**Report on Mobile Operating Systems**

End of Semester Assignment for ET4345 Operating Systems 2

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**Introduction**

I agree that the days of mobile phones being just used for voice communication are long gone. Mobile phones are now miniature computers and can perform a range of task that are similar to laptops or PC’s. Their small form factor makes them a key part of everyday life and we are becoming more and more reliant upon them. Effective operating systems are essential for these little personal computers to work. In the first part of this report I will discuss the differences between a laptop operating system and a mobile operating system found on phones and tablets. I will then clearly elaborate on how a smartphones operating system works differently from a traditional Windows operating system.

Then I will move onto my comparison of two mobile operating systems. For this I have chosen Windows Phone OS 8.1 and Android OS 12. I will compare them in different ways such as how they deal with the touch screen, keyboard, external devices and how memory is controlled along with the discussing the overall functions of the device. I will elaborate on how the operating systems handle external devices and layout some key findings in a table for ease of viewing. Finally I will discuss what I think is the best mobile operating system and give my reasons why.

In part two I will elaborate on the challenges faced by developers when they are publishing an app on the Google Play Store and the Apple App Store. Here I will write about differences in app design, differences in programming language, system requirements and difference in devices for each respective operating system (Android OS and iOS). I will give my opinion on the major engineering obstacles that developers face when publishing an app on both marketplaces and give an insight into how to overcome these challenges.

**Part 1 Section 1**

There are many differences between a laptop computers operating system and a mobile phones operating system. In recent years the gap has become narrower however they are still two totally different beasts as they both have different use cases, architecture and features. Mobile and laptop operating systems are developed in different ways as they are for different purposes. Laptops use computer operating systems which are also shared with desktop computers. Mobile phones on the other hand started off their existence as just a mobile phone that was only used to make phone calls but then evolved to text and more recently have grown in similarity to computer operating systems with the advent of mobile applications. This increased workload has caused mobile phones to evolve into miniature, portable computers. In the laptop operating system world the two main contenders are Microsoft windows and Apples Mac OS. Similarly Apple are also at the forefront of the mobile operating system along with their rival Android. Mobile operating systems are a much newer concept than laptop operating systems which allowed mobile OS’s to build on what laptop operating systems had already achieved in the past.

Mobile operating systems are essential to run applications on devices such as phones and tablets. It must be more lightweight and simpler than laptop operating systems as it has to be able to run on much smaller and in most cases less powerful hardware than its laptop counterparts. Some operating systems that are found on mobile devices include iPhone OS, Android, Windows mobile, Blackberry OS, Symbian, Linux for phones and Harmony OS. Many of these are grandchildren of the Linux operating system found on laptops which is of course open source. In the Apple ecosystem iOS was influenced by its predecessors BSD and NeXTSTEP which are based on UNIX. In order to be successful mobile operating systems must combine features of laptops and desktops with portable hand-held devices. Mobile devices always come with an operating system installed out of the box. Today’s most popular operating system is Android followed by iOS. Android was developed by Google and had its debut back in 2008, which seems like a lifetime ago today. The benefit of Android is that it is open source opposed to iOS which is fairly lockdown unless you jailbreak it. Benefits of a mobile operating system are that it is very easy to understand and learn how to use almost immediately as it has to cater for every type of user. With its touch interface instead of keyboard and mouse the graphics are very important and must be attractive and intuitive. The apps on a mobile operating system are often similar to their counterparts on a laptop operating system but are slimmed down and made more lightweight in order to allow ease of use and not to overload the smaller device. Some of the operating systems main focusses on a mobile device are controlling network usage and preserving battery life while maintaining performance where possible, this is less of an issue with laptops as they have larger batteries and are often used plugged in to the mains power supply. Also, they are most often used on unlimited Wi-Fi networks where network data conservation is less of an issue.[[1]](#endnote-1)

Desktop operating systems are controlled with keyboard and mouse for the most part. Touch screen applications are often mated with the more traditional input options however this is not common. An operating system is a group of programs (software), that acts as a link between the physical hardware and input / output devices along with managing and providing the necessary files for all of the devices programs to run. Users can interact directly with the operating system through a user interface, such as Windows command prompt or Linux terminal windows. Most laptops come with an operating system preinstalled however it is not uncommon to delete it and install one that suits your needs better. On a laptop the OS provides aids in task scheduling, printing, input and output control, peripheral control and memory allocation.[[2]](#endnote-2) Windows was introduced in the mid-1980s and the most recent version is Windows 11, which was released in 2021.

