**OptionMenu & Context Menu**

- In android, there are three types of Menus available to define a set of options and actions in our android applications.
- The Menus in android applications are the following:
  - Android Options Menu
  - Android Context Menu
  - PopUp Menu

```
class MainActivity : AppCompatActivity() {
    lateinit var tv:TextView
    override fun onCreate(savedInstanceState: Bundle?) {
        super.onCreate(savedInstanceState)
        setContentView(R.layout.activity_main)

        tv = findViewById<TextView>(R.id.textview)
        registerForContextMenu(tv)
    }

    override fun onCreateContextMenu(
        menu: ContextMenu?,
        v: View?,
        menuInfo: ContextMenu.ContextMenuInfo?
    ) {
        super.onCreateContextMenu(menu, v, menuInfo)
        menu?.setHeaderTitle("Choose Color")
        menu?.add(102,1111,1,"RED")
        menu?.add(102,1112,2,"GREEN")
        menu?.add(102,1113,3,"BLUE")
        menu?.add(102,1114,4,"BLACK")
    }

    override fun onContextItemSelected(item: MenuItem): Boolean {
        when(item.itemId){
            1111->{tv.setTextColor(Color.RED)}
            1112->{tv.setTextColor(Color.GREEN)}
            1113->{tv.setTextColor(Color.BLUE)}
            1114->{tv.setTextColor(Color.BLACK)}
        }

        return super.onContextItemSelected(item)
    }
    override fun onCreateOptionsMenu(menu: Menu?): Boolean {
        menu?.add(101,1001,1,"New Group")
        menu?.add(101,1002,2,"New Broadcast")
        menu?.add(101,1003,3,"Linked Devices")
        menu?.add(101,1004,4,"Starred Messeges")
        menu?.add(101,1005,5,"Payments")
        menu?.add(101,1006,6,"Settings")

        return super.onCreateOptionsMenu(menu)
    }

    override fun onOptionsItemSelected(item: MenuItem): Boolean {
        when(item.itemId){
```

```
            1001->{ Toast.makeText(applicationContext,"New Group is
Clicked",Toast.LENGTH_LONG).show()}
            1002->{ Toast.makeText(applicationContext,"New Broadcast is
Clicked",Toast.LENGTH_LONG).show()}
            1003->{ /*tv.setTextSize(40f)*/ tv.textSize=40f}
            1006-
>{startActivity(Intent(applicationContext,SettingActivity::class.java))}
        }

        return super.onOptionsItemSelected(item)
    }
}
```

**What is the use of Dialog? Explain key methods required for managing the dialog lifecycle.**

**Dialog**

- Android supports following seven types of dialog
  - Dialog, AlertDialog, CharacterPickerDialog, DatePickerDialog, ProgressDialog, TimePickerDialog and custom dialog.
- Dialog may be launched once / repeatedly.

**Key Methods to manage dialog lifecycle**

- **showDialog()**
  - used to display a dialog.
- **dismissDialog ()**
  - used to stop showing a dialog.
  - It is kept in Activity's dialog pool,
  - If showDialog() is used after it cached version is displayed.
- **removeDialog()**
  - used to remove dialog from Activity's Object Dialog pool.
  - Dialog is not kept for future use.
  - If showDialog() is used after it then dialog must be recreated.

**Adding Dialog to an Activity**

- Define unique id for the dialog (within activity)
- Implement **onCreateDialog()** method → To return a dialog when unique id is passed.
- Implement **onPreapraeDialog()** method → To initialize dialog appropriately.
- Launch the dialog using **showDialog()** method. → Pass unique id.

**Defining a dialog**

- **onCreateDialog()** method is used to define dialog.
- Dialog must be defined in advance.
- Each dialog will have special unique identifier (integer)
- It is called only once for initial dialog creation.

**Initializing a dialog**

- To re-initialize dialog when dialog is shown from activity's dialog pool.
- **onPreapreDialog()** method is used.
- It is called each time **showDialog()** method is called.
- it is used to modify the dialog before it is again shown to the user.

**Launching a dialog**

- **showDialog()** method is used to show a dialog.
- Unique if of dialog is passed as a argument to display appropriate dialog.

**Dismiss dialog**

- Most dialogs have automatic dismissial circumstances.
- To forcefully dismiss a dialog **dissmissDialog()** method is used and unique id is passed as argument.

**Removing dialog**

- dismissDialog() doesn't destroy a dialog, dialog can be shown again that is it's cached content is displayed.

