|  |  |  |  |
| --- | --- | --- | --- |
| **Technical Report Documentation Page** | | | |
| **1. Report No.** | **2. University Accession No.** | **3. Recipient’s Catalog No.** | |
| BCSF09A | Not Allocated Yet | Not Allocated Yet | |
| **4. Title and Subtitle** | | **5. Report Date** | |
| Technical Comparison Between Android And IOS With Respect to Their Architecture. | | 27-11-2012 | |
| **6. Performing Organization Code** | |
| PUCIT, University of the Punjab | |
| **7. Author(s)**  Bilal Ahmed Yaseen  Muhammed Awais Tariq | | **8. Performing Organization Report No.** | |
|  | | Not Allocated Yet | |
| **9. Performing Organization Name and Address** | | **10. Work Unit No.** | |
| Punjab University College of Information Technology  University of the Punjab, Allama Iqbal Campus  Shahrah-e-Quaid-i-Azam, PC 5400 Lahore, Pakistan | |  | |
| **11. Contract or Grant No.** | |
|  | |
| **12. Sponsoring Organization Name and Address** | | **13. Type of Report and Period Covered** | |
| N/A | | Term Paper Technical Report | |
| **14. Sponsoring Agency Code** | |
| N/A | |
| **15. Supplementary Notes** | | | |
|  | | | |
| **16. Abstract** | | | |
| This technical report contains the information about the most commonly used smart phones and the operating systems that are used by these smart phones. After this a brief introduction of the android and IOS operating system has been described. A basic comparison between these has been started by describing their history shortly. Then, the technical comparison has been made by describing the core architecture of both applications. The comparisons of these Operating Systems have been made by different aspects that clarify the main differences between both. | | | |
| **17. Key Words** | | **18. Distribution Statement** | |
| — Android, IOS, Architecture, Operating System, application. | | No restrictions. | |
| **19. Security Classification (of this report)** | **20. Security Classification (of this page)** | **21. No. of Pages** | **22. Price** |
| Unclassified. | Unclassified. | 18 | NA |

**Form PUCIT F R001.1 Reproduction of completed page authorized**

Technical Comparison Between Android And IOS With Respect to Their Architecture.

**Final Report**

**November 2012**

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**www.pucit.edu.pk**



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# Acknowledgement:

First of all I am greatly thankful to Almighty Allah who gives us the encouragement and power to complete any task. I am thankful to my parents and siblings for their appreciation and prayers for me because without the encouragement and prayers of my parents I cannot do anything. I am also thankful to Sir Waqar Jaffry and Sir Bilal Shahzad who taught us each and every thing that was required for the accomplishment of this task. This is the result of the kind supervision of my teachers. I am also thankful to my loving partner Mr. Awais Tariq who also worked me thoroughly. In the last but not least I am also thankful to my class fellows, peers and friends for their kind suggestions and recommendations for the further improvements and enhancements in this report.

**Abstract:**

This technical report contains the information about the most commonly used smart phones and the operating systems that are used by these smart phones. After this a brief introduction of the android and IOS operating system has been described. A basic comparison between these has been started by describing their history shortly. Then, the technical comparison has been made by describing the core architecture of both applications. The comparisons of these Operating Systems have been made by different aspects that clarify the main differences between both.

1. **Introduction:**

**1.1. Smartphones:**

A **smartphone** is a [mobile phone](http://en.wikipedia.org/wiki/Mobile_phone) built on a [mobile operating system](http://en.wikipedia.org/wiki/Mobile_operating_system), with more advanced computing capability and connectivity than a [feature phone](http://en.wikipedia.org/wiki/Feature_phone). The first smartphones combined the functions of a [personal digital assistant](http://en.wikipedia.org/wiki/Personal_digital_assistant) (PDA) with a mobile phone. Some other features

* [portable media players](http://en.wikipedia.org/wiki/Portable_media_player)
* [compact](http://en.wikipedia.org/wiki/Compact_camera) [digital cameras](http://en.wikipedia.org/wiki/Digital_cameras)
* [pocket video cameras](http://en.wikipedia.org/wiki/Pocket_video_camera)
* [GPS](http://en.wikipedia.org/wiki/GPS_Phone) navigation
* [web browsers](http://en.wikipedia.org/wiki/Web_browser)
* [touchscreens](http://en.wikipedia.org/wiki/Touchscreen)
* [Wi-Fi](http://en.wikipedia.org/wiki/Wi-Fi)
* [Mobile Broadband](http://en.wikipedia.org/wiki/Mobile_Broadband).

