

Native Data Handling

One of the most popular way to create applications program is to make them natively.

native app dev. means creating a mobile app that is dedicated to a specific platform (OS) as native app are dedicated to a specific platform, they provide higher user engagement than hybrid apps.

Written in Java or Kotlin

Benefits of Native App Development

- ① Best performance
- ② more secure
- ③ more interactive and intuitive
- ④ allow developers off^{to} access the full feature set of device
- ⑤ Have fewer bugs during development

Best performance .

- quick load time
- app is created and optimized for a specific platform
- fast and responsive bcoz built for a specific OS and compiled using the platform's core language & APIs.

Secure :- rely on technologies JS, HTML, CSS developing a native app a way to

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to guarantee your user reliable data protection

more interactive & intuitive

- run smoothly when it comes to user i/o
- they inherit their devices' OS interface which makes them look and feel like an integrated part of device.
- Benefit is the superior User experience
- full feature set of device

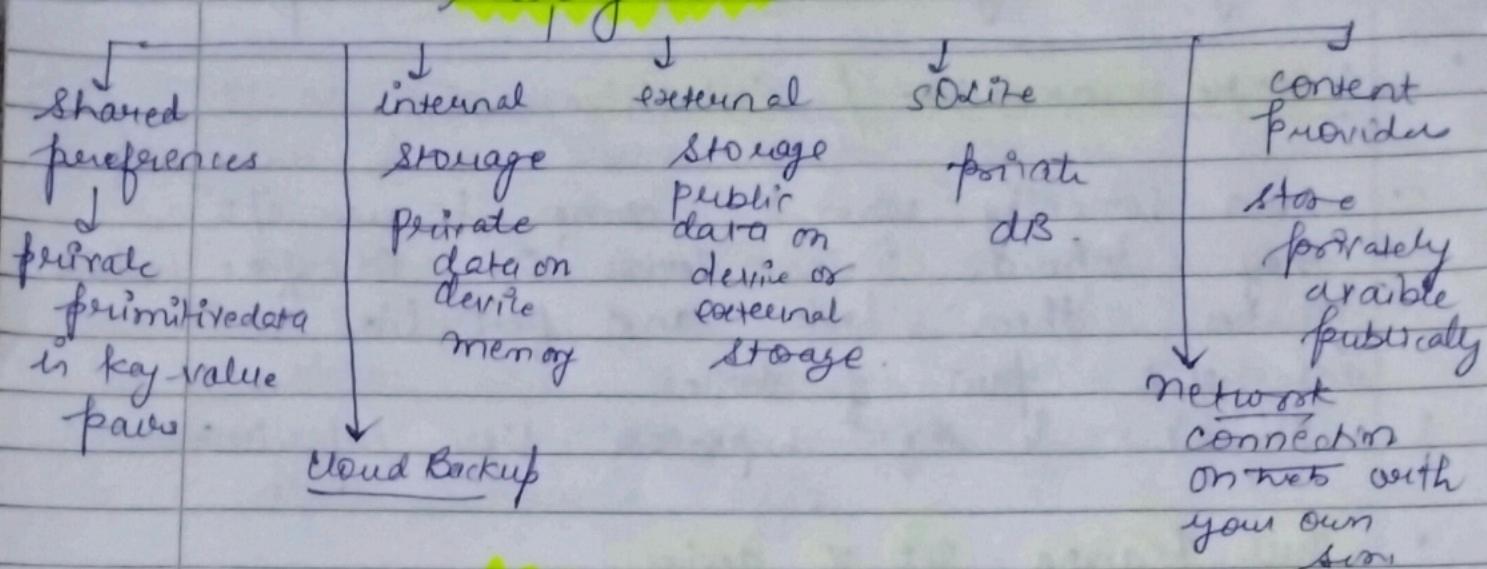
- as specific to platform they take full advantage of the software and OS's features
- these apps can directly access the hardware of devices, such as GPS, Camera, etc
- offer faster execution, result in better User experience

fewer Bugs during development :-

it's much more difficult to maintain 2 different app in codebase than in two application in 2 codebase

when you develop a hybrid app, there's an Native app added layer that you don't control over which can increases the chances of bugs occurring.

Storing Data



files

External storage
(Public directories)

Internal storage
(private directories?)

- not always available, can be removed.
- physical external storage like SD card.
- would be readable.
- On uninstall app, system cannot remove file from app to app.
- used
 - want to share data with other apps.
 - doesn't require access modification.
- Always available
- Use device's file system.
- only you app can access unless explicitly set to be readable or writable.
- On app uninstall, system removes files from internal storage.
- used when you want to be sure that neither the user nor other app can access your files.

External Storage

- on device or sd card

- uses - permission

android:name =

 android.permission.

 WRITE_EXTERNAL_STORAGE "/>

 READ

- use private directories.

- just for your app.

- App has permission
read / write

- Permanent storage =

getFilesDir()

- Temporary storage =

getCacheDir()

How much storage left,

- 1) if there is not enough space throws IOException
- 2) size of file getFreeSpace()
getTotalSpace()
- 3) if you

SQLite database

Other storage option :-

- 1) firebase - store and sync data with the firebase cloud database
data is synced across all clients and remain available when you are offline.

- Connected app share data

- Hosted in cloud

- Data is stored in JSON.

- Data is synchronized in realtime to every connected client

- 2) network connection can use the network to store & retrieve data on your own web-based services.
uses • java.net.*;
 android.net.*

- 3) Backing up data
 ① Auto Backup for APP level 23 and higher

- ② automatic backup app data to cloud.
 ③ no code required & free.