To force activity to remove dialog from Activity pool **removeDialog()** method with unique id of dialog as argument is used.

### Alert Dialog

```
var ad = AlertDialog.Builder( context: this)
ad.setMessage("Are you enjoying??")
ad.setTitle("Enjoying")
ad.setPositiveButton( text: "Yes",
    DialogInterface.OnClickListener { dialogInterface, i ->
        Toast.makeText(applicationContext,
            text: "Thank You for your feedback",
            Toast.LENGTH_LONG).show()
})
ad.setNegativeButton( text: "No",
    DialogInterface.OnClickListener { dialogInterface, i ->
    Toast.makeText(applicationContext,
        text: "Oh God! I will definitely teach you again",
        Toast.LENGTH_LONG).show()
})
ad.show()
```

### Progress Dialog

```
var pd = ProgressDialog( context: this)
pd.setTitle("Downloading")
pd.setMessage("File Downloading")
pd.max = 100
pd.setProgressStyle(ProgressDialog.STYLE_HORIZONTAL)
pd.show()

Thread(Runnable {
    var count=0
        while(count<=100) {
            try {
                pd.progress = count
                count += 10
                Thread.sleep( millis: 1000)
            } catch (i: InterruptedException) {
            }
        }
    pd.dismiss()
}).start()
```

### DatePicker Dialog

```
var c :Calendar = Calendar.getInstance()
var dp = DatePickerDialog( context: this,
    DatePickerDialog.OnDateSetListener { dp, yy,mm, dd ->
                dt = "$dd/${mm+1}/$yy"
                editText.setText(dt)
    }, c.get(Calendar.YEAR),
       c.get(Calendar.MONTH),
       c.get(Calendar.DAY_OF_MONTH)
)
dp.show()
```

### TimePicker Dialog

```
var  c :Calendar = Calendar.getInstance()
var tp = TimePickerDialog( context: this,
    TimePickerDialog.OnTimeSetListener { tp, hh, mi ->
        dt = dt + " $hh : $mi"
        editText.setText(dt)
},  c.get(Calendar.HOUR),
    c.get(Calendar.MINUTE),
     is24HourView: false)
tp.show()
```

## Explain various methods of Canvas and Paint class with example.

**Canvas Class**

- The Canvas class holds the "draw" calls.
- To draw something, you need 4 basic components:
  1. A Bitmap to hold the pixels,
  2. A Canvas to host the draw calls (writing into the bitmap),
  3. A drawing primitive (e.g. Rect, Path, text, Bitmap), and
  4. A paint (to describe the colors and styles for the drawing).

**Methods of Canvas**

- **drawColor(int color)**
  Fill the entire canvas' bitmap (restricted to the current clip) with the specified color,

- **drawBitmap(Bitmap bitmap, float left, float top, Paint paint)**
  Draw the specified bitmap, with its top/left corner at (x,y), using the specified paint, transformed by the current matrix.

- **drawText(String text, float x, float y, Paint paint)**
  Draw the text, with origin at (x,y), using the specified paint.

- **getHeight()**
  Returns the height of the current drawing layer.

- **getWidth()**
  Returns the width of the current drawing layer.

- **drawCircle(float cx, float cy, float radius, Paint p)**
  Draw the specified circle using the specified paint

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**Paint Class**

- The Paint class holds the style and color information about how to draw geometries, text and bitmaps.

**Constructor**

- **Paint()**
  Create a new paint with default settings.
- **Paint(int flags)**
  Create a new paint with the specified flags.

**Methods of Paint**

- **setColor(int color)** : It is used to set paints color.
- **setTextSize(float size):** Set the paint's text size.
- **setTypeface(Typeface t)**: Set or clear the typeface object.
  setTypeface(null) will assign default font settings to paint.
- **setStyle(Paint.Style):** Paint style controls how an object is filled with color.
  For example, the following code instantiates a Paint object and sets the Style to STROKE, which signifies that the object should be painted as a line drawing and not filled (the default):
  - Paint p = new Paint();
  - p.setStyle(Paint.Style.STROKE);

- **setAntiAlias(boolean aa)**
- Antialiasing makes many graphics—whether they are shapes or typefaces—look smoother on the screen.
- This property is set within the Paint of an object. or by using setFlags(), setting or clearing the ANTI_ALIAS_FLAG bit AntiAliasing smooths out the edges of what is being drawn, but is has no impact on the interior of the shape.

  Paint p = new Paint(Paint.ANTI_ALIAS_FLAG)
  p.setAntiAlias(false)

- **setShader()**

We can set the paint gradient using setShader() method.

