# BCA

# SEMESTER – 6

# 0301605

## MOBILE APPLICATION DEVELOPMENT USING ANDROID

**Prof. Nirav Suthar**

# TEXT BOOK

- Android – Wireless Application Development Volume-1
  - Publisher : - Pearson
  - Author : - Lauren Darcey
    Shane Conder

# Topics

**Introduction to Mobile Operating System**

- Introduction
- Additional requirement for Mobile OS
- Constrained of smart Mobile OS
- Type of Mobile OS
  - Android
  - IOS
  - Black Berry
  - Microsoft
  - Symbian
- Generalize Architecture of Mobile OS
- Comparison of Mobile OS

# Topics

**Android Operating System**

- Introduction
- History of Android OS
- Versions of Android OS
- Architecture of Android OS

# Introduction

- A mobile operating system, also called a **Mobile OS.**
- Mobile OS that is specifically d**esigned to run on mobile devices such as mobile phones, smartphones, PDAs, tablet** computers and other handheld devices.
- Mobile OS is **responsible for determining the functions and features available on mobile device**, such as thumb wheel, keyboards, WAP, synchronization with applications, email, text messaging and more.
- Mobile OS will **also determine which third-party applications (mobile apps)** can be used on your device.

# Additional requirements for Mobile OS

- Mobile and computer operating **systems have been developed in different ways and for different uses.**
  - computer operating systems **were not really designed for mobile use over wireless networks.**
  - Computer OS focused on a lot of technical specifics related to items like
    - **Boot protocols,**
    - **Program threads**
    - **Multiple process handling (Threading)**
    - **CPU operation**

      **and other elements of the traditional OS.**

# Additional requirements for Mobile OS

- Mobile and computer operating **systems have been developed in different ways and for different uses.**
  - **Mobile OS focused on newer issues like**
    - **Responsive and Compact design**
    - **Consistent network access**
    - **Voice and Text based Communication**
    - **Computing on Mobility**
    - **Notification Management**
    - **Effiecient Power Management**
    - **Location Based Service Management**

# Additional requirements for Mobile OS

- Mobile and computer operating **systems have been developed in different ways and for different uses.**
  - **Mobile OS focused on newer issues like**
    - **Support for specific communication protocol (like MIP...)**
    - **Support for a variety of input mechanisms**
    - **Support for Integrated Development Environment.**

      **and other elements of providing software applications used across diverse wireless environments.**

# Constraints for Mobile OS

- **Smaller screen size for more information to display**
  - Stay focused on the user's immediate task. **Display only the information that users need at any given moment.**
- **One screen appears at one time**
  - Use a **single screen if possible. If your application requires multiple screens to be open** at the same time, use a split screen or rethink the flow of your application.
- **Shorter battery life**
  - Try to handle **data transmission efficiently**. The less often the device needs to transmit data, the longer the battery lasts.

# Constraints for Mobile OS

- **Wireless network connections**
  - Try to **simplify how your application creates network connections.** Compared with standard LANs, longer latency periods that are inherent in some wireless network connections can influence how quickly users receive information that is sent over the network.
- **Slower processor speed**
  - Avoid processor-intensive tasks where possible. **Slower processor speeds can affect how users perceive the responsiveness of an application.**
- **Less available memory**

# Types of Mobile Operating Systems

- Android OS (Google Inc.) - Google
- IOS - Apple
- Black Berry - Research in Motion
- Microsoft - Windows
- Symbian – Symbian Ltd and Nokia
- Harmony OS: The harmony operating system is the latest mobile operating system that was developed by Huawei for the use of its devices. It is designed primarily for IoT devices.
- Palm OS: The palm operating system is a mobile operating system that was developed by Palm Ltd for use on personal digital assistants (PADs). It was introduced in 1996. Palm OS is also known as the Garnet OS.
- WebOS (Palm/HP): The WebOS is a mobile operating system that was developed by Palm. It based on the Linux Kernel. The HP uses this operating system in its mobile and touchpads.

# Types of Mobile Operating Systems

- **Android OS (Google Inc.)**
  - The **Android mobile operating system is Google's open and free software stack** that includes an operating system, middleware and also key applications for use on mobile devices.
  - The first commercial version, **Android 1.0, was released on September 23, 2008.**
  - Updates for the open source Android mobile operating system have been developed under "dessert-inspired" version names **(Cupcake, Donut, Eclair, Gingerbread, Honeycomb, Ice Cream Sandwich)** with each new version arriving in alphabetical order with new enhancements and improvements.

