Review and Evaluation of Performance Measures in the Mobile Operating Systems

Farhad Soleimanian Gharehchopogh, Farzaneh Abbaspour, Maryam Tanabi, Isa Maleki

Abstract— Nowadays, in the world of technology and communication, with the technology development and mobile devices enter the public acceptability of users across the world are faced, lack of consideration of security, performance and speed of Mobile Operating Systems(MOSs), practically on operating system limits the influence. MOS is an operating system for mobile devices and smart phones that is and responsible for controlling such devices. The operating system can directly affect the security, performance, speed, software capabilities support and affect the quality of work of mobile devices. In this paper, we review MOSs and to introduce and compared in terms of the MOSs, security, performance and speed are described.

Index Terms— Mobile Operating Systems, Mobile Devices, Security, Performance, Speed

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1 INTRODUCTION

Increasing the production of MOS for mobile phones, competition has led to the construction of new operating systems and smart day to day development. New operating system for mobile devices is increasing every day and mobile devices are become so advanced these days that most operating systems, mobile devices are speed and performance growing [1, 2]. Required operating system due to mobile devices that using the operating system can be the applications installed on the phone better manage, and to access too virtual world. In recent years, the evolution of structure and MOSs performance has been good progress. So, MOSs have been developed and expanded and new versions of operating systems are introduced. Also, the ability of MOSs in response to user demand for various services is developed every day.

MOS is a program that as the interface between the user and the mobile device hardware works. The purpose operating system providing environmental that software the user to easily run and manages [2]. Operating system with organize, manage and control the optimal use of hardware resources, and provides purposive for mobile phones. Operating systems, hardware to correctly interpret and in this context several facilities and necessary for run other applications on mobile devices provide [1].

In recent years, users of mobile devices just used for talking

and text messages. However, by adding the ability for these devices to access the internet, have an important role in human life. In today world, on the mobile devices can install in various types of applications and also, by using of these devices to connect to internet [2]. Mobile devices for music, video and games online and offline, are used. All operations are performed on a mobile device should be compatible with the operating system installed on the device [2].

Mobile devices that are connected to the internet nowadays and has facilities such as GPS or network connection to the internet, must have a with high security operating system [3]. Because the dangers of Internet threats for mobile devices is increasing, security acts should be considered in MOSs. Mobile devices that are connected to the Internet are exposed to the risks and vulnerabilities related with Internet. For reduce security risks, potential security of weaknesses their mobile users must and also be aware of your phone settings [4]. If the mobile OS companies identify security problems, they can apply protective strategies to enhance and security of mobile devices. Nowadays, programs that are written with the intent destruction and influence are day to day more widespread. If you want to secure your phone against malware threats and destructive programs the maintained, you can anti-malware programs install on your mobile [3]. Thus, the probability of being infected by destructive files on a mobile device can be greatly reduced. In this paper, on data provide security, performance and speed of the MOS design will focus.

We have organized the general structure of this paper as follow: in the second section, discussed about the research work done in the field of MOSs; in the third section, will describe MOSs; in the fourth section, we discuss the MOSs; in the fifth section, we will to provides suggestions in the field improving security, speed and performance MOSs; and finally in the sixth section, we will conclude.

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- **Farhad Soleimanian Gharehchopogh** is Currently Ph.D candidate in Department of Computer at Hacettepe University and honour lecture in Computer Engineering Departmant, Science and Research Branch, Islamic Azad University, West Azerbaijan, Iran. Email: bonab.farhad@gmail.com , farhad@hacettepe.edu.tr , website: www.soleimanian.com
- **Farzaneh Abbaspour** is a M.Sc. student in Computer Engineering Department, Science and Research Branch, Islamic Azad University, West Azerbaijan, Iran. Email: abbaspour.farzaneh@gmail.com
- **Maryam Tanabi** is a M.Sc. student in Computer Engineering Department, Science and Research Branch, Islamic Azad University, West Azerbaijan, Iran. Email: Maryam.tanabi@gmail.com
- **Isa Maleki** is a M.Sc. student in Computer Engineering Department, Science and Research Branch, Islamic Azad University, West Azerbaijan, Iran. Email: maleki.misa@gmail.com

