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Google Android OS Vs. Apple iOS

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Abstract — In today's scenario rising importance of Smartphone's has triggered intense competition among different technology like Symbian, Google, Microsoft and Apple. The two most popular Smartphone operating systems are selling like crazy, with no sign of slowing down. Google's Android and Apple's iOS are operating systems used primarily in mobile technology, such as Smartphone and tablets. Android, this is Linux-based and partly open source. You should choose your Smartphone and tablet systems carefully, as switching from iOS to Android or vice versa will require you to buy apps again in the Google Play or Apple Store. Now a day, Android is the world's most commonly used Smartphone platform and is used by numerous diverse phone manufacturers. iOS is only one used on Apple devices, such as the iPhone. This paper presents a brief review, comparison and differentiation of android operating system from Google and iPhone operating system from Apple.

Keywords – Android, iOS, Mobile Operating System, Mobile Development Environment, App Security

I. INTRODUCTION

A Smartphone is a mobile phone built on a different mobile operating system, with additional advanced computing capability and connectivity than a characteristic phone. The first smart phones combined the functions of a personal digital assistant (PDA) with a mobile phone. Some other features are portable media players, GPS navigation, compact digital cameras, pocket video cameras, touch screens, web browsers, Wi-Fi, Mobile Broadband. There are many Operating Systems for smart phones. The main mobile operating systems (OS) used by modern smart phones in includes Google's Android, Apple's iOS, Nokia's Symbian, RIM's BlackBerry OS, Samsung's Bada, Microsoft's Windows Phone, Hewlett-Packard's web OS. But in this paper, I have described the detailed analysis of two operating system mainly Google's Android and Apple's iOS. Android from Google and IOS from Apple provides not only operating system but also provide a mobile development platform because both of them are facing tough competition against each other [3]. The comparisons of these Operating Systems have been made by different aspects that clarify the main differences between both.

II. MOBILE OPERATING SYSTEM

An Android vs iOS battle is something significance discussion about with anyone who uses smart phones today. Both operating systems have attractive good point of view to select them. And we can find both operating systems on different platform like smart phones, Gadgets, Smart watches, TV's, gadgets, even cars in some places. Although what can both operating system platforms offer?

2.1. HISTORY

2.1.1. Android

So, let's begin with Android. The whole thing started back in 2003 when some guys named Andy Rubin, Rich Miner, Nick Sears and Chris White initiated and started a company named Android Inc. Company wasn't very popular back then. Yes, it developed to a certain extent fast but it became well-known worldwide when Google bought it in 2005.The major milestone occurred in the development of the Android system on November 5th, 2007. On this day, Google unveiled the Open Handset Alliance (OHA), a consortium of technology manufacturer that would work collectively to create open mobile device standards. And it's formed by Google, HTC, Sony, Dell, Intel, Motorola, Samsung, LG. Android appeared for the initial first time [7]. Its fundamental coding was based on open source code and it was meant for future smart phones. In 2008 OHA released Android 1.0. In November of the same year we got Android Beta SDK (Software Development Kit). Android was specially created for touch-screen mobile devices.

2.1.2. iOS

iOS (previously iPhone OS) is a mobile operating system developed and distributed by Apple Inc. Apple was founded by Steve Jobs, Stephen Wozniak, Ronald Wayne in 1976. Initially launched with the first iPhone in 2007, but also used for iPod Touch (2007), iPad (2010), and iPad Mini (2012). Contrasting Microsoft's Windows Phone and Google's Android, Apple does not license iOS for installation on non-Apple hardware cording to the special media event held by Apple on September 12, 2012, 400 million devices had been sold by June 2012 [7]. Apple's iOS Operating system for Apple's mobile devices. Unlike Microsoft's Windows and Google's Android for all touch screen mobile devices where iOS is not available for Non-Apple hardware.

