable";
}
Toast.makeText(getBaseContext(), provider + " " + statusString, Toast.LENGTH_SHORT).show();
}
```

Monitoring a Location

- One very cool feature of the LocationManager class is its ability to monitor a specific location.
- This is achieved using the addProximityAlert() method.
- The following code snippet shows **how to monitor a particular location such that if the user is within a five-meter radius from that location, your application will fire an intent to launch the web browser**:

Monitoring a Location

```
import android.app.PendingIntent;
import android.content.Intent;
import android.net.Uri;
//---use the LocationManager class to obtain locations data---
lm = (LocationManager)
getSystemService(Context.LOCATION_SERVICE);
//---PendingIntent to launch activity if the user is within
// some locations---
PendingIntent pendingIntent = PendingIntent.getActivity(
this, 0, new Intent(android.content.Intent.ACTION_VIEW,
Uri.parse("http://www.amazon.com")), 0);
lm.addProximityAlert(37.422006, -122.084095, 5, -1, pendingIntent);
```

Monitoring a Location

- The addProximityAlert() method takes **five arguments**:
  - Latitude
  - Longitude
  - Radius (in meters)
  - Expiration (duration for which the proximity alert is valid, after which it is deleted; –1 for no expiration)
  - Pending intent
- Note that if the Android device's screen goes to sleep, the proximity is also checked once every four minutes in order to preserve the battery life of the device.

References

- Textbook
- Android Documentation:
  - https://developers.google.com/maps/documentation/android-sdk/start
  - https://developer.android.com/guide/topics/location/index.html
  - https://developer.android.com/guide/topics/location/strategies.html
  - https://developer.android.com/training/location/
  - https://developers.google.com/maps/documentation/android-api/
  - https://developers.google.com/maps/documentation/android-api/start
  - https://developers.google.com/maps/documentation/javascript/geolocation
  - https://developers.google.com/maps/faq