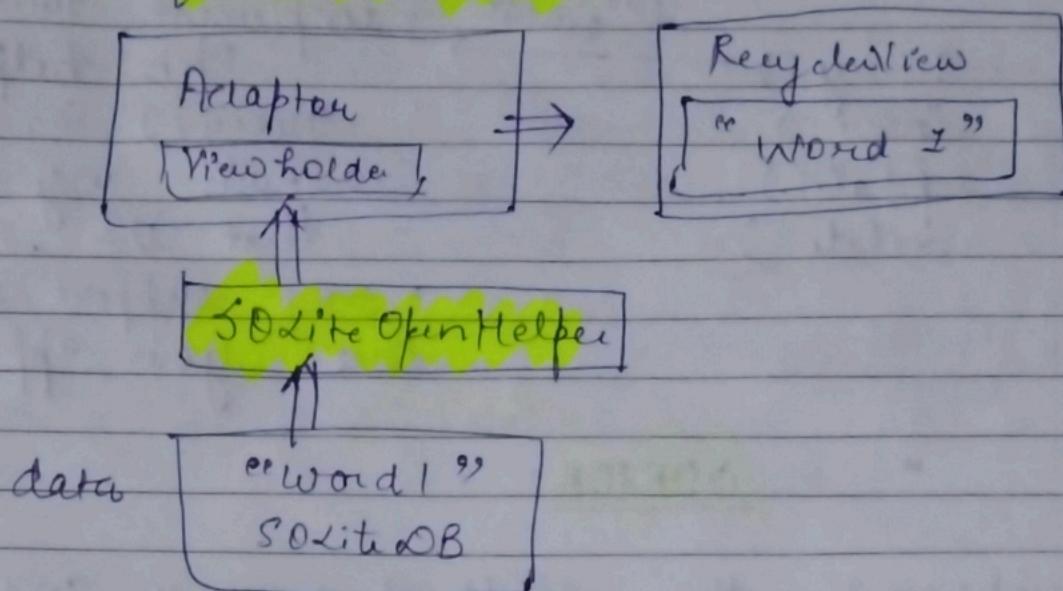
- 4) Backup API for android 5) (level 22)

- registered for android Backup service to get a Backup Service key.
- config create a Backup agent by extending the BackupAgentHelper class.
- Request backups when data has changed

5) SQLite Database:

- 1) versatile & straightforward to implement.
- 2) structured data that you need to store persistently.
- 3) Access, search and change data frequently.
- 4) primary storage for user or app data
- 5) Data can be represented as rows and columns.

Components of SQLite Database



all the interactions with the database is done through SQLiteOpenHelper

- executes your sql requests
- manage dB.
- Separates data & interaction from app
- keep complex app manageable

CRUD

Implement a SQLite Database

- Create data model.
- Subclass SQLiteOpenHelper
 - 1) Create constants for tables.
 - 2) OnCreate() → create SQLiteDB with tables
 - 3) OnUpgrade(), optional methods.

In main activity, create instance of SQLiteOpenHelper
call methods of SQLiteHelper to work with
the dB.

DB operation

- 1) query()
- 2) insert()
- 3) update()
- 4) delete()

executing queries

- implement query() in open helper class
- query() can take & return any data type that UI needs.
- only support queries that your app need

CURSOR

it represents the result of a query and basically points to one row of the query result this way android can buffer the query result efficiently as it does not have to load all data into memory

SQLite DB always represents result as cursor `mMoveToFirst()` is used to point the cursor position from where you want to get data from the cursor

Materialcursor is a mutable cursor implementation backed by an array of objects that automatically expands internal capacity as needed

Operation

- 1) `getCount()` → no of rows
- 2) `getColumnNames()` → string array with column name
- 3) `getPosition()` :- current position
- 4) `close()` :- releases all resources & invalidates the cursor

Content Values

It is used to insert rows into tables. Each content values object represents a single table row as a map of column names to values.

It stores data in key-value pairs
or

Set of key value pairs stored in a hash table

column value of field

Note Content values are key-value pair, which are updated or inserted in the dB, whereas cursor is used to store the temporary result.

Android Graphics

- android provides a huge set of 2D-drawing API's that allow you to create graphics.
- android has got visually appealing graphics and mind blowing animation.
- Android framework provides a rich set of powerful APIs for applying animation to UI elements and graphics as well as drawing custom 2D & 3D graphics.

Three Animation System used in android

Animation is the process of adding a motion effect to any view, image or text. with animation you can add motion to view or can change the shape of specific view.

Property Animation

View

Animation

Drawable Animation

- change a property's value over a specific length of time.
- that change the view of an object such as visibility & opacity.
- lets you load a series of drawable resources one after another to create more dramatic effects such as an object appear or disappear.
- used to create an animation.
- this animation is the most robust framework which lets you animate any properties of any object, view or non-view objects.
- also known as Tween animation.
- works by displaying a running sequence of drawable resources that image frame by frame inside view object.
- android.Animation provide classes that handle property animation.
- android.view.animation.
- Used to animate the content of a view method
- startAnimation()
- clearAnimation()

BMP file → Bitmap image file a image file format that contains bitmap graphics data. BMP images are device independent and require no graphics adapter to display them.

Date: / / Page No.: 1. Canvas

is a class in Android that performs 2D drawing of different objects onto the screen. It is a low level graphics tools.

Android framework provide a set of 2D-DRAWING APIs which allow user to provide own custom graphics onto a canvas or modify existing view.

Ways to Draw 2D Graphics :-

↓
Draw animation into a View from your layout ↓
Create your animation directly to a canvas

methods of canvas class

drawText(), drawRoundRect(), drawCircle()
drawRect(), drawBitmap()

View is used to draw simple graphics that do not need to change dynamically. ∵ canvas is better when app. needs to redraw itself regularly

Spruicing

today's word is incomplete without mobile apps. so the technology is at boom everyone learn the. But main difficulty occurs when we publish our app & didn't spruce up ∵ of poor design or other minor but imp. rules.

How we will spruce up our mobile App.

1) focus on Interactive Design :-

design of your app is the major part that grabs more attention.

If the UI is not good it may be possible the level of engagement of people towards your app will fail.

∴ design is imp to please the end user.

2) Goal Driven Design :-

while solving a problem through app development one thing we have to care of is the design that we are creating must be Goal-Driven design.

like it is for children, Adults, technical person

3) Desirability :- On's app must be accessible and usage enough not for technical but also for novice person also designed should be creative enough so that the target audience will not bore from it.

grinned

4) function familiarity \Leftrightarrow app that we create is suitable enough that every person didn't face any difficult regarding the functionality of it.

∴ user friendly.

5) Response to user :- designed in such a way that the app will respond to the user if he is going incorrect action or missed something etc.

6) Color Selection :- Our app should not only user-friendly or effective but also its success is depending upon the color we choose.

App designer will follow color trends in order to get maximum efficiency.

Audio Recorder

in Android for audio or radio recording there is a built in class called MediaRecorder. This helps to easily record radio or audio files. Android framework provides built in support for capturing and encoding common audio & video formats.

methods of MediaRecorder class

- set AudioSource()
- set Audio Encoder()
- set Output Format()
- set Output file()
- Stop()
- start()
- release()

Get Current location in Android \Rightarrow

android's location
Manager API

fused location provider
Google Play Service button
APIs

\Downarrow
this is best : it
optimizes the device's use of
battery power.

