A Comparative Study of Mobile Operating Systems

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Abstract--- Mobile operating systems are the operating systems to run mobile devices such as smart phones, tablets, PDAs and other hand held devices. Mobile devices added a drastic change in the daily life nowadays. There are a wide variety of mobile operating systems are available in the market such as Android, Apple iOS, Symbian OS sailfish ,firebox etc which provides the combined features of personal computer operating systems and the features including touch screen, cellular, Bluetooth, Wi-Fi, GPS navigation system, camera, speech recognition, voice recorder, music player etc. This paper gives a comparison study between different operating systems used in the mobile devices.
Keywords--- Operating system, Mobile OS, Hand held devices, Mobility

I.   INTRODUCTION

Mobile devices support mobility which encompasses the movement of people, ideas and things, as well as the broader social implications of those movements. Mobile operating systems are the operating systems to run the mobile devices such as smart phones, tablets, PDAs and other hand held devices. Today, mobile phones have become an important yet common product. Nowadays we can easily find people carrying two or three mobile phones. It has truly become an essential part of our everyday life. Taking about its impact, mobile technology affects our life in both ways – positively and negatively.

There are a wide variety of operating systems are available in the market with various features such as touch screen, cellular, Bluetooth, Wi-Fi, GPS navigation system, camera, speech recognition, voice recorder, music player etc. The worldwide sales of mobile devices, especially for smart phones, grew day by day. According to Gartner's latest market estimates, 968 million smart phone devices sold to end users in 2013[1], from which 79% of the devices run using Android Operating system.

This paper gives an overview about different mobile operating systems which are most commonly available in the market.

II.   FEATURES OF DIFFERENT MOBILE OSS

There are a wide variety of operating systems are available in the market with different mobile devices. From those, some of the most commonly used and popular mobile operating systems are reviewed here. Table 1 shows the comparison of Shipments and market share of top five mobile operating systems for the years 2012 and 2011 [9].

Table 1: Shipments and market share of top five smart phone operating systems

Operating System	Unit Shipments in 4Q12	Market Share in 4Q12	Unit Shipments in 4Q11	Market Share in 4Q11
Android	159.8	70.1%	85.0	52.9%
iOS	47.8	21.0%	37.0	23.0%
BlackBerry	7.4	3.2%	13.0	8.1%
Windows Phone	6.0	2.6%	2.4	1.5%
Linux	3.8	1.7%	3.9	2.4%
Others	3.0	1.3%	19.5	12.1%

(a)   Android Operating System

Android is a complete set of software or software stack for mobile devices which includes an operating system, middleware and key mobile applications. The android operating system is based on the Linux Kernel and is designed primarily for touch screen mobile devices such as smart phones and tablet computers. Android was unveiled in 2007 along with the founding of the Open Handset Alliance: a consortium of hardware, software, and telecommunication companies devoted to advancing open standards for mobile devices. The HTC Dream, released on October 22, 2008 was the first publicly available smart phone running on Android.

Android's source code is released by Google under the Apache License which allows the software to be freely modified and distributed by device manufacturers, wireless carriers and enthusiast developers. Android has the largest number of applications or apps available for download in Google Play store which has had over 1 million apps published and over 50 billion downloads. Android is the most used developer platform which is used by 71% of the mobile developers [2].

As of May 2015, Android became the most popular mobile OS, having the largest installed base and is a market leader in most countries including the United States [3]. In the third quarter of 2013, Android's share of the global smart phone market was 81.3% [4].

The first release of android was in September 23, 2008 and has numerous updates which incrementally improves the operating system by adding new features and fixing bugs. The latest released version is 4.4.2 which is named as KitKat, released on December 9, 2013 [5]. Table 2 shows the different versions of Android with their code name, release date and API level [6].

Table 2: Different versions of Android

Version	Code name	Release date	API level
6.1	Marshmellow	May 15,2015	21
5.1	Lollipop	October 15, 2014	20
4.4	KitKat	October 31, 2013	19
4.3.x		July 24, 2013	18
4.2.x	Jelly Bean	November 13, 2012	17
4.1.x		July 9, 2012	16
4.0.3–4.0.4	Ice Cream Sandwich	December 16, 2011	15

Version	Code name	Release date	API level
3.2	Honeycomb	July 15, 2011	13
2.3.3–2.3.7	Gingerbread	February 9, 2011	10
2.2	Froyo	May 20, 2010	8

Memory Management

Android is designed in a memory efficient manner which ensures the power consumption at a minimum level by managing the apps stored in memory automatically. The system will automatically suspend the apps from the memory when it is no longer in use to save the battery power and processing power [7].

Security and Privacy

In android, a sandbox is provided to the applications to restrict the access to the system's resources without permission of the user. User can accept or refuse permissions at the time of installation of the app. Android version 4.2 *Jelly Bean* released in 2012 includes inbuilt malware scanner to work with Google Play which can scan apps installed from third party sources also and can alert the system [8]. The open source nature of Android allows the users and developers to modify the security features according to their requirement.