Mobile operating systems main focus is to allow applications to run on mobile devices whereas on a laptop the OS is the environment in which the user operates a personal computer. Mobile operating systems use NAND to store the data which is very quick to access. Laptops use ram and hard drives to store their data which isn’t as fast but large quantities of RAM mitigate the delay along with high speed M.2 solid state drives which are becoming more common. Mobile operating systems typically use small amounts of RAM (2-4GB) whereas on a laptop RAM ranges from 8-32GB or even more. The mobile operating system heavily optimises the software to take full advantage of the smaller amount of RAM. Laptop operating systems are not really optimized for energy loss as they are typically used in one place at a time, whereas a mobile phone is carried around with the user and battery life is the most important factor, therefore the mobile OS optimises itself to work while preserving power loss.[[3]](#endnote-3)

**Part 1 Section 2**

I will be comparing two mobile device operating systems. They are Windows Phone OS and Android OS. Windows Phone OS is now discontinued since January 2020 however Android OS is still thriving to this day and is receiving updates regularly. I will be comparing Windows Phone OS version 8.1, its final release and the current version of Android OS which is version 12. Version 12 was released in October 2021 and succeeded Android Red Velvet Cake which was version 11. Android has millions of users around the globe however Windows Phone OS only has a few thousand at the moment and it is declining rapidly due to it being discontinued.

Android is developed by Google and Windows Phone OS was developed by Microsoft. The Android OS is free whereas Windows Phone OS was closed source which also meant there was a license fee but it was built into the cost of the device. There are many applications available for Android OS systems however even at its peak there were never many applications available for Windows Phone OS. It just never really took off. Both operating systems support multiple languages and languages and they also allow for remote access, web connectivity and email services natively. Again, Android OS is an open source platform that is structured around a modified version of the Linux kernel along with taking hints from other open source software. It could be said that android is the most powerful OS as it allows the user to customize almost everything and install millions of different games and apps. When creating the Android operating system developers used languages such as C, Java and C++. The first version of Android was launched in 2008 and new releases come out regularly. As I said above this is not the case for Windows Phone OS as it no longer receives updates or support. One of Android OS main benefits was the number of apps available as it is open sourced and even the development software is available online. It is called Android Studio and it makes it relatively easy for anyone to develop apps that run on the Android operating system.[[4]](#endnote-4)

Some main features of the Android operating system that put it head and shoulders above Windows Phone OS at the time were its gorgeous user interface which is very intuitive and looks appealing too. Android also features native support for multi touch which allows input from multiple fingers on the screen at once. Due to Androids optimisation running multiple apps is a breeze. Users can jump between apps in the foreground and the background without the device lagging. On the home screen you can use widgets to display key information and they are also resizable and customizable, in true open sourced fashion. Built into the Android operating system there are features such as Wi-Fi Direct and Android Beam. These allow apps to discover each other and pair over a high-speed internet connection. Android Beam is based on Near Field Communication technology which allows users to share data instantly by bringing their two phone within 4cm of each other.