How to build a Video Player

- for viewing video we have MediaPlayer class in Android.
- to insert video in Android app \rightarrow res \rightarrow raw \rightarrow video file

Steps to build a VideoPlayer :-

- for frontend we just need one component i.e. VideoView
- the icon like play, pause, forward will only come when we touch on VideoView and will only come for 3 sec
- Coming to backend part :: Java coding we are getting media Control by `vw.setMediaController(new MediaController(this))`
- thead the video of raw folder in Asset and making a call to a method called `setVideo()` by giving an argument to it of the first video
- Now in `setVideo()` defining we need an Uri Obj so as to pass to a method called as `setVideoURI()`.
- Now code of generating a dialog box is done

7)

inside the method called onComplete.

at last, we have handled the coding the code of user's action.

Debugging

allows you to go through each line of code & evaluating your app's variable, methods & how well your code is working.

Start debugging

- Set breakpoints in your app's code
- From toolbar select debug
- View > tool > Debug
- Click the debugger tool

How to debug DB in Android

- Android Debug DB library is a useful tool for troubleshooting & shared preferences in android.
- You can also always get the debug address URL from your code by calling the method `DebugDB.getDebuggerUrl()`.

An Android Debug DB allows you to examine database & shared preferences straight in your browser.

also enables you to look at the structure of your DB in a debugable format.

How does Android App work?

Involves several process that happen in a sequential manner.

- after writing code when developer click RUN button in Android studio, takes plenty of operation and process starts at the backend.
- every operation in backend is crucial and inter-dependent.

Main steps :-

D)

- 1) Building the APK file.
- 2) Deploy the Application
- 3) Run the Application

APK file.

Android package kit is the file format for app used on the Android OS. compiled with Android studio which is an official IDE for building Android software.

Apk file includes all the the software program's code & assets
(extension for Android package file) (.apk file)

D) Building the APK files \Leftrightarrow

i) Code compilation :-

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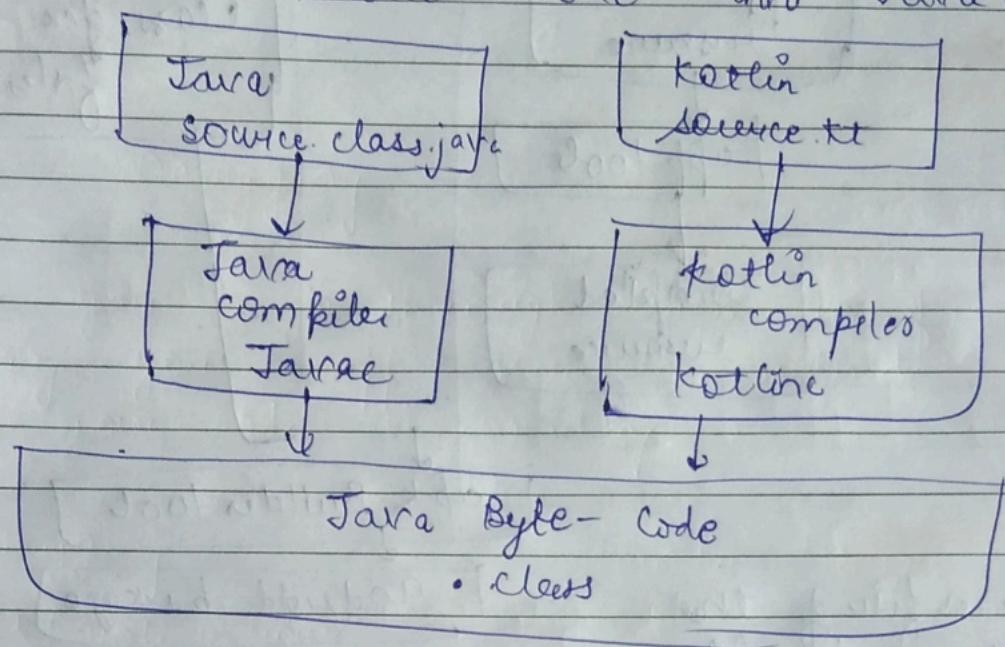
Building the APK files ↗

i) Code compilation :-

Android app source files are written in either Java or Kotlin.

Both languages generate code that can be

compiled to Java Byte Code which is executable on JVM, the process begin with the compilation of Java / kotlin source code into Java class file.

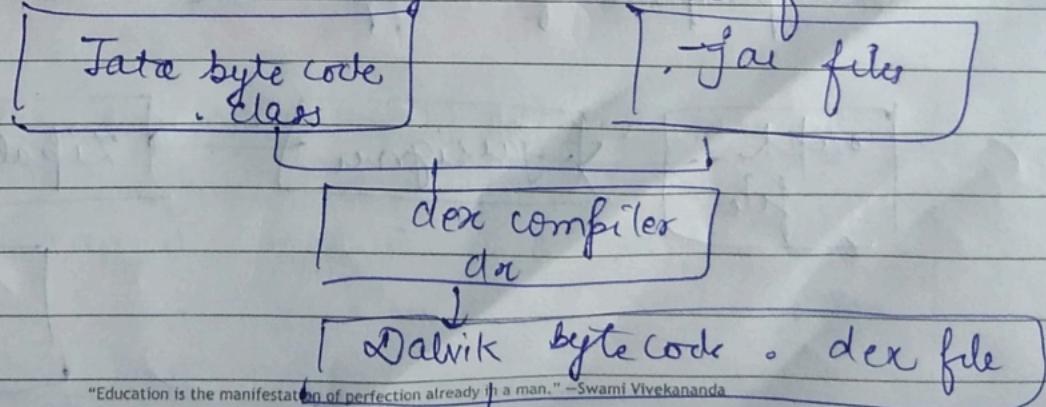


(ii) Conversion into Dalvik bytecodes :

