

A Comparative study between the android and symbian operating systems

Navneesh Singh Malhotra

Abstract— For many years, the symbian operating system was considered to be the undisputed Kaiser of mobile platforms. The concept of a large screen, data—centric device which runs applications does not seem revolutionary now, but it was symbian that had initiated these advancements in the world of mobile technology. Until the development of android, symbian was considered to be the epitome, as far as mobile platforms are considered. But as soon as android hit the market, its users rose at an alarming rate. Today, it is the android operating system that has replaced the symbian operating system. There are various reasons as to why and how this happened. The main objective of this research paper is to explain all these analytical and technical reasons. In this research paper I will be talking about the android and symbian operating systems, their features, advantages, lack points and compare them on the basis of their history, applications, capabilities, graphical user interface, kernel, execution, upgrades available and various other factors. This paper is a complete collection of all the arguments and comparisons that prove that symbian is a story of the past, and android is the new leader.

“SYMBIAN IS LIKE A SINKING SHIP, AND EVEN ITS CAPTAIN (NOKIA) HAS DECIDED TO ABANDON IT. ON THE OTHER HAND, ANDROID IS LIKE THE RISING SUN, EVERYONE IS CAPTIVATED BY ITS CHARISMA.”

—SUDHAR PICHAJ, SENIOR VICE PRESIDENT (ANDROID, CHROME AND APPS) GOOGLE.

General Terms

Comparative study between the android and symbian operating systems.

Index Terms— Android, symbian, mobile operating system, kernel, bugs, market share.

I. INTRODUCTION

It may be sliding into obscurity today, but symbian was a mondo success in the mid-to-late 2000's. Back in the mid-2007, approximately 65% of the cell phones ran on the symbian operating system. The London-based symbian designing software took phones into a world beyond simply making calls and sending text messages. But with the launch of the first android powered phone, htc dream, which was launched on 22 October 2008, symbian's downfall began. Since 2008, Android has seen numerous updates which have incrementally improved the operating system, adding new features and fixing bugs in previous releases. Each major release is named in alphabetical order after a dessert or

sugary treat; for example, version 1.5 *Cupcake* was followed by 1.6 *Donut*. The latest released version is 4.3 *Jelly Bean*; however, version 4.4 *Kit-Kat* was announced on September 3, 2013.

II. SYMBIAN

A. History of Symbian

Symbian is a mobile operating system and computing platform designed for smart phones [10]. Symbian was originally developed by Symbian Ltd., as a descendant of Psion's EPOC and runs exclusively on ARM processors. The current form of Symbian is an open-source platform developed by Symbian Foundation in 2009, as the successor of the original Symbian Operating system [17]. Symbian rose to fame from its use with the S60 platform built by Nokia, first released in 2002 and powering most Nokia smart phones. UIQ, another Symbian platform, ran in parallel, but these two platforms were not compatible with each other. Symbian^3, was officially released in Q4 2010 as the successor of S60 and UIQ, first used in the Nokia N8, to use a single platform for the OS. In May 2011 an update, Symbian Anna, was officially announced, followed by Nokia Belle (previously Symbian Belle) in August 2011. The Nokia 808 Pure View is official the last Symbian Smartphone.

B. Symbian and its features

Since mobile phone resources and processing environments are highly constrained, Symbian was created with 3 design principles: (i) Real time processing, (ii) Resource limitation, and (iii) Integrity and security of user data. To best follow these principles, Symbian uses a hard real-time, multithreaded microkernel, and has a request-and-callback approach to services. Symbian's system model is segmented into 3 main layers [11]:

- a. *OS Layer*: Includes the hardware adaptation layer (HAL) that abstracts all higher layers from actual hardware and the Kernel including physical and logical device drivers. It also provides programmable interface for hardware and OS through frameworks, libraries and utilities etc. and higher-level OS services for communications, networking, graphic's, multimedia and so on.
- b. *Middleware Layer*: Provides services (independent of hardware, applications or user interface) to applications and other higher-level programs. Services can be specific application technology such as messaging and multimedia, or generic to the device such as web services, security, device management, IP services and so on.
- c. *Application Layer*: Contains all the Symbian

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Navneesh Singh Malhotra, Department of electronics and Communication, Jamia Millia Islamia

provided applications, such as multimedia applications, telephone and IP applications etc.

