
Unit 1- Android and its Tools

Course Outcome:

Interpret features of Android operating system.

Unit Outcomes:

- 1a. Explain the given basic terms related to Android system.
 - 1b. Explain with sketches Android architecture for the given application.
 - 1c. Identify tools and software required for developing the given Android application with justification.
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Contents:

- 1.1 Introduction to android, Open Handset Alliance, Android Ecosystem
 - 1.2 Need of Android, Features of Android
 - 1.3 Tools and software required for developing an Android Application
 - 1.4 Android Architecture
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1.1 Introduction to android, Open Handset Alliance, Android Ecosystem

Introduction to android

- **Android** is an open source operating system based on Linux with a Java programming interface for mobile devices such as Smartphone (Touch Screen Devices who supports Android OS) as well for Tablets too.
- The operating system has developed a lot in last 15 years starting from black and white phones to recent smart phones or mini computers. One of the most widely used mobile OS these days is android.
- The android is a powerful operating system and it supports large number of applications in Smartphones.

What is Android?

Android is a stack of software for mobile devices that are an Operating System, Middleware and Key Applications.

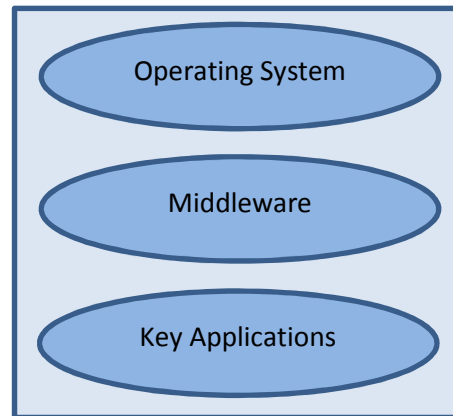


Figure 1.1: Android Operating System

- Android is a Linux-based operating system which is designed for touchscreen mobile devices like smartphones and tablet computers.
- It is an open source technology that allows the software to be freely modified and distributed by device manufacturers, wireless carriers and developers.
- Android was unveiled during 2007 along with the founding of the Open Handset Alliance.

Open Handset Alliance

The Open Handset Alliance (OHA) is a association whose goal is to develop open standards for mobile devices, promote innovation in mobile phones and provide a better experience for consumers at a lower cost.

The OHA is the group that is in charge of the Android smartphones operating system. It was created by Google.

The **Open Handset Alliance** (OHA) is consortium of multiple companies like Samsung, Sony, Intel and many more to provide services and deploy handsets using android platform.

Android Ecosystem

Ecosystem in Market terminology refers to the inter-dependence between demand and supply.

In the Android ecosystem this translates to inter-dependence between users, developers, and equipment makers. One cannot exist without the other:

- Users- buy devices and applications
- Equipment makers- sell devices, sometimes bundled with applications
- Developers- buy devices, then make and sell applications

1.2 Need of Android, Features of Android

Need of Android

There are so many reasons you should choose Android platform for mobile application development.

1. Zero/negligible development cost

The development tools like Android SDK, JDK, and Eclipse IDE etc. are free to download for the android mobile application development. Also Google charge a small fee \$25, to distribute your mobile app on the Android Market.

2. Open Source

The Android OS is an open-source platform based on the Linux kernel and multiple open-source libraries. In this way developers are free to contribute or extend the platform as necessary for building mobile apps which run on Android devices.

3. Multi-Platform Support

In market, there are a wide range of hardware devices powered by the Android OS, including many different phones and tablet. Even development of android mobile apps can occur on Windows, Mac OS or Linux.

4. Multi-Carrier Support

World wide a large number of telecom carriers like Airtel, Vodafone, Idea Cellular, AT&T Mobility, BSNL etc. are supporting Android powered phones.

5. Open Distribution Model

Android Market place (Google Play store) has very few restrictions on the content or functionality of an android app. So the developer can distribute theirs app through Google Play store and as well other distribution channels like Amazon's app store.

