
AND230

# Google Maps

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# Objectives

1. Explore Android map options
2. Configure an application to use Google Maps
3. Display a map in your application
4. Add markers to a Google Map
5. Adjust the map position and perspective

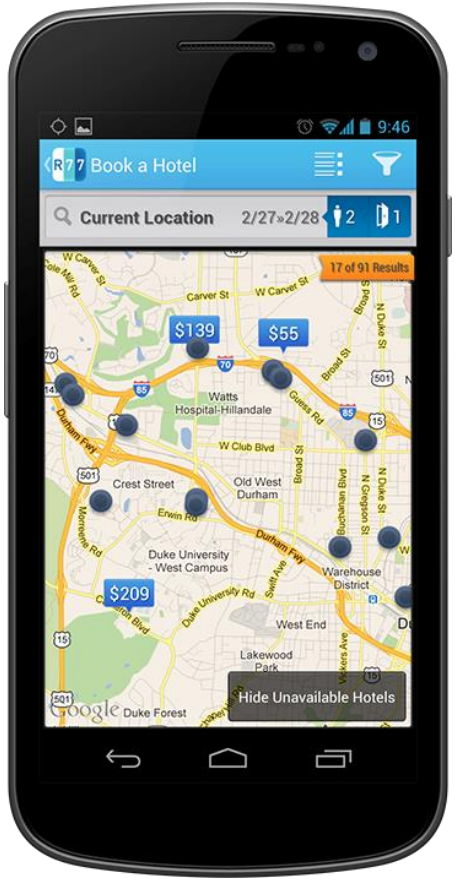
# Explore Android map options

# Tasks

1. Launch the default map application
2. Identify the components of Google Play Services
3. Install Google Play Services on an Android emulator

# Maps in Android

- Map support can enhance applications in a variety of ways
  - interactive points-of-interest
  - point-to-point navigation
  - tour guides
  - current location tracking
  - …



# Launching the "Maps" application

- Android supports launching installed map application through registered Uri – can use this to switch to app and display a specific location

```
private void ShowLocationOnMap()
{
    var seattle = Android.Net.Uri.Parse ("geo:47.6,-122.3");
    Intent intent = new Intent(Intent.ActionView);
    intent.SetData(seattle);
    if (intent.ResolveActivity(this.PackageManager) != null) {
        StartActivity(intent);
    }
}
```

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    intent.SetData(seattle);
    if (intent.ResolveActivity(this.PackageMa
        StartActivity(intent);
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}
```

"geo" MIME scheme, must pass latitude and longitude coordinates

# Launching the "Maps" application

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```
private void ShowLocationOnMap()
{
    var seattle = Android.Net.Uri.Parse ("
    Intent intent = new Intent(Intent.Action
    intent.SetData(seattle);
    if (intent.ResolveActivity(this.PackageManager) != null) {
        StartActivity(intent);
    }
```

Should check to see if URI is supported; e.g. if a mapping application is registered



There are other URIs available to launch specific Google Maps features such as turn-by-turn navigation, see: http://bit.ly/gmaps-intents

# Integrating maps

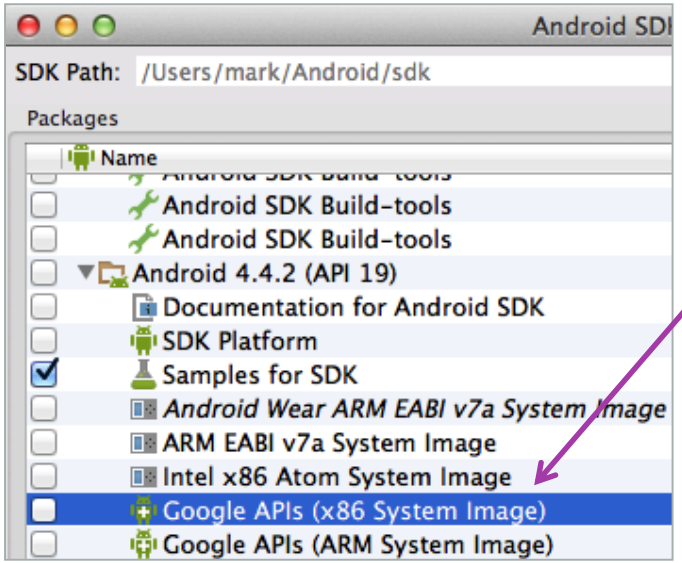
- Several integrated mapping options available for Android
  - Google Maps V2
  - Bing Maps (AJAX)
  - ESRI ArcGIS
  - OMSDroid (open source)
  - MapsForge (open source)
  - Nutiteq
  - Mapbox

# Getting started with Google Maps

- Google ships a variety of additional libraries (.APKs) for Android, one of which is **Google Play Services** which gives the device access to *Google-provided services*

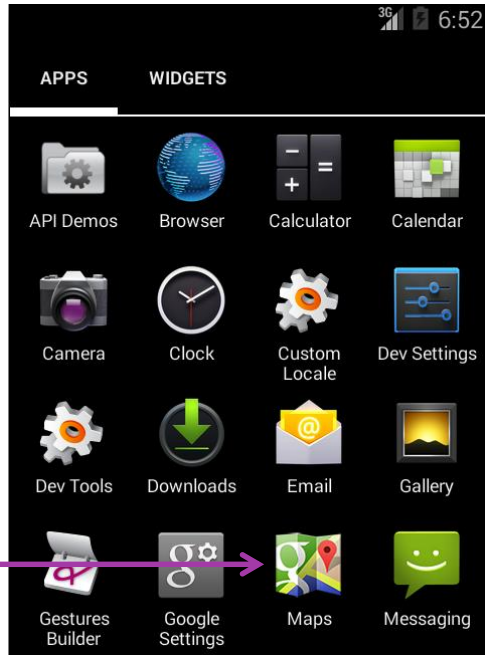
# Using Play Services on an Emulator

- Google includes an emulator image which has Play Services pre-installed



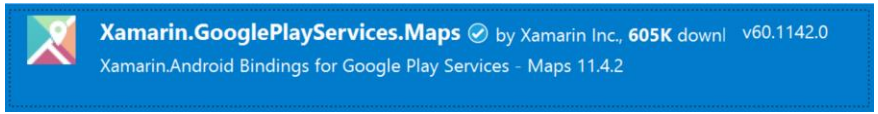

Make sure to use the x86 image!

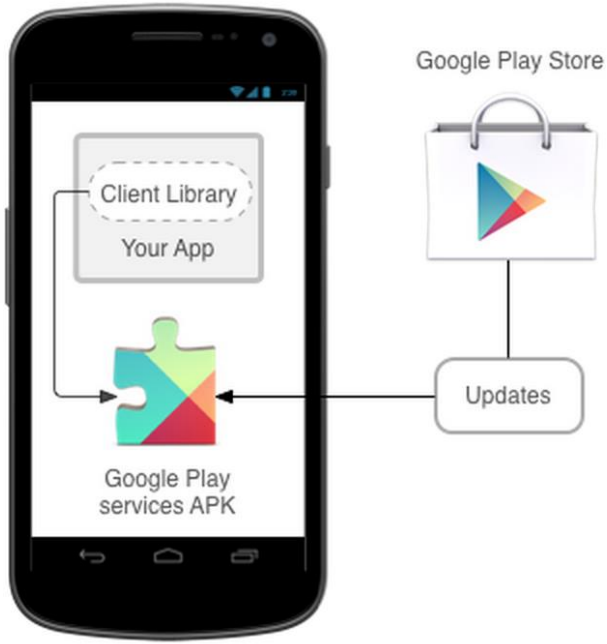
Standard apps, such as **Maps** are installed



# Google Play Services component

- Must add **Google Play Services - Maps** NuGet package to your Xamarin.Android application to access mapping features

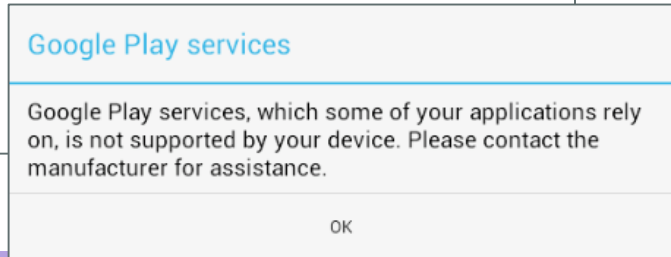


# Google Play services on devices

- Google Play Services is a licensed product that is not present on all physical devices – if it is not installed, then Google Maps will not work properly on the device

```
int error = GoogleApiAvailability.Instance
                    .IsGooglePlayServicesAvailable(this);
if (error != ConnectionResult.Success) {
   var dialog = GooglePlayServicesUtil.GetErrorDialog(
                     error, this, 0, null);
   dialog.DismissEvent += delegate { this.Finish(); };
   dialog.Show();
   SetContentView(new View(this));
}
```



# Flash Quiz

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# Flash Quiz

① How can you ensure there is a map application present?

a) `StartActivity`

b) `ActionView`

c) `ResolveActivity()`

d) `Android.Net.Uri.Parse()`

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b) `ActionView`

c) **`ResolveActivity()`**

d) `Android.Net.Uri.Parse()`

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② What optional component must be included in the Android SDK Manager?

a) Google Play Services
b) Android Support Repository
c) Google Repository
d) Google Play Licensing Library

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③ Which emulator images have Play Services pre-installed?