2 LITERATURE REVIEW

Usually in mobile phones, a system software called the operating system to control hardware and the applications that run, used. Certainly one of the most distinguishing features mobile devices their operating systems. Mobile phone users in order to use applications from different operating systems can use. So far, different operating systems for mobile phones in the world are designed and implemented. Each operating system features, advantages and limitations are specific. Acquaintance with the characteristics of MOSs from the view security speed and performance is very important. In this context we to review several of the work done regarding to MOSs refers.

Researchers [1] operating system iOS, Android and Symbian terms of the applications, performance, reliability and security are analyzed. And expressed the features and the capabilities of MOSs has good progress. Them in their paper, to this result reach that each operating system has a special feature for users.

In [2] Researchers have investigated a variety of MOSs. They in their paper, the operating systems Symbian, Windows Mobile, Android, Bada and Blakberry terms of the various versions, graphical user interface, programming language, and connection with communications technologies are examined.

Researchers [5] to investigate the characteristics of the Android operating system for mobile devices are discussed. And it with Symbian and Windows MOSs has been compared. They in their paper, Android operating system terms of facilities that Google for it has provided have been investigated. They in their paper, expression that Windows Mobile is dependent on specific hardware and non-portable have been introduced. According to them results, Android operating system is a leading in mobile platform.

In [6] for sending secure SMS in the devices that of Android use an encryption method is used. One of the most fundamental services used in mobile phones, Short Message Service (SMS) is generally welcomed by users all over the world has faced. In this service people can write short messages via mobile phone and send to each other. Them in their paper, for sending SMS messages from the sender to the receiver using the algorithms AES (Advanced Encryption Standards) will be encrypted. The method proposed in this paper works only on Android devices. Their goal is encrypted SMS: protect data to encrypted form for recipients the message, protecting of information misuse the message and security and confidentiality of is the message.

K. Sharma in [7] to discuss Android and iPhone operating systems is discussed. In this article, based on the operating system platform and the performance is evaluated. He has expressed that the Android platform is based on Java and running the Dalvik virtual machine is using. So, now the Android platform is the fastest. He expressed according to review the two operating systems, that Android in mobile devices is advancing better.

In [8] researchers have examined the Symbian operating system. Them in their paper, to several versions examine this operating system are discussed and expressed that with development the operating systems iOS, Android and Windows Phone Symbian value declined.

Process Access computer remote with the help of Android mobile phones by the researchers in [9] is presented. Process was performed based on the method VNC (Virtual Network Computing). This is achieved through the Wi-Fi network. They also in their paper have the most powerful Android operating system for a smartphone operating system introduced. And have admitted that products based on Android, gradually a wider range of the communications products such as mobile phones, televisions, netbooks and tablets will take.

Researchers [10] to review promotion and development releases of the Android operating system and its features are discussed. They in their paper, several versions of SDK (Software Development Kit) in the Android operating system have been studied and have described the development of this operating system, every day, more and more phones are support it.

Some of researchers [11] have tried, with addition of encryption algorithms to SMS somewhat solve security problems. They in their paper, a method for secure SMS based on encryption a combination compression on the Symbian operating system are presented. Them in their paper, to reduce the length use of compression SMS and also for encrypting messages the RSA algorithm used. And for increasing security of a signature is added to the SMS. Based on them experimental results, SMS data security has increased compared to normal. The purpose them of this paper has been enhance the security of SMS in the Symbian OS.

3 MOBILE OPERATING SYSTEMS

After extended use of applications and development of mobile devices, companies manufacture mobile devices in order to enhance and attract more customers, the MOSs were designed. In mobile devices, an operating system with high performance is vital. Thus, with the rapid development smart phone market, a variety of operating systems for smart phones were manufactured [12].

Increasing production operating systems for mobile phones has caused, of a communication device to a portable device, with variety applications become. MOSs must standards, such the internet protocols collection on mobile devices, data exchange using infrared and Bluetooth alongside other support services [2].