Windows Phone OS was meant to work alongside Windows 10 for personal computers however as the mobile OS started to die, Microsoft gradually phased it out of their plans. Windows Phone OS uses a user interface that was derived from Metro. It features tile like interfaces that matched its desktop counterparts. The phones home screen resembles a laptops start menu also. This is not a great approach as laptops and phones have massive dissimilarity’s such as screen size and input type (touch vs keyboard and mouse). Windows Phone OS featured Cortana a virtual assistant, similar to Androids Google assistant. Due to being owned by Microsoft the operating system had engrained support for many apps that the user did not want or need such as SharePoint, Skype and Microsoft Exchange. I would see all of that as bloatware that slows down the operating system and would put me off using a phone with Windows OS. Android also has bloatware from Google but it isn’t nearly as invasive. This is heightened when Android comes prepacked on a Samsung phone for example, featuring all of Samsung’s latest bloatware to encourage you to stick within the Samsung ecosystem. The Windows Phone OS featured the now almost extinct Internet Explorer which felt like going back to the early 2000s when it was used. Android at least features Google Chrome built into its OS which is lightweight and powerful, a great choice in today’s world. Windows OS featured an application which was the at the forefront of almost every screen on the device and never really went away. It was called The Hub and was basically a large piece of bloatware that the whole operating system was structured around. It allowed for connectivity to social media and Microsoft services such as XBOX Live. The Windows Phone OS also featured a search bar natively that would use the Bing search engine. Windows Phone OS was only installed on phones from a select number of phone brands such as Nokia mainly and also Acer and less so BLU.[[5]](#endnote-5) In the final release of Windows Phone 8.1 OS, Microsoft added new features such as a notification centre similar to Androids at the time along with tab syncing among Windows desktop devices and an option to customise the tiles on the OS start screen.

The Windows Phone OS featured a black theme throughout which reduced power drain on OLED devices. Instead of widgets Windows opted for Hubs. They allowed local content on the phone to be combined and displayed with online content from social media sites and weather applications. From these hubs’ users could like and comment on several social media sites, which is quite cool. Windows Phone OS also featured multi touch technology and allowed for the theming of third-party apps. Android uses an on-screen keyboard which is the same as what Windows Phone OS used. It also allowed a physical keyboard to be paired with the phone over Bluetooth, the same as what Android allows. The more I research about Windows Phone OS, the more it seems as if they copied Android to the letter. Like Android uses a multitasker with a carousel of apps so did Windows Phone OS. It was invoked with a physical arrow key at the bottom of the device as opposed to Androids burger bar button. Both operating systems allow for connectivity over cellular networks, Wi-Fi and Bluetooth and while also featuring NFC capabilities.

Microsoft Update provided updates to the Windows Phone OS as it does in other Windows operating systems. In version 8 of Windows Phone OS allowed for untethered updates. This meant that updates could be done by the operating system itself without the need to be plugged into a computer. In contrast Android OS allowed over the air updates for years previous. In later years one of Microsofts General Managers said that Windows Phone OS would be an ad-serving machine.[[6]](#endnote-6) This meant that the user would receive notifications regarding advertisements along with toast notifications pushing content related to the user. I feel as if this was detrimental to the longevity of Windows Phone OS. Both Android and Windows Phone OS also allowed for screenshots, by pressing a combination of physical buttons on the device.

**For ease of viewing I have outlined some differences between Android OS and Windows Phone OS in the table below.**

|  |  |  |
| --- | --- | --- |
| **Feature** | **Android OS 12 (Current)** | **Windows Phone OS 8.1 (Final)** |
| Kernal | Linux Kernal | Windows CE |
| Apps Available | 2.22 Million Apps | 300,000 Apps |
| Widgets | Fully Customizable | Tiles on home screen |
| Search Feature | Google | Bing |
| 3rd Party Keyboard Apps | Yes | No |
| Multitasking | Yes | Yes |
| Call reply actions | Yes | No |
| Tethering | Yes | No |
| Video Chat | Yes (Native) | No (Must use 3rd party apps) |
| Folders | Yes | No |

[[7]](#endnote-7)