Features of Android

There are numerous features of android. Some of them are listed below:

Feature	Description
Connectivity	Android supports multiple connectivity technologies including GSM/EDGE, IDEN, CDMA, EV-DO, UMTS, Bluetooth, Wi-Fi, LTE, NFC and WiMAX

Storage	SQLite, a lightweight relational database, is used for data storage purposes
Media support	Android supports various type of audio/video/still media formats like: H.263, H.264, MPEG-4 SP, AMR, AMR-WB, AAC, HE-AAC, AAC 5.1, MP3, MIDI, Ogg Vorbis, WAV, JPEG, PNG, GIF, BMP and WebP
Web browser	The web browser available in Android is based on the open-source Blink (previously WebKit) layout engine, coupled with Chrome's V8 JavaScript engine supporting HTML5 and CSS3
Messaging	SMS and MMS are available forms of messaging, it also include threaded text messaging and Android Cloud To Device Messaging (C2DM) and now support the enhanced version of C2DM, Android Google Cloud Messaging (GCM) is also a part of Android Push Messaging services
Multi-tasking	Multitasking of applications, with unique handling of memory allocation, is available, using this user can jump from one task to another and at the same time various application can run simultaneously
Resizable widgets	Widgets are re-sizable, so users can expand them to show more content or shrink them to save space
Multi-touch	Android has native support for multi-touch which was initially made available in handsets such as the HTC Hero
Wi-Fi	A technology that lets apps discover and pair directly, over a high-bandwidth peer-to-peer connection.
Screen capture	Android supports capturing a screenshot by pressing the power and home-screen buttons at the same time. This features supports after Android 4.0
Android Beam	A popular NFC-based technology that lets users instantly share, just by touching two NFC-enabled phones together
Multi-Language	Android supports multiple languages, also supports single direction and bi-directional text

1.3 Tools and software required for developing an Android Application

The android developer tools let you create interactive and powerful application for android platform. The tools can be generally categorized into two types.

- SDK tools
- Platform tools

SDK tools

SDK tools are generally platform independent and are required no matter which android platform you are working on. When you install the Android SDK into your

system, these tools get automatically installed. The list of SDK tools has been given below –

Sr. No	Tool & description
1	android This tool lets you manage AVDs, projects, and the installed components of the SDK
2	ddms This tool lets you debug Android applications
3	Draw 9-Patch This tool allows you to easily create a NinePatch graphic using a WYSIWYG editor
4	emulator This tools let you test your applications without using a physical device
5	mksdcard Helps you create a disk image (external sdcard storage) that you can use with the emulator
6	proguard Shrinks, optimizes, and obfuscates your code by removing unused code
7	sqlite3 Lets you access the SQLite data files created and used by Android applications
8	traceview Provides a graphical viewer for execution logs saved by your application
9	Adb Android Debug Bridge (adb) is a versatile command line tool that lets you communicate with an emulator instance or connected Android-powered device.

Three important tools are android, ddms and sqlite3.

1. Android

Android is a development tool that lets you perform these tasks:

- Manage Android Virtual Devices (AVD)

- Create and update Android projects
- Update your sdk with new platform add-ons and documentation

2. DDMS

DDMS stands for Dalvik debug monitor server that provides many services on the device. The service could include message formation, call spoofing, capturing screenshot, exploring internal threads and file systems etc.

Running DDMS

From Android studio click on Tools>Android>Android device Monitor.

How it works

- In android, each application runs in its own process and each process run in the virtual machine. Each VM exposes a unique port, that a debugger can attach to.
- When DDMS starts, it connects to adb. When a device is connected, a VM monitoring service is created between adb and DDMS, which notifies DDMS when a VM on the device is started or terminated.

3. Sqlite3

- Sqlite3 is a command line program which is used to manage the SQLite databases created by Android applications. The tool also allows us to execute the SQL statements on the fly.
- There are two ways through which you can use SQLite, either from remote shell or you can use locally.