_____
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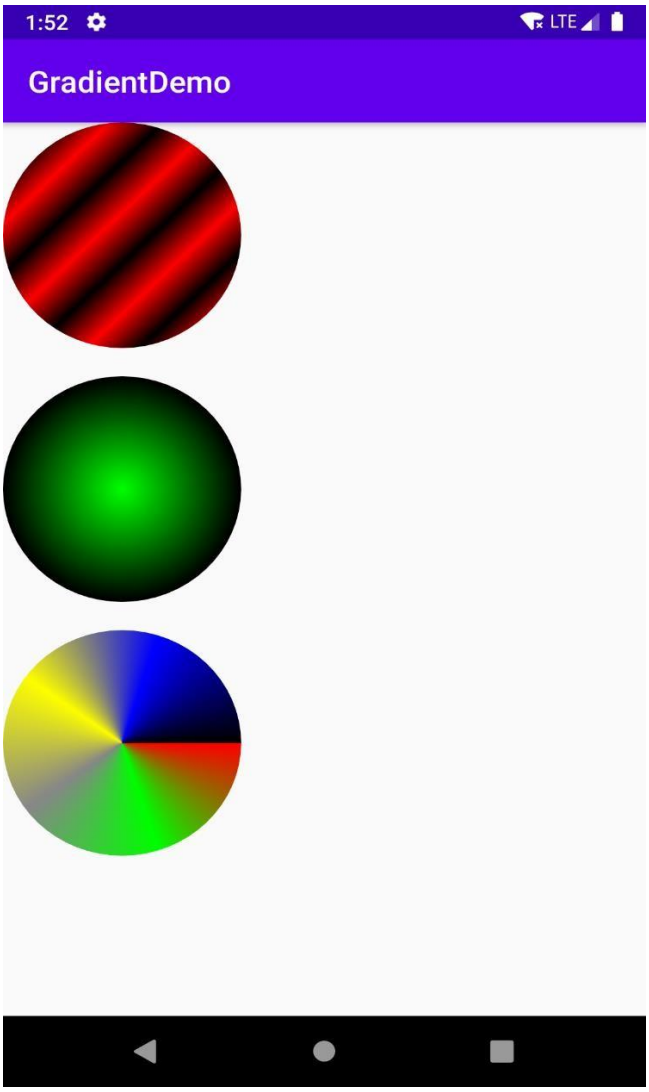
_____

**Working with Paint Gradients**

- You can create a gradient of colors using one of the gradient subclasses.
- The different gradient classes, including
  - LinearGradient,
  - RadialGradient, and
  - SweepGradient

  are available under the superclass android.graphics. Shader.
- All gradients need at least two colors—a start color and an end color—but might contain any number of colors in an array.
- The different types of gradients are differentiated by the direction in which the gradient "flows." Gradients can be set to mirror and repeat as necessary.
- You can set the Paint gradient using the setShader() method.




**Working with Linear Gradients**

- A linear gradient is one that changes colors along a single straight line.
- You can achieve this by creating a LinearGradient and setting the Paint method
- setShader() before drawing on a Canvas, as follows:

```
var p = Paint(Paint.ANTI_ALIAS_FLAG)
var lg = LinearGradient(0f,0f,45f,45f,
Color.RED,Color.BLACK,Shader.TileMode.MIRROR)
p.shader = lg
canvas?.drawCircle(200f,200f,200f,p)
```

**Working with Radial Gradients**

- A radial gradient is one that changes colors starting at a single point and radiating outward in a circle.
- The second circle in diagram is a radial gradient between green and black.
- You can achieve this by creating a RadialGradient and setting the Paint method.

```
var p = Paint(Paint.ANTI_ALIAS_FLAG)
var rg = RadialGradient(200f, 650f, 200f, Color.GREEN,
Color.BLACK, Shader.TileMode.MIRROR)
p.shader = rg
canvas?.drawCircle(200f,650f,200f,p)
```

**Working with Sweep Gradients**

- A sweep gradient is one that changes colors using slices of a pie.
- This type of gradient is often used for a color *chooser*. The last circle at the bottom of diagram is a sweep gradient between red, yellow, green, blue, and magenta.

```
var p = Paint(Paint.ANTI_ALIAS_FLAG)
var sg = SweepGradient(200f, 1100f,
intArrayOf (Color.RED, Color.GREEN, Color.GRAY,
Color.YELLOW, Color.BLUE, Color.BLACK), null)
p.shader = sg
canvas?.drawCircle(200f, 1100f, 200f,p)
```

