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A Review of Different Comparative Studies on Mobile Operating System

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Abstract: The main purpose of this study is to discuss the different comparative studies on mobile operating system. From the last few years with the use of mobile, the mobile technology is also increasing at a fast speed. Now a day's different mobile phone companies are competing in the market each having its own hardware and software. Each company mobile phone has its own interface and they are looking to provide new features to their customers. Each company use different operating system like Apple using iOS, Samsung using Android and Nokia using Symbian. In this study we will give, you review of different comparative studies on mobile operating systems done by different authors.

Keywords: Android, iOS, symbian

INTRODUCTION

With the use of mobile, the mobile technology is also developing day by day. The mobile phone has made our life easily. We can perform different task of our daily life on mobile phones in few seconds. We can transfer money, pay utility bills by using mobile phones in few seconds for which we have to go to banks that takes a lot of time. When a customer goes to market to buy a cell phone he gets confused when he see number of cell phones developed by different companies. Each cell phone has different features and use different operating system. There are number of operating systems that are used by different companies. These operating systems are listed below:

Symbian OS: Nokia uses the Symbian OS in their cell phones.

Android OS: Google developed android OS and it was based on Linux kernel. Samsung and HTC use the Android OS.

iOS (iPhone OS): Apple developed the iOS. It is used in iPhone, iPod.

BlackBerry OS: BlackBerry uses the BlackBerry OS in their cell phones.

Windows phone: Nokia and HTC use Windows Mobile Operating System in their Windows Phones.

The OS listed above have different features. All OS differ from one another. This study will give you review of different comparative studies on mobile

operating systems and difference between these operating system.

METHODOLOGY

We are aiming to review different mobile operating systems used in different mobile phones. For this purpose, we have studied different papers related to mobile operating system and we will provide a brief review of these studies.

LITERATURE REVIEW

Sharma *et al.* (2013), according to them now a day's advancement in mobile technology has become a big challenge in the mobile market this study discusses different technologies used with different mobiles in the market. 0G was the first generation with only analog feature i.e., only voice call was allowed and no data feature presents different generation of mobile. The 1G was little advance that allowed limited data feature with voice call. The 2G was little more advance than the previous one with voice call, sms and cellular network features. The 3G brought more advance features like streaming data, broadband and voice. The 4G added advance features in the previous generation like high-speed broadband and high data rate. Along with advancement in mobile technology, different operating systems were designed to support these technologies. Comparison of these operating systems is given below:

Symbian OS: The "Symbian Ltd" company designed this operating system and the first programming language used by this OS is C++. Nokia mobiles use

this operating system. The integrated development environment used for this OS is Carbide C++, code warrior, Visual C++. Where programmer is free to use any programming language.

Android OS: This OS is designed for those operating system which are based on Linux kernel and developed first by Google and then by Open Handset Alliance (OHA). The primary language used was java. Applications can be written in any language but later on, it is too compiled on ARM code. Samsung and HTC use this OS.

iPhone OS: Apple company designed this operating. The native language is C and apple company products use this OS.

Blackberry OS: This OS was designed by Research in Motion (RIM) for blackberry smart phones. It provides multitasking and specially was designed for touch screen, track ball input features. The OS is used by blackberry Smartphone and it was written in C++.

Window OS 7: This OS was designed by Microsoft and was written in C ++. It is only used in the special market that is window mobile market.

In the study the authors has further discussed and compare android and apple OS:

- The loading time of iphone is less than the android.
- The android drag and drop feature allow the user to continue his/her current work in case of any missed instance but apple force the user to close the current task.
- Maintenance is easy in apple OS as it is controlled by Apple. However android is used by multiple platforms and it is not easy to provide the maintenance on different platforms.

The competition of mobile technology shows the future of the mobile market. The price of the mobiles will reduce and functionality will increase. The most competitors like apple and android has already started to work to meet the challenges of the future.

Jindal and Jain (2012), according to them with ongoing competition in mobile market, the motive of every mobile company is to provide the best features and ease to use interface to the users. However, perfection needs time. This study analyzes different OS bases on features, lacking advantages. Authors also provide the new ideas to make add new features in different OS based on his comparison. In mobile world, the complex OS contain user interface. Therefore, the OS is hidden from the user. Operating system is a key element in performing the task the choice of OS is important as it shows that what functions does that OS support. The OS provides a software platform on top of

which other application programs can run. The applications are written for OS so the choice of an OS matters a lot.

Types of mobile OS platforms: The existing OS used by the computers can differentiate mobile operating system.

