

Location Based Services (LBS) and Geocoding

Location Based Services (LBS)

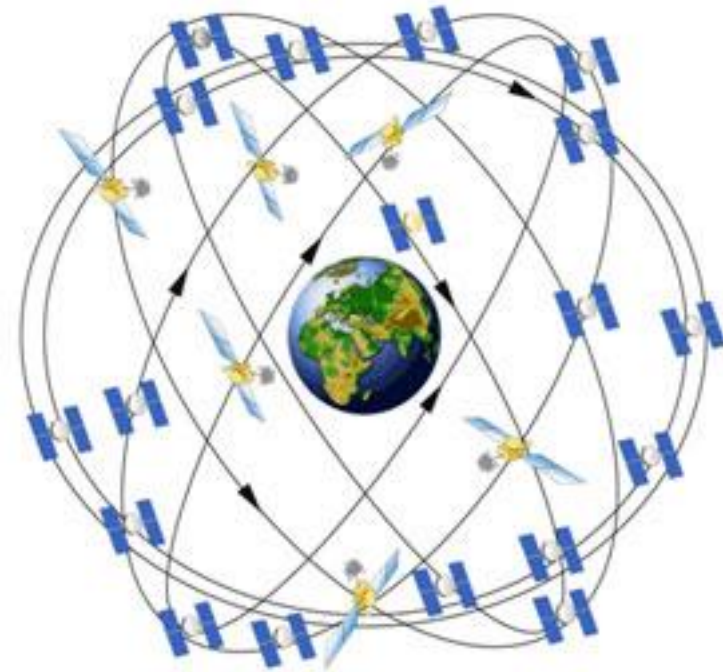
- **Location and Google maps are separate!!**
- Location for Android devices include:
 - GPS
 - cell-ID (cell tower)
 - Wi-Fi networks
- Geocoding – converting from latitude and longitude to street address

LBS System Settings



GPS

- 24 core satellites
- medium earth orbit, 20k km above the earth
- 6 orbital planes with 4 satellites each
- generally 4 satellites in line of sight at any spot on the earth