a) Android SDK Build-tools
b) Google APIs (x86 System Image)
c) Google APIs (ARM System Image)
d) SDK Platform

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# Summary

1. Launch the default map application
2. Identify the components of Google Play Services
3. Install Google Play Services on an Android emulator

# Configure an application to use Google Maps

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# Tasks

1. Create an API key
2. Register your application with Google Maps API
3. Set required permissions to use location in your application

# Adding support for Google Maps

- There are several required steps to utilize Google Maps features

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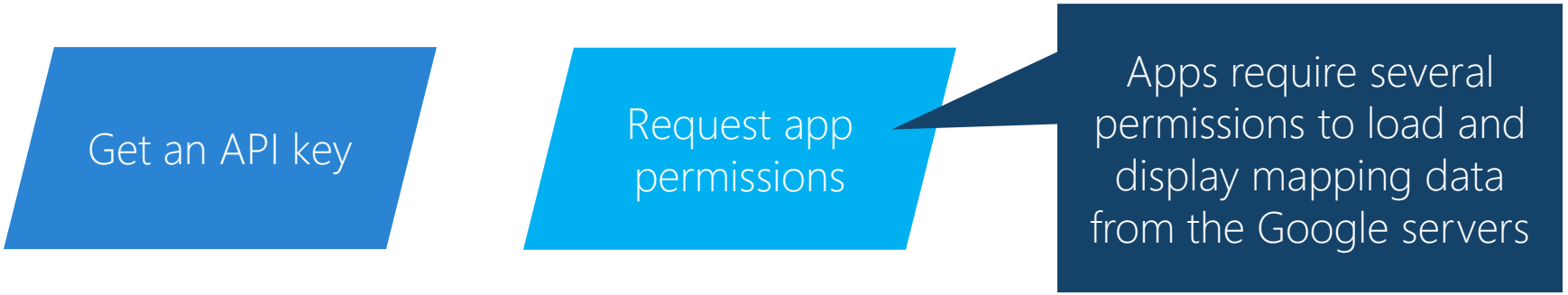
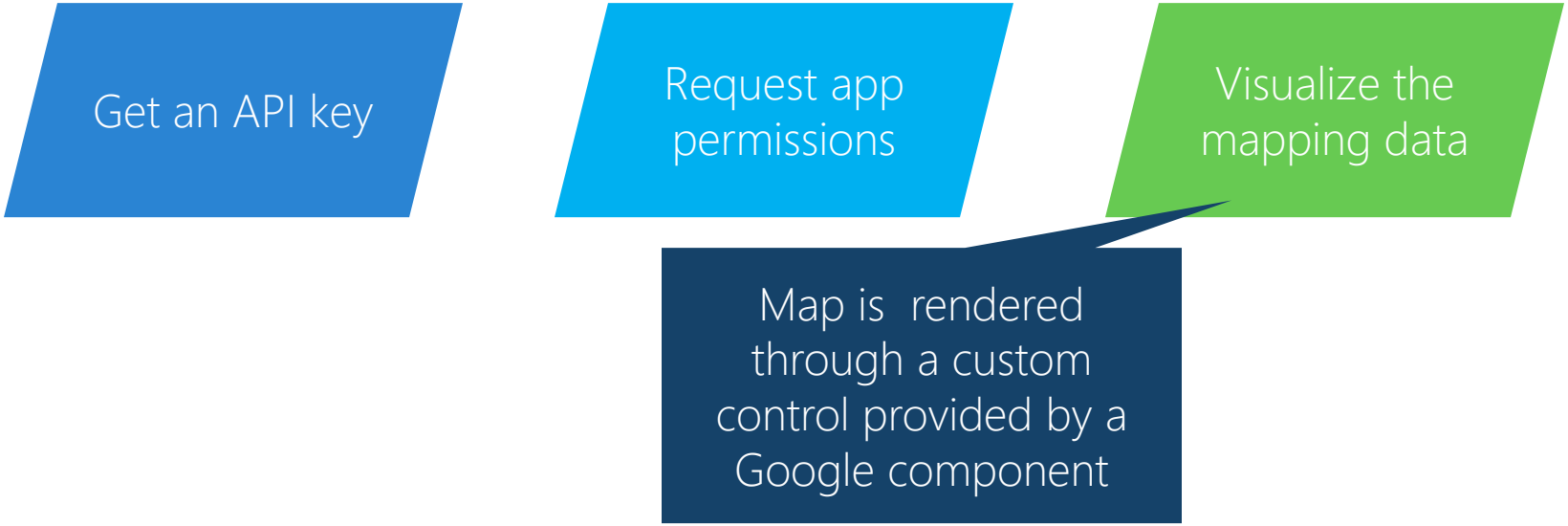


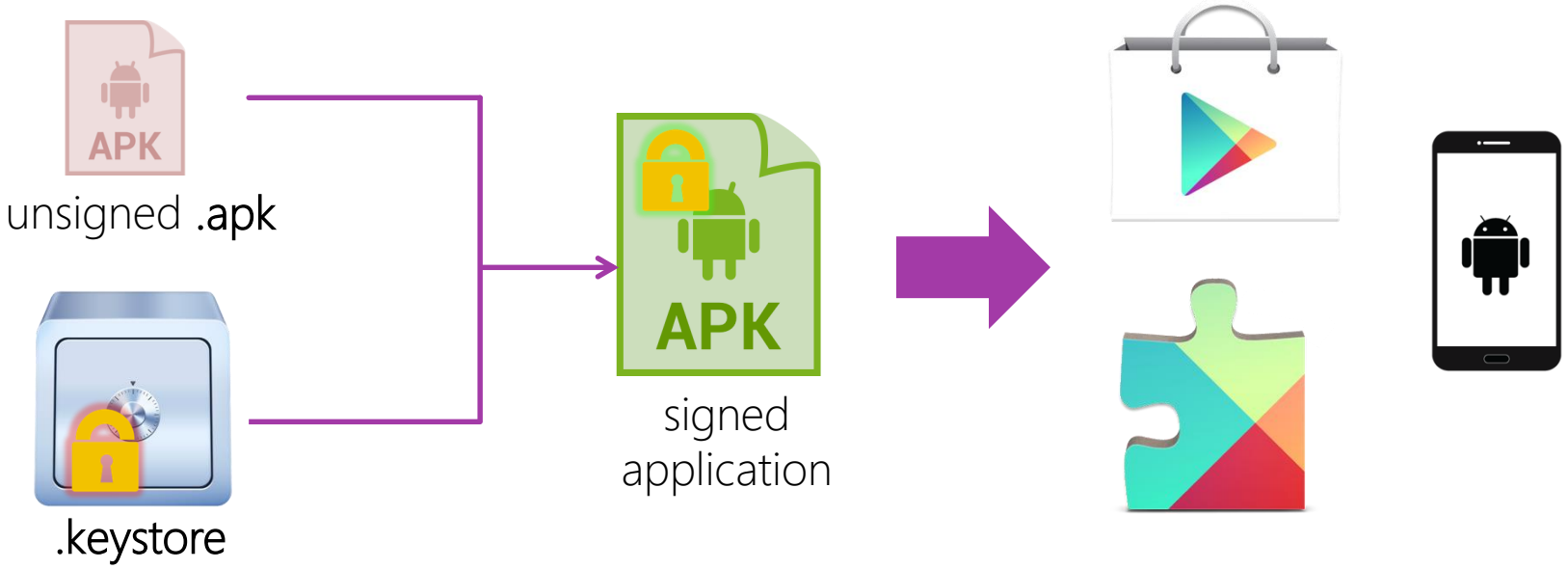
# Adding support for Google Maps

- There are several required steps to utilize Google Maps features



# What is the keystore?

- Keystores provides a unique identifier for the application / publisher; it is a signing certificate added to the app as part of the build process



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# Where is the keystore?

- Keystore default location is operating-system specific, and can be configured on a per-project basis; the **debug keystore** is normally at:

Windows

```
%LocalAppData%\Xamarin\Mono for Android\debug.keystore
```

macOS

```
~/.local/share/Xamarin/Mono for Android/debug.keystore
```

# Get an API key: retrieve SHA1 fingerprint

- Google Play Services uses the SHA1 fingerprint of the signing keystore to identify the application; this can be found using the Java **keytool** utility

```
keytool -list -v -keystore [filename]
        -storepass [password]
        -keypass [password]
```

Must include **-v** switch to get entire fingerprint signature



You will need the *debug* keystore fingerprint during development and the *release* keystore fingerprint to submit to the Google Play Store – both must be registered!