In every operating system, user interface effectively plays a crucial role in the popularity. Features such as display size, method of data entry, storage and processing, some of elements have an impact in this field [1]. Therefore, careful de-

sign of the user interface (UI), an essential part of the design process MOSs. Offer the best performance for the MOSs, user interfaces is necessary to be designed to be compatible with the demands of users. User Interface for users depending on the operating system very important. Many of errors caused by the operating system is that in user interface design, needs of users are not well considered. Poor design user interface, this means that users can not to some operating system features (such as speed run programs) achieve. Therefore, users feel that the operating system is weak.

MOSs typically must terms of execution speed and performance have high capability. Therefore, manufacturing companies MOSs should consider this feature. To overcome these limitations, the best solution choice is a good programming language for operating system is designed. The possibility that in the a low level programming languages, operating system errors face more than a high level language. In the programming languages if due memory overflows are not properly controlled, reduce the speed and performance in MOSs. Therefore, programming languages can be used efficient memory for program execution. Some of programming languages offer a style of programming that can produce a large amount of unused memory. Therefore, if the operating system is written in a language that is properly controlled memory operating system performance more of becomes.

MOSs have the highest efficiency, must use of software applications to optimize the operating system. Application software optimized operating system must have the following features: Additional information remove, optimize memory RAM, remove the Additional processing, information display mobile devices, securing files, erase completely remove the software from your mobile device.

Security in MOSs is an important component in the design of operating system. Existence weaknesses or vulnerabilities in MOSs, the way influence and access to mobile devices will be available to the attackers. Most risks that facing MOSs influence the risk of viruses and worms. Therefore, the security in MOSs the mobile device is one of the most important issues and nowadays with the development of Internet and mobile devices to connect to the Web environment has increased in importance [13]. Every operating system is susceptible to influence and if we say an operating system against viruses and malware penetration resistance is a concept without foundation. Usually the best way to prevent malware is installed security software. Every operating system has a number of security factors, when in the design of MOSs these are factors not carefully, permeability security holes are created. These factors include user settings, services, and operational functions and operating systems interfaces or software it. Unauthorized access, sensitive data steal and privacy such as constant and common threats the smallest opportunity and weaknesses to penetrate the operating system use [14].

Mobile devices, due to the much information such as contact list, credit card information etc kept. All this information was important must security and operating system in environments is a good security. Therefore, in order to protection of mobile devices, the operating system must be able to perform authentication, access control and data protection [13].

Manufacturers of MOSs, software applications are designed so that the CPU and memory of the mobile phone, as optimal use. Also application specific interfaces in the operating system placed until peripherals like digital cameras can easily be included in the phone.

Mobile devices like personal computers, different operating systems. Each operating system can be implemented by one or more programming language. Each of the following operating systems specific techniques to provide services on mobile devices is used.

3.1 Android

Android is now the most popular MOS by Google in 2008 for mobile phones and tablets presented [1]. Android is based on Linux operating system is designed and built. This operating system based on Linux kernel is developed. The main idea of Android, Open Source is its meaning that everyone with install a program called SDK (Software Development Kit) can for this operating system develop their favorite applications and it in Android software store called Android Market Place is for sale [5].

In fact management and optimization of memory, associated with hardware, services mobile, security, data processing management and resource management the mobile device is done by the Linux kernel and Android is just a layer relationship between the user and the operating system provides. This software layer is implemented by Java. But because this operating system does not have JVM for run Java program code must be converted to Dalvik code and then by the Dalvik Virtual Machine (DVM) to run [1, 5]. Dalvik, a Java virtual machine with for Android OS is optimized to consume RAM, CPU and battery less.

Android, like Linux is Open Source, and many developers are working on it [7]. The most important difference between Android and other operating systems is that Android is an Open Source operating system [15]. Because of the Android Open Source possibility of development and design of applications related for this operating system user security there [12]. Many of developers, Android applications are design with consideration of the security of user applications.