Platform tools

- The platform tools are customized to support the features of the latest android platform.
- The platform tools are typically updated every time you install a new SDK platform. Each update of the platform tools is backward compatible with older platforms.
- Some of the platform tools are listed below –
 - Android Debug bridge (ADB)
 - Android Interface definition language (AIDL)
 - aapt, dexdump and dex etc.

1.4 Android Architecture

Android architecture or Android software stack is categorized into five parts:

1. Linux kernel
2. native libraries (middleware),
3. Android Runtime
4. Application Framework
5. Applications

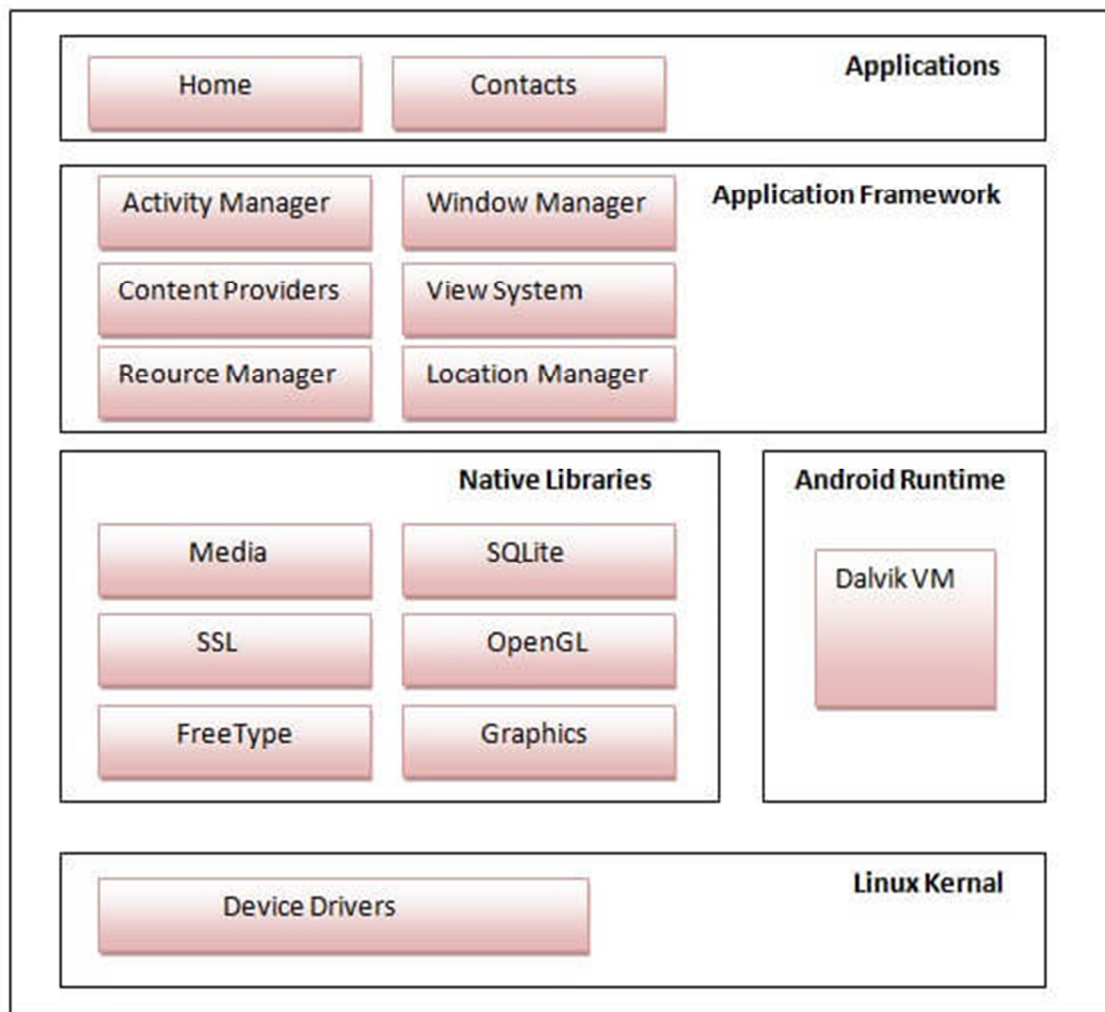


Figure: Android Architecture

1) Linux kernel

It is the heart of android architecture that exists at the root of android architecture. **Linux kernel** is responsible for device drivers, power management, memory management, device management and resource access.

2) Native Libraries

Running on the top of the kernel, the Android framework was developed with various features. It consists of various C/C++ core libraries with numerous of open source tools. Some of these are:

1. The Android runtime:

The Android runtime consist of core libraries of Java and ART(the Android RunTime). Older versions of Android (4.x and earlier) had Dalvik runtime.

2. Open GL(graphics library):

This cross-language, cross-platform application program interface (API) is used to produce 2D and 3D computer graphics.

3. WebKit:

This open source web browser engine provides all the functionality to display web content and to simplify page loading.

4. Media frameworks:

These libraries allow you to play and record audio and video.

5. Secure Socket Layer (SSL):

These libraries are there for Internet security.

3) Android Runtime

In android runtime, there are core libraries and DVM (Dalvik Virtual Machine) which is responsible to run android application. DVM is like JVM but it is optimized for mobile devices. It consumes less memory and provides fast performance.

4) Android Framework

On the top of Native libraries and android runtime, there is android framework. Android framework includes **Android API's** such as UI (User Interface), telephony, resources, locations, Content Providers (data) and package managers. It provides a lot of classes and interfaces for android application development.

1. Activity Manager:

It manages the activity lifecycle and the activity stack.

2. Telephony Manager:

It provides access to telephony services as related subscriber information, such as phone numbers.

3. View System:

It builds the user interface by handling the views and layouts.