# Example: getting the SHA1 fingerprint

```
> keytool -list -v -keystore ~/.local/share/Xamarin/Mono\ for\
Android/debug.keystore -storepass android -keypass android

Certificate fingerprints:
     MD5:  56:37:EB:CB:58:41:2F:0C:84:89:2B:E0:8E:51:D3:95
     SHA1: 1F:6B:A7:6D:E6:8E:87:69:1A:62:44:14:59:4B:9F:4F:3B:EE:35:E9
     Signature algorithm name: SHA1withRSA
     Version: 3
```



Must deploy an app to create the debug keystore in the default location (shown here for macOS), or can create a new keystore (typical for release builds)

# Example: getting the SHA1 fingerprint

```
> keytool -list -v -keystore ~/.local/share/Xamarin/Mono\ for\
Android/debug.keystore -storepass android -keypass android

Certificate fingerprints:
     MD5:  56:37:EB:CB:58:41:2F:0C:84:89:2B:E0:8E:51:D3:95
     SHA1: 1F:6B:A7:6D:E6:8E:87:69:1A:62:44:14:59:4B:9F:4F:3B:EE:35:E9
     Signature algorithm name: SHA1withRSA
     Version: 3
```

Want the entire SHA1 signature – this is how Google will validate the calling application

# Example: getting the SHA1 fingerprint

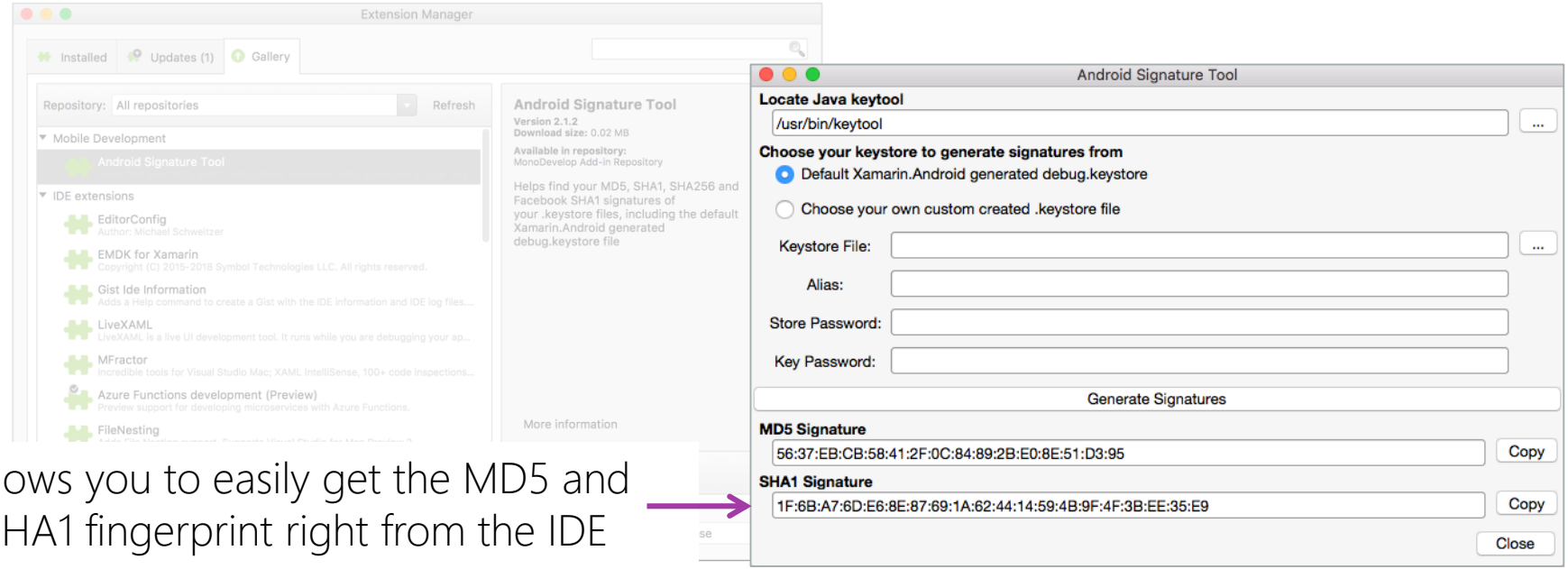
```
> keytool -list -v -keystore ~/.local/share/Xamarin/Mono\ for\
Android/debug.keystore -storepass android -keypass android

Certificate fi
     MD5:  56                                  :8E:51:D3:95
     SHA1: 1F                                  :59:4B:9F:4F:3B:EE:35:E9
     Signature
     Version:
```

Store password and Key password are always "android" for the default debug keystore, these values will change for custom keystores

# Getting the SHA1 fingerprint [macOS]

- Visual Studio for Mac has an optional add-in you can use to find the keystore signature – use **Visual Studio > Extensions...** to install



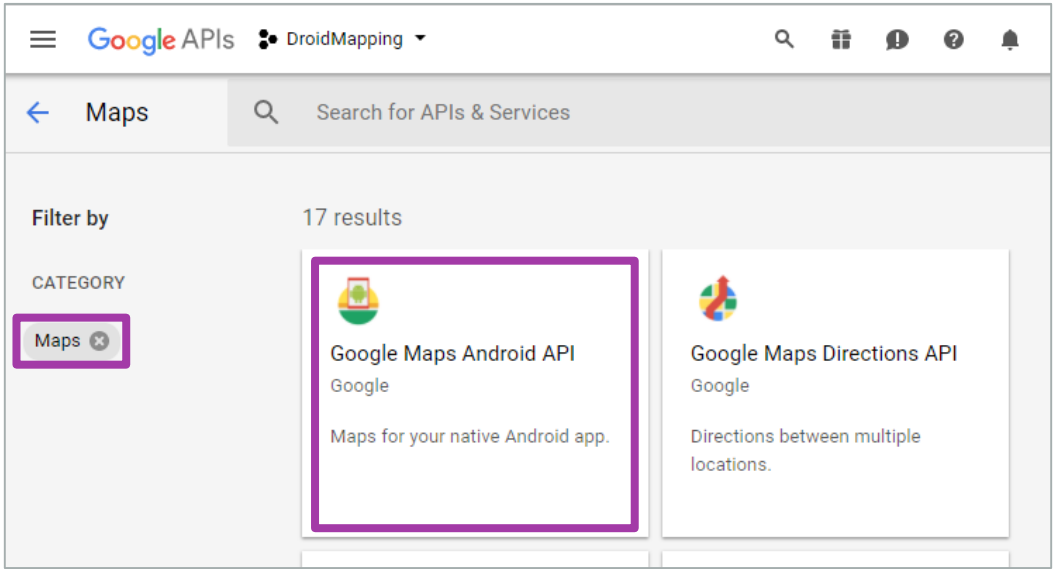

Allows you to easily get the MD5 and SHA1 fingerprint right from the IDE

# Group Exercise

Locate your keystore and SHA1 fingerprint

# Get an API key: create a project

- Must create or have a project in the Google APIs console *and* add the Google Maps Android API v2 service to the existing project

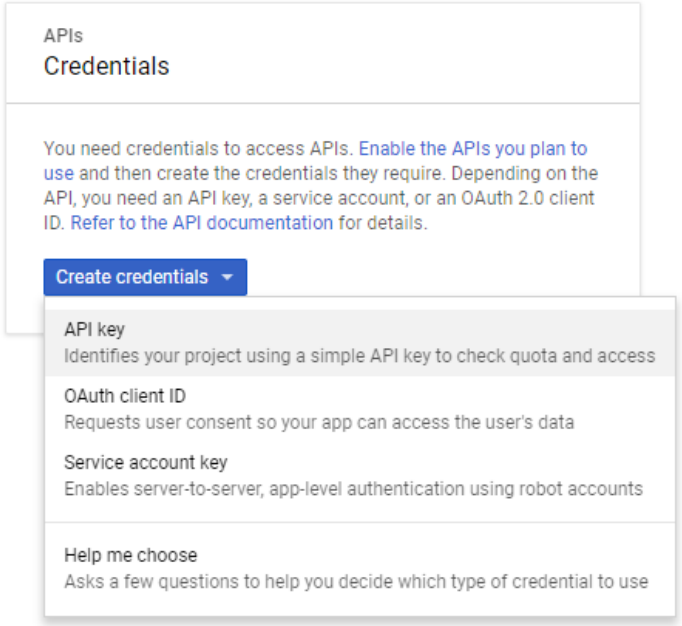



Go to https://console.developers.google.com to access the API console

# Get an API key: register the fingerprint

- Can create a new public API access key for the application in the credentials section