Symbian's design is subdivided into technology domains, each of which comprises a number of software packages [13]. Each technology domain has its own roadmap, and the Symbian Foundation has a team of technology managers who manage these technology domain roadmaps.

The Symbian System Model [11] illustrates the scope of each of the technology domains across the platform packages.

Packages are owned and maintained by a package owner, a named individual from an organization member of the Symbian Foundation, who accepts code contributions from the wider Symbian community and is responsible for package.

III. ANDROID

Android is a computing platform designed for use in smartphones and other devices [6]. This technology, which is owned by Google, Inc., includes an operating system, software and applications. The operating system is based on Linux, which provides advanced computer processing. Android technology is maintained and continues to be developed by the Android Open Source Project (AOSP). Android is open source and Google releases the code under the Apache License. This open-source code and permissive licensing allows the software to be freely modified and distributed by device manufacturers, wireless carriers and enthusiast developers.

A. History of Android

Android, Inc. was founded in Palo Alto, California in October 2003 by Andy Rubin (co-founder of Danger), Rich Miner (co-founder of Wildfire Communications, Inc.), Nick Sears (once VP at T-Mobile), and Chris White (headed design and interface development at WebTV to develop, in Rubin's words "smarter mobile devices that are more aware of its owner's location and preferences"[5]. The early intentions of the company were to develop an advanced operating system for digital cameras, but when it was realized that the market for the devices was not large enough, they diverted their efforts to producing a smart phone operating system. Despite the past accomplishments of the founders and early employees, Android Inc. operated secretly, revealing only that it was working on software for mobile phones. Google acquired Android Inc. on August 17, 2005, making it a wholly owned subsidiary of Google. Key employees of Android Inc., including Rubin, Miner and White, stayed at the company after the acquisition. Not much was known about Android Inc. at the time, but many assumed that Google was planning to enter the mobile phone market with this move. At Google, the team led by Rubin developed a mobile device platform powered by the Linux kernel.

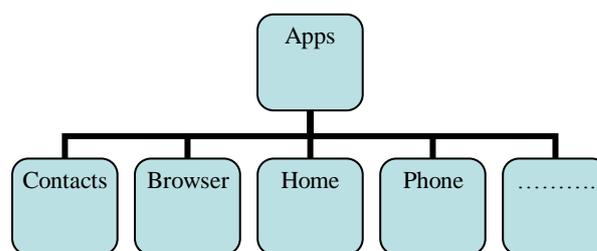
In 2010, Google launched its Nexus series of devices—a line of smart phones and tablets running the Android operating system, and built by a manufacturer partner. HTC collaborated with Google to release the first Nexus Smartphone, the Nexus One. Since then, Google has become

famous for its nexus series , which includes both , mobile phones as well as tablets.

B. Android and its features

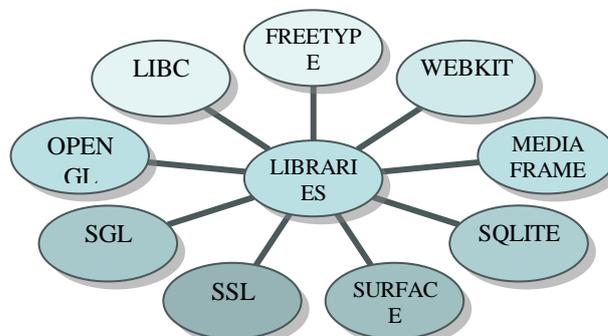
The Android platform is a software stack for mobile devices that consists of an operating system, middleware and key applications [4]. Android offers many features covering the areas of application development, Internet, media, and connectivity. These features include Application framework, Dalvik virtual machine, Integrated browser, Op- timized graphics, SQLite for structured data storage, Media support for common audio, video, and still image formats, GSM Telephony, Bluetooth, EDGE, 3G, and WiFi, Camera, GPS, Compass, and a rich Development environment. The Android platform primarily consists [14]:-

a. *Applications:* This includes a set of core applications that come with the Android distribution like Email Client, Messaging application, Contacts application, browser, Web browser etc.