**Gradient using XML**

- Create the following shape drawable file named linear_gradient.xml, radial_gradient and linear_gradient in drawable folder

**linear_gradient.xml**

```
<?xml version="1.0" encoding="utf-8"?>
<shape xmlns: android =
"http://schemas.android.com/apk/res/android"
  android:shape="oval">
  <gradient
    android:type="linear"
    android:angle="45"
    android:startColor="#F00"
    android:centerColor="#000"
    android:endColor="#0f0"
    ></gradient>
</shape>
```

**radial_gradient.xml**

```
<?xml version="1.0" encoding="utf-8"?>
<shape xmlns:android =
"http://schemas.android.com/apk/res/android"
  android:shape="oval">

  <gradient
    android:type="radial"
    android:gradientRadius="200"
    android:startColor="#F00"
    android:endColor="#0F0"
    android:centerColor="#000"
    ></gradient>
</shape>
```

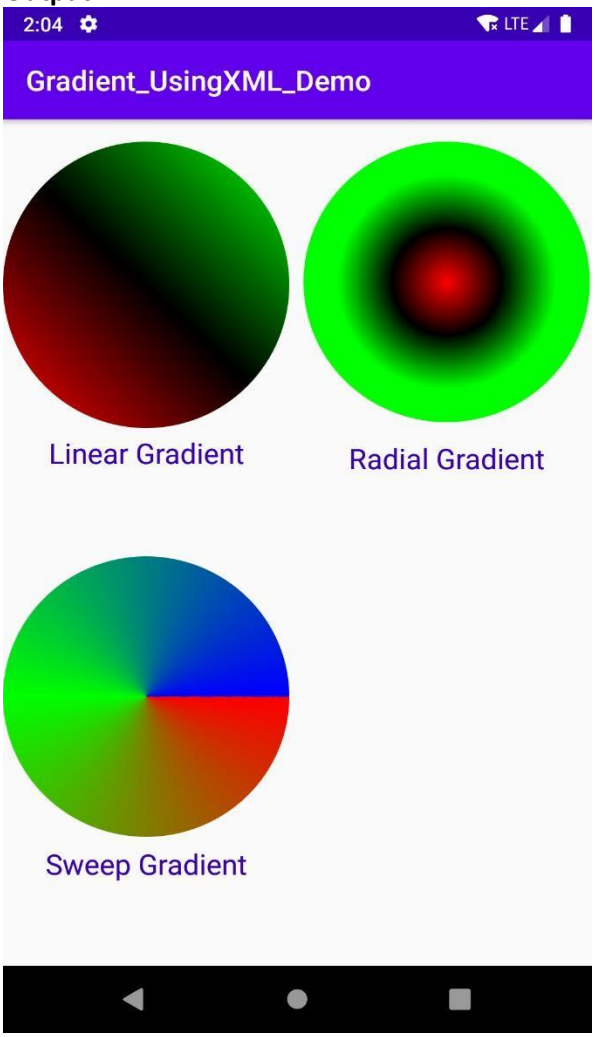
**sweep_gradient.xml**

```
<?xml version="1.0" encoding="utf-8"?>
<shape xmlns:android=
"http://schemas.android.com/apk/res/android"
  android:shape="oval">

  <gradient
    android:type="sweep"
    android:startColor="#F00"
    android:centerColor="#0F0"
    android:endColor="#00F"
    ></gradient>
</shape>
```

***activity_main.xml***

```
<ImageView
  android:id="@+id/imageView"
  android:layout_width="200dp"
  android:layout_height="0dp"
  app:srcCompat="@drawable/linear_gradient" />

<ImageView
  android:id="@+id/imageView2"
  android:layout_width="200dp"
  android:layout_height="200dp"
  app:srcCompat="@drawable/radial_gradient" />

<ImageView
  android:id="@+id/imageView3"
  android:layout_width="0dp"
  android:layout_height="200dp"
  app:srcCompat="@drawable/sweep_gradient" />
```

**Output**



**What is Frame-by-Frame Animation?Explain in detail?**
**OR**
**What is Tweened Animation? Explain in detail.**
**OR**
**Differentiate Frame-by-frame animation and Tweened animation.**

**Frame-by-Frame Animation**

- It is like a digital flipbook
- Series of similar images with a subtle (slight) differences display on the screen in a sequence.
- When these images are displayed quickly it gives illusion of a movement (animated). This technique is called Frame-by-Frame animation.
- Animation smoothness depends on
- Adequate no. of frames
- Choosing appropriate speed for swapping (changing) images.

