

Study on Android Operating System And Its Versions

M. Narmatha¹, S. Venkata KrishnaKumar²

1. MPhil scholar, PSG College of Arts & Science, Coimbatore, India.

2. Associate Professor, Department of Computer Science, P.S.G College of Arts and Science, Coimbatore, India

Abstract:

Android Operating System is developed for smart phones and tablets. It is a Open source Software. Android is the most widely used mobile Operating System by the people nowadays. Android Software Stack contains four Layers: application layer, application framework layer, Libraries, Linux kernel. This Paper Describes about the Software Stack and versions of Android Operating system.

Keywords: DVM, Linux kernel, version, OHS.

1. Introduction:

Android was founded by a company, named android Inc. in Palo Alto of California, U.S in 2003 whose founder was Andy Rubin. Early intension of the company was to develop an advanced Os for digital cameras, but then it was realized that market for such devices was not large enough so that diverted their attention to producing a smart phone OS. Android was then acquired by the Google in 2005 and unveiled its distribution in 2007 with formation of Open Handset Alliance led by Google. Android mobile operating system is based on the Linux kernel and is developed by Google. Android OS has its own virtual machine called DVM which is used for executing the android application. One of the reasons for the success of Google's OS is the constant improvement of its many versions, with every new one offering more advanced features, faster access to the internet. Another reason for the Android's popularity is its strong collaboration with

mobile devices manufacturers, while it is main global competitor.

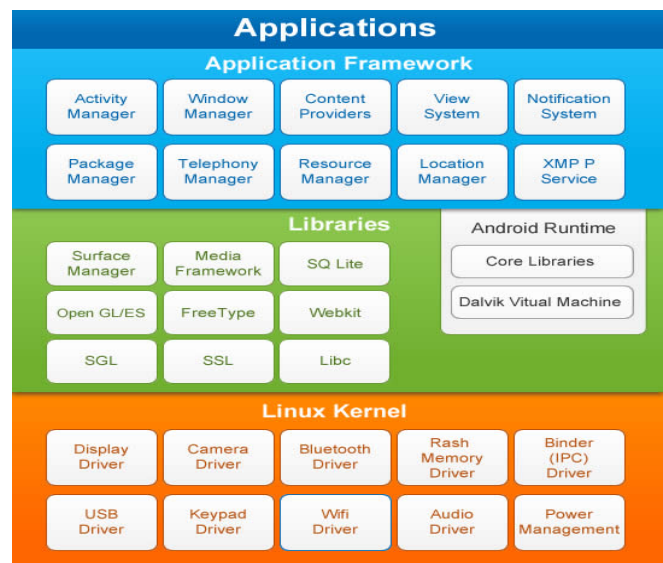
Open Handset Alliance:

The Open Handset Alliance (OHA) is a consortium 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.

2. Android Architecture:

Software stack is split into four layers. That are

1. Application layer
2. Application Framework
3. Libraries
4. Linux kernel



2.1 Linux Kernel:

Lower layer of android operating system is Linux kernel. It does not really interact with the users and developers. The Linux Kernel provides a level of abstraction between the device hardware and the upper layers of the Android software stack. Based on Linux version 2.6, the kernel provides pre-emptive multitasking, low-level core system services such as memory, process and power management in addition to providing a network stack and device drivers for hardware such as the device display, Wi-Fi and audio. Also, the kernel handles all the things that Linux is really good at such as networking and a vast array of device drivers, which take the pain out of interfacing to peripheral hardware.

2.2 Libraries:

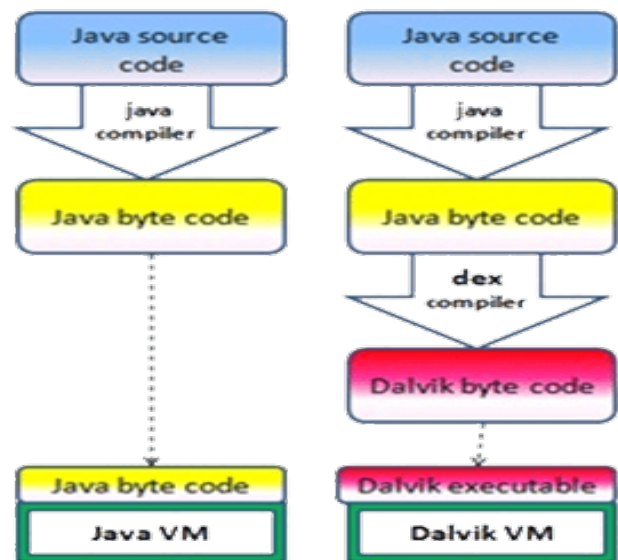
On top of Linux kernel there is a set of c/c++ libraries used by the various components of the android system. Some of the core libraries are listed below:

- System c library – a BSD– derived implementation of the standard and system library (libc) tuned for embedded Linux-based devices.
- SQLite - It is used to access data published by content providers and includes SQLite database management classes.
- SSL - It is used to provide internet security.
- SGL – the underlying 2D graphics engine.
- Libwebcore – a modern web browser engine which powers both the android browser and an embedded web view.
- OpenGL - It is used to provide Java interface to the OpenGL/ES 3D graphics rendering API.

- Media framework - It is used to provide different media code which allow the recording and playback of different media formats.
- Web Kit - It is the browser engine used to display internet content or HTML content.

2.2.1 Android Runtime:

Dalvik Virtual Machine:



Dalvik is a purpose built virtual machine designed specifically for android which was developed by Dan_Bornstein and his team. It was mainly developed for mobile devices. Dalvik Virtual Machine is same as JVM but only difference is that it is designed and optimized for Android. Every android application runs in its own process is called Dalvik virtual machine. Dalvik uses its own 16 bit instruction set than java 8 bit stack instructions, which reduce the Dalvik instruction count and raised its interpreter speed. The Dalvik VM executes files in the Dalvik Executable (.dex) format which is optimized for minimal memory footprint. The VM is register based, and runs its classes compiled by a java language compiler that have

been transformed into the .dex format by the included “dx” tool. The Dalvik VM dependent on the Linux kernel for underlying functionality such as threading and low level memory management.

2.3 Application Framework:

It provides many higher level services to applications in the form of Java classes. Application developers are allowed to make use of these services in their application. This framework describes the concept that Android applications are constructed from reusable, interchangeable and replaceable components.

The Android framework includes the following key services:

- 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.
- Package Manager – The system by which applications are able to find out information about other applications currently installed on the device.
- Telephony Manager – Provides the telephony services available on the device such as status and subscriber information.

- Location Manager – Provides access to the location services allowing an application to receive updates about location changes.

2.4 Applications:

The applications are at the top layer of the Android stack. The user of the Android device would mostly interact with this layer. Android will ship with a set of applications including an email client, calendar, browser, maps, contacts, others. All applications are written using java programming language.

3. Android Version history:

Android is updating day by day since its release. These updates to the base operating system mainly focusing on fixing bugs as well as adding new features to provide more comfortable environment. The most recent released versions of Android are:



2.0/2.1(Éclair), the user interface and introduced HTML5 and Exchange ActiveSync 2.5 support.
2.2(Froyo), which introduced speed improvements with JIT optimization and the

Chrome V8 JavaScript engine, and added Wi-Fi hotspot tethering and Adobe Flash support

2.3(Gingerbread), which refined the user interface, improved the soft keyboard and copy/paste features, and added support for Near Field Communication

3.0(Honeycomb), a tablet-oriented release which supports larger screen devices and introduces many new user interface features, and supports multiform processors and hardware acceleration for graphics.

4.0(Ice Cream), a combination of Gingerbread and Honeycomb into a "cohesive whole. This version had new features added to the Smartphone's Such as photo enhancements, offline email searching, facial recognition unlock, network data, and usage monitoring.

4.1-4.3(JellyBean), the new focus on responsiveness with Project Butter, Jelly Bean brings multi-user accounts, actionable notifications, lock screen widgets, quick-settings in the notification bar, Photosphere to the "stock" Android camera and Google Now. Jelly Bean is hailed by many as the turning point for Android, where all the great services and customization options finally meet great design guidelines.

4.4 (Kitkat), KitKat brought a lighter, flatter and far more colorful look to Android, but many more changes were under the hood. These were the foundation for things like the Google Now launcher, SMS integration with Hangouts, and easier and faster use all around.

5.0(Lollipop), Google released Android 5.0 Lollipop with the Nexus 6 and Nexus 9, and it ushered in a new design language and support for 64-bit devices. It's also the first time Google has provided developer beta previews of the software.