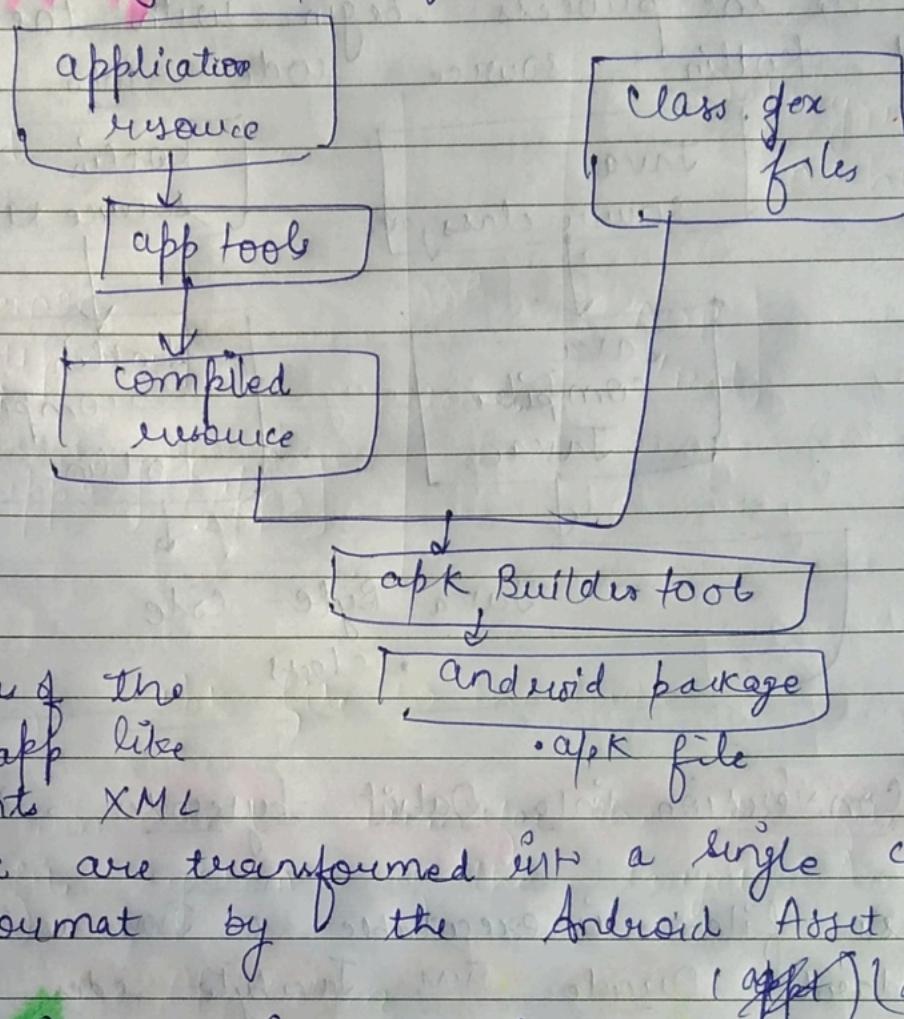
• Class file is executable on JVM as it contains the standard Oracle JVM Java byte codes.

But this format is not suitable for android devices and android has its own unique byte code format known as Dalvik-byte code. Dex compiler translates the Java byte code into the dalvik byte code.

during compilation dex command ties up all .class files & .jar files are create single class.dex file



(iii) Generating .apk file :→



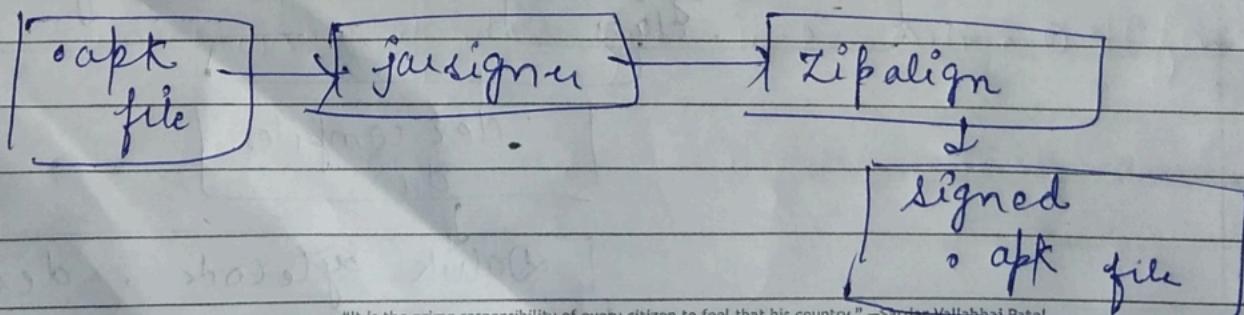
resources files of the android app like images, fonts, XML

layout, etc. are transformed into a single compiled resource format by the Android Asset Packaging tool (aapt) (aapt)

- apk file contains all the necessary data to run the android app.

(iv) App Distribution :→

- apk file is now ready to use application package and developers can use this file for the purpose of app distribution.



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Android app. Need to be digitally signed with a certificate so that the can be installed by the user.

Oracle Java Development Kit provides the javasigner tool to sign the .jar file or .apk file. further the compressed parts of the signed .apk file are required to line up on byte boundaries in such a manner so that android os can read without uncompressing the file.

the byte alignment of file is assured by running the signed.apk file through the zipalign tool.

is a zip archive alignment tool that help to ensure that all uncompressed files in the archive are aligned relative to start of the file.

2) Deploy the Application

it is the process of installing configuration and enabling a specific application or set of app. usually through an application manager.

Deploying means putting it on a web server so that it can be used either putting through internet.

