# Mobile Application Development

## Chapter Three: Activities, Intents and Services

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- Android Activities, Intents and Services
- Characteristics of Mobile Applications
- Successful Mobile Development

# Architecture Components


- Developers have full access to the frameworks
- APIs allow to reuse the framework's components

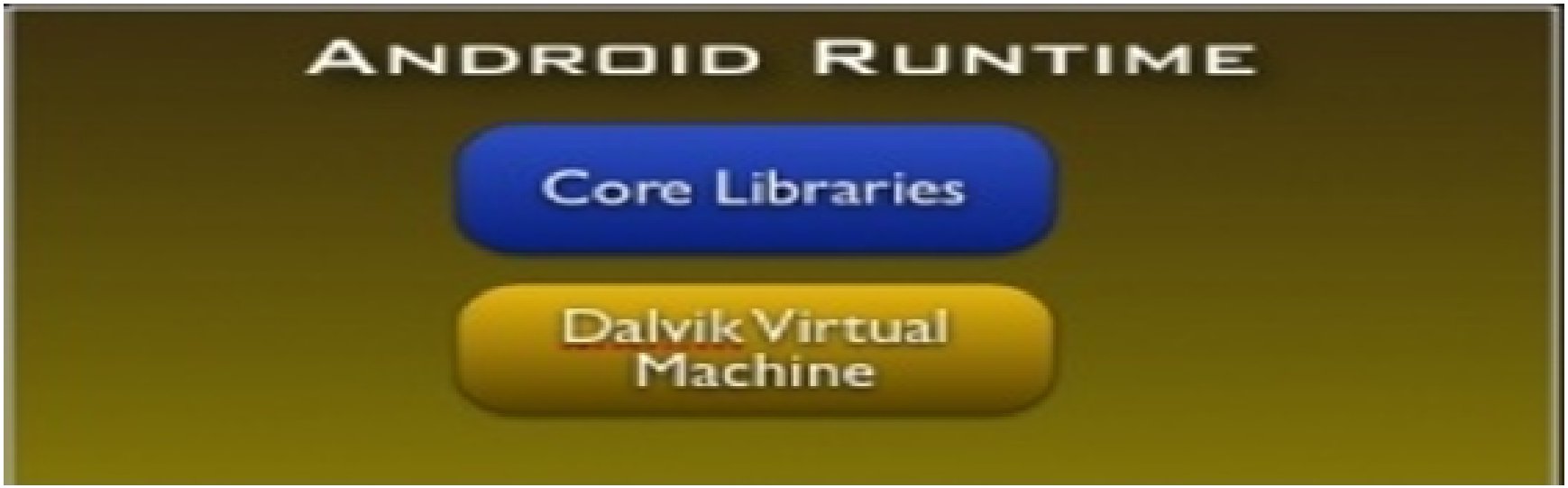
# ...Cont'd

| Feature | Role |
|---|---|
| View System | Used to build an application, GUI Objects and embedded web browser |
| Content Provider | Enables applications to access data from other applications, or to share their own data |
| Resource Manager | Provides access to non-code resources (graphics, and layout files) |
| Notification Manager | Enables applications to display customer alerts in the status bar |
| Activity Manager | Manages the lifecycle of applications & Provides common navigation |

# ...Cont'd


- Includes a set of C/C++ libraries
- Used by components of the android system
- Developers can use through the android application framework

# ...Cont'd




- Provides most functionalities for:
  - Data structures
  - Utilities
  - File access
  - Network access
  - Graphics

# ...Cont'd


- Relies on Linux Kernel 2.6 for core system services
- Perform memory and process management
- Network Stack
- Driver model
- Provides security
- Provides an abstraction layer between the hardware and the software stack

# Android UI

- User interface design in Android is a graphical representation of views displayed on a smartphone or tablet.
- It allows users to interact with the features, and contents of the application.
- To design UI, you need no prior programming knowledge, although it is nice to have web development skills or programming skills.
- Most applications have a user interface with which users can interact.
- Android provides various pre-built UI components that allow you to build a GUI for your application.