- **Real time operating system:** Such kings of OS respond to the input and generate the results immediately. Such kinds of OS are used for scientific uses where memory and resources availability is crucial. Such devices have very limited or zero end user utilities.
- **Single user single tasking operating system:** Better than RTOS. One user can do one task only. Palm OS in palm hand held devices is an example.
- **Single user multi tasking operating system:** Microsoft windows and Apple Mac are the examples where one user can run more than one application at a time.
- **Multi user operating system:** UNIX and mainframe OS are the examples. It allows minimum two and maximum hundred or more users to run the application at the same time.

Android: This technology is based on java software. This requires software development kit to create applications. The SDK is open source and can freely download from the internet. That is why it can be run on multiple operating systems. Android is a multi process technology. Each process runs on its own process. In addition, the process level security is enforced through Linux facilities. Android is an open source platform. It allows the user to load any software from any developer on a device.

IOS (Apple): This operating system has no security and it does not allow all third party programs on the device. However, this feature also reduces the risk of malicious software. The iPhone OS 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.

Symbian: Accenture maintains it. It was used by Nokia 60 series. The latest version is used in Nokia N8. The authors conclude that IOS is enjoying the mobile market due to the largest and popular apple company support. While android is also getting popularity due to its wide variety of application store. On the other hand, the Symbian is lacking in supporting the applications. While talking about graphical user interface it is super in IOS and android is also in the same race. However, symbian is lacking this facility. On the other hand talking about hardware support. IOS has a good hardware support. While android is still working to make it better. In addition, Symbian is the best one for supporting hardware.

Tiwaskar *et al.* (2012), according to them now a day's smart phones are a vital part of our life and working like a laptop. This study describes the architecture of mobile computing and comparison of various software factors of various mobile operating systems. New features of android OS are also introduced.

Mobile computing: Mobile Computing is a technology that allows transmission of data, via a computer, without having to be connected to a fixed physical link. Three important facets of mobile computing are mobile communication, mobile hardware and mobile software.

COMPARATIVE ANALYSIS OF MOBILE OS

A mobile is a kind of wireless device that is able to share the data using its own operating system. Open source means the specific application but it allows allow changing the coding to change the functionality of application. User can access the internal application and can make changes according to their own requirements. The symbian OS is partially open access and it is only open source for the business. While windows OS is restricted. Whereas android gives full access for Open source and users can make changes easily to the applications. The home screen is different in every mobile of same or different brand. The android supports five home screens with dynamically fitting widgets that means the widgets are displayed according to the screen size and space available on the screen. The Symbian provides three home screens with six slots on each screen. These six slots may be used for Apps and widgets. Windows Phones use the Metro UI based on a Live Tile home screen that is bright and colorful.

The Android phone must be re-charged every 4 h or so because it uses the most powerful hardware on the market to balance the lack of internal performance, while a Symbian Smartphone will be alive in battery for many days. This is because Symbian manages the perfect balance between power utilization and receptiveness of the device. It is the case of Windows. The battery power does not last for long and has to be charged periodically.

The study concludes that android is more preferred than symbian and windows but it is more susceptible to security threats and viruses due to the permission of anonymous applications submission. However, as user point of view the android OS is mostly preferred OS than the other two OS.

Khomh *et al.* (2012), according to them many software companies prefer to reuse existing grown-up software to deliver a high quality system in a short period. One of the best examples is of Google who used Linux operating system into android OS for the mobiles. This study author has conducted an experiential study to understand how Android adapts the Linux kernel. Using software repositories from

Linux and Android, author assessed the effort needed to reuse and adapt the Linux kernel into Android.

Linux is a very flexible Operating system so the mobile carriers also adopt it as an OS. Famous handset vendors of this OS are Motorola, NEC, Panasonic and Samsung. The cost of adapting existing software is less than making new software.

During software adaptation, three principal phases are particularly important and if these are not done properly then software adaptation can become more expensive than making a new one. The three phases are:

- The initial modification of the existing software system to reuse its functionalities in the adapted system.
- The maintenance of the adapted system to keep it updated with changes from the original system.
- The corrective maintenance of the adapted system to fix bugs carried down from the original system as well as the new bugs introduced during the previous development phases of the adapted system.

Results show that 99% of Linux kernel's functionalities were reused into Android and only 0.7% of Linux kernel's files were modified during this adaptation. On average, only 5% of Android files were modified because of a merge from Linux and the lasting impact of a merging commits is less than three subsequent commits. Linux developers fix 95% of bugs reported on the Android kernel.