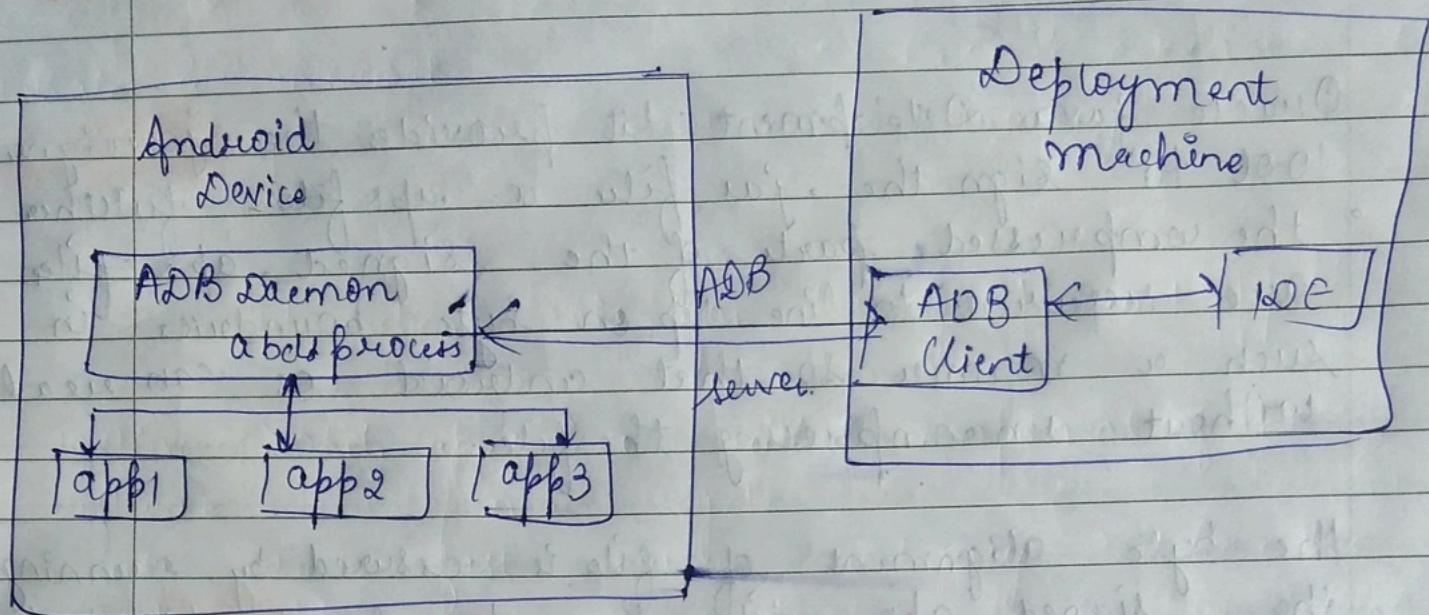
i) Android Debug Bridge ADB

ADB deploys an app to android devices.

It has command line that acts an interface and facilitate developer to communicate with an android application.

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ADB daemon → it setup a connection to that port



1) transfer apk file to the device

ADB command transfer the apk file into the local file system of the target Android device

3) Run the Application

1) App launch request

Zygote process is the parent to all Android app and it launch the app. When a user makes the request to close it.

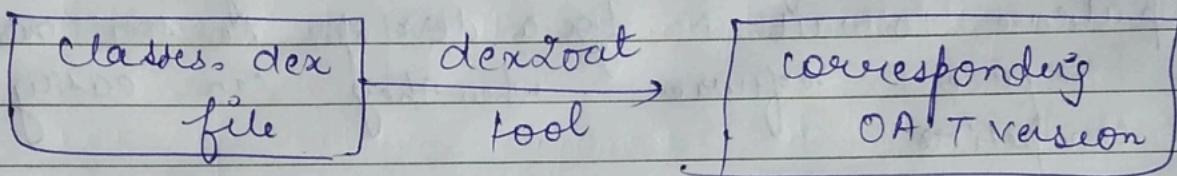
It is a special type of OS process that enables code sharing btw different instances that run across DVM.

2) conversion of odex file into native DEX format

When a new application is installed the Android optimizes the data and generate a corresponding OAT file.

The classes.dex file is placed in a separate directory & android compiles the Dalvik byte code with ahead-of-time (OAT) compilation into native machine code.

Before OAT, dex2oat tool is used to convert the dex file into oadex file. It holds the optimized byte code.



White Box Testing

- It examines the functionality of software knowing the internal structure or coding.
- Structural & code-based, clear box and transparent testing.
- Requires knowledge of programming.
- Recommended for algo testing.
- Done at low level of testing.

Black Box Testing

- Without knowing the internal structure or coding.
- Functional testing, data-driven or closed-box.
- Less programming knowledge is required.
- Not suitable for algorithm testing.
- Done at high level of testing.

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- done by developer
- performed by software testers.
- Base is internal working
- Base is external working

Automation tools for testing Android App

testing mobile apps is a critical component of the software development cycle.

you want fast services and may not have the patience to wait for a developer to see our defect in a piece of software when they can easily go to competitor.

∴ companies need to have efficient, fast, reliable testing and practice for all their apps.

Best automation tool

- ① Appium
- ② Robotium
- ③ Roboton
- ④ Squish for Android
- ⑤ K-MAX
- ⑥ Espresso
- ⑦ Moneytalk

Appium

an open source automation tool that supports a wide range of Android OS versions.

Starting from 2.3 upwards. has a UI automator and support for a wide range of programming languages like Java, Ruby, PHP, python, etc. It is cross platform and easily test multiple devices in parallel.

Has a few limitation such as lack of detailed reports & being a bit slow.

Robotium

Open source automation tool that supports native & hybrid mobile apps running Android version from 1.6 upwards.

- easy & quick way to write test cases without knowing high level of coding.
- capable of automatically running multiple android routines
- fast testing speed

Kobiton

- Has both free & paid version
- either of them give testers the ability to check the real devices.
- It also supports automation of action that manual testing would require
- it easy & quick to identify and resolve issues
- free trial for limited time.
- Parallel tests.

Squish for Android

a premium tool that supports native, web & hybrid mobile apps.

- tool runs on both simulated & real devices
- easy to use

kMAX

One of the most best automation tool for testing how mobile app behav. under different network connection

it establishes the effect of poor as well as normal connectivities.

includes 3G, 4G, LTE etc

additional testers can use kMAX tool to recreate certain scenarios and especially those that had issues