# ...Cont'd

- The core building blocks/ fundamental components of android are:
- Views: are used to customize user interface (UI) design.
  - A view is considered as a building block for a proper user interface created from the view class.
  - Are UI elements that are drawn on screen including buttons, forms, check-boxes, text-views, etc.
  - Anything that you see is a view.
- Layouts: view hierarchies that control screen format and appearance of the views.
  - Layouts are kept in the folder called resources.
  - The layout can be created with a simple XML layout file located in the resource layout folder of any project you work on.
  - Android studio creates a default XML layout file in the resources layout folder that is extremely useful.

# Advantages of XML layout

- There are many advantages of XML layout.
- These are:
  - It is an immensely popular and widely used format.
  - It helps to provide the UI component from the logic, which in turn provides the flexibility to change one component without affecting the other.
  - It is much easier to generate than writing direct code.
  - It allows an easier drag and drop to generate interfaces for the android application.
- Units of measurement
  - DP $\rightarrow$ Density independent pixel
  - SP $\rightarrow$ Scale independent pixel
  - PX $\rightarrow$ Pixel
  - PT$\rightarrow$ Point

# Layout Types

- Constraint
- Linear
- Relative
- Table
- Absolute
- Frame

# ...Cont'd

- Layout types
- Constraint: a view group that allows you to position and size widgets in a flexible way.

```
<androidx.constraintlayout.widget.ConstraintLayout xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:app="http://schemas.android.com/apk/res-auto"
    xmlns:tools="http://schemas.android.com/tools"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    tools:context=".MainActivity">

    <Button
        android:id="@+id/onclickinsert"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:onClick="onClickInsert"
        android:text="Go To Insert Activity"
        android:textSize="24sp"
        app:layout_constraintBottom_toBottomOf="parent"
        app:layout_constraintEnd_toEndOf="parent"
        app:layout_constraintStart_toStartOf="parent"
        app:layout_constraintTop_toTopOf="parent" />
</androidx.constraintlayout.widget.ConstraintLayout>
```

# ...Cont'd

- Layout types
- Linear: a view group that aligns all children in a single direction vertically or horizontally.

```
<androidx.appcompat.widget.LinearLayoutCompat xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:app="http://schemas.android.com/apk/res-auto"
    xmlns:tools="http://schemas.android.com/tools"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    tools:context=".MainActivity">

    <Button
        android:id="@+id/onclickinsert"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:onClick="onClickInsert"
        android:text="Go To Insert Activity"
        android:textSize="24sp"
        app:layout_constraintBottom_toBottomOf="parent"
        app:layout_constraintEnd_toEndOf="parent"
        app:layout_constraintStart_toStartOf="parent"
        app:layout_constraintTop_toTopOf="parent" />
</androidx.appcompat.widget.LinearLayoutCompat>
```

# ...Cont'd

- Android Layout attributes
  - android: id
  - android: layout_width
  - android: layout_height
  - android: layout_marignTop
  - android: layout_weight
  - android: layout_gravity
  - android: layout_paddingRight. . . .

# ...Cont'd

- Android Layout controls
  - Text input fields
  - Buttons
  - Checkboxes
  - Seek bars
  - Toggle buttons
  - Zoom buttons