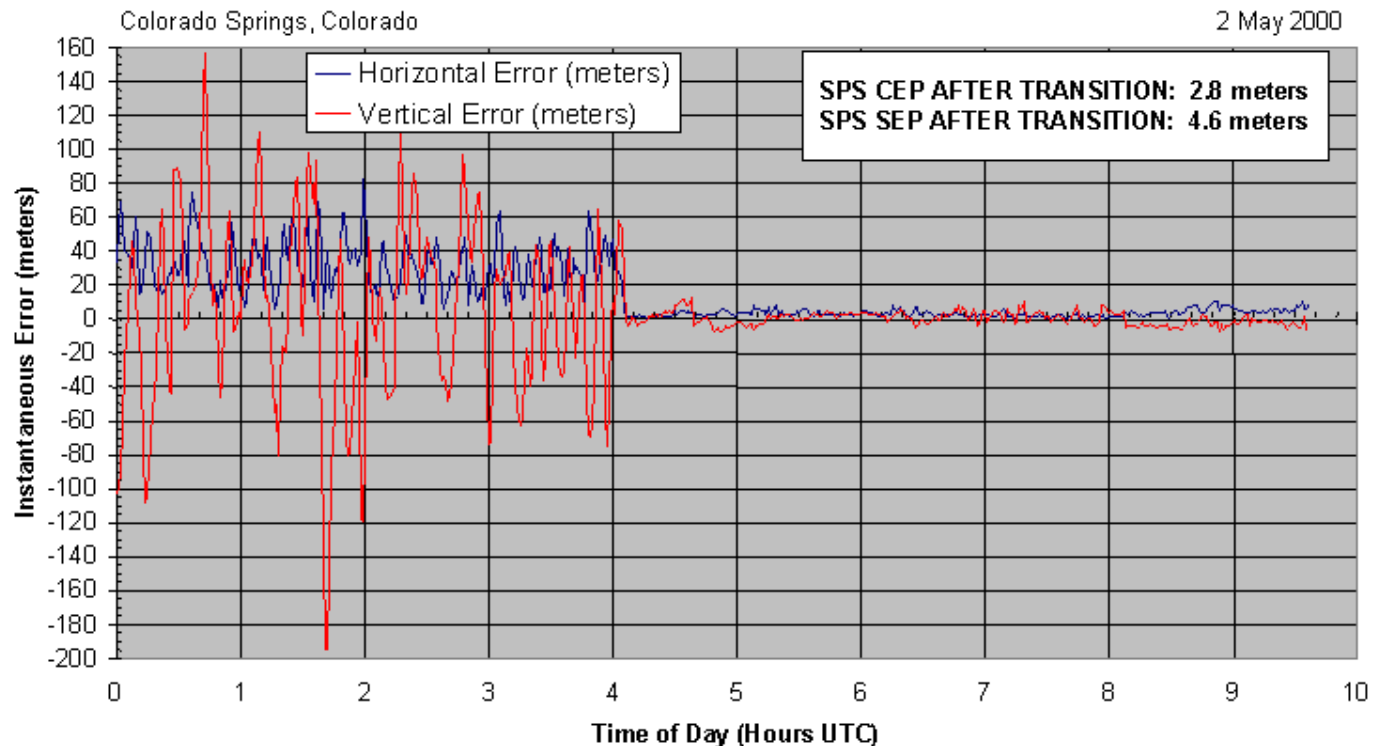
GPS Accuracy

- Selective Availability: intentional degradation of signals for civilian use

— ended
in 2000



SA Transition -- 2 May 2000



GPS

- Accurate within 20ft
- only works OUTDOORS
- quickly consumes battery power
- Slow to acquire satellites or re-acquire if lost

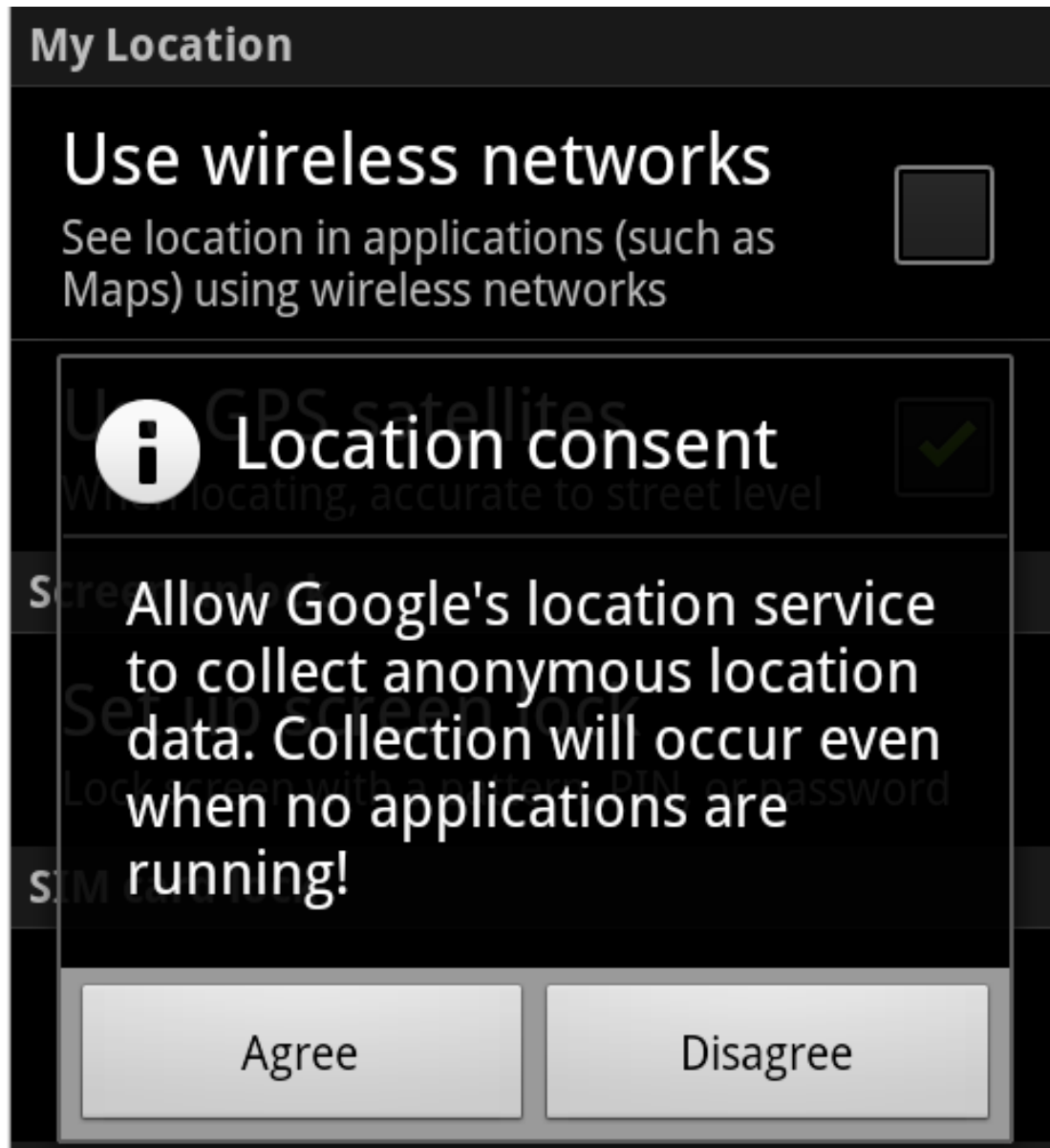


How does Wi-Fi Fix Location?