**1.2 Smartphones OS:**

There are many Operating Systems for smart phones. The main [mobile operating systems](http://en.wikipedia.org/wiki/Mobile_operating_system) (OS) used by modern smartphones includes the following:

* [Google](http://en.wikipedia.org/wiki/Google)'s [Android](http://en.wikipedia.org/wiki/Android_%28operating_system%29)
* [Apple's](http://en.wikipedia.org/wiki/Apple_Inc.) [iOS](http://en.wikipedia.org/wiki/IOS)
* [Nokia](http://en.wikipedia.org/wiki/Nokia)'s [Symbian](http://en.wikipedia.org/wiki/Symbian),
* [RIM's](http://en.wikipedia.org/wiki/Research_In_Motion) [BlackBerry OS](http://en.wikipedia.org/wiki/BlackBerry_OS)
* [Samsung](http://en.wikipedia.org/wiki/Samsung)'s [Bada](http://en.wikipedia.org/wiki/Bada)
* [Microsoft](http://en.wikipedia.org/wiki/Microsoft)'s [Windows Phone](http://en.wikipedia.org/wiki/Windows_Phone)
* [Hewlett-Packard](http://en.wikipedia.org/wiki/Hewlett-Packard)'s [webOS](http://en.wikipedia.org/wiki/WebOS),

Such operating systems can be installed on many different phone models, and typically each device can receive multiple OS software updates over its lifetime.

1. **Android Introduction:**

In this section we will briefly introduce the android platform by first telling a bitter about its history and then its architecture.

**2.1 Brief History:**

In July 2005, Android, Inc., a small startup company based in Palo Alto, California, USA, was bought by Google. At that time Android, Inc. is not well-known except that they made software for mobile phones. At Google, a team was set up to produce a mobile device platform that aims to provide a flexible and upgradable system. It is reported that Google had already lined up a series of hardware component and software partners and signaled to carriers that it was open to various degrees of cooperation on their part. More speculation that Google would be entering the mobile-phone market came in December 2006.

In September 2007, InformationWeek covered an Evalueserve study reporting that Google had filed several patent applications in the area of mobile telephony. Ultimately Google unveiled its smartphone Nexus One that uses the Android open source mobile operating system. The device is manufactured by Taiwan’s HTC Corporation, and became available on January 5, 2010.

On Feb 16, 2010 Google announced that 60,000 Android cell phones are shipping per day.

Android, originally meaning “robot”, is a mobile operating system using a modified version of the Linux kernel. It was initially developed by Android Inc., a firm later purchased by Google, and lately by the Open Handset Alliance. It allows developers to write managed code in the Java language, controlling the device via Google-developed Java libraries.

**2.2 Basic Architecture:**

****

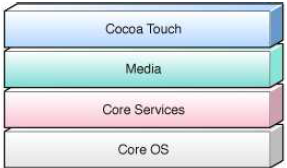
* Android relies on Linux version 2.6 for core system services such as security, memory management, process management, network stack, and driver model. The kernel also acts as an abstraction layer between the hardware and the rest of the software stack. It is implemented by programming language C.
* The middleware level includes Runtime and Libraries. The Runtime includes core libraries, providing most of the functionality available in the core libraries of the Java programming language, and Dalvik virtual machine which allows every Android application runs in its own process. The Libraries is used by various components of the Android system, such as Media Libraries, 3D libraries, and etc.
* The upper level is Application framework and Application. Application framework is offering developers the ability to build extremely rich and innovative applications. Developers are free to take advantage of the device hardware, access location information, run background services, set alarms, add notifications to the status bar, and much, much more. All applications are written using the Java programming language.

1. **IOS Introduction**
   1. **Brief History:**

The version history of iPhone OS began with the release of the iPhone on June 29, 2007. This operating system from Apple Inc. did not have an official name until the release of the iPhone SDK on March 6, 2008. Before then, Apple marketing literature simply stated that the iPhone runs "OS X", a reference to iPhone OS’s parent, Mac OS X. The current version of iPhone OS is 3.1.3. The Developer Beta for version 3.0 was made available on March 17, 2009; iPhone OS 3.0 was released June 17, 2009

**3.2 IOS Architecture:**

IPhone OS (known as iOS, or iPhone OS X in its early history) is a mobile operating system developed and marketed by Apple Inc. It is the default operating system of the iPhone, the iPod Touch, and the upcoming iPad. It is derived from Mac OS X, with which it shares the Darwin foundation, and is therefore a Unix-like operating system, by nature. iPhone OS has four abstraction layers: the Core OS layer, the Core Services layer, the Media layer, and the Cocoa Touch layer, as shown in following figure. The operating system uses less than 500 megabytes of the device’s memory.