# Reading Assignment

- Relative layout
- Table layout
- Absolute layout
- Frame layout

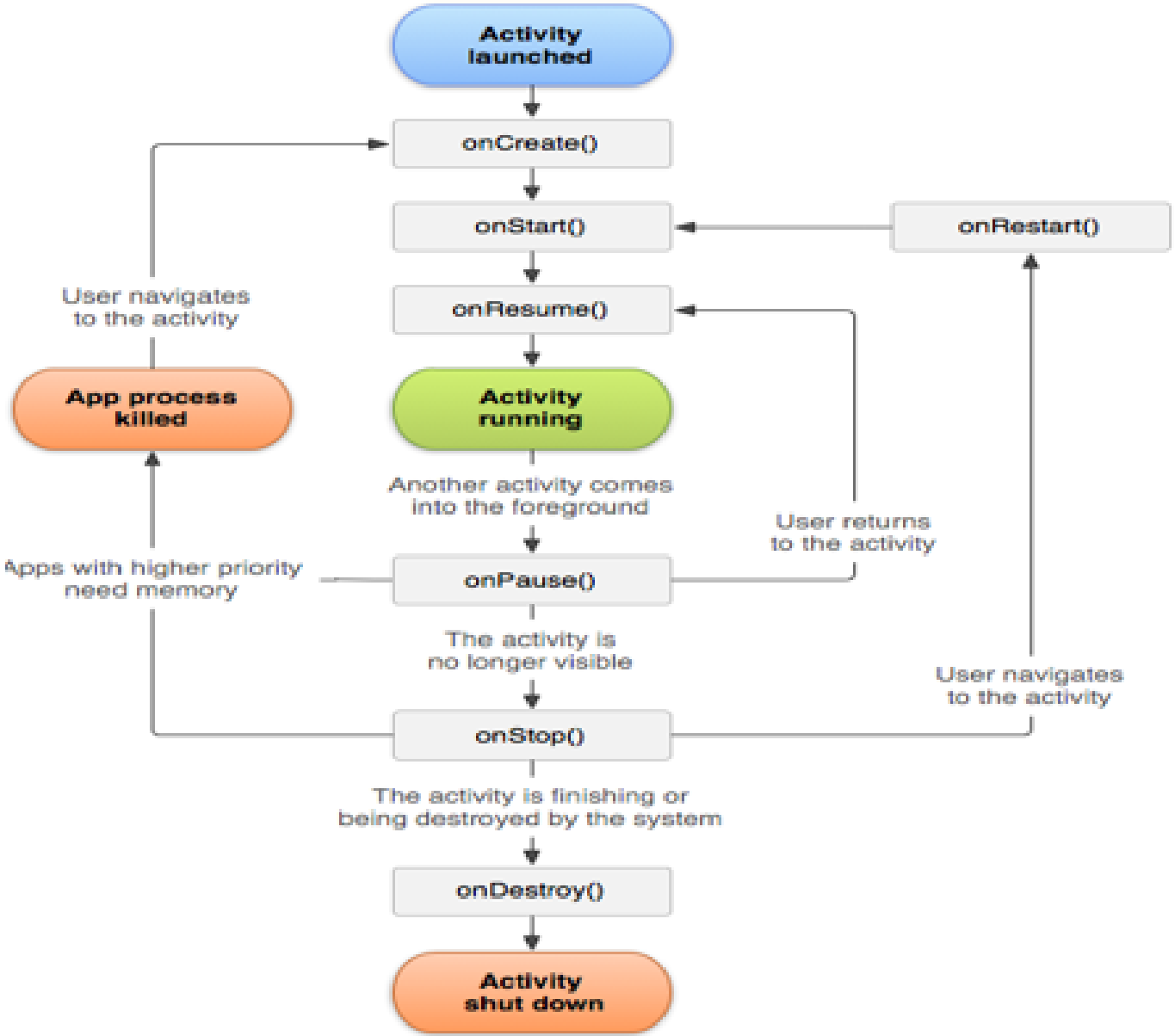
# ...Cont'd

- Fragments: represent a behavior or a portion of user interface in an activity.
- Resources: external elements, such as strings, constants and drawable pictures.
- Sub-folders in resources folder;
  - Drawable
  - Layout
  - Mipmap
  - Values
- Manifest: configuration file for the application.
- Configurable items include;
  - Permission $\rightarrow$ call, sms, Internet
  - Setting launcher activity
  - Meta-data....

# Activity

- Activity: is a class that represents a single screen.
- Provides user interaction.
- An application can have multiple activities.
- An activity has essentially four states:
  1. If an activity is in the foreground of the screen (at the top of the stack), it is active or running.
  2. If an activity has lost focus but is still visible (that is, a new non-full-sized or transparent activity has focus on top of it), it is paused.
  3. If an activity is completely obscured by another activity, it is stopped.
  4. If an activity is paused or stopped, the system can drop the activity from memory by either asking it to finish, or simply killing its process.