2.2. PLATFORM

Android platform is a platform for mobile devices that's based on the Linux Kernel. The development of Android apps can be done either by the Android SDK and the Eclipse IDE or ADT bundle. This Android SDK includes tools and APIs. It can be programmed by the C/JAVA Language. Most of the android applications that run on the Android Platform are written in Java but there is no Java Virtual Machine. in its place, the Java classes are first compiled into what are known as Dalvik Executables and run on the Dalvik Virtual Machine. Google charges 36$ per an Android developer account and approves the apps quickly which thus, can be dangerous for the device i.e. the security provided by Android is less. With more than 500,000 apps on the Google Play and an account at a cheap price, it is a good OS to develop apps in.

On the other side, Apple platform allows its users to develop iOS applications using the Xcode app. Apple® tools requisite to implement iOS applications only run on the OS X operating system on Intel-based Macs. iOS is Apple's proprietary mobile operating system (OS) for its mobile devices, such as the iPhone, iPad and iPod Touch. The operating system is based on the Macintosh OS X. The latest version of Xcode is Xcode 5®. Xcode® 6.0 (the minimum required version) runs only on OS X version 10.9 (Mavericks) or greater, and includes the iOS 8 SDK. Apple charges $99 per annum for a developer account and takes a lot of time to approve the apps, that is it maintains security and developer earn 70% of revenue. With more than 900,000 Apps in the App Store, it is definitely a good OS to develop apps in. For developing software for Mac Os and iOS, Xcode is a suite of tools used. An Integrated Development Environment (IDE) that used to perform edit, compile, run and Debug source code. Xcode suite supports Objective C, C, C++, Objective C++, Java, AppleScript, Python and Ruby source code with a number of different programming models

III. SYSTEM ARCHITECTURE

3.1. Android Architecture

Android operating system is a Linux based OS that uses a stack of software components. As shown in figure, the main four layers of this architecture are Linux kernel, Libraries and android runtime, Application framework and Applications. in this architecture each lower layer uses a sort of encapsulation, while providing call interface to the upper layers [2,3,5].

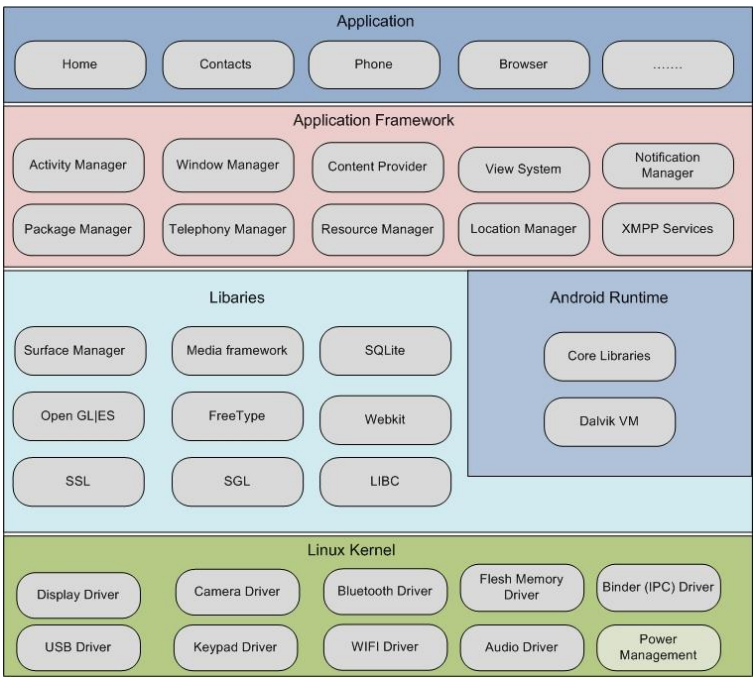

Figure – 1 Android Architecture

3.1.1. Linux Kernel

Linux kernel is the heart of android architecture that support core system services like security, memory management, network stack, power management, process management and device management. This provides a level of abstraction between the device hardware and the rest of software stack.