****

* The Core OS and Core Services layers contain the fundamental interfaces for iPhone OS, including those used for accessing files, low-level data types, Bonjour services, network sockets, and so on. These interfaces are mostly C-based and include technologies such as Core Foundation, CF Network, SQLite, and access to POSIX threads and UNIX sockets among others.
* The Media layer contains the fundamental technologies used to support 2D and 3D drawing, audio, and video. This layer includes the C-based technologies OpenGL ES, Quartz, and Core Audio. It also contains Core Animation, which is an advanced Objective-C based animation engine. It uses a mixture of C-based and Objective-C based interfaces.
* The Cocoa Touch layer provides the fundamental infrastructure used by your application. For example, the Foundation framework provides object oriented support for collections, file management, network operations, and more. It is based on Objective-C.

1. **Comparisons and Analysis**

Now, we are going to compare and analyze both in some respects in detail and then in respects briefly.

The following portion will make clear all the differences:

**4.1 Development Environments**

1. **Language**

**• Android**: Java

• **IPhone:** Objective-C

1. **IDE**

* **Android:** Android development leverages the excellent JDT tools; Everything Java is indexed, the IDE has a rich model of the source code, and refactoring is seamless; JDT’s incremental compiler provides immediate feedback with errors and warnings as you type.
* **IPhone:** Xcode IDE, Instruments, iPhone simulator, frameworks and samples, compilers, Shark analysis tool, and etc.

1. **Programming Model**

* **Android:** With Android’s support for multiple processes and component reuse, the platform itself provides support for Intents and Activities (Intent is just a variant of a command); provide a way of declaring user preferences in XML; XML format is extensible allowing custom UI components to be integrated.
  + - * **IPhone:** MVC design pattern, provide a way of declaring user preferences in XML; iPhone developers that wish to customize preferences will have to implement a UI from scratch.

1. **UI Builder**
   * + - *Android*: Android UI builder can’t display UIs how they’ll actually appear.
       - *IPhone*: iPhone app developers are given a good UI builder; It’s flexible and can model some sophisticated UIs.

**4.2 Ease to port third party applications**

**4.2.1 Android:**

Basically speaking, Android shares more in common with other Java platforms than with desktops with Desktop Linux. Rather than running desktop Linux PC software (which is built using the X11 "X Window System" paired with a window manager like KDE or GNOME) like Nokia’s N900 running Maemo Linux, Android supplies a modified Java Virtual Machine similar in many respects to the BlackBerry OS and Symbian phones designed to run Java ME apps. Google has modified Android’s Java byte code interpreter (which it calls Dalvik) to avoid having to pay Sun licensing fees for the official JVM in Android. This enables Google to offer Android for free, and without any interference from Sun. It also effectively makes Android a Java platform, not a Linux platform.

One fundamental characteristic of Android that is both strength and weakness is its insular nature. Android’s unique user space stack offers no compatibility glide path for porting applications to and from conventional Linux environments, but it does offer a significantly higher degree of cohesion across devices, which means less fragmentation and a more predictable target for third party software developers.

**4.2.1 IPhone:**

Apple has taken an entirely different approach to delivering its mobile software platform. Rather than building a byte code interpreter based upon a specific, customized implementation of Java ME, Apple introduced the iPhone running a scaled down version of its desktop Mac OS X Cocoa development environment. This leverages the installed brain trust of the company’s Mac developers rather than the installed base of Java ME coders in the existing smartphone market.

It’s still possible to port Java code to the iPhone, but it requires more translation work as Apple only supports Objective-C/C as an iPhone development language in its own tools. Rather than allowing iPhone developers to easily port over desktop Mac apps to the iPhone, the great overlap between iPhone and Mac development tools appears to have been more of strategy to draw developer attention to the Mac. Apple already sells about twice as many iPhones as it does Macs, and the iPhone certainly casts a larger mindshare net than the Mac platform does itself.

**4.3 Reliability and security**

**4.3.1 Android:**

Android is a multi-process system, in which each application (and parts of the system) runs in its own process. Most security between applications and the system is enforced at the process level through standard Linux facilities, such as user and group IDs that are assigned to applications. Additional finer-grained security features are provided through a "permission" mechanism that enforces restrictions on the specific operations that a particular process can perform, and per-URI permissions for granting ad-hoc access to specific pieces of data. As an open platform, Android allows users to load software from any developer onto a device. As with a home PC, the user must be aware of who is providing the software they are downloading and must decide whether they want to grant the application the capabilities it requests. This decision can be informed by the user’s judgment of the software developer’s trustworthiness, and where the software came from.

**4.3.2 IPhone:**

IPhone has no security software and Apple doesn’t let people load third-party programs on the device, which could reduce the risk of infection from malicious software. When the iPhone is connected to the Web, dangerous possibilities emerge.

The iPhone 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 iPhone 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 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. Applications on the iPhone call the security services APIs directly rather than going through the Cocoa Touch or Media layers. Networking applications can also access secure networking functions through the CF Network API, which is also located in the Core Services layer.

