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Senior seminar

Android development

**Android Development**

Android development is becoming a very important factor in society. There are so many different phone models that use android software. We must think about why people have smartphones. One of those reason are apps or applications. Therefore, android development is important there are close to 2.8 million apps on the Google Play store as of March 2017. Even though android apps are added daily onto Google Play there is still a very high demand for apps. With many more being added over that year. These apps span from games to lifestyle, and social media being one of the biggest. In this paper we will begin to understand about android development and why it is important, along with the history of Androids. Then we will go into the android versions. We will go over java and why android uses java. There will also be info on how android uses memory management and then we will dive into how to develop an app and the security risks with Androids and developing risks. The final thing that is addressed is going to be how to keep yourself safe from the security risks that were addressed.

**What is Android Development and why is it important?**

So, what is android development? It’s the process by which new applications are created for devices running the Android operating system. Androids use a familiar programming language called Java. Later in this essay we will be talking a lot more about java. Android developers use Java along with the android software development kit. The android development kit is a set of development tools used to develop applications for the android platform. This development kit is also called Android SDK which is called the software development kit. Android development is important for so many reasons. The major reason is it’s the reason why android phones are selling off the shelves so much and because of the low prices and different choices of phones compared to Apple. Android users are going to keep rising more and more especially as apple users switch to android. Android apps are used by businesses for so many things that span from lifestyle such as weather apps, social media, schools, to the best one by far games. Apps are more like icing on the cake because of how sweet they are towards the experience you will receive from having an android.

**History of Androids**

Before we get more into android development. Let’s talk about the history of Androids and who developed them. The Android operating system have come a long way since 2003 when only four technology experts joined forces to establish Android Inc. The interesting thing about Android is that it wasn’t originally supposed to be for cell phones it was going to be designed for digital cameras, creating a kind of camera that would access computers. (Brachmann, n.d.) After a while they soon realized that there wouldn’t be a lot of people that would want a digital camera like that so they decided to switch their idea and start focusing on Android for cellular phones. Nowadays there are so many phone brands that are using Androids operating system compared to IOS because only one brand has IOS which is apple. Here is an interesting fact about Android a guy from apple left apple and decided to create the android operating system. His name was Rubin. The history behind Rubin is interesting. A man named Rubin from Utica College originally worked for Apple as a software engineer between 1989 and 1992. He earned his name Android at Apple from his coworkers because of his love in robotics too. After this he worked with general magic and then web tv. But it was acquired by Microsoft and it became MSN TV. After 1999 Rubin went and started his own company named Danger. This is the startup that invented the T- Mobile sidekick. The one thing Rubin did not know is his company would be acquired by Google. There was one phone call that was probably the biggest call of his life it was from Larry page one of Googles co-founder. This call is the call that is what made Android what it is today. Since this day there have been many new versions to android some of which are these. There have been many latest updates and versions to the android operating systems.

**Android versions**

With every Android operating system the versions each one is named after a yummy dessert. The first version was named Alpha in November 2007 which was the very beginning of the operating system. Then it went to the Beta that came out in November 5 also known as the Androids birthday this version was an enormous success. Afterwards Android left there Alpha and Beta versions behind and created Android 1.0 in September of 2008. Next came 1.1 or petit four but this one was originally for the HTC Dream. Next in line came 1.5 or Cupcake which was released in April 27, 2009 that was based on Linux, this was the first time they named their updates or versions after a dessert and this theme will be used henceforth. Next came 1.6 or Donut which came out on September 15, 2009. This is where the world was beginning to be at your fingertips or you could get driving instructions and surf the web. Later on, they upgraded to Android 2.0 also known as Éclair. This version was released on October 26, 2009 and included some new enhancements like making your home screen just how you want it. Arrange apps and widgets across multiple screens and in folders. Stunning live wallpapers respond to your touch. (Android-history, 2015). Later on down the road Android upgraded again this time to Android 2.2 or Froyo this version was released in May of 2010.Froyo included some new features like voice Typing that would let you input text, and Voice Actions would let you control your phone, just by speaking. When this version came out the Android operating system started becoming more popular and hands free since now people could text with their voice. Of course, with all good things there are even better things to come this version of Android was around for a while and that was android 2.3 or Ginger Bread which was released in December of 2010 on the 6th. which is what the Samsung galaxy S came around and was using for their operating system. This version allowed new sensors that would be great for gaming. So, you could touch, tap, tilt, and play whenever or wherever.