Android operating system since the high performance of its in multitasking activities shows many have been attention. Android tools to easily accessible for users and is supported by Google. Android graphics files are processed by the OpenGL [1]. The default browser the Android based on Framework open source Web-Kit is design and developed. This operating

system all the mobile communication network is required us-ers such as GSM, EDGE, 3G, Bluetooth and Wi-Fi support [5]. Mobile phones equipped with the Android OS, such as GPS and camera features high quality support and of the software SQLite to store and manage data using [1,5]. From the other features Android OS widgets are the features such as weather information and display the calendar are provide users [10]. Other features Android OS sales service application software to the Android Market. A special application called the An-droid Market already installed on Android phones and allows users to purchase and download the necessary software. All applications are available in Android Market not sale rather more than half of the software on the Android Market free is available and consequently Android OS more free software for users will provide [5].

Android platform is a technique called sandboxing uses. This technique for security between devices and software programs on your phone or tablet virtualization layer provides. Thus, if a user without knowing to download malware on your device the malware can not to other parts of the device penetrate and cause damage is information. In reality virtual the framework makes software downloads until possibility communicate with other programs and device to a minimum [13]. Although in the Android OS are many restrictions on the installation program and access to parts of there are different but, still not be ensure safety against malware.

Of the strengths Android can be versatile, fast access and easy to Internet services, variety number of software and easily de-velopment of applications named [5]. Security procedures in the Android through standard Linux facilities takes place such as user and group ID that are assigned to applications [1].

3.2 iOS

iOS operating system, the first and only generation of Apple operating system for mobile devices and portable. This operat-ing system was first introduced in 2007 on the iPhone device [1]. iOS in terms of the architecture and functionality is very similar to the Mac OS operating system. iOS is Apple proprie-tary operating system based on multi-touch control interface design. In the iOS, there are four main layers [7]: the Core OS layer, the Media layer, Cocoa Touch layer, the Core Services layer.

API security functions the operating system iOS in layer the core services the operating system [1]. Applications installed on the iPhone device instead of the communicating with a touch layer or the media layer directly with applications pro-gram interface (API) to communicate [1].

A positive point is that iOS is less virus, fast boot and software are compatible with the operating system. Weaknesses of iOS can be exclusive (software especially Apple) Transfer multi-media files limitations named.

3.3 Windows Mobile

Windows Mobile is the extensive operating system along with a number of the original programs and applications for the mobile phones that based on the Microsoft win32 API the works. This is operating system similar to the desktop version of Windows is designed.

Some of the features that distinguish this operating system is another operating system the screen it. It the screen contains information such as the current date, information about owner of the phone, appointments, email messages and some daily tasks are predefined. Additionally, a status bar contains icons such as Bluetooth are located also on this page.

Windows Mobile has many different versions [2]:

Windows Mobile 2003: the third version was called Windows Mobile that Windows Mobile 2003 was introduced in June 2003, in fact first version of the operating system as "Windows Mobile" was. Windows Mobile 2003 SE: Windows Mobile 2003 Second Edition that Windows Mobile 2003 SE is called offered in March 2004. Windows Mobile 5.0: This operating system is based on Windows CE 5.0. Of the working environment .NET support the ability to run applications is .NET. Windows Mo-bile 6: this version was introduced in February 2007. This op-erating system consists of three versions is standard:

1. Windows Mobile 6 Standard: for smartphones without touch screen

2. Windows Mobile 6 Professional: for have PDA that the mo-bile phone capabilities.

3. Windows Mobile 6 Classic: for have not PDA basic that mo-bile phone the capability.

One of the other projects is Microsoft Windows Phone 7. It is an operating system for smart phones made by the Microsoft Company and is the successor to Windows Mobile [2]. In this operating system Instead of using programs based on the Mi-crosoft windows of Microsoft programs Silverlight is used [2]. The user interface this operating system Metro is called.