The problems with android operating systems are some device manufacturers add alternative UI front ends which reduces OS consistency and also the applications are not validated.

(b)   iOS

iOS is a mobile operating system developed and distributed by Apple Inc. which was previously known as iPhone OS and was unveiled in 2007 for the iPhone. It had a 21% share of the smart phone operating system units shipped in the fourth quarter of 2012, behind Google's Android [9]. iOS is Apple's mobile version of the OS X operating system which shares the Darwin foundation and various application frameworks. The later release iOS 7, was released on September 18, 2013 [9].

The next version iOS 8 has improved integration between Apple devices, both mobile and desktop. Apple introduced several new "Continuity" features that are designed to connect the iPhone, iPad, and Mac "like never before". AirDrop, Apple's peer-to-peer file sharing protocol, now works between iOS and Mac devices. Handoff, a newly introduced feature, works on the same sharing principles and lets users start a task on one device and instantly pick it up on another.

The latest iOS 9 is Apple's newest operating system for iOS devices like the iPhone and the iPad, released to the public on September 16, 2015. iOS 9 builds on the content introduced with iOS 7 and iOS 8, bringing subtle design changes, refined features, improved functionality, and performance enhancements. iOS 9's biggest focus is on intelligence and proactivity, allowing iOS devices to learn user habits and act on that information, opening up apps before we need them, making recommendations on places we might like, and guiding us through our daily lives to make sure we're where we need to be at the right time. Siri is at the heart of the changes, and the personal assistant is now able to create contextual reminders and search through photos and videos in new ways. Swiping right from the home screen also brings up a new screen that houses "Siri Suggestions," putting favorite contacts and apps right at your fingertips, along with nearby restaurant and location information and important news.

Memory Management

iOS provides Reference counting method for dynamic memory management. In this method, each object keeps a count of how many other objects are using it and when the count becomes zero, that

object is deallocated and the memory is released. When memory is running low, all running apps in the iOS will get a low memory warning to release any memory that it is not currently using. If the low memory condition persists, the system will eventually terminate the apps [11].

Security and Privacy

The features of iOS helps to protect personal information by automatically encrypting the e-mail messages and third party applications using passcode. iOS provides privacy by blocking cookies and prevent websites from tracking. The iOS 7.0.6 addresses vulnerability at the time of handling encrypted communications which allows intercepting, reading or modifying encrypted email, web browsing, tweets and other transmitted data.

The applications which are developed to use in iOS must be approved by Apple before being made available via marketplace and also iOS does not provide Adobe Flash support [10].

(c)   BlackBerry OS

The BlackBerry OS is the proprietary mobile platform developed by RIM (Research in Motion), exclusively for its BlackBerry smart phones and mobile devices. It offers native support for corporate mail via MIDP, which enables effortless wireless sync with Microsoft Exchange, Lotus Domino and email, contacts, calendar, notes and so on, while used along with the BlackBerry Enterprise Server. This OS additionally supports WAP 1.2. Its network architecture is differing than other operating systems.

Blackberry provides end to end encryption. It is using two encryption options. Advanced Encryption Standard (AES) and Triple Data Encryption Standard (Triple DES). Data sent to the BlackBerry smart phone is encrypted by BlackBerry Enterprise Server using the private key retrieved from the user's mailbox. The encrypted information travels securely across the network to the smart phone where it is decrypted with the key stored there. It's enabled RSA SecurID Two - Factor Authentication. Additional authorization also available when users access application data or corporate intranets.

(d)   Windows

Windows is the most popular computer operating system. Past five years they are started to give more attention on mobile operating system also. It is offering new user interface with 'Metro' design. They designed Windows CE (Compact Edition) specifically for handheld devices, based on Windows API. Later introduced Windows 8 mobile OS released at June 2012, its support, many of great features like multi core processor support, hifi screen resolution, higher storage support and near field communications. This mobile OS is almost simulating the personal computer version of Windows 8.

The next version Windows 10 Mobile will be hitting the market by the end of 2015. The key thing to know about Windows 10 Mobile is that while the version running on your handset will be optimised for a smaller screen it's still just considered Windows 10. So apps and features will look similar on your phone to on your desktop. You get the full versions of Office, Word and PowerPoint and they will look and operate much the same as the desktop versions. Settings screens will also look and operate in the same manner across devices and apps will be universal, so Photos, Music, Videos and more will be much the same on desktop, phone and tablet and you can switch between Windows devices almost seamlessly.

III.   CONCLUSION

If we talk about today's mobile generation the mobile phone is the ideal technology. And for the next few years, internet connected mobile computing devices will drop radically in price and will increase in functionality. In choosing apt and secured mobile OS, after filtering out the analysis portion,

we can bring up few key points. Users have some priority features when choosing the operating system based on their work nature or personal interests. It's like user friendly, high security, professional motions, multiple capabilities, official activities, entertainment, financial activates, search, news etc. Based on user priority ranking they can check which operating system is capable to fulfill user requirements. Based on that they can choose apt and secured one.

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