Hammershøj *et al.* (2009), according to them mobile Social Networking is becoming a reality motivated by the introduction and further expansion of Smartphone. One of the changes in the advance capabilities of Smartphone is to enabling these mobile devices to bring in the advantages of the convergence process and bring the advanced Internet applications and services like social networking to the mobile devices. However, the device market is dominated by a number of different technological platforms, including different Operating Systems (OS) and 'software development platforms', resulting in a diversity of different competing solutions on the market driven by different actors. The aim of this study is to give a relative analysis of these technological platforms and recognize their strengths and weakness for being the platform of the future.

The author has done analysis based on following parameters:

Openness: It takes into account the extent of open source is the OS.

Look and feel: The overall impression of the graphical user interface, the general user experience and how the

OS launches and handles the vast amount of applications.

Web integration: The implementation of the OS towards being an online community terminal.

Future perspectives: The approach evaluations and predictions done by other analysts on how the OS is going to perform in the growing Smartphone market in the future:

- **iPhone:** iPhone OS is developed by apple. This OS is able to support applications from apple and from third party vendors. This OS is unable to perform multitasking. Any development in this OS is controlled by apple. However to keep the position of the iPhone, Apple will have to continue development and innovations, as an iPhone is an expensive product in a market with many comparatively even challengers.
- **Android:** This is the result of OHA with the Google as partner for implementation. This is an open source OS. However, applications created by Google are not open source. It has multitasking support. This is a suitable choice for cloud computing. Google chrome is especially supported by cloud computing.
- **Symbian:** Before symbian was the much stronger OS. However, the development of the new OS like android and iphone has already challenged the future of symbian OS. However, looking at the roadmap for the further development of Symbian and other supporting open source initiatives done by the Symbian foundation with Nokia in the lead, it seems that Symbian will still be a strong competitor on the Smartphone market in the future.
- **Blackberry:** It was designed by RIM (Research in Motion). This OS truly support multitasking in high speed. Loading time of applications is also fast. Business people due to especially the smart e-mail handling originally adopted the Blackberry. RIM exclusively controls the development for the OS and it will probably be around for years to come. However, especially android, iPhone and the future Windows Mobile 7-enabled Smartphone can be hard competitors.
- **Windows mobile:** This OS is property of Microsoft and is not open source. It is limited in terms of applications and functionality like other operating systems.

Conclusion: The Apple/iPhone model may be seen as the originator and leader. Symbian has for long time been the dominating technology, however, it seems that in the conversion to the Smartphone other operating systems like iPhone and Android are taking the lead. In the Smartphone market, some of the operating systems like iPhone and Blackberry are tightly connected to the

business logic of the platforms, with realistic consumer bases. Hence, it is difficult, at least in the near future, to see a winning operating system on the market. However, the Google/Android initiative of developing an OS, which can run on all mobile devices, is important and interesting to follow in the future.

Wooley (2010), according to author iPhone development can only officially be done on a fairly recent MAC in Objective C while Compare this with Android development, which is done in the Eclipse IDE which works on all of the major operating systems, using the Java programming language. Objective C is for all practical purposes only used for Mac progress whereas Java is one of the world's most popular programming languages (DedaSys, 2001).

Porting difficulty: Porting application in android is difficult. Porting will be first done in standard C and then it has to be compatible with the functionality of iphone. Whereas porting application in android is easy due to java language.

Virtualization: Apple is very restricted they will probably not ever be virtualized by anyone other than themselves. iPhone does not support any virtualization functionality and the Android OS is one of the many virtualized Operating Systems that support VMware's Mobile Virtualization Platform (VMware).

Reliability: According to users prospective, the apple is more reliable in terms of hardware and network infrastructure. The Android OS is by its multitasking nature more susceptible to processes incompatibility with each other and causing system insecurity.

Security: Security wise it is difficult to compare both operating Systems. The iPhone only allows one user application to run at a time, which is more secure theoretically. Additionally, the restriction to one user application at a time has prevented any antivirus programs from working on the iPhone.

By comparison android's multitasking is more susceptible to attacks. However, its security model is also much better. Android was able to take advantage of the years of research in locking down the Java Virtual Machine (JVM) in protecting their OS. In addition, the multitasking nature of the Android OS has allowed antivirus programs to be written for it.

CONCLUSION

The discussion above concludes that android is more preferred than symbian and windows but it is more susceptible to security threats and viruses due to the permission of anonymous applications submission. However, as user point of view the android OS is

mostly preferred OS than the other two OS. While talking about graphical user interface it is superb in IOS and android is also in the same race. However, symbian is lacking this facility. On the other hand talking about hardware support. IOS has a good hardware support. While android is still working to make it better. In addition, Symbian is the best one for supporting hardware.

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