3.4 Symbian

Symbian is an operating system for mobile phones that Nokia is corporation the leading creators of this product. Symbian is operating system that due to the high flexibility, the ability to provide the highest performance to run applications on Nokia devices. Symbian is a programming language C++ [2]. Symbi-an programming event-based and when applications do not connected with the CPU is off. That this work causes the bat-tery usage time increases. The core of the Symbian operating system, based on the microkernel Architecture. This operating system is Open Source. Symbian OS has good features such as Multitasking, Multithreading and memory management [16]. Symbian OS is not immune from the attacks of various viruses and virus penetration in the operating system typically is done easily via Bluetooth and using methods such as the question of the user to install software and for the installation a warning

will appear and to the user system is transferred and threaten the security of the system.

Symbian OS on a different the user interface is provided. Now is written to both the user interface for Symbian. The first and most popular user interface Symbian, S60 is called. User interface other Symbian the UIQ is called that is possible to use the touch screen with the pen. UIQ user interface based on C++ programming language has been formed [8].

Symbian positive features include [2]: 1. Symbian is an operating system with great flexibility and to this reason has the highest performance with minimal hardware facilities and mobile phones that use of this operating system will not be faced with a shortage of memory. 2. Symbian operating system has a good stability and when of the CPU is not using the system automatically goes to silent mode. In resulting in battery consumption and hardware resources are many savings. 3. Positioning the satellite is free. 4. With both system whether the touch and non-touch is matched.

But there are weaknesses in this operating system [2]: 1. Touch technology has not advanced that much, and not in competition with other products. 2. Symbian OS is the low number of applications.

3.5 Blackberry OS

Blackberry is operating system that by RIM for BlackBerry smartphones was developed. This operating system supports multitasking capability [2]. BlackBerry OS in between the mobile platform has good security. BlackBerry devices to send SMS and emails are known as secure devices. The reason for this is that text messages and emails via a secure and through the server BlackBerry are passing away from an attacker. So, BlackBerry OS good speed, the ability to program execution professional and also due to the secure email service is a special place among the users [2]. The screen Blackberry operating system is composed of large icons that users are directed to the desired application.

BlackBerry operating system that has the least flaws (such as memory errors), powerful hardware and software of producers to develop applications support. Although many users may think that the BlackBerry is an outdated operating system but the new version of the operating system that offers excellent features to users. Of other features the BlackBerry mobile devices is that in addition to having a keyboard device touch technology also benefit.

3.6 Bada

Bada is one of the newest operating system is built supplied by Samsung that the mobile phones with touch screen is designed [2]. The first version of this operating system in 2010 and the second version introduced in 2011. Bada OS based on the Linux kernel Free BSD and Open BSD is developed [2]. Bada is a versatile operating system and the touch process also

supports. Bada operating system furthermore speed and efficiency, quality and is very facilities. Mobile devices are the Bada operating system features such Bluetooth, Wi-Fi and GPS. Bada user interface has the capability enable programmers to develop it. Flash support is a feature of the Bada OS.

4 DISCUSSION

Mobile devices in recent years with the development of operating systems based on mobile platforms have been developed greatly. Every operating system has been produced for work and particular goals and should not expect that all the MOSs provide features and capabilities for users. Android operating systems, iOS, Symbian, Windows Mobile, BlackBerry and Bada, perhaps more than they have added new features. But, order for a Professional operating system and the latest models MOSs have, features, capabilities and limitations of the operating system will be discussed.

Can be said about the efficiency and speed of Android operating system has been a successful and of Windows Mobile, and perhaps in many cases, ahead of Symbian has. Also, in the Android operating system are not faced a shortage of applications.

The user interface is one of the major goals of any company producing MOS will consider it. Android than Symbian and Bada advantage is better graphics. Security existent in Android as the security Linux, namely the possible variability of the virus is very low. But it can destruction or influence too much (because it is Open Source). Nevertheless, because the virus superior than other operating systems. Therefore, devices that use the Android OS can be connected to each source and device without having to be concerned viruses and malware.

Operating system iOS, of bugs and regiments that in other MOS that are, to great extent is innocent and flawless. Also in terms of speed and memory resources management and CPU are working very well and usually faster than other operating systems. One feature phones that use of operating system iOS, full coordination hardware and software. Because operating system is installed, precisely for the hardware the system is designed. But Android phones because they use an Open Source operating system and this is operating system developed by different programmers. Certainly, inconsistencies hardware and software for Android phones is undeniable.