# Android life-cycle of Activity



# Creating Activity

- An activity represents a single screen in an app.

```
protected void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.activity_main);
}
```

# Starting Activity

- You can start a new instance of an activity by passing an Intent to startActivity().
- The Intent describes the activity to start and carries any necessary data.

```
public void onClickInsert(View view){
    Intent Insert=new Intent(getApplicationContext(), InsertActivity.class);
    startActivity(Insert);
}
```

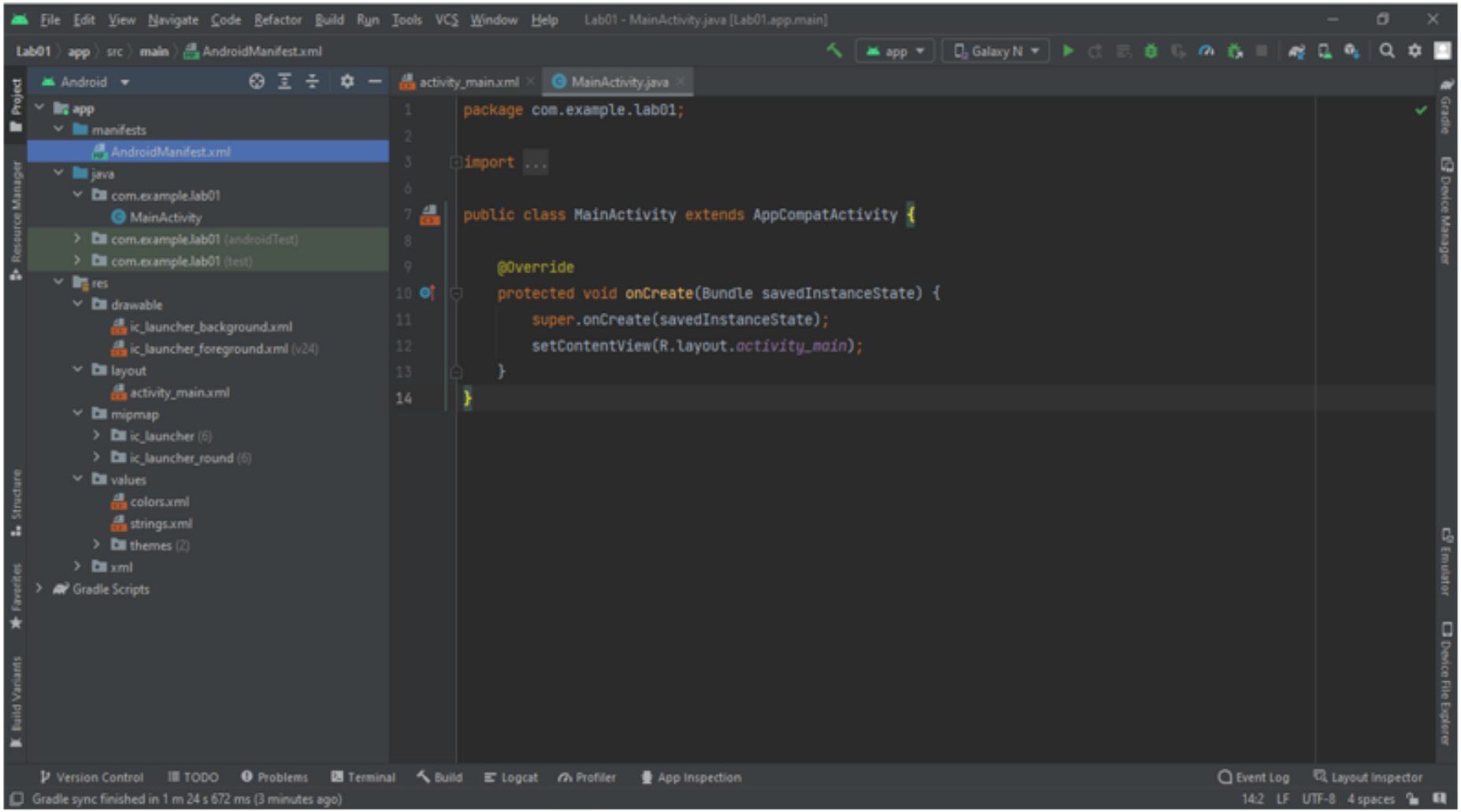
# Running your app. on a Real Device

- Set up your device
  - Plug in your device to your development machine with a USB cable.
  - You might need to install the appropriate USB driver for your device.
  - Enable USB debugging on your device.
    - ★ On Android 4.0 and newer, go to Settings → Developer options.
    - ★ Note: On Android 4.2 and newer, Developer options is hidden by default.
    - ★ To make it available, go to Settings → About phone and tap Build number seven times.
    - ★ Return to the previous screen to find Developer options.
- Run the app from Android Studio
  - Select one of your project's files and click Run from the toolbar.
  - In the Choose Device window that appears, select the running device, and click OK .
  - Android Studio installs the app on your connected device and starts it.