**When should be used?**
Best used for complicated graphics transformation which can not be implemented programmatically.

**Example**

```
var ad = AnimationDrawable()
var frame1 = resources.getDrawable
                (R.drawable.image1, null)
var frame2 = resources.getDrawable
                (R.drawable.image2, null)
var frame3 = resources.getDrawable
                (R.drawable.image3, null)

ad.addFrame(frame1, 200)
ad.addFrame(frame2, 300)
ad.addFrame(frame3, 200)

imageView.background = ad

//To Start Animation
   ad.start()

//To Stop Animation
   ad.stop()
```

**Tweened Animation**

- This animation is applied on single drawable resource which can be
  - Bitmap graphics, ShapeDrawable, TextView, Any other view
- Intermediate frames will be generated (rendered) by system.
- Android supports following tweening transformations which can be defined in xml or in java.
- alpha, rotate, scale, translate
- Common properties of these transformation are
- When to start (startOffset)
- How long to animate (duration)
- Whether to return to starting state when animation completes. (fillAfter)

**Tweening transformation**
For xml way create xml file under **res->anim** folder.

**Rotate (Spin)**

- Rotate is defined as degrees.
- To spin object clockwise ( 0 to 360 degree)or counterclockwise (0 to -360 degree) around pivot point (within object boundary)
- Pivot point can be → fixed coordinate / percentage

**spin.xml**

```
<rotate
   android:fromDegrees="0"
   android:toDegrees="360"
   android:duration = "5000"
   android:pivotX="50%"
   android:pivotY="50%">
</rotate>
```

```
var an =
AnimationUtils.loadAnimation(this,R.anim.spin)
imageView.startAnimation(an)
```

**Scale (Zoom)**

- Used to stretch object vertically / horizontally.
- Starting scale (fromXScale, fromYScale)
- Target scale (toXScale, toYScale)

**zoom.xml**

```
<scale
   android:fromXScale="1.0"
   android:fromYScale="2.0"
   android:toXScale="4.0"
   android:toYScale="4.0"
   android:pivotY="50%"
```

```
android:pivotX="50%"
android:duration = "5000"
></scale>
```

**//To Apply zoom animation**

```
var an =
AnimationUtils.loadAnimation(this,R.anim.zoom)
imageView.startAnimation(an)
```

**Translate (Movement)**

- Moves object from one coordinate to other.
- Starting position (fromXDelta, fromYDelta)
- Relative target location (toXDelta, toYDelta)

**move.xml**

```
<translate
android:fromYDelta="-100"
android:duration = "2500">
</translate>
<translate
android:toYDelta="100"
android:duration = "2500">
</translate>
```

```
var an =
AnimationUtils.loadAnimation(this,R.anim.move)
imageView.startAnimation(an)
```

**Alpha (Blink)**

- It is used to blink the object.

**blink.xml**

```
<alpha
android:fromAlpha="0.0"
android:toAlpha="1.0"
android:repeatMode = "reverse"
android:duration = "500"
></alpha>
```

```
var an =
AnimationUtils.loadAnimation(this,R.anim.blink)
imageView.startAnimation(an)
```

| Frame By Frame | Tweened Animation |
|---|---|
| It is performed on a set of images. | It can perform series of simple transformation. |
| Series of Similar Images with slight difference displays on the screen in a sequence. | An animation that performs transitions such as transparency, zooming, moving, and spinning on a graphic. |
| It is like a digital Flip Book. It is work only on image related control | It works on almost each view like TextView, ImageView etc. |
| When these images are displayed quickly it gives illusion of a movement (animated). | Intermediate frames for twinning transformations like alpha, rotate, translate and scales are generated by the system. |
| Animation smoothness depends upon no of frames and appropriate speed of changing the images. | Animation depends upon the when to start and how long to animation i.e. duration. |

## Location Based Services

- Location-based services" is an umbrella term that describes the different technologies you can use to find a device's current location.
- The two main LBS elements are
  - **Location Manager** — Provides hooks to the location-based services.
  - **Location Providers** — Each of these represents a different location finding technology used to determine the device's current location.
- Using the Location Manager, you can do the following
  - Obtain your current location
  - Follow movement
  - Set proximity alerts for detecting movement into and out of a specified area
  - Find available Location Providers
  - Monitor the status of the GPS receiver
- Access to the location-based services is provided by the Location Manager.
- To access the Location Manager, request an instance of the LOCATION_SERVICE using the getSystemService() method.