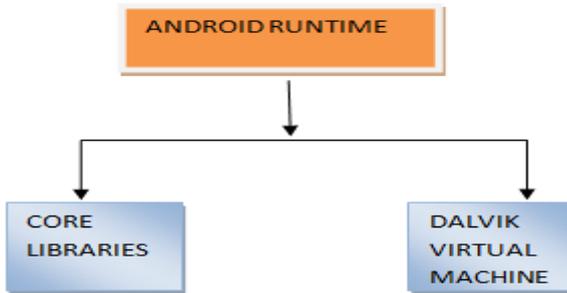
b. *Application Framework:* This layer has been designed to facilitate the reuse of components in Android. With the help of Application Framework elements (such as, Intents, Content Providers, Views, and Managers) in Android, developers can build their applications to execute on Android Kernel and inter-operate among themselves and with existing applications.

c. *Libraries:* Libraries include System C library, Surface Manager, 2D and 3D graphics engine, Media Codes, the SQL database SQLite and the web browser engine LibWebCore.

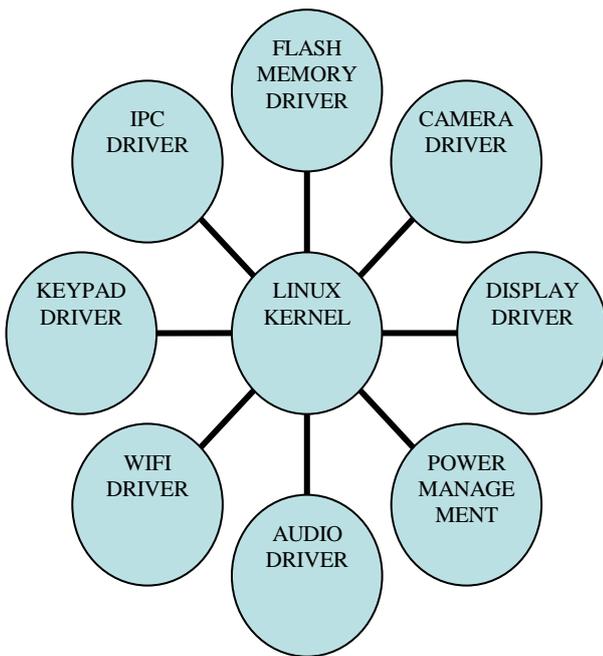


d. *Android Runtime:* The Android runtime has two

components. One is a set of Core libraries which provides the functions available in Java .The other is the Dalvik virtual machine which operates like a translator between the application side and the operating system. Every Android application runs in its own process, with its own feature and advantage of the Dalvik virtual machine.



e. *Linux Kernel:* Android uses a modified version of Linux for core system services, such as Memory Management, Process Management, Network Stack, Driver Model and Security. For more information on the Android platform and a schematic of the Android architecture the readers are referred to [13] and [3].



IV. POINTS OF CAMPARISON

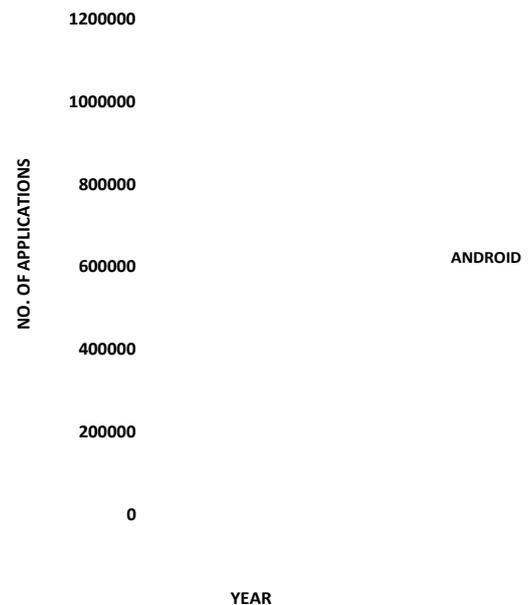
In an interview in 2008, Andy Rubin, Google’s director of mobile platforms commented that [1], “There should be nothing that users can access on their desktop that they cannot access on their cellphones.”