- This is where the SHA1 fingerprint and package name are registered

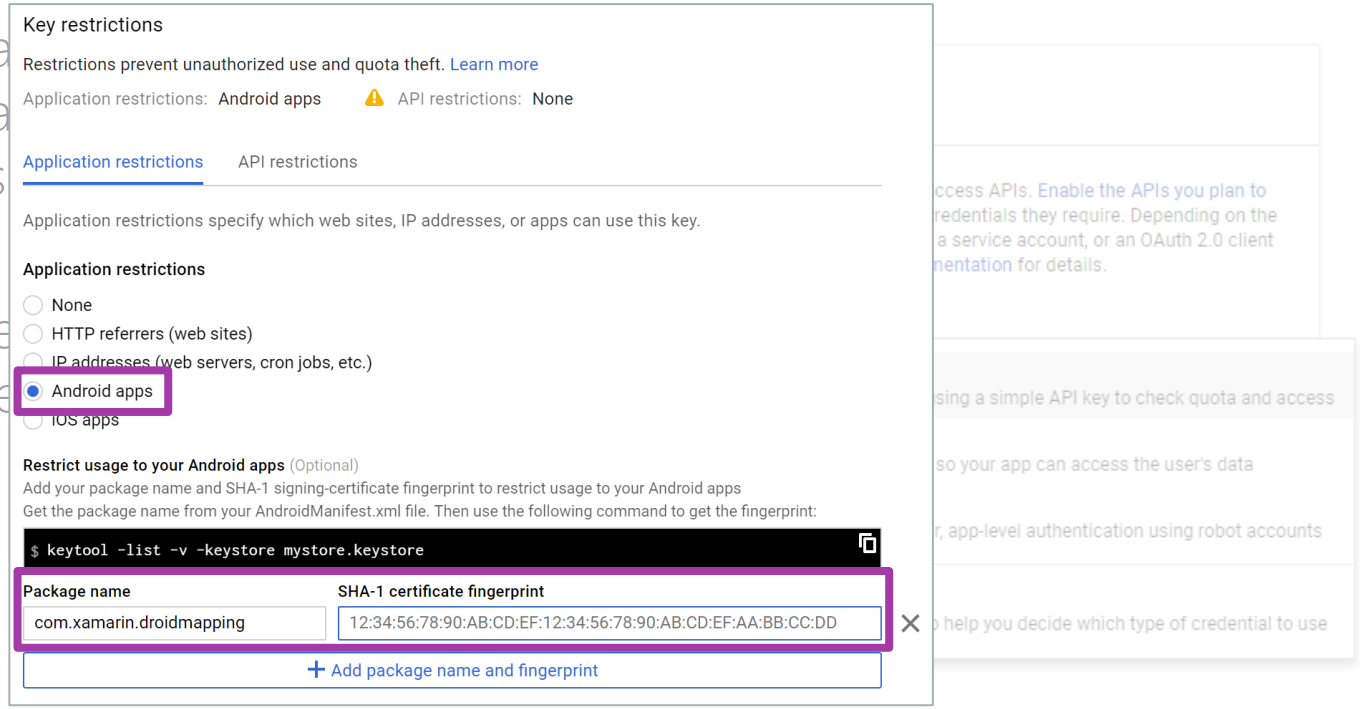





Google allows you to create an unrestricted key that doesn't depend require the SHA1 – this is not recommended – if the key leaked it could be used outside of your application

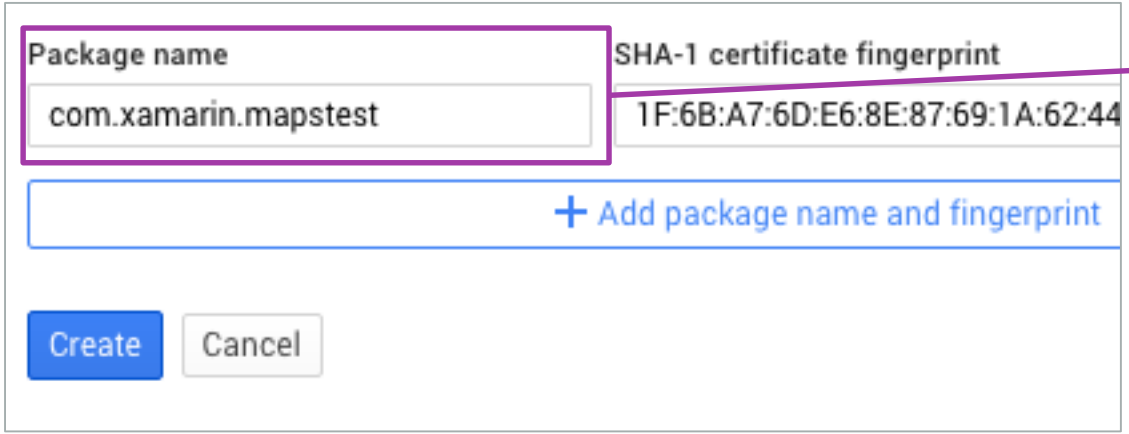
# Get an API key: register the fingerprint

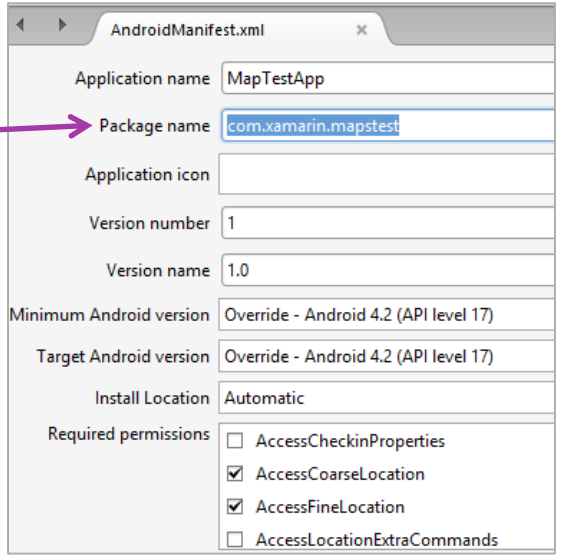
- Can create a key for the a credentials s
- This is where and package



# Synchronizing the package id

- Package Name registered in Google Play console must match the one in the app manifest



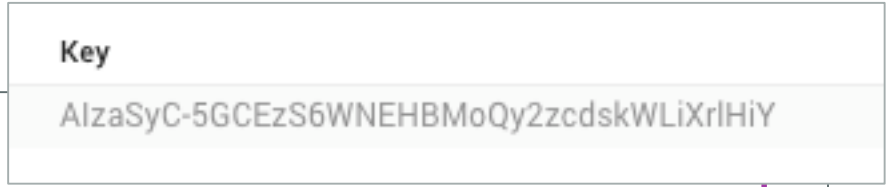



# Get an API key

- Once registered, the app will have an assigned API key – this is what needs to be added to the binary to identify the app to Google Maps

# Assign the API key to the app

- The API key value must be registered in the Android Manifest under the key **com.google.android.geo.API_KEY**, can either hand-edit the manifest or add it with an assembly-level **`[MetaDataAttribute]`**

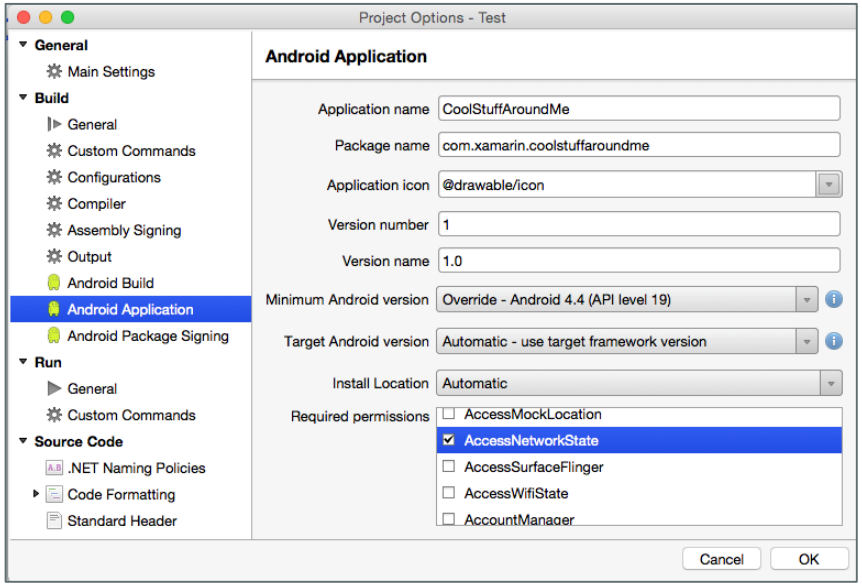



```
using Android.App;

#if RELEASE
[assembly: MetaDataAttribute("com.google.android.geo.API_KEY",
                             Value = "release_key_goes_here")]
#else
[assembly: MetaDataAttribute("com.google.android.geo.API_KEY",
                             Value = "AIzaSyC-5GCEzS6WNEHBMoQy2zcdskWLiXrlHiY")]
#endif
```

# Required Android permissions

- Mapping requires several permissions to access network state, internet; optionally, location permissions are required to use the user's location




Permissions can be edited with the project properties GUI

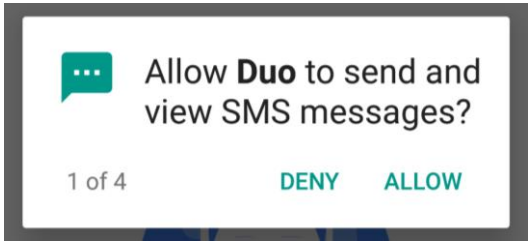
# Android permissions in the manifest

- Permissions set in the GUI are automatically added to the **`AndroidManifest.xml`**

```
<?xml version="1.0" encoding="utf-8"?>
<manifest ...>
    <uses-sdk android:minSdkVersion="15" />
    <application />
    <uses-permission android:name="android.permission.INTERNET" />
    <uses-permission android:name="android.permission.ACCESS_NETWORK_STATE" />
    <uses-permission android:name="android.permission.ACCESS_FINE_LOCATION" />
    <uses-permission android:name="android.permission.ACCESS_COARSE_LOCATION" />
</manifest>
```

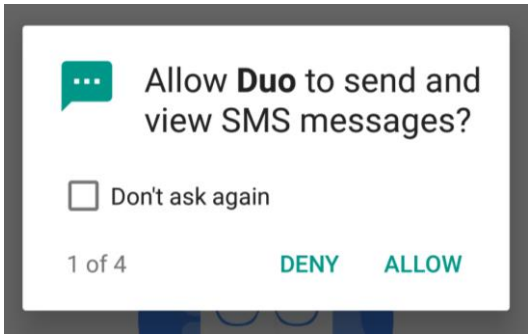
# Android's granular permission model

- Android 6.0 and newer requires explicit approval from the user at runtime for permissions allowing access to a user's personal information