1. **Some Important Points Clearing the Differences:**

**5.1 Android:**

1. SMS delivery report - for the IPhone you need a third party apparently
2. Notifications without INTERNET - one of the biggest drawback of the IPhone is that you cannot have notifications without Internet -> the notifications are stored on the Apple servers
3. Can install applications from any site - IPhone applications can only be installed from the Apple store (unless the phone is jail broken)
4. Multiple physical menu buttons - used for navigation and quick shortcuts, allows greater screen size (no more software menus)
5. Physical menu button allows recent 6 tasks (like ALT+TAB in Windows) - absolutely useful
6. Can install on the Home screen - widgets, shortcuts, folders
7. Physical keyboard - on some models
8. Can install different/homebrewed firmware
9. Background apps/ multitasking
10. Dev. SDK is free and cross platform. IPhone is for $100+ and only works on MAC.
11. Programming is done in Java; bridges exist from J2ME, C#, etc. IPhone uses Objective C
12. Programming - can run interpreters. IPhone only allows running Objective C byte code
13. Easy access to the SD card (both from computer and from the phone). Can copy MP3s, read eBooks, etc.
14. Cheaper than the IPhone
15. Easy removable/replaceable battery.

**5.2 IPhone:**

1. Screen brightness/clarity
2. Bigger software keyboard - because of the wider screen
3. Great 3D apps and hardware
4. Easy data synchronization
5. Proximity sensor - saves battery and "locks" the screen
6. Zoom using two fingers - pictures, browser, etc - though some Android phones also support multi touch
7. **Comparisons:**

In this section a brief comparison has been made to clarify the differences pictorially by using the both means figures and tables.

**6.1 Figures:**

This figure describes the market shares of operating systems of smart phones.

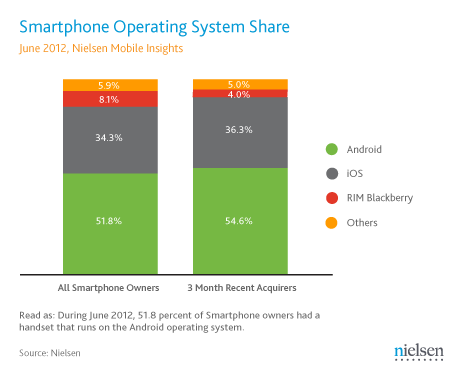
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Figure-1

And this figure describes the difference between android and ios with respect to their usage.

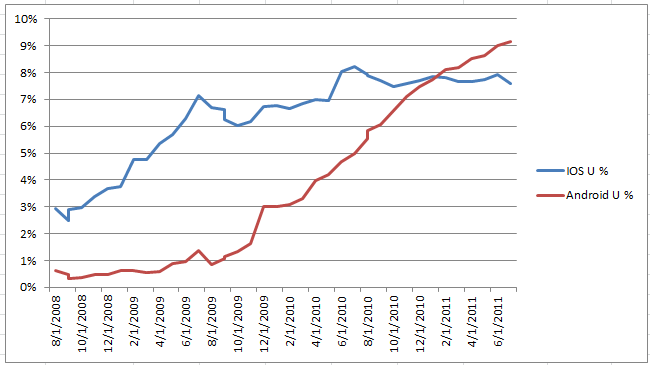
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Figure-2

**6.2 Tables:**

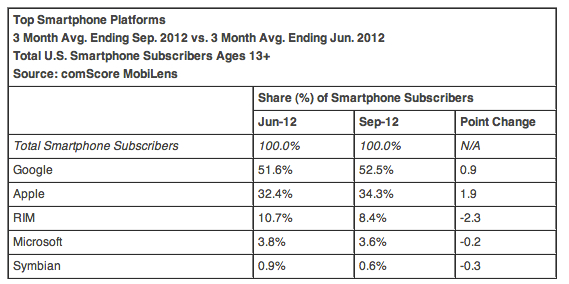
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Figure-3

**7. Conclusion**

Conclusion of both competitors is defined as follow in form of advantages and disadvantages.

|  |  |  |
| --- | --- | --- |
|  | **Android** | **IOS** |
| Advantages | 1. Open-source, ease in third-party apps | 1. Sufficient documentation |
| 2. Multi-tasking | 2. Sophisticated development |
| 3. Flexible | 3. Uniformed product |
| 4. Can solve security issues | 4. Support multi-task after V4.0 |
| 5. Can be virtualized | 5. |
| Disadvantages | 1. Versatile products | 1. Too many restrictions, not flexible |
| 2. Insufficient documentation | 2. Not ease to third-party apps |
| 3. If Apps are too long then it force closes those apps. | 3. Security issues |
| 4. Can also slow down if installing more apps | 4. Cannot be virtualized |

Table-1

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* <http://adrianvintu.com/blogengine/post/Comparison-of-Android-vs-IPhone.aspx>