The android operating system managed to satisfy the above stated quote, but symbian was not completely successful in this venture. There are various points and reasons because of which android was successful in taking over symbian and

becoming the most popular and sought after operating system in today’s time:-

- The applications for symbian involve a very long and tedious set of codes. Hence, the number of available applications is inconsiderable in comparison to the ones available for android.
- In 2005[10] through ‘Symbian Signed’, an initiative, gave third-party apps the symbian stamp of approval without the need to get them checked out by a testing house. While 10,000 applications is not much, it did take over seven years for symbian to reach that milestone. However, "as it turns out, after-market software sales for symbian smart phones remained low", according to an academic paper authored by former symbian exec David Wood and San Jose university professor Joel West. On the other hand , the android operating system reached the milestone of 100,000 in less than 2 years , from the year its rage began .
- Large communities of developers [2] regularly write applications (apps), including games, social networking, and business modules, for Android smart phones. There are a wide range of free Android apps, including games and productivity titles, and paid apps are even more common. Android technology — which is used by thousands of developers because it is freely available for download — has given software developers the opportunity to sell their creations to a wide group of consumers.

The chart shown depicts the rise in the number of available applications for android [9] from 2009 till 2013.



- Symbian was designed in the 1990s for devices with very little power, and even fewer capabilities. It

doesn't even support proper C++ exceptions, and has some major legacy support issues.

- Developers usually design and write applications to a particular GUI (GRAPHICAL USER INTERFACE). The more GUIs, the more fragmented the development process becomes and the harder it is to provide decent quality assurance and customer support. This is a major drawback for symbian due to the continuous shifts in their GUIs.
- Android consists of a kernel based on Linux kernel [14], with middleware, libraries and APIs written in C, and application software running on an application framework which includes Java-compatible libraries based on Apache Harmony. Android uses the Dalvik virtual machine with just-in-time compilation to run Dalvik 'dex-code' (Dalvik Executable), which is usually translated from Java bytecode. Whereas, The Symbian kernel supports real-time response to build a single-core phone around it—that is, a phone in which a single processor core executes both the user applications and the signaling stack. The real-time kernel has a microkernel architecture containing only the minimum, most basic primitives and functionality. It has been termed a nano kernel, because it needs an extended kernel to implement any other abstractions. For further information regarding analysis of Dalvik virtual machine, please refer to [15].
- The computing power of Android smart phones[3] is more than Symbian because of the newer and more powerful processes with a frequency of 1 GHz and more (with Symbian to 680 MR). Android has greater screen resolution. So, for example, the Android-Smartphone is much more convenient to read and surf the Internet. Memory for some models is up to one gigabyte, while Symbian applications are often closed due to lack of memory. Android is trying to use the newest, namely, the graphics processor, the performance of which is 3-4 times greater than that of Symbian.
- Portability is a very important assessment criterion. Symbian OS has many references in this area and having standardized architecture and the openness to software. But the fact that Symbian mostly runs on Nokia cell phones and that it is not Java based lets it fall behind Android. The Android Mobile platform is a Linux & Java based which allow us to use it on many different platforms unlike Symbian .
- The qualities of Android reveals the fact that it offers unlimited applications whilst the Symbian provides restricted. Also, platform offers a whole lot much more choices on the subject of user's productiveness.
- From a developer's point of view also, Android has several advantages, as listed below[5]:-
 - 1.) The entire Application framework can be reused and replaced by selective components.
 - 2.) Support for 2D and 3D graphics (OpenGL ES 1.0). So, lot of business for animation developers.
 - 3.) Reliable and enhanced data storage (using SQLite framework).
 - 4.) Developers can create media common applications, since it supports common media.
 - 5.) File formats (MPEG, MPEG3, MPEG4, H.286, AAC, AMR, JPG, PNG, GIF and more).
 - 6.) GSM, EDGE, 3G, HSCSD, Wi-Fi network applications support (Depends on hardware) .
 - 7.) Open source Web-Kit and Engine-based web-browser.
 - 8.) GPS, Navigational compass, Touch-Unlock, and accelerometer applications support (Depends on hardware).
 - 9.) Androids development environment includes a device emulator, debugger, performance profiling tool, and an Eclipse IDE plug-in.
- Whereas, in symbian, commercial developers who can afford the cost can apply to have their software signed via the Symbian Signed program. Developers can self sign their own programs. But, the available features do not include access to Bluetooth, GSM, voice calls, GPS etc. Some operators have decided to reject all certificates other than the Symbian Signed certificates.
- Symbian OS is subject to a variety of viruses[8].Some programs are listed below[10] and [16]:-