3.1.2. Libraries:

On the top of linux kernel, there are Native libraries including WebKit, FreeType, OpenGL SQLite, Media, C runtime library (libc) etc. The SQLite library is a useful for storage and sharing of application data. The media libraries are useful to provide playback and recording of many popular audio and video formats. SSL libraries are responsible for Internet security. FreeType is useful for font support. The surface manager manages accessibility of display subsystem and composites 2D and 3D graphic layers from multiple applications.

3.1.3. Android Runtime

In android runtime, there are java core library and Dalvik Virtual Machine (DVM). DVM is like JVM but it is responsible to run and optimized for android application. It uses less memory and gives faster performance. The Android runtime provides a set of java core libraries which enable developers to developed Android applications using standard Java programming language.

3.1.4 Application Framework

Android framework is available on the top of libraries and android runtime. Application framework provides reuse of its components. Any other app can free its functional components and all other apps can access and use this functional component. Android framework provides different services including Android API's such as UI (User Interface), notification manager, resource manager, locations, Content Providers (data) and package managers. It provides a lot of interfaces and class for application development.

3.1.5 Applications

Application layer is available on the top of application framework. That means any android application to be installed on this layer only. A set of core applications such as client, SMS program, contact, calendar, maps, games and browser etc.

3.2. iOS Architecture

iOS is Apple's mobile operating system which support for iPhone and other Apple's devices such as ipad, itouch and Apple TV. iOS has iOS software development kit (SDK), which includes the code, information, and tools developers need to develop, test, run, debug, and tune applications for iOS application. However, loading an application onto the device [4, 6].

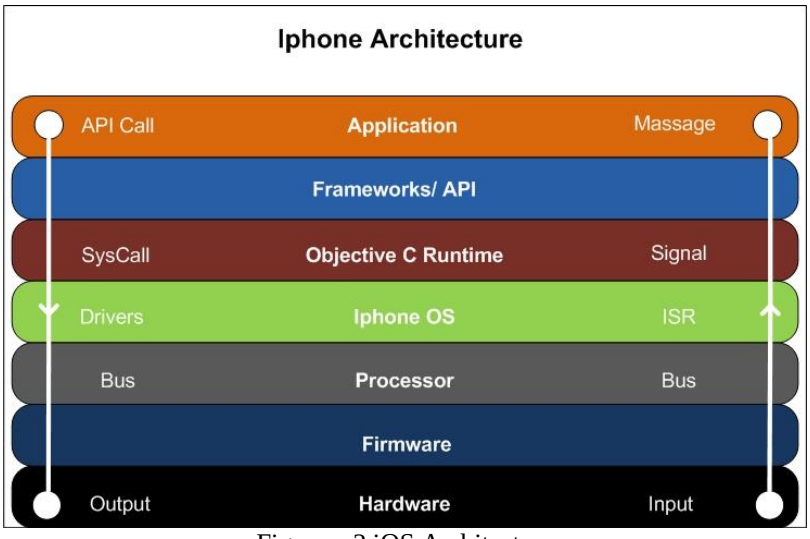

Figure – 2 iOS Architecture

3.2.1 Hardware

In iPhone, the physical chips soldered to the iPhone's circuitry are considered as Hardware. The actual processor includes in this layer, but the instruction set and in-memory descriptor tables are part of "processor" layer.

3.2.2 Firmware:

In Firmware, the chip-specific code is either included within memory in/around the peripheral itself, or within the drive for said peripheral.

3.2.3 Processor:

Processor is referred as the ARM instruction set and the interrupt descriptor table. They all are set up during boot and driver initialization by iPhone OS.

3.2.4 iPhone OS:

iPhone OS is the kernel, drivers, and services that constitute the iPhone OS. It reside between the user space and hardware.

3.2.5 Objective-C Runtimes:

Objective-C runtime is composed of both the Objective-C dynamically-linked run-time libraries and the underlying C libraries.