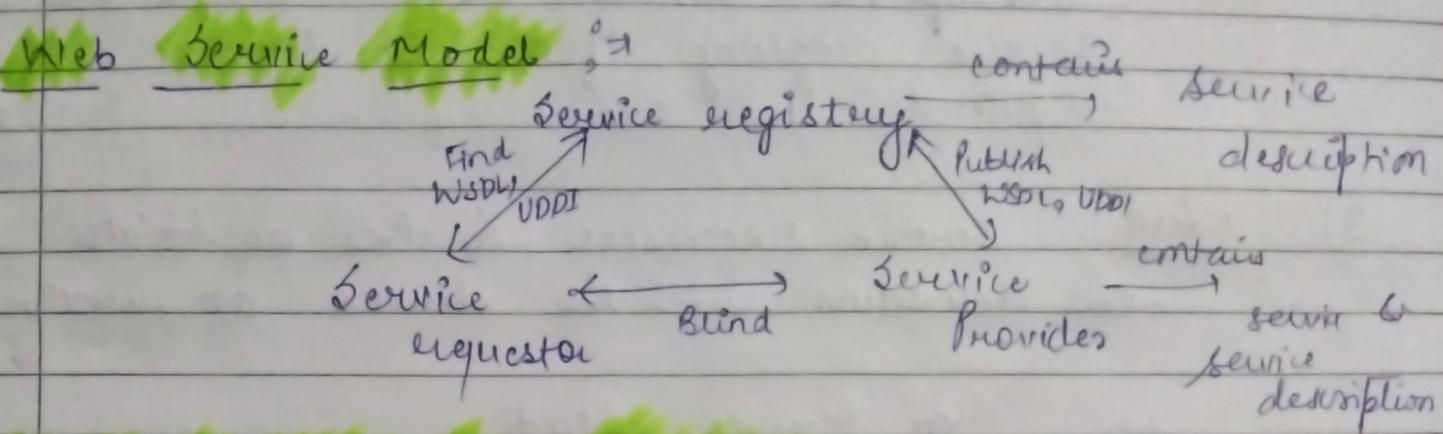
- use of real & simulated mobile network traffic.

Web Service

is any piece of software that makes itself available for the internet and uses a standard XML messaging system. XML is used to encode all communication of a web service

Allow companies to reduce the cost of doing e-business & to deploy solutions faster

- Need a common program to program communication model



Roles in Web server Architecture

- 1) Service provider:
 - owner of the service
 - platform that hosts access to services
 - 2) Service requestor :- Businesses that require certain functions to be satisfied
 - App. looking for and invoking an interaction with a service.
 - 3) Service registry :- find service & obtain binding information for service during development

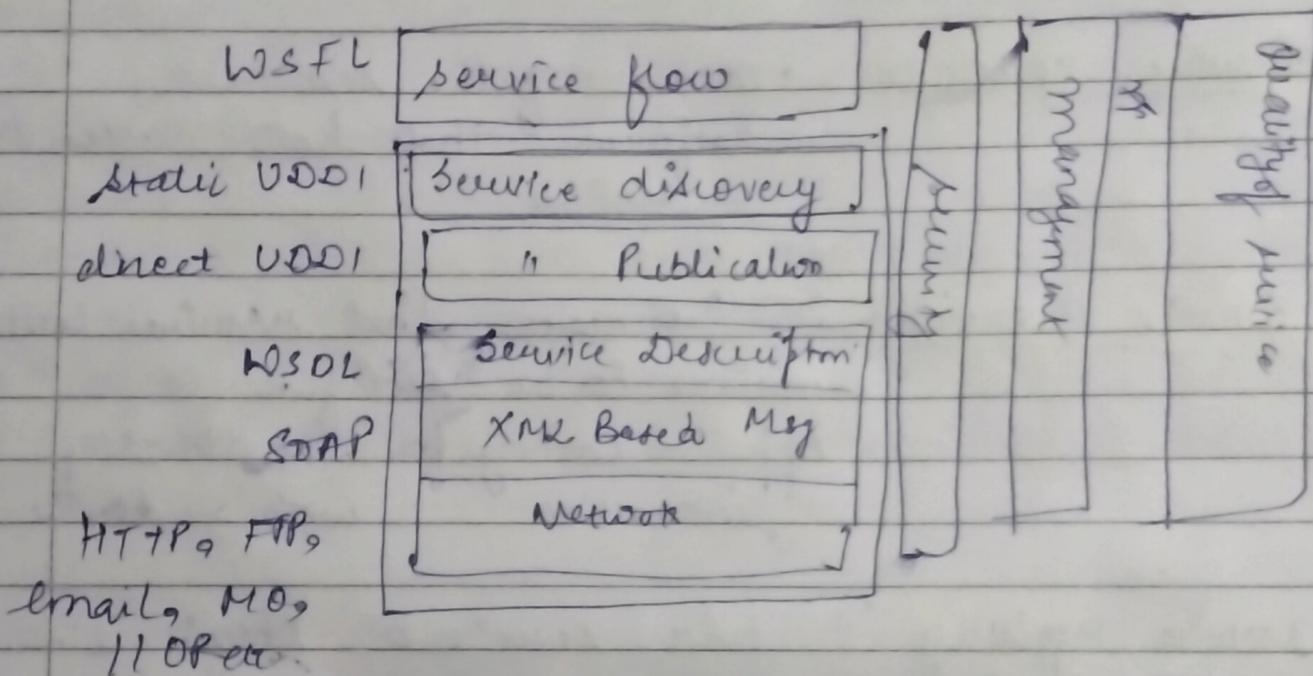
Operations in Web Model :-

-) Publish →
Service descriptions need to be published
in order for service requests to find
them

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- a) find :- Service requester retrieves a service description directly or queries the service registry for the service required.
- b) bind : Service requester invokes or initiates an interaction with the service at runtime.

Web Service Stack



SOAP (Simple Object Access Protocol)

- it is communication based protocol
- " is for com " between diff
- a format for sending messages.
- Platform independent
- language "
- Based on XML
- simple & extensible

SOAP hides the technical choices & implementation details from both parties.

version 1.0, 1.1, 1.2

SOAP message structure

- request invokes a method on a remote object.
- response returns result of running the method.
- SOAP defines an envelope "wrap the msg itself".
- msg is different vocabulary
- namespace prefix is used to distinguish the 2 part

WSDL (Web Services Description language)

- written in XML.
- is an " " document
- used to describe Web services.
- used to locate web services.
- not yet a W3C standard.

document structure

- <portType> element
defines a web service, the operations that can be performed.
- <message> :- defines the data elements of an operation.
- <types> :- defines the data type