Symbian operating system can not to good use of hardware resources and most of the applications installed to use this resource, most of its operating system, the hardware resources are available and consume. And this is one of the large failings and of the factors failure Symbian OS are considered.

Bada operating system environment are very attractive and practical. However, the duplication of the Android OS and iOS be seen and also very good performance in terms of speed and hardware resources management in its can be found. User

environment this operating system very professional and simple is designed and meanwhile in search field to find anything in it (such as missing files, etc) probably has the best search capability. One of the limitations that growth of this operating system it is software. Therefore, one of the problems that users are facing Bada operating system software is Bada. Software Bada can not to be offline installed and users must be online to install the software. Whereas in Android operating system can be every the software transferred to the phone and to install it. Blackberry operating system itself highly does not show and perhaps the biggest factor in the lack of popularity this operating system, the lack of software it against the rapid growth the software products other operating systems. Although the extent of applications to the BlackBerry operating system is not Android OS but very good facilities such as easy communication between the phone and computers, capability work with social networking sites, virtual stores, world business and compatibility with most services send and receive messages in its have been presented. One of the problems BlackBerry devices compared with iOS and the Android operating systems a few applications and this program is the high price.

5 SUGGESTIONS

Mobile phones, of the equipment are essential in of our daily communication. Mobile phones have become a valuable tool for communicating users. Users are increasingly of mobile communications and organization for business use. Approach mobile phones work with the arrival a new generation of operating systems for mobile phones, created a substantial difference in performance. For develop and extend the capabilities the operating systems, we offer suggestions in this field.

First suggested to enhance the performance MOSs, programming is optimal. One of the most effective and efficient ways to increase speed the operating system using of optimized programming. If production companies the operating systems, in programming languages of algorithms efficient are use, algorithms that for mobile CPU and memory engaged not unduly and also used memory after early release, somewhat of the problems (slowness and regiment) is the operating system prevents. For a MOS, parts of code that are critical and more time to devote to their operations can be a small change in section code critical execution time applications dramatically reduced. To do this, there is usually no need for big changes but rather mostly small tips (such as memory quick empty and its contents) have a significant impact. Observe these principles will increase the quality of Operating Systems and by changing a small portion of code performance operating system greatly increases.

The second proposal relates to the security of MOSs. For produce a secure operating system proposed that production company of teams of software security design to help MOSs. They by using the latest technologies than set up and maintain a secure operating system can act. Manufacturing companies of MOSs must itself the operating system security as far as possible of the design process, as well as their implementation. Security team, itself professional activity on how influence to an operating system know and can help production companies that the operating system may be faced with the kind of attacks. Also security team in design test security to help Operating system company manufacturer. This team by knowing sensitive and critical parts the operating system can control access to files, events (including intrusion detection) guarantee. Thus, security teams experience of by using platform security models and security tests could enhance the security of MOSs. Thus, identifying and analyzing vulnerabilities in each of MOSs result effort and processing teams of software security. And must companies of experience them for produce secure operating system to use. But we must note that no security method is not without errors and problems and better and more accurate analysis can be accelerated to the security of MOSs.

6 CONCLUSION AND FUTURE WORK

In this paper, we review the MOSs discussed. MOSs, each of which has advantages and disadvantages and not be explicitly announced that the one is better than another; But according to the features of any operating system, users must select the appropriate operating system, therefore everything to security, performance and speed MOSs leads. Since the each MOS has weaknesses, not possible to prevent viruses and malware were activity. But in the world today, these weaknesses are improving faster unbelievable and each MOS can be perfect for the users in the near future. Therefore, the best way to security MOSs, is that before downloading applications to make sure they are not virus. This assessment significantly increases the security the operating system. We hope in the future, manufacturing companies enterprises MOSs, for enhance security and performance the operating systems more efficient and more reliable ways for users provide.

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