# Internal Details of Hello Android Example

- Here, we are going to learn the internal details or working of hello android example.
- Android application contains different components such as java source code, string resources, images, manifest file etc.
- Let's understand the project structure of android application.
  - onCreate method: is called when Activity class is first created.
  - setContentView(R.layout.activity_main): gives information about our layout resource.
  - Here, our layout resources for main activity are defined in activity_main.xml file.

# ...Cont'd


File Edit View Navigate Code Refactor Build Run Tools VCS Window Help
Lab01 - MainActivity.java [Lab01.app.main]
Lab01 app src main AndroidManifest.xml
app
Galaxy N
Android
activity_main.xml
MainActivity.java
app
manifests
AndroidManifest.xml
java
com.example.lab01
MainActivity
com.example.lab01 (androidTest)
com.example.lab01 (test)
res
drawable
ic_launcher_background.xml
ic_launcher_foreground.xml (v24)
layout
activity_main.xml
mipmap
ic_launcher (6)
ic_launcher_round (6)
values
colors.xml
strings.xml
themes (2)
xml
Gradle Scripts
package com.example.lab01;
import ...
public class MainActivity extends AppCompatActivity {
@Override
protected void onCreate(Bundle savedInstanceState) {
super.onCreate(savedInstanceState);
setContentView(R.layout.activity_main);
}
}
Version Control
TODO
Problems
Terminal
Build
Logcat
Profiler
App Inspection
Event Log
Layout Inspector
Gradle sync finished in 1 m 24 s 672 ms (3 minutes ago)
14:2 LF UTF-8 4 spaces

# Intents

- An Intent is a messaging object you can use to request an action from another app component.
- It is a component used to invoke components, message wirings etc.
- Bind individual components to each other at runtime.
- There are two types of intents.
  - Explicit Intents: specify which application will satisfy the intent, by supplying either the target app's package name or a fully-qualified component class name.
  - You'll typically use an explicit intent to start a component in your own app, because you know the class name of the activity or service you want to start.
    - ★ e.g, you might start a new activity within your app in response to a user action.
  - Implicit Intents: don't name a specific component, but instead declare a general action to perform, which allows a component from another app to handle it.
    - ★ e.g, if you want to show the user a location on a map, you can use an implicit intent to request that another capable app show a specified location on a map.

# ...Cont'd

```
public void onClickInsert(View view){
    Intent Insert=new Intent(getApplicationContext(), InsertActivity.class);
    startActivity(Insert);
}
```

# Services

- Service: is a background process that can run for a long time (e.g. music).
- A service is a component that performs operations in the background without a user interface.
- Should be used if something needs to be done while the user is not interacting with application.
- Needs to be declared in manifest file.
- There are three ways of using service:
  - Foreground: a service that will let the user know about what is happening in the background.
    - ★ e.g, in Music appl., the user can see the ongoing song on the device as a form of notification.
  - Background: the user will never know about what is happening in the background of the application.
    - ★ e.g, while sending some images over Whatsapp, Whatsapp compresses the image file to reduce the size.
  - Bound: is used when one or more than one application component binds the service by using the bindService() method.

# Difference between Service and IntentService

- Usage:
  - If you want some background task to be performed for a long time, then you should use the IntentService.
  - You can use service for the tasks that don't require any UI and also it is not a very long running task.
- How to Start?:
  - To start a service, call the onStartService() method
  - To start IntentService, use Intent $\rightarrow$ i.e. start the IntentService by calling Context.startService(Intent).
- Running Thread: service always runs on the main thread while the IntentService runs on a separate worker thread that is triggered from the main thread.
- Triggering Thread: service can be triggered from any thread while the IntentService can be triggered only from the main thread.