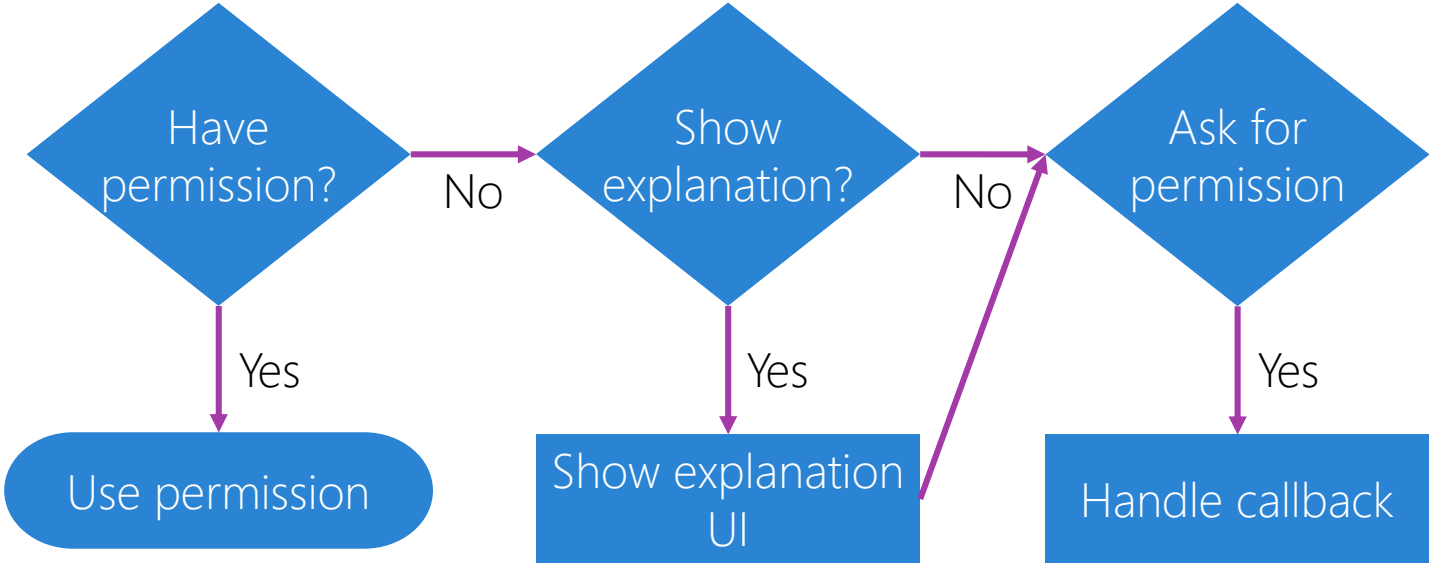

First permission request

Second permission request



# Requesting individual permissions

- To acquire specific permissions, ask Android to present the request and show a custom explanation if they have previously denied



# Request Android permissions at runtime

- Check if a permission was already granted before asking for it from the user at runtime, providing an explanation as needed

```
if (CheckSelfPermission(Manifest.Permission.AccessFineLocation)
    == Permission.Granted && …) {
    // Already have permission!
}
else if (ShouldShowRequestPermissionRationale(Manifest.Permission.AccessFineLocation)
    || …) {
    // Show UI explaining why we need permissions, then request permissions.
}
else {
    RequestPermissions(new[] { Manifest.Permission.AccessFineLocation, … },
        yourPermissionRequestCode);
}
```

# Request Android permissions at runtime

- Users responses to permission requests are verified and handled in the **`OnRequestPermissionsResult`** method Android calls on your activity

```
public override void OnRequestPermissionsResult(int requestCode,
                                                 string[] permissions,
                                                 Permission[] grantResults)
{
    switch (requestCode)
    {
        case yourPermissionRequestCode:
            // Verify they granted permission and handle accordingly.
            break;
    }
}
```

# Flash Quiz

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# Flash Quiz

① You can use the same API key on more than one development machine (True or False)?

a) True

b) False

# Flash Quiz

① You can use the same API key on more than one development machine (True or False)?

a) True

b) False

# Flash Quiz

② How does Google Play Services authenticate your application?

a) Shared password
b) API key + SHA1 keystore fingerprint + package name
c) X.509 certificate
d) No authentication necessary

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# Flash Quiz

③ Which permissions must be present in your Android app's manifest to show the user a Google Map? (Select all that apply)

a) INTERNET
b) ACCESS_NETWORK_STATE
c) ACCESS_FINE_LOCATION
d) WRITE_EXTERNAL_STORAGE

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# Group Exercise

Obtain a Google API key for Google Maps V2

# Summary

1. Create an API key
2. Register your application with Google Maps API
3. Set required permissions to use location in your application

# Display a map in your application

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# Tasks

1. Add a Map UI into your app
2. Configure the map view
3. Display current location on the map

# Google Maps Basics

- **`GoogleMap`** is the main class for the Google Maps Android API – it is created automatically when you insert a map into the UI
- **`MapView`** and **`MapFragment`** are used to add the map visualization into the UI screen
- Requires API Level 12 or the Android Support library

# Using MapFragment

- Can insert the map into a layout as a *fragment* – this is the most common approach and manages both the map UI and lifecycle

Main.axml

```
<fragment xmlns:android="http://schemas.android.com/apk/res/android"
          android:id="@+id/map"
          android:layout_width="match_parent"
          android:layout_height="match_parent"
          class="com.google.android.gms.maps.MapFragment" />
```

class defines the object which will draw the fragment – in this case **MapFragment**



There is no designer support for this – this must be added by hand into the XML

# Accessing the MapFragment

- Use the **`FragmentManager`** to find and get a reference to the created UI fragment

```
public class MainActivity : Activity
{
   ...
   protected override void OnCreate(Bundle bundle)
   {
      var mf = FragmentManager.FindFragmentById(Resource.Id.map) as MapFragment;
      ...
   }
}
```

Use the assigned **`android:id`** to locate the fragment

# Creating a fragment in code

- **`FragmentManager`** also allows direct insertion of fragments from code

```
MapFragment mapFragment;

protected override void OnCreate(Bundle bundle)
{
    ...
    mapFragment = MapFragment.NewInstance(); // Create fragment
    FragmentTransaction trans = FragmentManager.BeginTransaction();
    trans.Add(Android.Resource.Id.Content, mapFragment);
    trans.Commit();
}
```

Must identify the view parent for the fragment

# Using MapView

- **`MapView`** is a *view*-derived class that can be used to host the map in a child fragment (to avoid fragments-in-fragments)

MapFragment.axml

```
<com.google.android.gms.maps.MapView
      android:id="@+id/mapview"
      android:layout_width="fill_parent"
      android:layout_height="fill_parent" />
```

**`MapView`** can be placed in any Layout as a child, or used as the root Layout element on it's own (that's essentially what a **`MapFragment`** is)

# Using MapView – manage lifecycle

- Must forward lifecycle events from the fragment owner to the **MapView**

```
public class MapsFragment : Fragment {
   MapView mapView;

   public override View OnCreateView(LayoutInflater inflater, ...) {
      var view = inflater.Inflate(...);
      mapView = view.FindViewById<MapView>(Resource.Id.mapview);
      mapView.OnCreate(savedInstanceState);
      return view;
   }

   protected override void OnResume()  {
      base.OnResume();
      mapView.OnResume();
   }
}
```

Must forward **OnCreate**, **OnResume**, **OnDestroy** and **OnLowMemory**

# Which one should I use?

- Use a **`MapFragment`** if you are hosting the map in an **`Activity`** layout
- Use **`MapView`** if you are hosting the map in a **`Fragment`** layout (such as in a **`ViewPager`**)
- They both produce *exactly the same* visualization

# Getting the Google Map instance

- **MapFragment** and **MapView** will create the **GoogleMap** object automatically; can be retrieved through **GetMapAsync**

```
public class MainActivity : Activity, IOnMapReadyCallback
{
    GoogleMap map;
    public void OnMapReady(GoogleMap googleMap)
        map = googleMap;
    }

    protected override void OnCreate(Bundle bun

        ...
        var mf = FragmentManager.Find                    agment;
        mf.GetMapAsync(this);
        ...
}
```

Map not available until it has been initialized with Google's web services, must pass interface **IOnMapReadyCallback** to **GetMapAsync**

# Getting the Google Map instance

- **`MapFragment`** and **`MapView`** create the **`GoogleMap`** object, can be retrieved through **`GetMapAsync`**

```
public class MainActivity : Activity, IOnMapReadyCallback
{
    GoogleMap map;
    public void OnMapReady(GoogleMap googleMap) {
        map = googleMap;
    }

    protected override void OnCreate(Bundle bundle) {
        ...
        var mf = FragmentManager.FindFragmentById(Resource.Id.map) as MapFragment;
        mf.GetMapAsync(this);
    }
}
```

Common to implement directly in activity

# Getting the Google Map instance

- **MapFragment** and **MapView** create the **GoogleMap** object, can be retrieved through **GetMapAsync**

```
public class MainActivity : Activity, IOnMapReadyCallback
{
    GoogleMap map;
    public void OnMapReady(GoogleMap googleMap) {
        map = googleMap;
    }

    protected override void OnCreate(Bundle
        ...
        var mf = FragmentManager.FindFragment
        mf.GetMapAsync(this);
```

```
) as MapFragment;
```