- Used to use StreetView cars
- Now, use devices themselves to map locations to wi-fi spots
- Apple and Microsoft do the same thing



Google Location Services



WiFi or Network

- Accurate within 1 mile
- Works inside and out
- Low power consumption
- Fast location acquisition

LBS How to use

- Add appropriate permission to `AndroidManifest.xml`
- Get instance of `LocationManager` using `getSystemService` method using `LOCATION_SERVICE`
- Choose location provider (from all providers or using `getBestProvider` method)
- Implement a `LocationListener` class
- Call `requestLocationUpdates` method with chosen provider so `LocationListener` start receiving location information

Manifest Permissions

- FINE = GPS

```
<uses-permission android:name="android.permission.ACCESS_FINE_LOCATION"/>
```

- COURSE = WiFi (network) or cell tower

```
<uses-permission android:name="android.permission.ACCESS_COARSE_LOCATION"/>
```

LBS- Main Classes

- LocationManager
 - Obtain current location
 - Track movement
 - Set proximity alerts for areas
 - Find available Location Providers
- Location Provider
 - Various location-finding technologies

Location Manager

- Gatekeeper
 - Selects particular location providers (GPS, WiFi, network, AGPS)
 - Lists available location providers
 - Registers for location updates
- Can be simple to use

```
locationManager = (LocationManager) getSystemService(Context.LOCATION_SERVICE);  
Location location = locationManager.getLastKnownLocation(LocationManager.GPS_PROVIDER);
```

Location Providers

- Entities that encapsulate the functionality of a particular location provider
- Distinguished directly by
 - LocationManager.GPS_PROVIDER
 - LocationManager.NETWORK_PROVIDER
 - LocationManager.PASSIVE_PROVIDER

```
locationManager.getLastKnownLocation(LocationManager.GPS_PROVIDER);
```

Location Providers

Select by Criteria

- Can ask for a location provider indirectly by criteria;
- Suppose low power consumption is the most important criteria.

```
Criteria criteria = new Criteria();  
criteria.setPowerRequirement(Criteria.POWER_LOW);  
provider = locationManager.getBestProvider(criteria, false);  
Location location = locationManager.getLastKnownLocation(provider);
```

- Use Criteria to filter on accuracy of returned location, accuracy of bearing, speed and altitude etc.

Location Based Services

GeoCoding

- Translate between street addresses and latitude/longitude coordinates
- Uses a webservice
 - Many geocoding services available
- Forward Geocoding
 - Finds Latitude/longitude of an address
- Reverse Geocoding
 - Finds street address given latitude/longitude

Location Based Services

Geocoding

1. Uses a webservice so do the call in a separate thread
2. Pass it a location object
3. It will return an address

Update Current Location

LocationListener

- Listens for location changes

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

Update Current Location

- Register the `LocationListener` to receive location updates
- `locationManager.requestLocationUpdates(LocationManager.NETWORK_PROVIDER, 15000, 10, locationListener);`
 - provider: name of provider to register with
 - minTime: the minimum time interval for notifications, in milliseconds. only a hint to conserve power, and actual time between location updates may be greater or lesser than this value.
 - minDistance: min distance interval for notifications in meters
 - the listener itself

STOP Updating Current Location

- Stop getting updates when you are finished
- `locationManager.removeUpdates(myLocationListener);`

Location Listener

```
// Acquire a reference to the system Location Manager
LocationManager locationManager = (LocationManager) this.getSystemService(Context.LOCATION_SERVICE)

// Define a listener that responds to location updates
LocationListener locationManagerListener = new LocationListener() {
    public void onLocationChanged(Location location) {
        // Called when a new location is found by the network location provider.
        makeUseOfNewLocation(location);
    }

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

    public void onProviderEnabled(String provider) {}

    public void onProviderDisabled(String provider) {}
};

// Register the listener with the Location Manager to receive location updates
locationManager.requestLocationUpdates(LocationManager.NETWORK_PROVIDER, 0, 0, locationManagerListener);
```

LocationManager - Useful Methods

- `addProximityAlert(double latitude, double longitude, float radius, long expiration, PendingIntent intent)`
 - Sets a proximity alert for the location given by the position (latitude, longitude) and the given radius.
- `List<String> getAllProviders()`
 - Returns a list of the names of all known location providers.
- `Location getLastKnownLocation(String provider)`
 - Returns a Location indicating the data from the last known location fix obtained from the given provider.

Best Practices

- Battery Life verses Accuracy
- Startup time
- Update Rate

References

- <https://developer.android.com/training/location/index.html>
- There are a lot of tutorials here

- <http://developerlife.com/tutorials/?p=1375>