# ...Cont'd

- Main Thread Blocking:
  - If you are using service, then there are chances that your main thread will be blocked because service runs on the main thread.
  - In case of IntentService, there is no involvement of the main thread.
    - ⋆ Here, the tasks are performed in the form of Queue.
- Stop Service:
  - To stop a service, you have to use stopService() or stopSelf().
  - In case of IntentService, there is no need of stopping the service because the Service will be automatically stopped once the work is done.
- Interaction with the UI:
  - If you are using IntentService, then you will find it difficult to interact with the UI of the application.
  - If you want to out some result of the IntentService in your UI, then you have to take help of some Activity.

# ...Cont'd

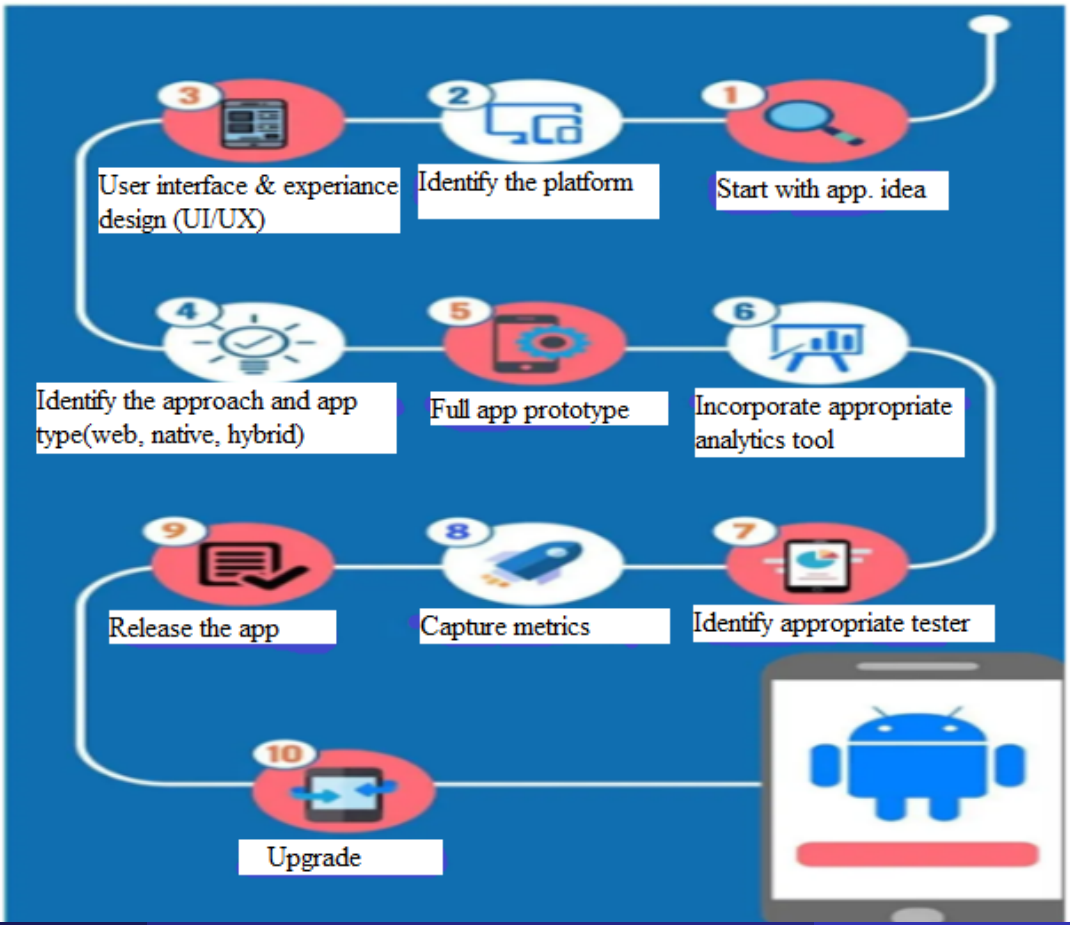
| Service | Intent Service |
|---|---|
| If the task doesn't require any and also not a very long task you can use service. | If the Background task is to be performed for a long time we can use the intent service. |
| we use the method **onStartService()** to start the service | we use the method **Context.startService(Intent)** to start the intent service |
| Service will always run on the main thread. | intent service always runs on the worker thread triggered from the main thread. |
| There is a chance of blocking the main thread. | tasks will be performed on a queue basis i.e, first come first serve basis. |
| To stop service we have to use **stopService()** or **stopSelf()** | No need to stop the service, it will stop automatically. |
| Easy to interact with the UI of the application. | Difficult to interact with the UI of the application. |

