In the exciting world of technology, it is hard to keep up with all the new developments. Mobile technology has significantly advanced over the decade. I remember when the word smartphone hadn't even been invented yet. All mobile phones were capable of doing were sending texts and making calls. The very first mobile operating system, Palm OS, was released as recently as 1996! Maybe not that recent, but recent enough. It encompassed basic features, such as memo-pad, the phonebook, and the to-do list. It wasn't until late 1997 that e-mail became a profound feature of mobile operating systems. Microsoft's first mobile device was introduced as the Windows Pocket, launched in 2000. By 2001, the Pocket PC came with MSN messenger and an enhanced user interface.

Android, launched by Andy Rubin, was a new development in 2003, along with the separate release of the very first BlackBerry Smartphone. The RIM BlackBerry operating system promised to be the new platform for ease of sending and receiving emails. In this year as well, the Windows Mobile platform was released with Bluetooth, windows media, and internet capabilities. In mid-2005, Android was purchased by Google, making it now Google Android (*A Comparative Study of Mobile Phone's Operating Systems,* 2012). In 2007, the Apple iPhone OS made its debut, at the very start of the year. With the emergence of these new devices with their unique operating systems, communication was revolutionized. The Symbian operating system was developed by a multitude of renowned mobile operators, which includes Nokia, Samsung, Motorola and Sony Ericsson (*History of Mobile Applications*, November 2012). Symbian, which was the operating system on the Nokia mobile devices, has significantly evolved. From the days of Snake and Tetris, Nokia has always been unique among its mobile device counterparts. Now its latest reigning mobile device, the Lumia and its many versions, has

been quite welcomed into the mobile market using the Windows mobile operating system. In mid-2008, the Apple iPhone OS introduced third-party application support. Here is where the real explosion of mobile app development occurred.

Of these mobile operating systems, the Google Android OS, and Apple iPhone OS come with developer tools and Software Development Kits (SDKs) that can be used by technology experts, beginner computer scientists, or anyone for that matter to come up with their own mobile applications. Android released a Beta version of their SDK in late 2007. The updates of the Android OS from Cupcake (version 1.5) to Donut (1.6) to Éclair (2.0), to Froyo (2.2), Gingerbread (2.3), Honeycomb (3.0), Ice cream Sandwich (4.0), Jellybean (4.1), and the latest, Kit Kat (4.4). As you can see, Google Android really enjoys sweet delicacies.

In regards to the current and unique features of each operating system, the latest version of the Apple OS (iOS 7) offers many extensive features. The programming language used is Objective –C (*Comparative Study of Different Mobile Operating Systems*, 2013). Built-in apps are more user effective with the help of the M7 Processor. Its designated browser, the Safari, has a sleek style and supports multiple web pages, private browsing, bookmark synchronization, and the ever-so-loved Reading List that allows you to view certain pages offline. These features, especially the Reading List, comes in exquisitely handy. A drawback however, is that the OS has a lack of support for Flash, which interferes significantly with the display of some webpages. The OS also supports multiple email accounts via iCloud Mail, Outlook, and Yahoo, for example. One feature of the Apple iOS that sets it apart from the others is the introduction of Siri, a unique voice-operated digital assistant that comes with a bit of sass and attitude on the side (which you can choose between a male or female voice now, by

the way). Samsung has tried to emulate this with their own S-voice, but the competition is tight.

The user interface that is unique to the Apple iOS is quite attractive. The fonts, icons, and placement of apps serve as an easier, more manageable functionality. The design is simple yet effective. The Control Centre can be easily accessed with a quick swipe upwards from the bottom of the screen. The Control Centre comes equipped with quick settings for your mobile device, the settings that are most often used such as WiFi capability, Bluetooth, screen brightness, and the like.