Drever.A is a SIS file trojan that tries to disable the automatic startup from Simworks and Kaspersky Symbian Anti-Virus applications. Hence , it does not allow the anti viruses to start up and causes other viruses to affect the phone as well.

Locknut.B is a SIS file Trojan that pretends to be a patch for Symbian S60 mobile phones. When installed, it drops a binary that will crash a critical system service component. This will prevent any application from being launched in the phone.Hence.it causes the phone to hang continuously and hinders its functioning.

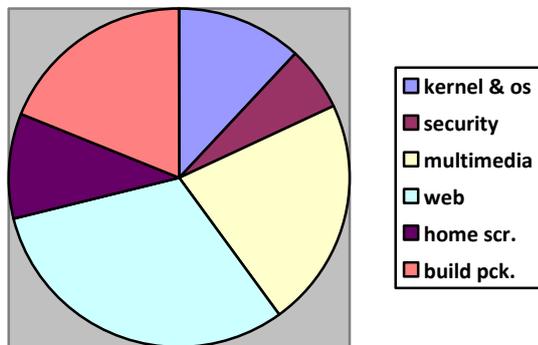
Fontal.A is an SIS file Trojan that installs a corrupted file which causes the phone to fail at reboot. If the user tries to reboot the infected phone, it will be permanently stick on the reboot, and cannot be used without disinfection – that is, the use of the reformat key combination which causes the phone to lose all data. Hence, if the phone gets infected by this virus, then the user is bound to loose his or her data.

- Symbian is also prone to a lot of bugs. In computer technology, a bug is a coding error in a computer program. The process of finding bugs and removing them is called debugging. A runtime bug is an error, that occurs while running the program.

In a research paper discussing about the bugs present in the symbian operating system, a total of 100 bugs were taken into account and the number of bugs present in the various segments of the operating system were observed [6].

The table above shows the number of bugs and the bug densities in various segments of a symbian operating system, from a total of 100 bugs that were considered. The chart representing the same is shown below:-

Segments	Bug Density (x10 ⁴)	No. of bugs
kernel and os services	0.03	12
Security	0.08	6
Multimedia	0.12	22
Web	0.17	31
home screen	0.38	10
Build package	0.63	19