I think that Android OS is the best operating system for mobile devices. This is down to the fact that it is a great and easily customizable open source operating system that runs on almost every phone and tablet on the market (excluding Apple devices, unless you jailbreak it). Another benefit of the Android OS is that it can run on affordable and high-end phones, giving a workable experience on both due to its lightweight nature and optimisation features. Another benefit is its wide ecosystem which links features from the Android operating system to its Google family. Android is highly customizable and when you root it which is allowed, it opens up a world of opportunity and you can load a custom operating system if you like. I think the main point of this is the freedom to do it, Google are so proud of the Android operating system that they haven’t really outlawed rooting in the same light as jailbreaking on iOS but instead turn a blind eye to it. This is because they know Android OS is so good. The variety of apps on the Google Play store is also a key selling point, there is an app that can do whatever you want it to do. For these reasons I believe that Android is the best mobile operating system.

**Part 2**

The first difference that comes to mind here is the difference in programming languages. iOS apps are written in Swift and you need an Apple developer account to compile them. You can also only write iOS apps in XCode on an Apple Mac computer or laptop. Android apps are written in either Java or Kotlin and can be written in any IDE, however Android Studio is on of the easiest to get to grips with. You do not need a developer account to compile the code to run it either. This means that you would have to write the app in each language to start off with.

Another issue facing developers here are system specific design differences. Due to the fact that touch interfacing doesn’t have 100% precision, the smallest clickable area on iOS IS 44 pixels whereas in Android it is 48px, the app would need to be modified to change these variables, otherwise it would be unusable. Android apps are developed using partitions. This means coding teams will need to break the app into fragment and activities where one activity is one app screen. For a finish you could have multiple activities. iOS apps on the other hand rely on view controllers, this is a key difference. Obviously, they are not compatible with each other as view controllers can manage an entire app screen or just a piece of the screen at any time.

Another main issue is the fact that Apple has a limited number of phones on the market, and only a select number of screen sizes and sensors to manage, however with Android there are various manufacturers making phones and tablets for them, all with varying screen sizes and some may have certain sensors while others may not. This is an issue. A developer would have to test their app on all Apple devices and then test it on a wide range of Android devices too – to insure it is compatible. This would take ages and they would never be able to test the app on every Android device but user feedback and report-a-bug implementation would be very useful here. We must then consider what versions of the OS’s that the app will run on, which requires more simulation and testing. I believe that it is possible to launch an app on both the Google Play Store and App Store, however it is very tricky for one person to do and would take lots of time. I believe it is much easier to write an app in Swift and launch it on the App Store as Swift is a very intuitive language and apple seem to have the structure of their apps down to a tee with their view controllers.[[8]](#endnote-8)

**Conclusion**

In conclusion I feel like I have addressed all of the questions that needed to be answered in this report. I believe my answers were effective and I believe that the research that I carried out will be beneficial to myself in the future, while revising. I really enjoyed this exercise as I feel as though I now have a much deeper knowledge into how operating systems work, especially on mobile devices and the differences between traditional desktop operating systems and mobile operating systems. I am satisfied with my findings on the Android operating system along with the Windows Phone OS, even though it has been discontinued, I can now understand why it was halted. When compared to an extensive open source operating system like Android OS, Windows Phone OS never really stood a chance! I enjoyed learning the differences between laptop and mobile operating systems also and it has really opened my eyes and showed similarities but also dissimilarities in ways which I did not expect. Before I began my comparison of mobile operating systems, I first had to siphon through all of them and do a little bit of research on each. I feel like this really opened my eyes to the differences between them and helped me choose the two that I felt was most interesting. I am satisfied in my findings that Android is the best mobile operating system and I now understand why. I really enjoyed researching the procedures to launch an app on iOS and Android and I feel this will benefit me in the future. It has exposed differences and obstacles that I have outlined above. All in all I really enjoyed the process of planning, researching and forming this report as it has broadened my horizons on the capabilities of operating systems and in my opinion mobile operating systems and devices are the way forward. I believe that the gap between mobile and desktop environments will become narrower and narrower over the next number of years with mobile devices leading the way, however there will always be a need for desktop devices and of course operating systems too.

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