# Types of Mobile Operating Systems

- **iPhone OS / iOS (Apple)**
  - Apple's **iPhone OS was originally developed for use on its iPhone devices.**
  - Now, **the mobile operating system is referred to as iOS** and is supported on a number of Apple devices including the iPhone, iPad, iPad 2 and iPod Touch.
  - The iOS mobile operating system is available only on Apple's own manufactured devices as the company does not license the OS for third-party hardware.
  - Apple iOS is derived from Apple's Mac OS X operating system.
  - Apple **announced iPhone OS 1 at the iPhone keynote on January 9, 2007.**

# Types of Mobile Operating Systems

- BlackBerry OS (Research In Motion)
  - The BlackBerry OS is a proprietary mobile operating system **developed by Research In Motion for use on the company's popular BlackBerry handheld devices.**
  - The BlackBerry **platform is popular with corporate users** as it offers synchronization with Microsoft Exchange, Lotus Domino, Novell GroupWise email and other business software, when used with the **BlackBerry Enterprise Server.**
  - **BlackBerry announced first version on January 1999.**

# Types of Mobile Operating Systems

- **Microsoft Mobile Edition**
  - Windows Mobile is a discontinued family of mobile operating systems **developed by Microsoft for smartphones and Pocket Pcs.**
  - Its origin dated back to **Windows CE in 1996, though Windows Mobile itself first appeared in 2000** as PocketPC 2000.
  - **It was renamed "Windows Mobile" in 2003, at which point it came in several versions.**