- < binding > define the msg format & communication protocol

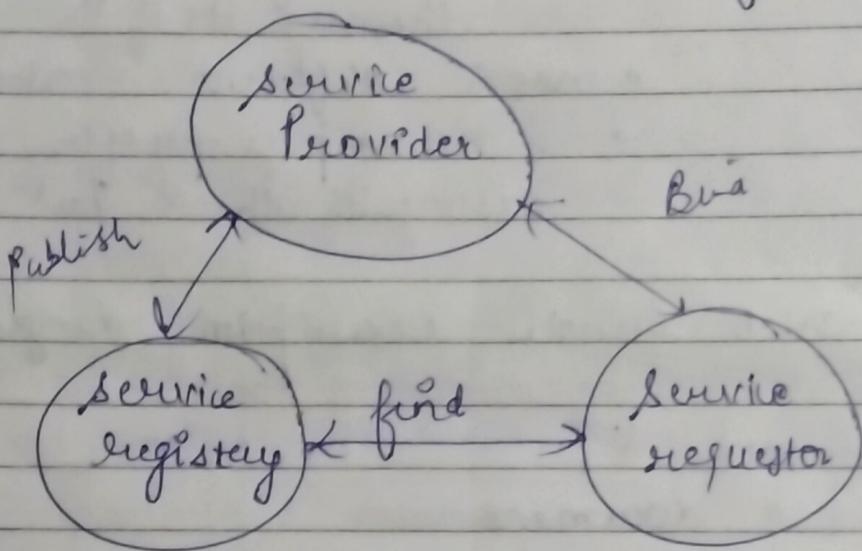
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UDDI (Universal Description, Discovery & Integration)

directory service where businesses can register & search for web services
it communicate via SOAP.

uses W3C Standard like XML, DNS, HTTP

uses WSDL to describe interface to web services.



Debugging Web Services

debugging is the process of fixing a bug in the software or to identify, analysing and removing errors.

this activity begins after the software fail to execute properly & concludes by solving the problem & successfully testing the software

Steps involved in debugging are :-

- 1) Identify the error
- 2) find the error location.
- 3) Analyze the error
- 4) Prove the analysis
- 5) cover Lateral Damage
- 6) fix & validate

the debugging process will always have one of 2 outcomes

↓
the cause will
be found &
corrected

↓
the cause
will not
be found.

Debugging Approaches / Strategies

- 1) Brute force
- 2) Backtracking
- 3) forward Analysis (Breakpoint)
- 4) Using past experience
- 5) cause elimination (introduce the concept of Binary partitioning : data leads to the error
Occurrences are organized to isolate potential causes)

Debugging tools

a computer program that is used to test or debug other programs. A lot of software like gdb and dbx are available for debugging. They offer console based command line interfaces.

Some Debuggers

- (1) Radare2
- (2) WinDbg
- (3) Valgrind

Testing

An activity to check whether the actual results match the expected result.

Process of finding & locating defects

Performed by testing team

Less complex

can be done manually or automatically

find defects

Debugging

process of finding & resolving problem

Process of fixing the identified defects

development team

complex program

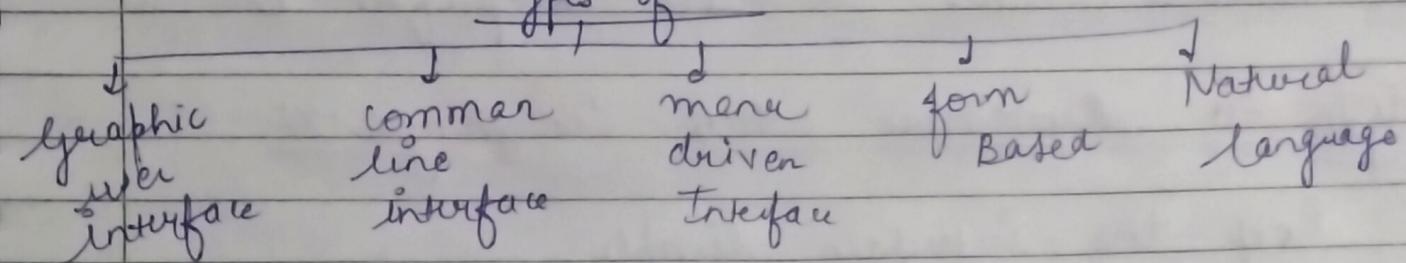
done manually,

more defects

Mobile User Interface Design

- UI defines the way human interact with the information system.
- series of pages, button, form and other visual that are used to interact with the device
- every app & every website have a UI

types of UI



Significance of UI

- A good UI focuses on making UI simpler & efficient
- Being a good UI one need to understand the goals, skills, preferences, and tendencies of the user to make a better interface

Why UI important

- how you present your product matters the most
- great design is great business.

Advantages of UI :-

- 1) no need to learn complex commands / language for working with UI

- Date _____
- usage of blocks & typography makes UX Better
 - Easy setup & easy to work with
 - easy for non-technical people

Disadvantages

- ① when not properly built, it can be very difficult to work with
- ② Takes times to build a perfect UI