The Apple OS also comes with great multitasking ability. You can easily interchange between apps or scroll through your list of activities by simply double pressing the home button. To simply close an activity you swipe it away. How great is that? Moreover, AirDrop is a new feature just introduced that enables simple and easy wireless file sharing. Similar to DropBox, but unique to the iPhone, this feature will allow you to easily share and integrate with contacts on your phone. Now, for the busy person with the hectic life, the Apple OS features a nifty notification centre, which simply collects and organizes the information about your current day, and of course, this notification centre is easily accessible by simply pulling down centre of your iOS device screen. The Apple OS now allows fingerprint identification, recognition of whether you're walking or driving when using Maps, and the ability to find your iPhone through Activation Lock if lost or stolen. The Maps app is also a unique feature to Apple mobile devices, as the developers replaced Google Maps with their own personalized Maps app (possibly because Google is associated with Android?). The music app built into iOS 7 now comes with iTunes Radio as well. You can even create your own radio stations, to stream your favourite songs. If you're into Instagram, a lot, then the camera app upgrade on this operating

system is for you. The App store on this OS also comes with great innovation, featuring a Near Me function that allows users to view apps that popular in their area. These simplistic (but effective) features and improvements, particular to the iPhone and only the iPhone (general Apple devices), only serve to make user experience even better than before.

This Apple mobile OS system, however, is said to be close-ended, and does not allow much freedom outside of the iOS environment. This is where the Google Android OS has succeeded in satisfying its users. Android's open-source system allows such great flexibility and personalization. Apple comes with security issues that prevents users from conducting certain activities, such as gambling. The Android OS does not come with this kind of restriction, all that matters is that you use their authorized software and apps from the Google Playstore, which features over 600,000 apps (a decent amount of which are free). The Playstore is open to publishers and developers of their own unique apps. However, Apple's close-ended operating system provides safer (and somewhat better) app instalments due to the fact that they screen all apps before publishing on their app store. It is a rigorous process but it enables certain malware to be avoided, unlike with Android systems. Another example of Android's versatility is its ability to converge with other system features and maintain a unique design. For example, while Samsung is on the Android platform, its popular devices such as the Samsung Galaxy are merged with the Bada OS. This is what distinguishes Samsung from other Android Devices, such as HTC, which utilizes BREW OS, merged with the basic Android operating system.

The programming language used to develop Android operating systems is Java (*Comparative Study of Different Mobile Operating Systems*, 2013). The Android OS is also known for its media management and widget designs, how easy and swift movement between

screens is, and the overall speed of the operating system, which is exquisite. Apps on Android operating systems have been known to be more prone to crashes, however. Voice Search is another profound feature for Android mobile devices, using Google. This allows you to Google search by pressing a little microphone on the side which allows you to state your inquiry as opposed to typing it out. You can also do this to send text messages as well. Android operating systems are also famous for their unique design pattern security locks, compared to the password or pin code entered in most mobile devices for security purposes. The Google Android operating system stands out in its own light, many users are fond of it and the user experience they enjoy, user interface is appealing and the overall execution on mobile devices is satisfactorily functional.

While Apple and Android operating systems tend to dominate, RIM BlackBerry operating systems come with quite a number of features and designs that are underrated and overlooked. This is due to its lack of exquisite app functionality when compared to iOS and Android OS. Recently, 70,000 apps were launched with the latest BlackBerry OS but this is minimal in comparison to the major competitors. The BlackBerry OS has great media management however, and its home screen layout is user friendly and accessible. Video editing is also possible on this operating system, right in your hands at your fingertips. The market explosion of app usage, however, is just too much to put the BlackBerry OS on top. Mobile users prefer the ease and availability on the more popular operating systems and that is what has really drawn this OS back.

Another decent operating system that, as of late, has sort of fallen under the radar due to the rave of the more popular operating systems, is the Windows Phone 8 operating system.

Microsoft Windows 8 operating systems are now what was known as Windows Mobile on the Pocket PC. The Windows Phone 8 operating system is notorious for its user interface composed of large tiles and a sleek top-down scrolling interface, compared to the side scrolling interfaces of Apple mobile and Google Android operating systems. Nokia has adopted the Windows Phone 8 mobile operating system as its primary platform and has retired its use of Symbian. Symbian is not that popular of an operating system in this day and age anymore, if at all. Over 100,000 apps are available to Windows mobile users on the Marketplace. This is very minimal compared to Androids 600,000 and Apple's 650,000. It outshines BlackBerry though in this area. Windows Phone 8 operating systems also come with much better storage capacity compared to Android mobile devices. One outstanding feature of the Windows Phone 8 operating system is the ability to use offline maps. This feature is miles ahead of the Android and Apple operating systems which only allow online usage of Maps. This is convenient because majority of the time a user needs to use a map it is around offline areas. With a lesser popularity, the Windows Phone 8 mobile operating system is still a potential of amazing features, functionality, and user experience.