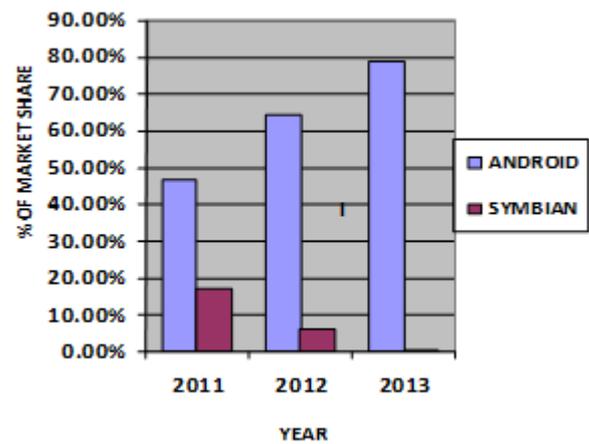


Most of the bugs (more than 90%) are permanent in nature, suggesting that the codebases are not yet mature. Development tools, Web, Multimedia and Build failures are most prevalent in the platform. This suggests the necessity for better mobile application development tools and need for caution in using third-party libraries. For further knowledge please refer [8] and [16].

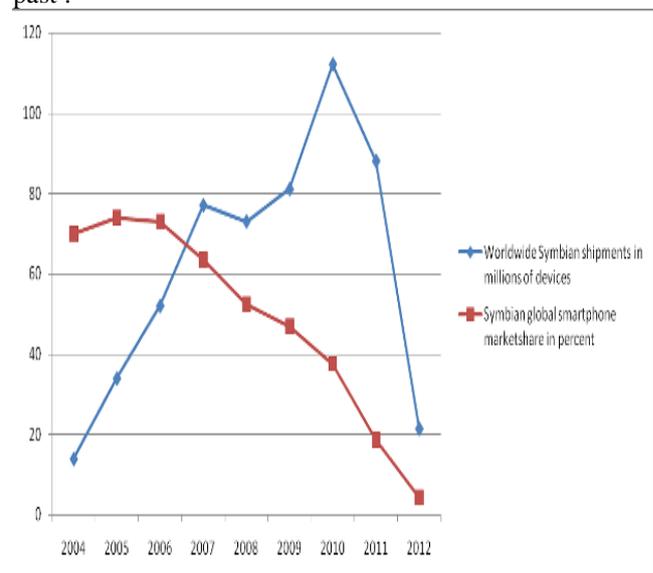
V. RESULT AND CONCLUSION

The result of this research paper can be simply estimated after considering the various prudent and rational comparisons drawn between the android and symbian platforms. The android is a more advanced and user-friendly operating system than symbian. The android operating system not only beats the symbian operating system on technological grounds, but also on the basis of popularity and sales.

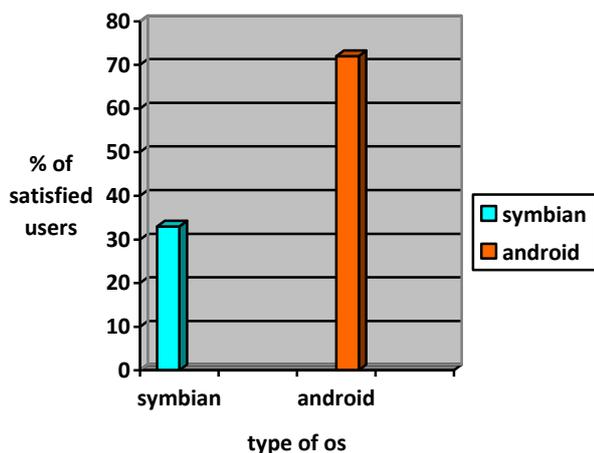
The chart shown below [7] depicts the comparison between android and symbian on the basis of their percentage market share in the years 2011, 2012 and 2013. From the chart it is absolutely clear that by mid-2013, android holds a whopping 79% market share under it, making it the leader of mobile platforms.



The second chart shows the drop in the worldwide shipments of mobile phones running on the symbian operating system [14]. These worldwide shipments are in millions of devices and the graph is a proof of the fact that symbian is past :-



Change wave research that has carried out a survey in 2012 for cell phone satisfaction rating by mobile operating system which shows that 72% people are satisfied with android OS as compared to the symbian operating system. The graph for the same is shown below [18] :-



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Navneesh Singh Malhotr, Department of electronics and Communication, Jamia Millia Islamia

From the graph we can see that 72% of the total users of android are satisfied, whereas, only 33% of the total users of symbian are satisfied.

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