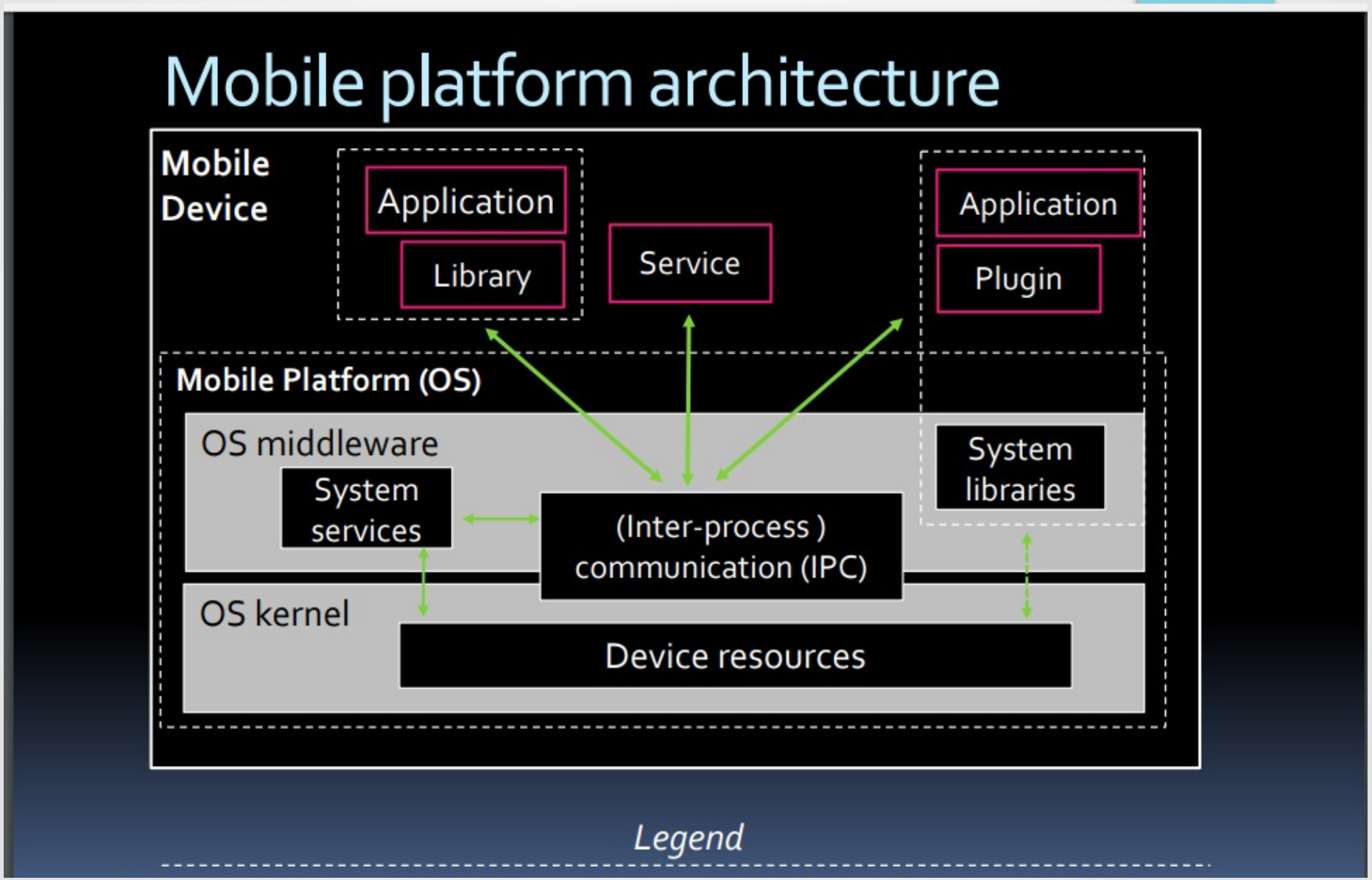
# Types of Mobile Operating Systems

- **Symbian OS (Nokia)**
  - Symbian is a mobile operating system (OS) targeted at mobile phones that offers a high-level of integration with communication and personal information management (PIM) functionality.
  - Symbian OS combines middleware with wireless communications through an integrated mailbox and the integration of Java and PIM functionality (agenda and contacts).
  - **Nokia has made the Symbian platform available** under an alternative, open and direct model, to work with some OEMs and the small community of platform development collaborators. Nokia does not maintain Symbian as an open source development project.

# Types of Mobile Operating Systems

- **Bada (Samsung Electronics)**
  - Bada is a proprietary Samsung mobile OS that was first launched in 2010.
  - The Samsung Wave was the first smartphone to use this mobile OS. Bada provides mobile features such as multipoint-touch, 3D graphics and of course, application downloads and installation.

# Generalize Architecture of Mobile OS



# Comparision of Mobile OS

| Specification | Android | iOS | BlackBerry | Microsoft |
|---|---|---|---|---|
| **Device Manufacturer** | OEMS | Apple | RIM | OEMs |
| **Latest Version** | Nougat (7.0 – 7.1.2) | 12.1.1 | 10.2.1 | Window 10 |
| **Remote Administration Interface** | Third Party agents use Android Device Admin API | Native Agent uses iOS MDM protocols | Native Agent uses BES protocols | Native Agent uses EAS protocols |

# Comparision of Mobile OS

| Specification | Android | iOS | BlackBerry | Microsoft |
|---|---|---|---|---|
| **Market Name** | Goggle Play | App Store | BlackBerry App World | Window Phone Marketplace |
| **License** | Free and Open Source | Proprietary Except for open source components | Proprietary | Proprietary Commercial software |
| **OS Family** | Linux | Dawin | QNX | Microsoft Window |

# Comparision of Mobile OS

| Specification | Android | iOS | BlackBerry | Microsoft |
|---|---|---|---|---|
| Programmed In | C, C++, JAVA,Kotlin | C, C++, Objective C, Swift | .NET, Silverlight, | C, C++ |

# Android Operating System

- **Introduction**
  - **Linux based** operating system it is designed primarily for touch screen mobile devices such as smart phones and tablet computers.
  - It is developed by Google and later the OHA (Open Handset Alliance). Java language is mainly used to write the android code even though other languages can be used.
  - One of the most widely used mobile OS
  - The android is software that was founded in **Palo Alto of California in 2003.**
  - low powered devices, that run on battery and are full of hardware like Global Positioning System (GPS) receivers, cameras, light and orientation sensors, WiFi and UMTS (3G telephony) connectivity and a touchscreen.
  - Supports large number of applications in Smartphones
  - **Written in JAVA, run in Virtual Machine**

# Android Operating System

## What is the Open Handset Alliance (OHA)?

→ It's a collaboration of several companies. Its a group of 79 hardware, software and telecom companies devoted to advancing open standards for mobile devices.