Can then cache off reference once Map has been created



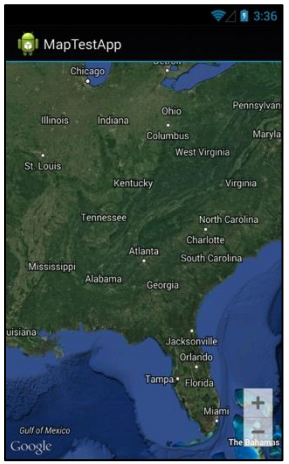
Almost all of the mapping APIs are exposed through the **GoogleMap** instance. You must be on the UI thread to interact with this object

# Changing the map style

- **`GoogleMap`** provides properties to change the type of data displayed, such as the **`MapType`** property which can be one of four values


Standard (default)


Satellite

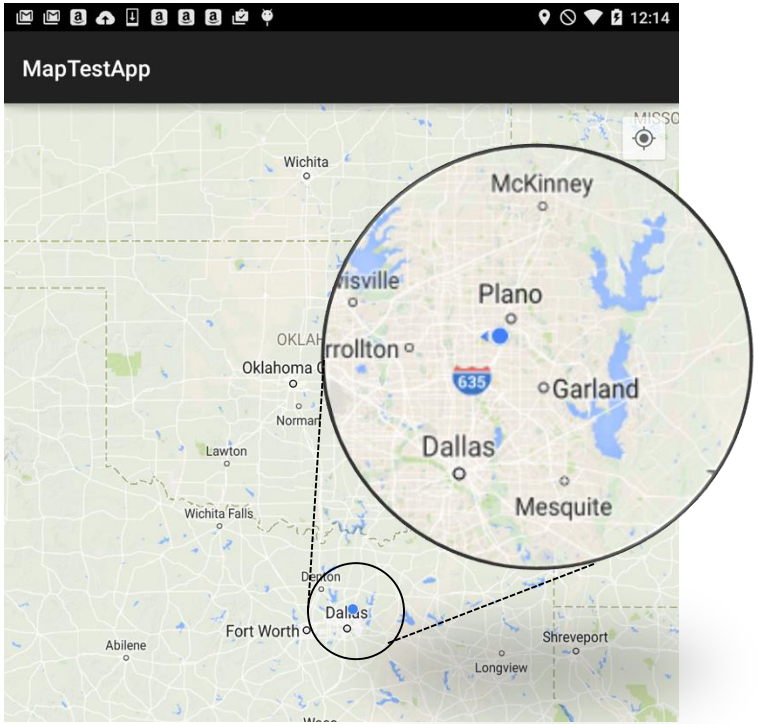



Hybrid


Terrain

# Noting the current location

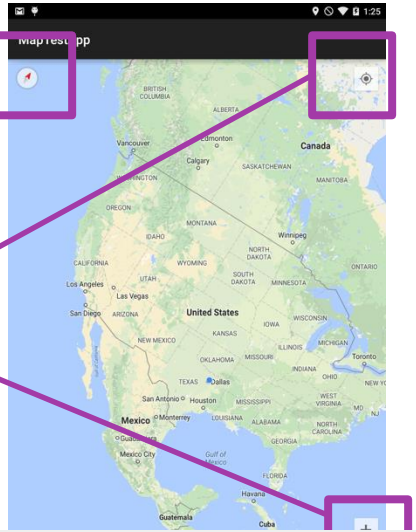
- Can turn on a location marker using the `MyLocationEnabled` property on `GoogleMap`
- Displays a glowing dot indicating the current location of the device, or a chevron if the device is moving
- Requires `ACCESS_COARSE_LOCATION` and `ACCESS_FINE_LOCATION` permissions



# Use UiSettings class to provide user control

- The **UiSettings** property on the **GoogleMap** turns various UI elements on and off in the display such as a compass and zoom controls

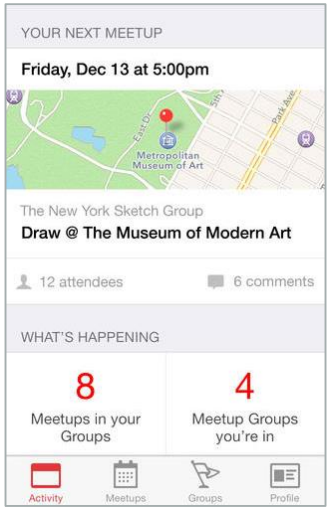
```
GoogleMap map ...
map.UiSettings.CompassEnabled = true;
map.UiSettings.MyLocationButtonEnabled = true;
map.UiSettings.ZoomControlsEnabled = true;
...
```




There is also a **GoogleSettings** class which can initialize the map to a known state when creating the **MapFragment** in code

# Built-in gestures

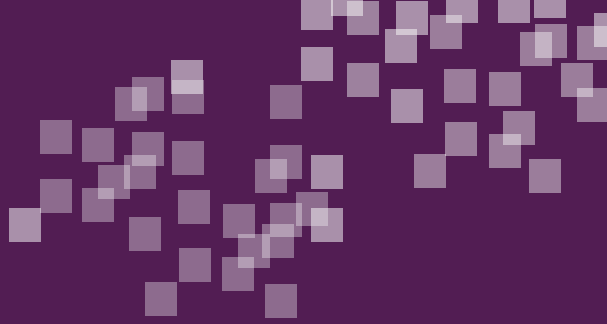
- Map control supports common gestures to zoom, rotate and scroll – these are enabled by default, but can be turned off with **`UiSettings`** to support read-only map views that cannot be altered




```
map.UiSettings.RotateGesturesEnabled = false;
map.UiSettings.TiltGesturesEnabled = false;
map.UiSettings.ScrollGesturesEnabled = false;
map.UiSettings.ZoomGesturesEnabled = false;
```

OR

```
map.UiSettings.SetAllGesturesEnabled(false);
```



# Individual Exercise

Adding support for Google Maps

Xamarin University

# Summary

1. Add a Map UI into your app
2. Configure the map view
3. Display current location on the map

# Add markers to a Google Map

# Tasks

1. Add map markers
2. Display marker details
3. Programmatically interact with the map

# Google Maps markers

- Markers allow you to annotate the map with different colored *pins*

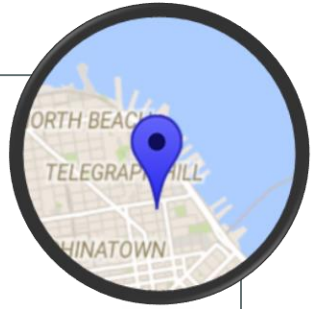



Particularly common to do this when creating static, immovable maps

# Adding a marker to the map

- Markers are created through the **`MarkerOptions`** class and added to the map using the **`GoogleMap.AddMarker`** method

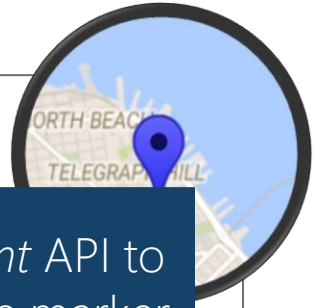
```
GoogleMap map;
...
LatLng Location_Xamarin = new LatLng(37.79, -122.40);
Marker xamarinMarker = map.AddMarker(
      new MarkerOptions()
         .SetPosition(Location_Xamarin)
         .SetIcon(BitmapDescriptorFactory.DefaultMarker(
                     BitmapDescriptorFactory.HueBlue)));
```



# Adding a marker to the map

- Markers are created through the **`MarkerOptions`** class and added to the map using the **`GoogleMap.AddMarker`** method

```
GoogleMap map;
...
LatLng Location_Xamarin = new LatLng(37.79, -1
Marker xamarinMarker = map.AddMarker(
      new MarkerOptions()
         .SetPosition(Location_Xamarin)
         .SetIcon(BitmapDescriptorFactory.DefaultMarker(
                     BitmapDescriptorFactory.HueBlue)));
```

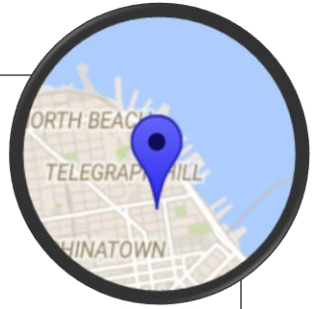


Uses a *fluent* API to describe the marker

# Adding a marker to the map

- Markers are created through the **MarkerOptions** class and added to the map using the **GoogleMap.AddMarker** method

```
GoogleMap map;
...
LatLng Location_Xamarin = new LatLng(37.79, -122.40);
Marker xamarinMarker = map.AddMarker(
      new MarkerOptions()
         .SetPosition(Location_Xamarin)
         .SetIcon(BitmapDescriptorFactory.DefaultM
                  BitmapDescriptorFactory.HueBl
```




Must always set position

# Adding a marker to the map

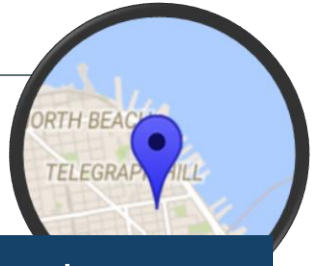
- Markers are created through the **MarkerOptions** class and added to the map using the **GoogleMap.AddMarker** method

```
GoogleMap map;
...
LatLng Location_Xamarin = new LatLng(37.79, -12
Marker xamarinMarker = map.AddMarker(
      new MarkerOptions()
         .SetPosition(Location_Xamarin)
         .SetIcon(BitmapDescriptorFactory.DefaultMarker(
                  BitmapDescriptorFactory.HueBlue)));
```