## Finding Last Known Location

```
var lm = getSystemService(Context.LOCATION_SERVICE)
                    as LocationManager
var loc = lm.getLastKnownLocation(
LocationManager.GPS_PROVIDER )

if(loc!=null) {
   tv.setText("Longitude = " + loc.getLongitude()
+          "\nLatitude = " + loc.getLatitude());
}
```

## Refreshing the Current Location

```
var ll = object:LocationListener{
   override fun onLocationChanged(p0: Location?) {
  tv.setText("Longitude = " + p0.getLongitude()
          +"\nLatitude = "+p0.getLatitude());
   }
   override fun onStatusChanged(p0: String?, p1: Int,
p2: Bundle?) {}
   override fun onProviderEnabled(p0: String?) {}
   override fun onProviderDisabled(p0: String?) {}
}
```

```
lm.requestLocationUpdates(
LocationManager.GPS_PROVIDER,
1000, // milliseconds
100.2f, // distance in meter
ll)
```

## Finding a Location Provider

- The LocationManager class includes static string constants that return the provider name for three Location Providers:
  - LocationManager.GPS_PROVIDER
  - LocationManager.NETWORK_PROVIDER
  - LocationManager.PASSIVE_PROVIDER

- To get a list of the names of all the providers available call getProviders, using a Boolean to indicate if you want all, or only the enabled, providers to be returned:

```
var enabledOnly = true;
var providers =
    locationManager.getProviders(enabledOnly);
```

## Permission Required

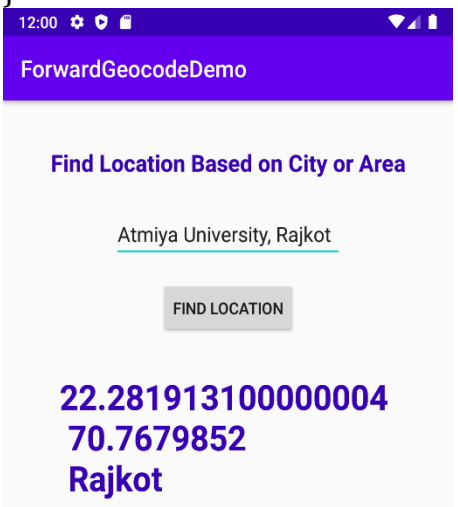
```
<uses-permission android:name=
"android.permission.ACCESS_FINE_LOCATION"
/>
<uses-permission android:name=
"android.permission.ACCESS_COARSE_LOCATION"
/>
```

## Using Geocoder

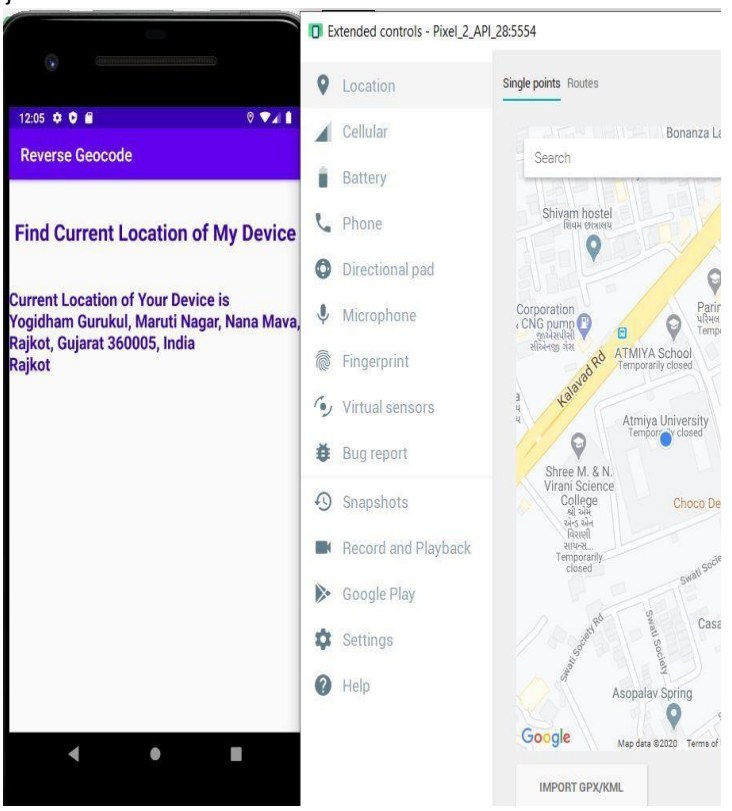
- Geocoding enables you to translate between street addresses and longitude/latitude map coordinates.
- This can give you a recognizable context for the locations and coordinates used in location based services and map-based Activities.
- The Geocoder classes are included as part of the Google Maps library, so to use them you need to import it into your application by adding a uses-library node within the application node as shown here:
- As the geocoding lookups are done on the server, your applications also requires the Internet usespermission in your manifest:

  **<uses-permission android:name= "android.permission.INTERNET"/>**
- The Geocoder class provides access to two geocoding functions:
- **Forward geocoding** — Finds the latitude and longitude of an address
- **Reverse geocoding** — Finds the street address for a given latitude and longitude

```
private fun forwardGeocode(city: String?){

var gc = Geocoder(this, Locale.getDefault())
var addresses = gc.getFromLocationName(city,2)
var address = addresses.get(0)

textView2.visibility = View.VISIBLE
textView2.setText("${address.latitude} \n
${address.longitude}\n ${address.locality}")
}
```




```
private fun reverseGeocode(loc: Location?) {
   var gc = Geocoder(this, Locale.getDefault())

   var addresses =
gc.getFromLocation(loc!!.latitude,loc.longitude,2)

   var address = addresses.get(0)
   textView2.setText("Current Location of Your Device
is\n${address.getAddressLine(0)} \n ${address.locality}
")
}
```




- Reverse geocoding returns street addresses for physical locations specified by latitude / longitude pairs.
- It's a useful way to get a recognizable context for the locations returned by location-based services.
- Forward geocoding (or just geocoding) determines map coordinates for a given location
- To geocode an address, call getFromLocationName on a Geocoder object.
- Pass in a string that describes the address you want the coordinates for, the maximum number of results to return, and optionally provide a geographic bounding box within which to restrict your search results:

## CREATING MAP-BASED ACTIVITIES

- One of the most intuitive ways to provide context for a physical location or address is to use a map.
- Using a MapView, you can create Activities that include an interactive map.
- Map Views support annotation using Overlays and by pinning Views to geographical locations.
- Map Views offer full programmatic control of the map display, letting you control the zoom, location, and display modes — including the option to display a satellite view.

### Introducing Map View and Map Activity

This section introduces several classes used to support Android maps.

- MapView is the user interface element that displays the map.
- MapActivity is the base class you extend to create an Activity that can include a Map View. The MapActivity class handles the application life cycle and background service management required for displaying maps. You can only use Map Views within MapActivity-derived Activities.
- Overlay is the class used to annotate your maps. Using Overlays, you can use a Canvas to draw onto any number of layers displayed on top of a Map View.
- MapController is used to control the map, enabling you to set the center location and zoom levels.
- MyLocationOverlay is a special Overlay that can be used to display the current position and orientation of the device.
- ItemizedOverlays and OverlayItems are used together to let you create a layer of map markers, displayed using Drawables and associated text.

### Getting Your Maps API Key

To use a Map View in your application, you must first obtain an API key from the Android developer website at http://code.google.com/android/maps-api-signup.html

- Without an API key the Map View cannot download the tiles used to display the map.
- To obtain a key, you need to specify the MD5 fingerprint of the certificate used to sign your application.
- Generally, you sign your application using two certificates: a default debug certificate and a production certificate.

- To use maps in your applications, you need to extend MapActivity.
- The layout for the new class must then include a MapView to display a Google Maps interface element.
- The Android maps library is not a standard Android package; as an optional API, it must be explicitly included in the application manifest before it can be used. Add the library to your manifest using a uses-library tag within the application node, as shown in the following XML snippet:

```
<uses-library
android:name="com.google.android.maps"/>
```

- To do this, you need to add a uses-permission tag to your application manifest for INTERNET, as shown here:

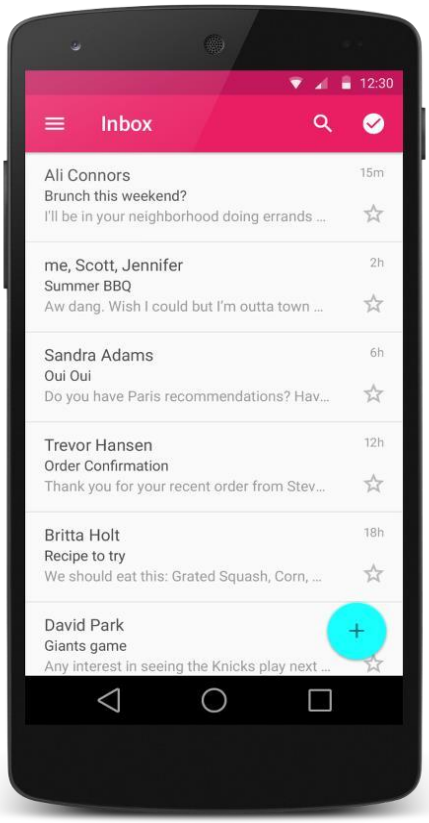
```
<uses-permission
android:name="android.permission.INTERNET"/>
```