3.2.6 Frameworks/API:

Frameworks/API layer is residing on top of the Objective-C runtime, which has API calls. API calls are Apple-distributed headers with the iPhone SDK, with some dynamic linking occurring at run-time.

3.2.7 Application:

The iPhone application available has to be purchased through the application store. The Apple-distributed iPhone compiler compiled the native code of application and Linker linked that code with the Objective-C run-time and C library. The entire application runs within the user space environment set up by the iPhone OS.

IV. FEATURES

4.1. Android OS

Android is a multi-process operating system, which can run multiple app at the same time. In android each application and part of the system runs in its own process. Android also support optimized graphics VGA, 2D graphics and 3D graphics. To deliver a fully functional solution for mobile devices need of set of software subsystems which is available in a Android software. The android software stack includes an operating system which is Linux kernel based, middleware that is based on Java and application layer such as contact manager, web browser, etc. android has a better application market budget. Android allowed you to change your mobile setting faster. It's also gives you much more option to fit your budget. . Android keeps information visible on your home screen. Android also support Java applications. Android is an open source platform supported by a large number of manufacturer of mobile devices. Android application can be easy access lot of free or premium. Android is a multitasking because android OS is capable of running many applications at the same time. Android supports multimedia function audio or video format such as MPEG-4, H.264, MP3, and AAC, AMR, JPEG, PNG, GIF. Android is also capable of wireless communication using 3G/4G network, 802.11 Wi-Fi networks, Bluetooth connectivity. Android also support media, multi touch, video calling, multi-tasking, screen/video capture, camera, GPS, Compass, Accelerometer, SQLite for structure data storage, Tethering, Massive External Storage Capability [8]. The continuous development in looks and features might soon leave other mobile OS far behind in the long run. Dalvik virtual machine optimized for mobile devices, GSM Telephony support; Integrated browser based on the open source WebKitengine, Optimized graphics powered by a custom 2D graphics library; 3D graphics based on the OpenGL ES 1.0, 1.1, or 2.0 specification. Android is not a single piece of software or hardware it include number of things.

4.2 Apple iOS

iOS is a Apple's Mobile operating system which contain number of different features in all variants of devices like iPod Touch, iPhone and iPad. It's very unwavering and secure operating system for iOS mobile devices. iOS has good support for cloud storage also fixed set of tool with clear potential and boundaries. iOS support Touch screen, Apple Safari Web browser, iTunes compatibility for USB connection, iMessage for Apple's Texting App, Tethering, Bluetooth, Wi-Fi, Voice control etc [4, 8].

V. STORE

5.1. Google Play Store

Formerly the Android Market is the Google play for the application of the Android operating system which is a digital distribution platform and an online electronics and digital media store, operated by Google. The service allows users to browse and download applications developed with the Android SDK and published through Google, as well as music, magazines, books, movies, and television programs [11]. Users can also purchase hardware, such as Chrome books, Google Nexus-branded mobile devices, and accessories, through Google Play.

5.2. Apple App Store

Easy access to free and premium apps from Apple store. The Apple App Store is a digital distribution platform for mobile apps for the iOS operating system, developed and maintained by Apple Inc. The service allows users to browse and download applications that were developed with Apple's iOS SDK. The apps can be downloaded directly to an iOS device, or onto a personal computer via iTunes [11]. Although Apple envisions the App Store to be a global product, in reality its market is restricted to national boundaries. In other words there are potentially as many distinct App Stores as are countries in the world - even within the European Union which has a single common market, each country has its own App Store.

VI. SECURITY BATTLE

The security of these devices is a growing concern and focus for smartphone users, with the dominance of iOS and the increasing popularity of Android devices in the mobile market. We are using our mobile phones for a much wider range of activities from social networking to online shopping, banking, and surfing the web. We all need to take sensible safety measures to ensure our phones and our information are safe from malware attacks and cybercriminals. Both android and iOS have Traditional access control such as password and idle-time screen locking to protect the device itself.