# Adding a marker to the map

- Markers are created through the **MarkerOptions** class and added to the map using the **GoogleMap.AddMarker** method

```
GoogleMap map;
...
LatLng Location_Xamarin = new LatLng(37.79, -122.40);
Marker xamarinMarker = map.AddMarker(
      new MarkerOptions()
         .SetPosition(Location_Xamarin)
         .SetIcon(BitmapDescriptorFactory.Defaul
                  BitmapDescriptorFactory.Hue
```




Call **AddMarker** to place the **MarkerOption** on the map – returns the marker instance

# MarkerOptions settings

- Various options can be configured through the fluent API exposed by the **`MarkerOptions`**

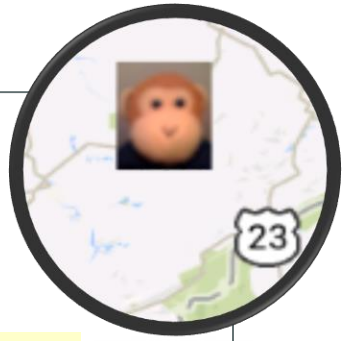
```
new MarkerOptions()
    .SetPosition(Location_Xamarin)
    .SetIcon(BitmapDescriptorFactory.DefaultMarker())
    .SetAlpha(.5f)
    .SetRotation(45.0f);
```

Properties are set on the resulting marker using fluent methods, each method returns the **`MarkerOption`** so you can chain them on a single statement

# Using custom images in the Marker

- Can set the marker to be a custom image (including transparency); use the **Anchor** to adjust the image position relative to the **LatLng** coordinate (centered by default)

```
Marker xamarinMarker = map.AddMarker(
        new MarkerOptions()
            .SetPosition(Location_Xamarin)
            .Anchor(1,1)
            .SetIcon(
          BitmapDescriptorFactory.FromResource(
                Resource.Drawable.Monkey));
```



# Changing Marker properties

- Marker settings can be altered at runtime through the **`Marker`** instance

```
Marker marker = ...

// Change the marker to be green to indicate "no problem"
marker.SetIcon(BitmapDescriptorFactory.DefaultMarker(
                    BitmapDescriptorFactory.HueGreen));
marker.Rotation = 180f;


...
marker.Remove(); // Remove from map!
```

# Info Window

- Can add popup info window to describe details for a given map marker, shown when the user taps the marker (or programmatically)

# Controlling the marker info window

- **`SetTitle`** displays the info window title and **`SetSnippet`** sets a single line of text in a slightly smaller font

```
var newYorkMarker = map.AddMarker(new MarkerOptions()
            .SetPosition(Location_NewYork)
            .InfoWindowAnchor(.5f,0)
            .SetTitle("The Big Appple")
            .SetSnippet("Get Details!"));

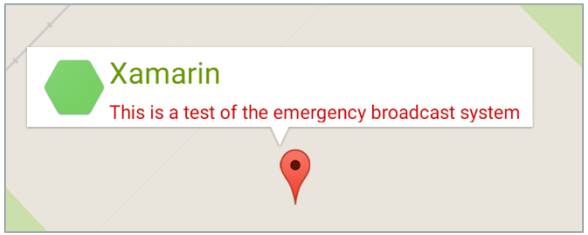
newYorkMarker.ShowInfoWindow();
```

Can request to show the info window immediately

# Customizing the info window

- Can assign **`IInfoWindowAdapter`** implementation to the map to provide complete customization of displayed view, can either provide just the *content* or the complete frame (to customize even the balloon style)

```
map.SetInfoWindowAdapter(
   new CustomMarkerPopupAdapter(LayoutInflater));
```



# Implementing IInfoWindowAdapter

```
public class CustomMarkerPopupAdapter : Java.Lang.Object, GoogleMap.IInfoWindowAdapter
{
   private LayoutInflater layoutInflater;
   public CustomMarkerPopupAdapter(LayoutInflater inflater) {
      layoutInflater = inflater;
   }

   // Used to draw frame + contents
   public View GetInfoWindow(Marker marker) { return null; }

   // Draw only contents
   public View GetInfoContents(Marker marker) {
      var view = layoutInflater.Inflate(...);
      ... // Fill in view from marker data
      return view;
   }
}
```

# Implementing IInfoWindowAdapter

```
public class CustomMarkerPopupAdapter : Java.Lang.Object, GoogleMap.IInfoWindowAdapter
{
    private LayoutInflater layoutInflater;
    public CustomMarkerPopupAdapter(Layou
        layoutInflater = inflater;
    }

    // Used to draw frame + contents
    public View GetInfoWindow(Marker marker) { return null; }

    // Draw only contents
    public View GetInfoContents(Marker marker) {
        var view = layoutInflater.Inflate(...);
        ... // Fill in view from marker data
        return view;
    }
}
```

Must derive from Java.Lang.Object *and* implement interface

# Implementing IInfoWindowAdapter

```
public class CustomMarkerPopupAdapter : Java.Lang.Object, GoogleMap.IInfoWindowAdapter
{
   private LayoutInflater layoutInflater;
   public CustomMarkerPopupAdapter(LayoutInflater inflater) {
      layoutInflater = inflater;
   }

   // Used to draw frame + contents
   public View GetInfoWindow(Marker marker) { return null; }

   // Draw only contents
   public View GetInfoContents(Marker marker) {
      var view = layoutInflater.Inflate(...);
      ... // Fill in view from marker data
      return view;
   }
}
```

Implement *either* **GetInfoWindow** or **GetInfoContents**

# Implementing IInfoWindowAdapter

```
public class CustomMarkerPopupAdapter : Java.Lang.Object, GoogleMap.IInfoWindowAdapter
{
   private LayoutInflater layoutInflater;
   public CustomMarkerPopupAdapter(LayoutInflater inflater) {
      layoutInflater = inflater;
   }

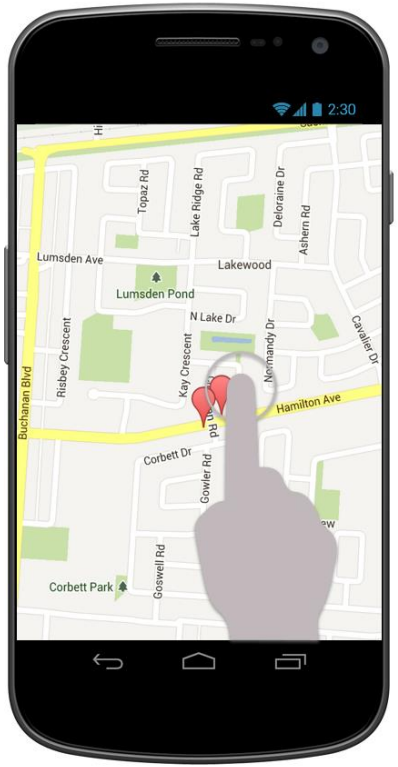
   // Used to draw frame + contents
   public View GetInfoWindow(Marker marker) { return null; }

   // Draw only contents
   public View GetInfoContents(Marker marker) {
      var view = layoutInflater.Inflate(...);
      ... // Fill in view from marker data
      return view;
   }
}
```

Can return null to get default behavior (e.g. to only draw *certain* markers)

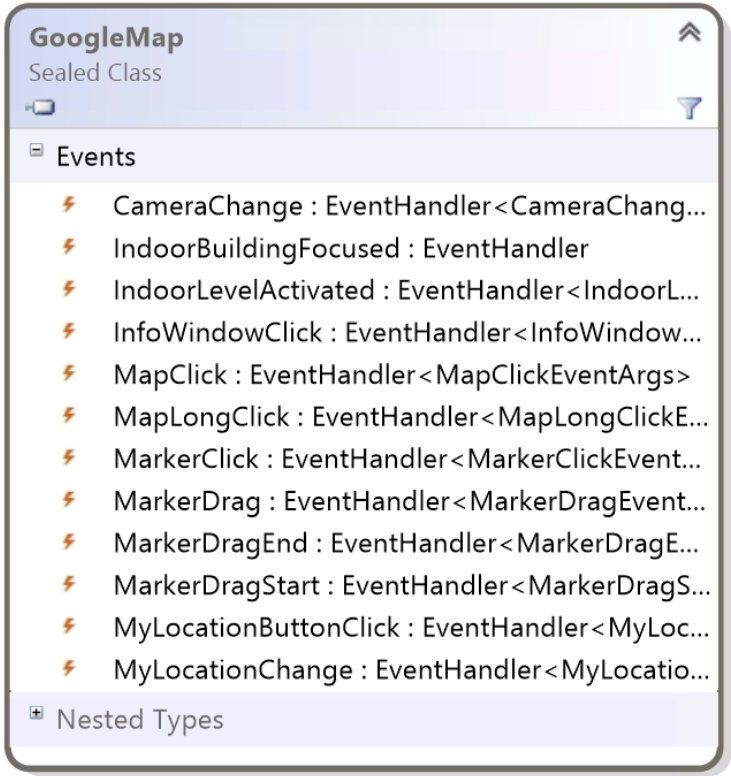
# Responding to interaction

- Several events are exposed on the **`GoogleMap`** to support adding user interactivity
  - click on a **`Marker`**
  - drag a **`Marker`**
  - click on an info window
  - long-click on the map



# Map Events

- Xamarin component exposes map interactivity as .NET events
- Can also use underlying interface notification support if desired (for behavioral reuse)
  - `SetOnMapClickListener`
  - `SetOnMarkerClickListener`
  - …



# Activating the marker

- Google Maps raises the **MarkerClick** event in response to user interaction with a marker, even if an info window is associated with it

```
map.MarkerClick += HandleMarkerClick;
...
void MapOnMarkerClick(object sender, GoogleMap.MarkerClickEventArgs e)
{
    e.Handled = false;
    Marker marker = e.Marker;
    if (marker.Equals(xamarinMarker)) {
        ... // tapped on Xamarin marker
    }
}
```

Passed **MarkerClickedEventArgs** to retrieve the marker which was activated

# Activating the marker

- Google Maps raises the **`MarkerClick`** event in response to user interaction with a marker, even if an info window is associated with it

```
map.MarkerClick += HandleMarkerClick;
...
void MapOnMarkerClick(object sender, GoogleMap.MarkerClickEventArgs e)
{
    e.Handled = false;
    Marker marker = e.Marker;
    if (marker.Equals(xamarinMarker))
        ... // tapped on Xamarin marker
    }
}
```

Handled flag (true by default) decides whether to perform the normal action – if this is true, then the Info Window will *not* be shown!