6.0 (Marshmallow), Android 6.0 gets better control over permissions, allowing you to control what parts of your data apps can access, rather than approve it by simply installing the app in the first place. That's just the beginning, and features like app linking and the new Assist

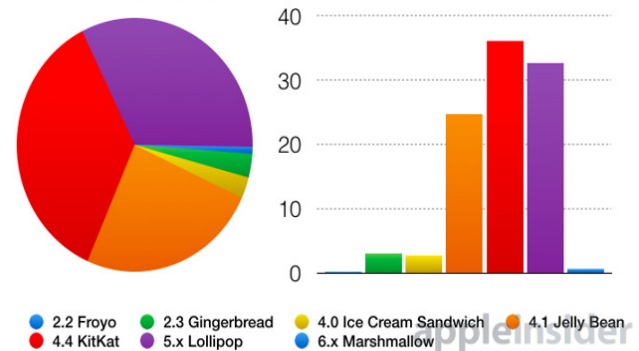
API will allow developers to build better and more powerful apps.

Android version distribution:

Distribution of Android OS versions in 2016 shown below. By this picture we know that the most widely distributed version is Android 4.4 (KitKat), another one is Android 5.x (Lollipop).

Android Distribution

Google Play users, Jan 3 2016



4. Android Security:

Nowadays near all of the tasks that you could only perform on a computer are also performed on mobile devices as well. This means that more sensitive information is stored on people mobile devices than before. The need for security is greater than ever for not only consumers, but large enterprise as well. Android software stack itself provides security to its application.

Key features includes physical access, app permission, the application sandbox, rooting.

Physical access

Android has a couple of features that can help to prevent hackers. The first is the unlock screen when the device is woken from sleep. The standard unlock screen is just the slider which

basically stops the screen from being activated in your pocket. But Android also allows you to set an unlock pattern, PIN or password. Unless the intruder knows the pattern, PIN or password they can't get access to your device. This is especially useful to keep little kids out of your phone or stop mischievous friends from sending emails.

App permissions

Every app that you install on your device needs to specifically ask you for permission to perform certain tasks. This is done when you install the app. What this means in practical terms is that apps have limited abilities. As well as limiting the abilities of apps, Android also controls how an app accesses the device's hardware. There is no direct hardware access allowed in Android; all access is through the different software layers which make up the Android OS. This means that rogue apps can't go around re-programming the microphone on your phone or bypassing the app permissions by talking directly to the video camera, etc.

The Application Sandbox

Android has another layer of protection in that it doesn't give one app access to the resource of another app. This is known as the 'sandbox' where every app gets to play in its own sandbox and can't use another app's toys! Android does this by giving each app a unique user id (a UID) and by running that app as a separate process with that UID. Only processes with the same UIDs can share resources which, as each ID is uniquely assigned, means that no other apps have permission.

Google's own words on this, "like all security features, the Application Sandbox is not unbreakable. However, to break out of the Application Sandbox in a properly configured device, one must compromise the security of the Linux kernel."

Rooting

In the world of Linux 'root' is the supreme user level which has the rights to perform any task. It is similar to the Administrator user on a Windows PC. By default, only the Linux kernel and a small number of core utilities run as this super user. But by 'rooting' your device (which means the root user level is available to all apps) then many of the security mechanisms described above are made null and void. This is because an app with root permission can modify any other part of the Android OS including the operating system itself, the kernel, and other apps.

Malware

It is an unfortunate reality, but reality none the less, that Android has a malware problem. First, for an app to be malicious it doesn't need to have access to the deeper levels of the OS. If an unsuspecting user installs a malicious app which sends premium rate SMS message and the user granted those privileges to the app when it's installed, then the malware has successfully been installed without breaking any of the security. Secondly, some malware actually comes with root exploits built-in. This means that when the app is installed it actually roots the device (without the user knowing) and by-passes all the system security. Thirdly, there is malware that just loves rooted phones. If the malware gets installed on a non-rooted phone it does nothing, but when installed on a rooted phone it unleashes all of its nastiness.

5. Conclusion:

Android operating system is now becoming best among all the other mobile operating system. All Google services can you have with one operating system, namely "Android". By Android versions its features are increased rapidly. So most of the users like Android smart phones, and it is best OS among all other OS like windows, iOS. The most

popular Android version is Android 4.4(kitkat). Android provide security to its application but IT also contains limitations of security. This paper covers some of the view points of Android OS.

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