These new features marked the dawn of the new age for the Android operating system and the phones that would use it. Now there was an Android version after that called android 3.0 or Honeycomb that was released on February 22, 2010 but it isn’t well known because, it was used more for tablets. The next biggest version was android 4.0 also known as Ice Cream Sandwich was released on October 19, 2011. This version of the Android was more of making everything laid out better and having a simpler and easier layout. This version would make Android an even better smart phone. In June 27, 2012 the Android version 4.1 or Jelly Bean had many updates to its look and feel here are just a few of the major ones Restricted profiles for tablets. You can now limit access to apps and content at home and work. For parents, this means you can create parental controls and for retailers, you can turn their tablet into a kiosk. Bluetooth Smart support. Bluetooth Smart minimizes power use while measuring and transmitting data for fitness sensors like Fitbit, Runtastic and other devices, making your phone or tablet more power efficient. Dial pad autocomplete. Just start touching numbers or letters and the dial pad will automatically suggest numbers or names. Improved support for Hebrew and Arabic they added more support for Hebrew and Arabic speakers with new builds for right­ to ­left layouts. Also, now with Google on their side you get the right information at the right time. Also, now with over 2.8 million apps on Google Play and over 1,000 different android devices you could do whatever you want on any device you have. Later down the road android 4.4 came out or KitKat. Which was a much better design and had some cool new features. With an all new immersive mode, which automatically hides everything except what you really want to see. Just swipe the edge of the screen to bring back your status bar and navigation buttons. Optimizing memory and improving your touchscreen so that it responds faster and more accurately than ever before. This means that you could listen to music while browsing the web, or race down the highway with the latest hit game, all without a hitch. (Android-history, 2015). Smart caller ID. Whenever you get a call from a phone number not in your contacts, your phone will look for matches from businesses with a local listing on Google Maps.

These are just some of the major updates and features. One of the versions since 2015 is Android 5.0 or Lollipop. This version is the best version so far with features that will work for the smallest screen like a watch to the biggest screens like a tablet. This version would allow you play music or videos on one device and pick it up on your other device. This version had an even better features like the all new battery saver mode where you can play for 90 minutes or more on your device. The material design was changed to a bolder, colorful, and responsive UI design for consistent, intuitive experiences across all your devices. Responsive, natural motion, realistic lighting and shadows, and familiar visual elements make it easier to navigate your device. Vivid new colors, typography, and edge-to-edge imagery help to focus your attention. A feature that most people don’t know about is Device Sharing. Which is a flexible sharing feature with family and friends. Multiple users for phones. If you forget your phone, you still can call any of your friends (or access any of your messages, photos etc.) by simply logging into another Android phone running Lollipop. Also perfect for families who want to share a phone, but not their stuff. Guest user for phones and tablets means you can lend your device and not your info. Screen pinning: pin your screen so another user can access just that content without messing with your other stuff. There are a few more versions that just came out too one of the newest is android 8.0 and its named Oreo. Oreo has some amazing features like picture in picture and so much more.

**What is Java?**

With all these versions of Android the language behind it is Java. Java, having been developed in 1991, is a relatively new programming language.   At that time, James Gosling from Sun Microsystems and his teambegan designing the first version of Java aimed at programming home appliances which are controlled by a wide variety of computer processors. Gosling's new language needed to be accessible by a variety of computer processors.  In 1994, he realized that such a language would be ideal for use with web browsers and Java's connection to the internet began.  In 1995, Netscape Incorporated released its latest version of the Netscape browser which was capable of running Java programs. Java is a popular programming language developed by Sun microsystems which is now owned by Oracle. Java was developed a while later after C and C++. Java has many of the features of these powerful languages. Java is an easy to read language for even beginners. It’s an object-oriented language. Java is a secure language android takes it a step farther because each Android application runs on the Linux-based operating system using a different user account. All android applications are closely monitored by the operating system and shut down if the operating system is playing nice with the like if its consuming too much power or becoming unresponsive, and the list can go on. Java is a very secure language to a point but even java has its own risks which will be brought up later. Java is easy to learn on your own because they are so many resources out there. Between websites, tutorials, books and even classes. It is one of the most taught programming languages in schools. Java is also one of the easiest languages to learn it is one of the most human readable languages even people that don’t know how to code can look at it and understand what it is doing.