6.1. Android Security

Android provide a finer grained security attributes that enforces restriction on the specific operation through a "Permission" mechanism that a particular process can perform and URI permission for granting ad-hoc access to specific pieces of data. Android is an open source platform that allows users to load a software or application onto a mobile device from any developer. The user must be aware of developer's of software as they are downloading and installing a software or application and user must have to decide whether they want to grant the application as it's requests. This decision can be informed by the user's decision of the software developer's trustworthiness, and where the software came from [1, 3, 5].

6.2. iOS Security

iOS has no security software and Apple doesn't let people load third-party programs on the device, from malicious software which could decrease the infection of risk, when the iOS is connected to the Web, dangerous possibilities emerge [1, 5].

The iOS Auto-Lock disables the device's screen after a preset time period of non-use, but the Passcode Lock feature takes that a step further. Whenever the device's display locks, whether due to Auto-Lock or because you've hit the iOS Sleep button–found on the top right of the device. Passcode Lock requires a four-digit code to be entered before the device can be employed again. The iOS security APIs are located in the Core Services layer of the operating system and are based on services in the Core OS (kernel) layer of the operating system. Applications on the iOS call the security services APIs directly rather than going through the Cocoa Touch or Media layers. Through the CFNetwork API, networking applications can also access secure networking function, which is also located in the Core Services layer.

VII. TECHNICAL SPECIFICATION

Attribute	Android	iOS
Developer	Google	Apple
OS	Linux	Mac OS
Initial Released	23rd Sep, 2008	29th July, 2007
Programming Language	C, C++, JAVA	C, C++, Objective C
Voice Command	Google	Siri
Source	Open Source	Closed, with open source component
IDE	Eclipse	Xcode
GUI	Android	Cocoa Touch
Available on	Mobile Phones & Tablets (Samsung, Lenovo, Micromax and Others)	iPhone, iPad, iPod Touch, Apple TV
Latest Release	Android 6.0 Marshmallow (October 5, 2015) Android 6.0.1 Marshmallow (December 7, 2015) API Level – 23	iOS 9 (September 16, 2015)
Map	Google Map	Apple Map
App Store	Google Play – 1,000,000+ apps. Other app stores like Snapdeal and Myntra also distribute Android apps. (unconfirmed ".APKs")	Apple app store – 1,000,000+ apps
Default Internet Browser	Google Chrome	Safari

Table – 1 Technical Specification of Android Vs. iOS

VIII. DIFFERENCES

Attribute	Android	iOS
Advantages	Multitasking	Sophisticated Development
	Ease of Notification	Sufficient documentation
	Easy access to thousands of applications via the Google Android App Market	Uniformed Product
	Phone options are diverse	Support Multi-task after
	Widget, Flexible	
	Google Maniac	
	Can solve security issues	
Disadvantages	Continuous Internet connection	Too many restrictions, not flexible
	Advertising	Not ease to third-party apps
	Versatile products	Security issues
	Insufficient documentation	Cannot be virtualized

Table – 2 Differences between Android and iOS

IX. CONCLUSION

Ultimately, Android and iOS Phone have a lot in common, and each provides a solid platform for business users to run the apps they need. Fundamentally, the choice is yours and the differences are not sufficient to place one much higher than the other. After reviewing the all features and configuration of the Android and the iOS, we can conclude that there is no clear advantage of the one over the other. But each also has one-of-a-kind, productivity-boosting features. Android is the most customizable, making it a good fit for power users. Meanwhile, iOS offers a simple but powerful interface that's backed up by the best overall selection of apps.

The open source nature of Android has considerably contributed to the reduction of flaws in the existing operating system. In conclusion, there is very little between the two, although the open source nature of Android offers the opportunity for a more diverse range of apps, if not more in actual number. With the iPhone OS you are restricted to apps and other software that Apple approves, while Android is open to anyone that wants to use the operating system to design an application. Apple charges for the App developers $100 While Google charges for Android developers only $5

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