# Android Operating System - OHA

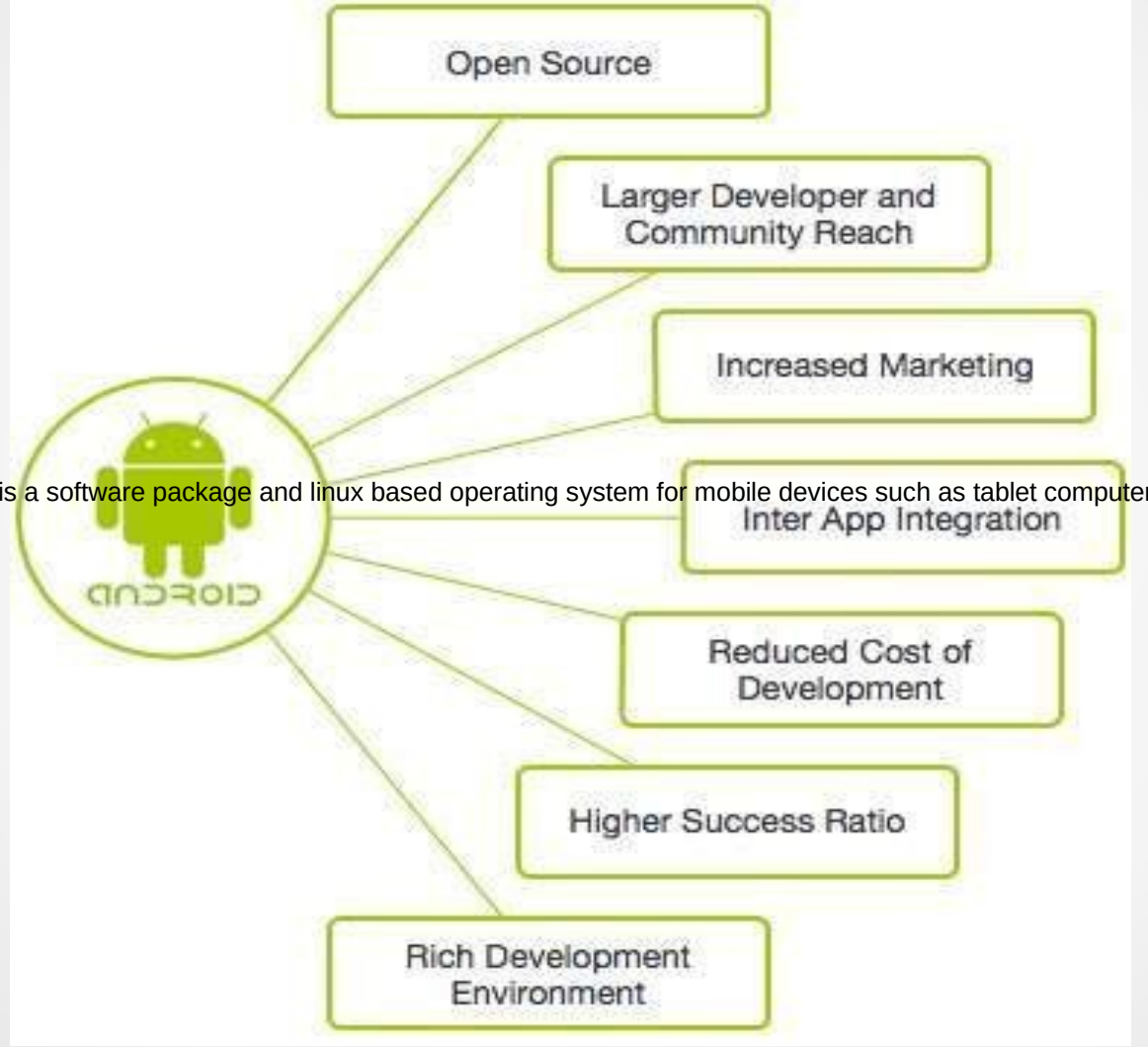
- It's a consortium of 84 companies such as google, samsung, AKM, synaptics, KDDI, Garmin, Teleca, Ebay, Intel etc.
- It was established on 5th November, 2007, led by Google. It is committed to advance open standards, provide services and deploy handsets using the Android Plateform.
- OHA member companies back the open platform concept for a number of reasons, as follows:

  **Lower overall handset costs**: Opens up resources, which facilitates the focus on creating innovative applications, solutions and services.