**Why android uses Java**

There are major reasons for Androids to use java. One of the biggest reasons is that java is used is that is a known language, and most developers do not need to learn it because it is such a known language. The second reason behind using java is that it doesn’t have pointer arithmetic like the other known language of C and C++. Java also runs in a virtual machine, so it doesn’t need to recompile it for every phone out there and it makes it more secure. Just think of all the different phones out there that uses android software. There is a large number of development tools that java has that works with android software. Java is an object-oriented language. Object oriented language is a style or technique that relies upon the definition of data structures called objects (Conder, n.d.). An object can be thought of much like a custom data type. There is also a rumor out there that they used java because google knew that there are way more java developers out there which meant they would be many apps being developed for there operating system which would lead to more money for them.

**Memory management**

Android memory management is cool on how it is done. According to welcome to mobile world they say that Android uses its own run time and virtual machine to manage application memory. Unlike either of these frameworks, the Android run time also manages the process lifetimes. Android ensures application responsiveness by stopping and killing processes as necessary to free resources for higher-priority applications. Each Android application runs in a separate process within its own Dalvik instance, relinquishing all responsibility for memory and process management to the Android run time, which stops and kills processes as necessary to manage resources. Dalvik and the Android run time sit on top of a Linux kernel that handles low-level hardware interaction including drivers and memory management, while a set of APIs provides access to all of the under- lying services, features, and hardware. Dalvik Virtual Machine Dalvik is a register-based virtual machine that’s been optimized to ensure that a device can run multiple instances efficiently. It relies on the Linux kernel for threading and low-level memory management. (welcome to mobileworld, n.d.) memory management goes in a list down so the critical priority is going to be active processes. Active processes are Active (foreground) processes are those hosting applications with components currently interacting with the user. These are the processes Android is trying to keep responsive by reclaiming resources. (welcome to mobileworld, n.d.) The high priority is visible processes and started service process. Visible processes are Visible, but inactive processes are those hosting “visible” activities. Started service process are Visible, but inactive processes are those hosting “visible” Activities. (welcome to mobileworld, n.d.) The low priorities are background processes and empty processes. Background processes are hosting Activities that aren’t visible and that don’t have any Services that have been started. (welcome to mobileworld, n.d.) Empty processes are To improve overall system performance, Android often retains applications in memory after they have reached the end of their lifetimes. (welcome to mobileworld, n.d.)

**How to develop an App**

In android development it’s not hard to develop an app. All you need is an environment to write in and build the applications. Eclipse is a popular development environment and it’s the preferred for android development. This environment software is free for Windows, Mac and Linux. A quick way to learn how to make an android application is to go to https://developer.android.com/training/basics/firstapp/index.html and go through the walkthrough. They will teach you step by step how to do a Hello World project. Which will be done in Android Studio. Now you need to also understand the Android operating system basics like The levels can be described as applications contains, like the Browser, Camera, Gallery, Music and Phone Application framework. An API which allows high-level interactions with the Android system libraries and runtime. The libraries for many common framework functions, like graphic rendering, data storage, web browsing. Also contains the Android runtime, as well as the core Java libraries for running Android applications. Linux kernel which is the communication layer for the underlying hardware. “To test the android application, you need to use a normal Android device, connect your device to your development machine (via USB). On your Android device turn on USB Debugging. Select Settings, Development Options, then enable the USB-Debugging option. You can also use the android simulator. These Android Virtual Devices allow you to test your applications on selected Android devices without access to the real hardware. Virtual devices give you the possibility to test your application for selected Android versions and a specific configuration. Even if you have a physical Android device available, you should get familiar with the creation and usage of Android virtual devices. After the AVD has started, you can control the GUI with the mouse. The emulator also provides access to the phone buttons via a menu on the right side of the emulator.” (Developers, n.d.)Once started, don’t stop the AVD during your development. If you change your application and want to test a new version, you simply re-deploy your application on the AVD.

**Android security risks**

Now with all this additional information about Android development we should mention the security risks. There are so many security risks to the android app development and to the OS itself. One of the major top security risks is the google play store. Just think of it the number of apps on the play store are close to 2 million apps or more while the number keeps growing every day. There are many apps on the google play store that have security flaws that us consumers don’t know about. The google play store is not well policed or scanned for malicious software and us consumers go about our day downloading apps without knowing what could be in the code in those apps. On top of that we always just agree to these apps getting permission to our media and files in our phones and our contacts even. Like why do they need in our contacts? The second major vulnerability is malicious software or malware. Did you know 95 percent of android mobile devices are at risk of being affected by some kind of malware or malicious software (Rajput, n.d.). You could be hacked and not even know it.