4. Location manager:

It finds the device's geographic location.

5) Applications

On the top of android framework, there are applications. All applications such as home, contact, settings, games, browsers are using android framework that uses android runtime and libraries. Android runtime and native libraries are using linux kernel.

Terminologies Related to Android**1. XML**

In Android, XML is used for designing the application's UI like creating layouts, views, buttons, text fields etc. and also used in parsing data feeds from the internet.

2. View

A view is an UI which occupies rectangular area on the screen to draw and handle user events.

3. Layout

Layout is the parent of view. It arranges all the views in a proper manner on the screen.

4. Activity

An activity can be referred as your device's screen which you see. User can place UI elements in any order in the created window of user's choice.

5. Emulator

An emulator is an Android virtual device through which you can select the target Android version or platform to run and test your developed application.

6. Manifest file

Manifest file acts as a metadata for every application. This file contains all the essential information about the application like app icon, app name, launcher activity, and required permissions etc.

7. Service

Service is an application component that can be used for long-running background processes. It is not bounded with any activity as there is no UI. Any other application component can start a service and this service will continue to run even when the user switches from one application to another.

8. Broadcast Receiver

Broadcast Receiver is another building block of Android application development which allows you to register for system and application events. It works in such a way that, when the event triggers for the first time all the registered receivers through this broadcast receiver will get notified for all the events by Android Runtime. To know more about the broadcast receivers, kindly refer [Android Basic Building Blocks](#).

9. Content Providers

Content Providers are used to share data between two applications. This can be implemented in two ways:

1. When you want to implement the existing content provider in another application.
2. When you want to create a new content provider that can share its data with other applications

10. Intent

Intent is a messaging object which can be used to communicate between two or more components like activities, services, broadcast receiver etc. Intent can also be used to start an activity or service or to deliver a broadcast message.