# Characteristics of Mobile Apps

- Run on resource constrained devices
- User friendly/simplicity for the end user
- High performance requirement
- Security sensitive
- Offline work
- Regular update
- Social media integration

# Successful Mobile Development

- To create a successful mobile application, you need to follow a systematic approach to the mobile app development lifecycle.
- Let you follow the following 10 steps to create a successful mobile application.



# ...Cont'd

- Step 1: Starts with an app idea
- To create a successful mobile application, the first thing you need to keep in mind is:
  - Identify a problem which can be resolved by your app
  - Decide the features of your app
  - The app should provide customer with tangible benefits including reducing costs via productivity enhancements, new revenue or improving the customer experience.
- Step 2: Identification /clarification of the platform
  - Application target users
  - Mobile platforms and devices to be supported
  - Revenue model

# ...Cont'd

- Step 3: UI/UX design
  - Designing your app is yet another significant factor which is responsible for success of an app in the market.
  - Good UX design and good UI-UX means good discoverability.
  - Designing an app is becoming increasingly popular as it create an instant impact on the mind of the user while ensuring usability of an app.

# ...Cont'd

- Step 4: Identify approach to develop the app – native, web or hybrid
  - A number of app developers prefer to follow the agile methodology.
  - Native: apps enables in delivering the best user experience but require significant time and skill to be developed.
    - ★ These apps are basically platform specific and require expertise along with knowledge.
    - ★ Native apps are costly as well as time taking to be developed and deliver the highest user experience amongst all the approaches.
    - ★ Downloaded from appstore/playstore
    - ★ Done for specific platform. e,g; Whatsapp
  - Web: apps are quick and cheap ones to develop and can run on multiple platforms.
    - ★ Developed using HTML5, CSS and JavaScript code.
    - ★ Less powerful than native apps.
    - ★ Accessed through web browsers. e.g; Gmail

# ...Cont'd

- Step 4: ...Cont'd
  - Hybrid: this approach is the latest approach to develop any app.
    - ⋆ It combines pre-built native containers with on-the-fly web coding in order to achieve the best of both worlds.
    - ⋆ In this approach, the developer augments the web code with native language to create unique features and access native APIs which are not yet available through JavaScript. e.g; Instagram
- Step 5: App prototype
  - It is actually the process of taking your idea and turning it into an application with some basic functionality.
  - A prototype makes it quite easier to sell your idea to potential buyers who can now actually view the tangible benefits instead of just visualizing or reading product description.
  - Helpful in attracting investors.

# ...Cont'd

- Step 6: Integrate an appropriate analytics tool
  - There is also a need to incorporate appropriate analytics which gives you a detailed picture of;
    - ★ How many visitors use your webs,
    - ★ How they arrived on your site and
    - ★ How can they keep coming back.
- Some of the mobile analytics tools that are used in this process:
  - Google Analytics
  - Firebase
  - Mixpanel
  - Preemptive

# ...Cont'd

- Step 7: Identify your testers: listen to them and incorporate relevant feedback
  - Beta testing is the first opportunity to get feedback from your target limited customers.
  - It is especially important as it enhances your visibility in the app store.
  - It not only reduce product risk but get you that initial push in the app store.
- Step 8: Release/Deploy the app: make your app. available to the market
- Step 9: Capture the metrics: to know the number of your app. users

# ...Cont'd

- Step 10: Upgrade your app with improvements and new features
  - After capturing the metrics it becomes important to upgrade your app with improvements and innovative features.
  - A mobile app without innovative features loses its usability in long run.
  - Upgrading your app with innovative features enhances its visibility along with downloads of an app.
  - Also ensure you keep updating your app to meet new guidelines offered by the various platforms, don't let your apps stagnate.

# Thank you!!!