  **Developer-friendly environment**: In the open-source community, developers share notes to expedite application development.

  **Post-development**: Provides an ideal channel for application marketing and distribution.

# Why Android ?




Android is a software package and linux based operating system for mobile devices such as tablet computers and smartphones.

# What is Android ?

- Android is a software package and linux based operating system for mobile devices such as tablet computers and smartphones.
- The goal of android project is to create a successful real-world product that improves the mobile experience for end users.

# Android Operating System - OHA

## Open Handset Alliance(OHA)

### Mobile Operators

China Mobile, China Unicom, KDDI, NTT DoCoMo, Sprint, T-Mobile, Vodafone, Telefonica


### Handset Manufacturers

acer, ASUS, GARMIN, htc, HUAWEI, lenovo, LG Electronics, MOTOROLA, SAMSUNG, Sony Ericsson, TOSHIBA

### Semiconductor Companies

AKM, Audience, ARM, intel, Atheros, Broadcom, MIPS, nVidia, ST Ericsson

### Software Companies

Ascender Corporation, ebay, Google, Living Image, myriad, NUANCE, OMRON, pv, SkyPoP

### Commercialization Companies

Aplix Corporation, BORQS, noser, tat, Teleca, WIND RIVER

Source: http://www.openhandsetalliance.com

# Features of Android

- It is open-source.
- Supports single direction and bi-directional text.
- Anyone can customize the Android Platform.
- A popular NFC-based technology that lets users instantly share, just by touching two NFC-enabled phones together.
- Android OS basic screen provides a beautiful and intuitive user interface.
- There are a lot of mobile applications that can be chosen by the consumer.
- It provides many interesting features like weather details, opening screen, live RSS (Really Simple Syndication) feeds etc.
- It provides support for messaging services(SMS and MMS), web browser, storage (SQLite), connectivity (GSM, CDMA, Blue Tooth, Wi-Fi etc.), media, handset layout etc.
- SQLite, a lightweight relational database, is used for data storage purposes.
- User can jump from one task to another and same time various application can run simultaneously.

# Features of Android

## Android Platform Differences

Android is hailed as "the first complete, open, and free mobile platform":

- Complete: The designers took a comprehensive approach when they developed the Android platform. They began with a secure operating system and built a robust software framework on top that allows for rich application development opportunities.
- Open: The Android platform is provided through open source licensing. Developers have unprecedented access to the handset features when developing applications.
- Free: Android applications are free to develop. There are no licensing or royalty fees to develop on the platform. No required membership fees. No required testing fees. No required signing or certification fees. Android applications can be distributed and commercialized in a variety of ways.

# Dalvik Virtual Machine

- Android uses **Dalvik virtual machine** which executes it's own byte code.
- Dalvik is a core component, as all Android user applications and the application **frame work are written in Java and executed by Dalvik.**
- Like on other platforms, applications for Android can be obtained from a central **place called Android Market** .

# History of Android

- Android Inc. was founded by **Andy Rubin, Rich Miner, Nick Sears, and Chris White in Palo Alto**, California in **October 2003.**
- Rubin described the Android project as **"tremendous potential in developing smarter mobile devices that are more aware of its owner's location and preferences".**
- The **main purpose of the company was to develop an advanced operating system for digital cameras,** and this was the support of its point to investors in April 2004.
- **In July 2005, Google acquired Android Inc. for at least $50 million.**

Android 1.5
(CupCake)

Android 1.6
(Donut)

Android 2.0 and 2.1
(Eclair)

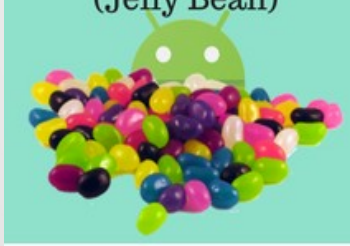
Android 2.2
(Froyo)

Android 2.3 and 2.4
(Gingerbread)

Android 3.0-3.2
(Honeycomb)

Android 4.0
(Ice-Cream Sandwich)

Android 4.1-4.3
(Jelly Bean)



Android 4.4
(KitKat)


Android 5.0- 5.1
(Lollipop)

Android 6.0
(Marshmallow)

Android 7.0
(Nougat)