With android operating systems being open source, you are at risk of over 75,000 identified security threats. Some of the most common Android malware and malicious software are Andr/PJApps-C, Andr/Generic-S, Andr/BBridge-A, Andr/DrSheep-A, and Andr/BatterD-A. These malware or malicious apps aim at sending personally identifiable information to a server to hack personal accounts, display ads on the phone, or may involve some sort of illegal action. (Rajput, n.d.) the third major risk is risks of android fragmentation. What does this mean? Well it means that there are multiple versions of android even on the latest devices. The Androids that are going to be more at risk are the ones that are not updated to the latest version because they will not have all the new security updates because they don’t send out all the latest security updates to older android versions. As was mentioned earlier is the granting apps permissions. Most developers ask for permissions to things that are not even needed. Which is dangerous because if there app gets hacked they now have all of our information and access to our contacts and all that dangerous stuff. Another major security risk is the operating system itself. Anybody can go in and customize their operating system. On top of that device manufacturers customize the operating system so that it functions optimally on their handheld device. The last major security risk is the programming environment itself because if they have security flaws that means the persons app is also going to have those security flaws in their app too. An example of this last major security risk. “Check Point Research first did some digging into the most popular tool for reverse engineering third party Android apps (APKTool) and found that both its decompiling and building APK features are vulnerable to the attack. After looking at the source code, researchers managed to identify an XML External Entity (XXE) vulnerability that is possible because its configured XML parser of APKTool does not disable external entity references when parsing an XML file. Once exploited, the vulnerability exposes the whole OS file system of APKTool users.” (Lynch, n.d.) In turn, this potentially allows the attacker to retrieve any file on the victim’s PC by using a malicious “AndroidManifest.xml” file that exploits an XXE vulnerability. Once that vulnerability was discovered, the researchers then looked at popular Android IDEs and found out that by simply loading the malicious “AndroidManifest.xml” file as part of any Android project, the IDEs starts spitting out any file configured by the attacker. (Lynch, n.d.) Thankfully after reaching out to the developers of the IDEs and tools they confirmed they fixed these security exploits.

On top of all this its literally so easy to become a developer on your phone and root it and all that stuff you just have to go to settings, about phone, and click on software info, then from there you click on build number 5 times and bam you now have the developer menu added to your phone and be careful because if you do this and change you phone in any way you are voiding your warranty and you are opening the door for a lot of different security risks. Th real question is why they would make it so easy to do this to your phone. One reason is it’s the way they are beating apple devices because they are more customizable then apples software. The only problem with that is the fact that apple is so much more secure then the Android operating system is right now. The reason apple is so secure is the fact that their operating system is built for one phone the IPhone. What does this mean? Well it means that Apple did one thing right and that is they have less vulnerabilities then an Android does.

Some Android developer issues the biggest one is There are thousands of different devices, with different screen sizes, chip architectures, hardware configurations, and software versions. Unfortunately, segmentation is the price to pay for openness, and there are thousands of ways your app can fail on different devices, even as an advanced android programmer. (Dimoski, n.d.) just think about it there are some phones that have a back button and some phones that have the back button built into the touchscreen when we swipe up. every developer has to take that into account for how they build app. Even the way the screen is there are so many different screens you have galaxy’s which have edge to edge. Then you have phones that have apples new notch at the top even which means developers have to make it so there apps are compatible and use that screen space.

**Ways to keep yourself safe**

So with all these security risks, how can you keep yourself safe? One way is to just Using the Google Play Store to download apps (or Amazon’s Appstore if you own one of its devices) already makes you among the more secure tiers of Android users – many dodgy apps are distributed through third-party Android app stores rather than the official ones. (the guardian, n.d.) Watch out for phishing and SMS. be on your guard for phishing, sites that try to get you to enter personal data and/or credit card details. Text messages and emails can all be phishing methods, and just because you're on your phone doesn't make them less dangerous. (the guardian, n.d.) download an antivirus software on your phone. Go an install anti-virus software – or if you're thinking of putting it on the device of someone else a number of options are available from the big names of the security world. A really nice one that is free is lookout security it has lost and theft protection and it also scans apps as you download them and if they are bad it will tell you to uninstall them.

**Conclusion**

With all this additional information in mind you can be on your way to developing an amazing android application. You just must know how to use java and the importance of your app to the operating system, so you don’t make it low priority or make it just kill your application. You must get an environment or IDE to code in that handles java and the developer tools. Just be weary of all the security risks and try to code so that you wont have too many vulnerabilities because you don’t want the user to get hacked or lose all of their data and stuff. Make sure that you make your application for the latest operating system version and that it will work with the screen because there are so many varied sizes and shapes. The most important thing is to just have fun when developing your cool new app for Androids because that’s what its all about.

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