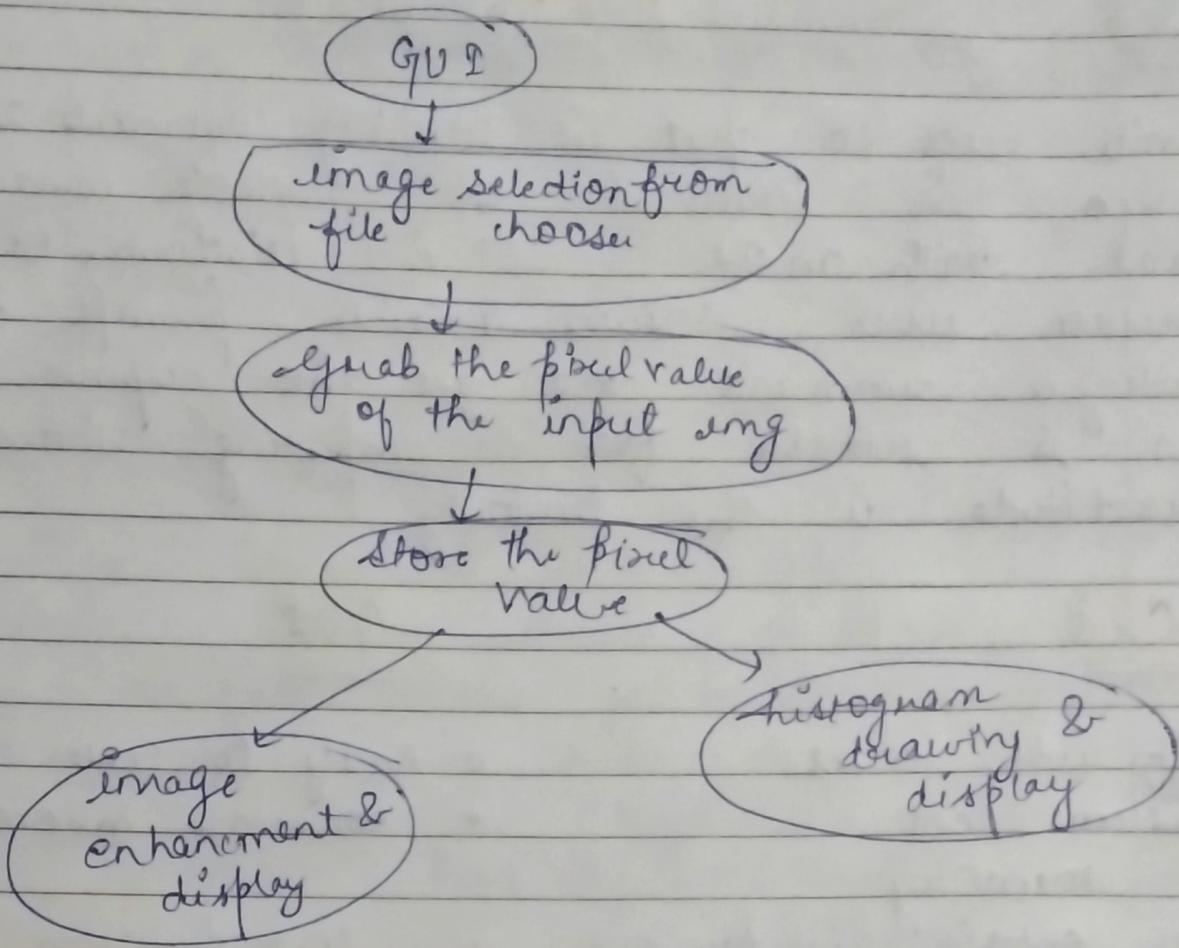
Points to Remember while designing a UI

- ① keep the interface simple.
- ② Be consistent and use common UI elements.
- ③ Placement of items.
- ④ Use of right colors.
- ⑤ Anticipate (make the user work less)

Graphical User Interface (GUI)

- user friendly interface used to communicate with the help of electronic device
- display all the content whether a text file or an object or pictures that a user wants to visualize.
- integrate well and can be used everywhere a mobile phone, tablet, laptop, and other electronic device
- Best in gaming

GUI format



Advantages / characteristics

- ① Very easy to use
- ② consists of different characteristics such as Menu, Tab, pointers, and many more
- ③ user need not to memorize command
- ④ Very intuitive & user friendly

Dis

- ① GUI create problem for gamma
- ② Bad GUI can mislead the user & reduces the efficiency.

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CLI(Command Line Interface)

permits user to put in writing commands associated degree in terminal or console window to interact with an OS. CLI is a platform or medium wherever user answers a visible prompt by writing a command and get the response.

CLI is suitable for computing where input exactitude is the priority

CLIGUI

- difficult to use.
- consume less memory
- can obtain high precision
- faster than GUI
- need only a keyboard.
- appearance can't be changed
- info is shown in plain text
- no menu
- no graphics used
- easy to use.
- consumes more memory
- low precision
- slow the CPU.
- need both mouse & keyboard
- can be changed
- any form text, image, visual etc
- menus are provided
- graphics used

#

Menu Driven Interface :-

used on cash machine, a ticket machine or

Information kiosks (museum)

- provide a simple & an easy to use interface composed to series of menu & sub-menu
- it can be good eg when designing the architecture of the machine

form Based Interface :-

- enables you to interact with an app
- provides limited choices as to use
- a form interface allow you to interact with system software might offer choice such as screen resolution, language keyboard style etc
- used to enter data into a system

Natural language Interface

- Spoken interface where the user interact with the computer by talking to it.
- commonly used by telephone system.
- Voice recognition
- Siri, Cortana, windows

OHA (Open Handset Alliance)

Is a consortium of 84 firms to develop open standards for mobile devices
(firms - HTC, Sony, Dell, Intel, Motorola, Texas Instruments, Google & LG Electronics)
• established on 5 Nov, 2007

Android Architecture

Android OS is a stack of software component which is roughly divided into 5 sections and 4 main

android stack :-

- ° system apps have no { Web & mobile / security }
- ° special status

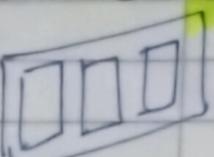
° system apps provide key capabilities to app developers

(used to define the UI that holds the UI controls or widgets that will appear on screen.)

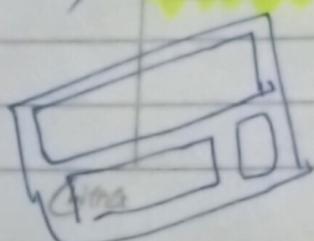
Layout defines the structure of a UI in your app all elements in the layout are build here using a hierarchy of View & ViewGroup objects

Types of Layout :-

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

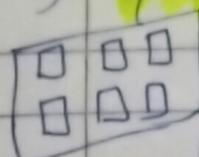


2) Relative Layout - that display child view in relative positions



list, frame, table, constraint

- 3) Table Layout :- that groups views into rows & columns
 - 4) Grid layout :- that displays items in 2d & scrollable grid



Common layout classes

- ConstraintLayout
 - GridView
 - LinearLayout
 - TableLayout

Layout created in XMC

Linear layout

and so it's orientation =
"vertical"

android: layout_width =
"match_parent"

```
LinearLayout L = new LinearLayout <EditText  
          (this);           -- />
```

L. set Orientation (Linear Layout) < Button --
VERTICAL > />
< /Linear Layout >

Events

are a useful way to collect data about a user's interaction with interactive components of an app.

ey Like Button backs or screen touch

Android framework maintains an event queue as FIFO.

Event handlers are triggered when an event happens and we have registered an event listener for the event, the event listener calls the event handler which is the method that actually handles the event.

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as the UI which is used to create interactive
UI component such as

Views

∴ if you look at your mobile device every UI element you see is a view
of images, buttons, text, etc.

Properties

- 1) have relationship with other views
- 2) may be visible or not
- 3) may be interactive
- 4) have properties (color, dimensions etc)

Context : context is an interface to global info about an app environment.

Context context = getApplicationContext();

Over 100! different types of views available for android system

ViewGroup & View Hierarchy

(parent) a type of view that can contain other views (children)

it is the base class for layout & view container.

- ScrollView
- LinearLayout
- RecyclerView

hierarchy