A popular mobile application that has really made a difference in how people use their mobile phone is that of WhatsApp. This convenient multi-messaging app enables individuals to talk to friends and family all over the world with the first year completely free. Of course this app needs data connection but it still is the handiest messaging app out there currently. It has digitized texting making it easier to have ongoing conversation, send images, audio, and video, as well as call. The impact of this app is substantive and it has not even been around too long. It is available on the Apple, Android, and Windows mobile operating systems, and has a great

user interface and design on each. Some individuals say to prefer how it works on a particular operating system, however. This is another example of how mobile operating systems differ in app usage. Individuals may prefer a particular operating system, not because of the extensive features it may have, but just overall functionality with applications.

The market share being distributed amongst these operating systems is wide. Google Android and Apple mobile operating systems lead the pack. In early 2008, the Apple iPhone OS dominated with approximately a 50% market share under their belt. Half the market of mobile users were on the Apple operating system. At that time BlackBerry was the runner-up, with roughly 22%, then Windows mobile with 11%, and Android falling in the minimal remaining. In a 2013 study, Android's market share had steeped to almost 79%, leaving the Apple iOS and Windows mobile operating system at approximately 18% and 3.2% respectively (*Jon Fingas,* 2014). However, the gap between market shares is just a minor portion of the competition between these dominant operating systems. The market penetration of each of these platforms varies extensively by region and user demographic. It has gotten to the point that some mobile device manufactures, such as HTC and Samsung, have sold phones with different platforms. In 2009, Android's most popular mobile operator was the HTC devices. Now in 2014, Samsung devices skyrocket in the Android market. The performance measure, eCPM (Effective Cost per Thousand Impressions), of the Apple iPhone OS compared to the Google Android OS is $400, 000 greater on average. Basically, the advertising revenue generated per 1000 impressions is extensively higher for products with the Apple OS. The Apple iPhone OS also outstands Google Android with a higher click-through rate (CTR). This means that people have actually clicked on more ads within their Apple OS mobile devices than on Android devices. App traffic and

revenues usually peak in the 5th month or Android, while in the 3rd month for Apple. However,
the Google Android has acquired a higher global fill rate.

So it is evident that the competition among these various mobile operating systems vary
on significant levels. Given each operating system's unique style, the similarities and differences
among them, and the personalized features offered, different users will have different choices.
While the major competition is between Apple iPhone OS and Google Android OS, Windows
Phones are still alive in this market due to the niche. Based on recent numbers, the market
research, and studies of mobile markets, in my opinion Android will continue to be on top in
the upcoming years, especially due to the growth in popularity of Samsung and HTC devices.
With the possibly soon-to-be-released iPhone 6 however, the competition is expected to be a
lot steeper. Due to the anticipated features and new capabilities of the upcoming mobile
device, demand is expected to increase for the Apple iPhone. Google Android may have to
approach the market with some extensive out-of-the-box features that will provide
never-before-seen user experiences in order to maintain their substantial lead.

References

Gaurav J., Mayank J. (November 2012). *A Comparative Study of Mobile Phone's Operating Systems.* International Journal of Computer Applications & Information Technology Vol. I, Issue III. Retrieved from: http://www.ijcait.com/IJCAIT/index.php/www-ijcs/article/viewFile/152/95

Jon Fingas, (2014). *Android climbed to 79 percent of smartphone market share in 2013, but its growth has slowed.* Retrieved from: http://www.engadget.com/2014/01/29/strategy-analytics-2013-smartphone-share/

John F. Clarke (2012). *History of Mobile Applications.* Retrieved from: http://www.uky.edu/~jclark/mas490apps/History%20of%20Mobile%20Apps.pdf

Richard Padilla, (2014). *iPhone Market Share Dips Slightly as Android Increases Lead in Global Smartphone Race.* Retrieved from: http://www.macrumors.com/2014/01/27/iphone-share-strong-android-lead/

T.N. Sharma, Mahender Kr., Beniwal, Arpita Sharma (2013). *Comparative Study of Different Mobile Operating Systems.* International Journal of Advancements in Research & Technology, Volume 2, Issue 3. Retrieved from: http://www.ijoart.org/docs/Comparative-Study-of-Different-Mobile-Operating-   Systems.pdf