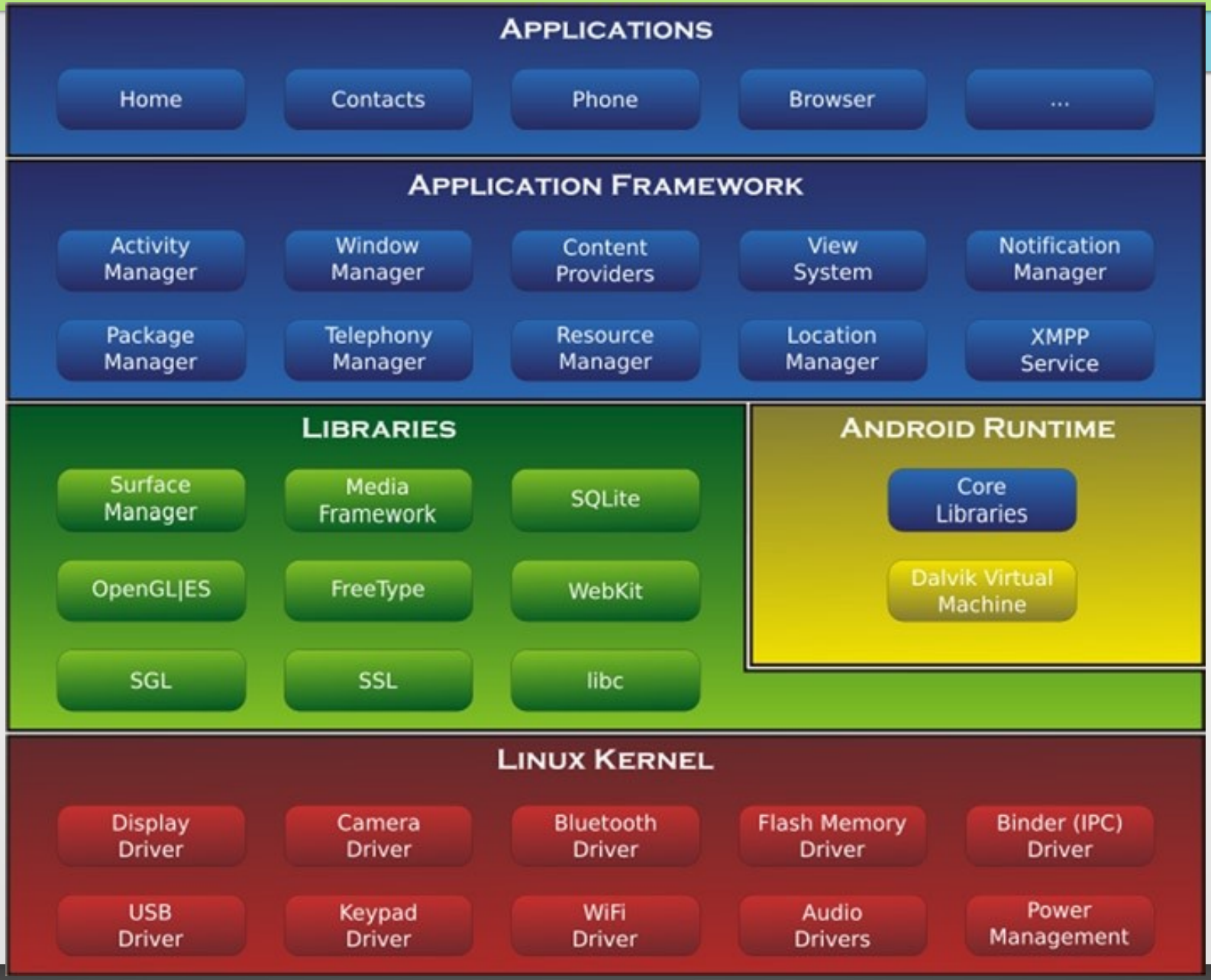
Android 8.0
(Oreo)