### SKELETON MapActivity

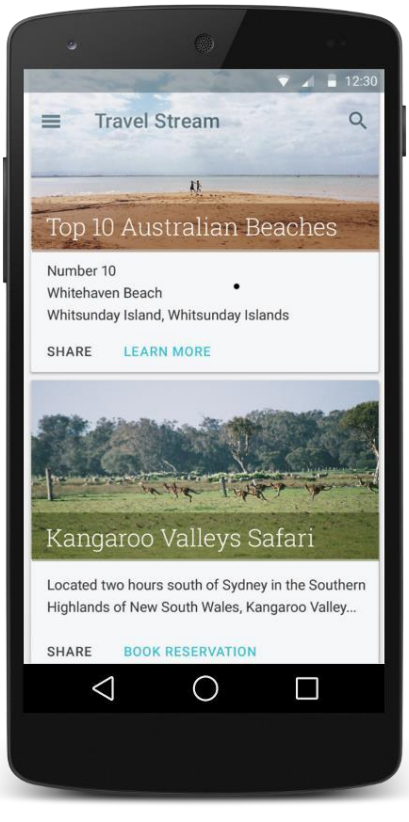
```
class MapsActivity : AppCompatActivity(),
OnMapReadyCallback {
   private lateinit var mMap: GoogleMap
   override fun onCreate(savedInstanceState: Bundle?) {
      super.onCreate(savedInstanceState)
      setContentView(R.layout.activity_maps)
       val mapFragment = supportFragmentManager
  .findFragmentById(R.id.map) as SupportMapFragment
      mapFragment.getMapAsync(this)
   }
   override fun onMapReady(googleMap: GoogleMap) {
      mMap = googleMap
      val rajkot = LatLng(-22.308155, 70.800705)
mMap.addMarker(MarkerOptions().position(rajkot).titl
e("Marker in Rajkot"))
mMap.moveCamera(CameraUpdateFactory.newLatLng(
rajkot))  }
}
```

**RecyclerView & CardView**

- RecyclerView is flexible and efficient version of ListView.
- It is a container for rendering larger data set of views that can be recycled and scrolled very efficiently.
- RecyclerView is like traditional ListView widget, and with more flexibility to customizes and optimized to work with larger datasets.
- If your app needs to display a scrolling list of elements based on large data sets (or data that frequently changes), you should use RecyclerView.




**A List using RecyclerView**




**A List using CardView**

**RecyclerView Overview**

- In the RecyclerView model, several different components work together to display your data. The overall container for your user interface is a RecyclerView object that you add to your layout.
- The RecyclerView fills itself with views provided by a layout manager that you provide.
- You can use one of standard layout managers (such as LinearLayoutManager or GridLayoutManager), or implement your own.
- The views in the list are represented by view holder objects. These objects are instances of a class you define by extending RecyclerView.ViewHolder.
- Each view holder is in charge of displaying a single item with a view. For example, if your list shows music collection, each view holder might represent a single album.
- The RecyclerView creates only as many view holders as are needed to display the on-screen portion of the dynamic content, plus a few extra.
- As the user scrolls through the list, the RecyclerView takes the off-screen views and rebinds them to the data which is scrolling onto the screen.

- The view holder objects are managed by an adapter, which you create by extending RecyclerView.Adapter.
- The adapter creates view holders as needed. The adapter also binds the view holders to their data.
- It does this by assigning the view holder to a position, and calling the adapter's onBindViewHolder() method. That method uses the view holder's position to determine what the contents should be, based on its list position.

**CardView Overview**

- Apps often need to display data in similarly styled containers. These containers are often used in lists to hold each item's information.
- The system provides the CardView API as an easy way for you show information inside cards that have a consistent look across the platform.
- These cards have a default elevation above their containing view group, so the system draws shadows below them.
- Cards provide an easy way to contain a group of views while providing a consistent style for the container.