# Dragging the marker

- Setting a marker as *draggable* will cause the map to raise **MarkerDragStart**, **MarkerDrag** and **MarkerDragEnd** events to track when the user drags the marker around

```
marker.Draggable = true;
...
map.MarkerDrag += OnMarkerDrag;
...
void OnMarkerDrag(object sender, GoogleMap.MarkerDragEventArgs e)
{
    Marker marker = e.Marker;
    LatLng pos = marker.Position;
    ... // Process the drag operation
};
```

Drag events passed event args with marker

# Interacting with the Info Window

- Google Maps raises the **`InfoWindowClick`** event when the user taps on a displayed info window popup for a marker

```
map.InfoWindowClick += HandleInfoWindowClick;
...
void HandleInfoWindowClick(object sender,
                           GoogleMap.InfoWindowClickEventArgs e)
{
    e.Handled = true;
    Marker marker = e.Marker;
    if (marker.Equals(xamarinMarker)) {
        ... // tapped on Xamarin marker info window
    }
}
```

# Interacting with the map directly

- **`GoogleMap`** exposes **`MapClick`** and **`MapLongClick`** to handle click interactions

```
map.MapClick += (object sender, GoogleMap.MapClickEventArgs e) =>
{
    LatLng pos = e.Point;
    ...
};
```

# Interacting with the map directly

- **`GoogleMap`** exposes **`MapClick`** and **`MapLongClick`** to handle click interactions

Can also capture raw motion events from the parent or a transparent overlay and then transform screen coordinates into locations using the **`Projection`** property

```
List<LatLng> touchPoints = ...;
void OnMotionEvent(object sender, MotionEvent e)
{
    if (e.Action == MotionEventActions.Move) {
       touchPoints.Add (
          map.Projection.FromScreenLocation(
             new Point(
                (int)e.RawX, (int)e.RawY)));
    }
    ...
}
```

# Flash Quiz

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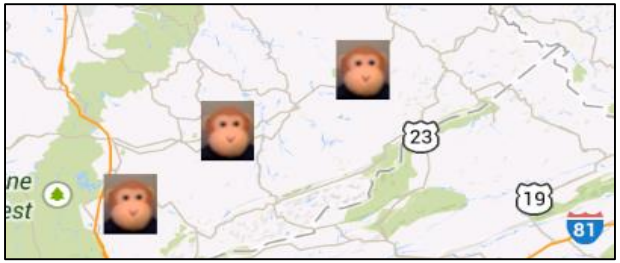
# Flash Quiz

① How were these marker images created?




a) `AddMarker`

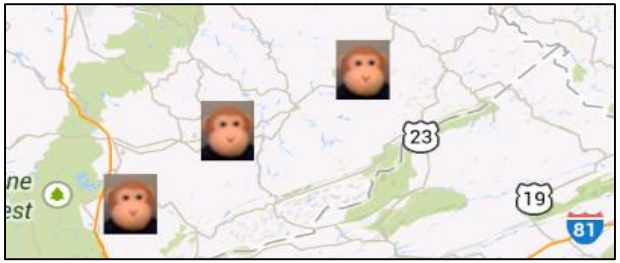
b) `MarkerOptions`

c) Both A and B

d) None of the Above

# Flash Quiz

① How were these marker images created?




a) `AddMarker`

b) `MarkerOptions`

c) Both A and B

d) None of the Above

# Flash Quiz

② Google Maps raises the `InfoWindowClick` event when the user taps on a displayed info window popup for a marker.

a) True

b) False

# Flash Quiz

② Google Maps raises the `InfoWindowClick` event when the user taps on a displayed info window popup for a marker.

a) True

b) False

# Individual Exercise

Working with markers

# Summary

1. Add map markers
2. Display marker details
3. Programmatically interact with the map

# Adjust the map position and perspective

Xamarin University

# Tasks

1. Update the map viewpoint
2. Animate camera position changes

# Google map surface

- Map is drawn as a flat plane on the screen with a camera looking down

- Position of the camera can be adjusted to change the
  - location
  - zoom
  - tilt
  - bearing

# Specifying the camera position

- The **CameraPosition** class identifies the location, bearing, tilt and zoom level; includes a fluent API to generate a specific position

```
CameraPosition pos = CameraPosition.InvokeBuilder()
      .Target(new LatLng(40.7, -74.0))
      .Zoom(20)
      .Bearing(155)
      .Tilt(65)
      .Build();
```

Latitude and Longitude are specified as **LatLng**

# Specifying the camera position

- The **CameraPosition** class identifies the location, bearing, tilt and zoom level; includes a fluent API to generate a specific position

```
CameraPosition pos = CameraPosition.InvokeBuilder()
      .Target(new LatLng(40.7, -74.0))
      .Zoom(20)
      .Bearing(155)
      .Tilt(65)
      .Build();
```

Zoom level at the center of the map, can get valid range with **MinZoomLevel** and **MaxZoomLevel**

# Specifying the camera position

- The **`CameraPosition`** class identifies the location, bearing, tilt and zoom level; includes a fluent API to generate a specific position

```
CameraPosition pos = CameraPosition.InvokeBuilder()
      .Target(new LatLng(40.7, -74.0))
      .Zoom(20)
      .Bearing(155)
      .Tilt(65)
      .Build();
```

Compass measurement clockwise from North

# Specifying the camera position

- The **CameraPosition** class identifies the location, bearing, tilt and zoom level; includes a fluent API to generate a specific position

```
CameraPosition pos = CameraPosition.InvokeBuilder()
      .Target(new LatLng(40.7, -74.0))
      .Zoom(20)
      .Bearing(155)
      .Tilt(65)
      .Build();
```

Viewing angle directly facing earth (down)

# Specifying the camera position

- The **CameraPosition** class identifies the location, bearing, tilt and zoom level; includes a fluent API to generate a specific position

```
CameraPosition pos = CameraPosition.InvokeBuilder()
      .Target(new LatLng(40.7, -74.0))
      .Zoom(20)
      .Bearing(155)
      .Tilt(65)
      .Build();
```

Call **Build** method to generate final position object

# Changing the camera viewpoint

- Camera position is changed by creating an *update request* through the **CameraUpdateFactory** and calling **MoveCamera** on the map

```
void ChangeCamera(CameraPosition pos)
{
    CameraUpdate update = CameraUpdateFactory
                                .NewCameraPosition(pos);
    map.MoveCamera(update);
}
```

**MoveCamera** will *immediately* transition the current view to the specified location identified by the passed **CameraUpdate**

# Adjusting the camera viewpoint

- **`CameraUpdateFactory`** has a variety of *adjustment* methods which apply to the current position

```
CameraUpdate update = CameraUpdateFactory.ZoomIn();
                      .ZoomOut();
                      .ZoomTo(...);
                      .ZoomBy(...);
                      .ScrollBy(x,y);
                      .NewLatLng(...);
                      .NewLatLngBounds(...);
                      .NewLatLngZoom(...);
```

Returned **`CameraUpdate`** can then be used to reposition the map location

# Animating the camera viewpoint

- Can also animate the position change – this will smoothly shift the location in the map from the current location to the specified one

```
CameraUpdate update = ...;
map.AnimateCamera(update);
map.AnimateCamera(update, 2000, null);
```

- `StopAnimation` can be used to halt the animation and immediately transition to the new position – for example if the user taps on the map

```
map.StopAnimation();
```

# Monitoring camera viewpoint changes

- Interactive maps can be adjusted with gestures, can monitor these changes by handling the **CameraChange** event

```
map.CameraChange +=
      (object sender, GoogleMap.CameraChangeEventArgs e) => {
         CameraPosition newPos = e.P0;
         ... // React to change
      };
```

# Flash Quiz

Xamarin University

# Flash Quiz

① What does the **`CameraPosition`** identify?

a) Tilt

b) Zoom

c) Target

d) All the above

# Flash Quiz

① What does the **`CameraPosition`** identify?

a) Tilt

b) Zoom

c) Target

d) All the above

# Flash Quiz

② What class do you use to create an update request?

a) `CameraUpdateFactory`

b) `CameraUpdate`

c) `CameraPosition`

d) None of the above

# Flash Quiz

② What class do you use to create an update request?

a) **`CameraUpdateFactory`**

b) `CameraUpdate`

c) `CameraPosition`

d) None of the above

# Individual Exercise

Changing the map viewpoint

# Summary

1. Update the map viewpoint
2. Animate camera position changes

# Thank You!

Please complete the class survey in your profile:
university.xamarin.com/profile