| Code name | Version number | Linux kernel version[3] | Initial release date | API level |
|---|---|---|---|---|
| (No codename)[4] | 1.0 | ? | September 23, 2008 | 1 |
| Cupcake | 1.5 | 2.6.27 | April 27, 2009 | 3 |
| Donut[5] | 1.6 | 2.6.29 | September 15, 2009 | 4 |
| Eclair[6] | 2.0 – 2.1 | 2.6.29 | October 26, 2009 | 5 – 7 |
| Froyo[7] | 2.2 – 2.2.3 | 2.6.32 | May 20, 2010 | 8 |
| Gingerbread[8] | 2.3 – 2.3.7 | 2.6.35 | December 6, 2010 | 9 – 10 |
| Honeycomb[9] | 3.0 – 3.2.6 | 2.6.36 | February 22, 2011 | 11 – 13 |
| Ice Cream Sandwich[10] | 4.0 – 4.0.4 | 3.0.1 | October 18, 2011 | 14 – 15 |
| Jelly Bean[11] | 4.1 – 4.3.1 | 3.0.31 to 3.4.39 | July 9, 2012 | 16 – 18 |
| KitKat[12] | 4.4 – 4.4.4 | 3.10 | October 31, 2013 | 19 – 20 |
| **Legend:** Old version Older version, still supported **Latest version** | | | | |
| Lollipop[13] | 5.0 – 5.1.1 | 3.16 | November 12, 2014 | 21 – 22 |
| Marshmallow[14] | 6.0 – 6.0.1 | 3.18 | October 5, 2015 | 23 |
| Nougat[15] | 7.0 – 7.1.2 | 4.4 | August 22, 2016 | 24 – 25 |
| Oreo[16] | 8.0 – 8.1 | 4.10 | August 21, 2017 | 26 – 27 |
| Petit Four[4] | 1.1 | 2.6 | February 9, 2009 | 2 |
| Pie[17] | **9.0** | 4.4.107, 4.9.84, and 4.14.42 | August 6, 2018 | 28 |

# Last two version

| Codename | Version | API level/NDK release |
| --- | --- | --- |
| Android11 | 11 | API level 30 |
| Android10 | 10 | API level 29 |

# Architecture of Android



# Architecture of Android

**Applications:**

Android comes with various robust applications that support everyday phone needs, s**uch as messaging, e-mail, Internet browsing, and various third-party applications.**

Written in JAVA programming

**Application Framework:**

Android provides developers the **ability and tools to create extensive, interactive, rich graphical applications to users,** and is targeted to deploy these applications to the Google Play Store.

# Architecture of Android

**Native Libraries :**

The **native libraries and the Android runtime exist in roughly the same space. The native libraries are compiled and preinstalled C/C++ binaries** that the Android system depends on.

android.app,android.content,android.database ,android.text,android.view,android.widget

**Surface Manager :**

This is **often referred to as Android's Window Manager.** Surface Manager is **used for composing what any individual screen will look like. It also does some more subtle things that help Android run smoothly**, such as off-screen buffering and transitions.

**SQLite:**

This is a **database used to persist information across sessions of an Android device.** On Android, the SQLite database is stored inside of the device's internal memory so SD cards can be interchanged without losing device-specific information.

- **Activity Manager** − Controls all aspects of the application lifecycle and activity stack.

  **Content Providers** − Allows applications to publish and share data with other applications.
- **Resource Manager** − Provides access to non-code embedded resources such as strings, color settings and user interface layouts.
- **Notifications Manager** − Allows applications to display alerts and notifications to the user.
- **View System** − An extensible set of views used to create application user interfaces.

# Architecture of Android

**WebKit:**

**WebKit allows for HTML to be rendered and displayed to Android very quickly and efficiently.** This is the default browser engine in the Android system and is available to system and third-party applications.

**OpenGL/ES:**

**The OpenGL engine processes graphics in Android.** OpenGL can render both 2D and 3D objects on Android. This also supports hardware acceleration on devices with dedicated graphic chips.

**Android Runtime:**

I**nside of the Android runtime are two primary components: the core Java libraries that Android provides, and the Dalvik virtual machine.** The Dalvik virtual machine is Google's implementation of Java that is optimized to be used on mobile devices. The more specific differences within Dalvik are very technical and aren't covered in this book.

# Architecture of Android

**Linux Kernel :**

- **provides access as close to the hardware as possible.**
- As a result, drivers are written in the kernel space to operate as fast and as efficiently as possible.
- These include things **like controlling the internal radios, turning on the stereo and camera, dealing with power and battery charging,** and operating the physical keyboard or buttons on the device.
- The Linux kernel, like **Android, is an open source project** and is used widely, particularly on servers in enterprise environments.

- **CEC exam for Module - 1 is on – 17 / 12 / 2020**