UNIT II ASSIGNMENT I – COMPUTER SYSTEMS

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Introduction

There were two medium sized communications companies that specialise in telecommunication: TelXGroup and CompanyA. These two corporations have merged to become a larger corporation and, as a result, TelXGroup needs to upgrade their systems due to an increment in users from 1200 to 2000. I used to lead CompanyA's networking department but, since the merger, I have been transferred over to TelXGroup's GICI, the Global InterConnectivity Initiative. Our department's task is to upgrade TelXGroup's hardware and software at TelXGroup HQ to handle the 800 user increment.

PI – Function of Computer Hardware Components

One main part of any computer is the **CPU**. CPU stands for **Central Processing Unit** and, as you may have guessed, is the 'brain' of the machine. To start off with, the **Program Counter** (or PC) starts at 0 and takes the number of the **Memory Address Register** (or MAR). The **Clock** also starts ticking. The MAR stores the address of the next program to be run, acting like a buffer, and the **Memory Buffer Register** (or MBR) via the External Universal Address Bus stores the instruction that will be executed. The PC runs the MAR number and, as a result, the MBR instruction that correlates to the MBR is executed.

Once the instruction has been **fetched** from memory, it is sent to the **Current Instruction Register** (or CIR). The CIR acts as a buffer that stores which instruction is currently being run. After this the numbers in the instruction are sent to the **Access Control Unit** (or ACU) and are computed. Finally, the program starts again and the PC is incremented by 1.

Another main part of any computer is the **Motherboard**. This piece of equipment links all the other parts of the computer together. The Motherboard has many different ports for all the components, including a SATA/IDE port to allow storage devices to interface with the CPU. IDE is an outdated mode of communication between the CPU and the data storage drives. It had two settings, master and slave. The master setting was used for your main storage systems that housed your OS and the slaves were used as secondary data storage and could be used in a RAID system. **Blah add more stuff here**

The **BIOS** (or Basic Input/Output System) is the program that loads up before your main OS such and Windows, OSX or Linux. With the BIOS you can change your **boot order**, meaning that you can choose what device to load up from and edit the data flow between different components.

The **PSU** (or Power Supply Unit) is, as described in the name, the main source of power for your computer. It takes power from the mains and converts the wattage down into a

useable format so that your computer can run without damaging certain parts due to a power overload.

An integral part of your computer is the **Fan** and **Heat Sink**. These two pieces of hardware cool down components in your computer, the former by blowing cool air over it and the later by transferring the heat away from the main component via induction.

To attach IO devices, which I will elaborate on later, different **ports** are required. One port type is a **USB** (or Universal Serial Bus). This allows many different types of peripherals to connect, such as keyboards, mice and chargers of other devices such as phones. Another port type is an **HDMI/VGA** (High-Definition Multimedia Interface and Video Graphic Array, respectively). These ports allow monitors to be connected to the computer, and HDMI is more modern whereas the VGA cables are slowing being removed from current computer builds.

Internal Memory is required in all systems, even those with outdated and small Operating Systems like Windows 3.1 and MSDOS. One type of Internal Memory is **Random Access Memory** (or RAM). RAM works by storing temporary data, allowing programs to understand what commands you are issuing. Even small things such as typing and moving the mouse require RAM as these are processes that take up small, but not non-existent, memory usage. Another important type of Internal Memory is **Read-Only Memory** (or ROM) is another type of high speed memory that cannot be written, as given by the name of the memory type. Read-Only memory is used in programs and systems that should not be edited by the user after the program has been started. An example of this is the Basic Input/Output System, which should stay the same after the main operating system has been started.

Specialist Cards are able to be added to any modern computer system. There are two main types of cards: **Network Cards** and **Graphics Cards**. Network cards allow your computer to connect to a network, meaning that it can communicate with other computers either via a **Local Area Network** (or LAN). There are two types of Network Cards, wired and wireless.

Networks based around wired cards require and either an Ethernet cable in order to be able to connect to the internet. On the flipside, a wireless network card does not require an Ethernet cable to connect to the internet; it is wireless and relies on signals sent and received by the wireless card in your computer and other cards on your router or other computers that you wish to connect to.

A Graphics Card is an important part of a computer if you wish to make use of **Graphical User Interfaces** (or GUIs). A graphics card generates all of the images (and the text) on the screen for the user to see and interact with. It also controls the generation of reactions when the user performs an action such as clicking a link or resizing a window. The graphics

card makes the text and images out of very small dots called pixels. Different amount of pixels on your screen means different resolutions. Higher range graphics cards can offer support for the highest current resolution, known as 'True4K'. True4K is 4096 x 2160 pixels in size. The resolution used below that is called UHD and is a size of 3840 x 2160 pixels. Another common resolution type used in many YouTube videos is 1080p, which is 1080 x 720 pixels in size. The better specifications your graphics card has, the better it is to render, and therefore create, images and videos in these resolution types.

Input/Output Devices are peripherals that connect to your computer and feed data into the machine and take data out of it. Some examples of input devices are a Keyboard, which allows characters to be placed into programs and files, and a Mouse, which allows the movement of the cursor and the ability to interact with the computer via clicking. An example of an output device is a monitor, which displays what is happening in the computer in the form of a GUI in real-time. This allows the user to see what is happening on their computer. An example of a peripheral that is both input and output is a touchscreen monitor as you can input data in the form of touching the screen to move the mouse and write text, and you can get output data from the screen itself.

When connecting devices together, **cabling** is required. The type of cabling that is most used is **coaxial** cables. Coaxial cables use wires made of copper that transmit data and energy via electrical impulses. These are the most commonly used cabling type as it is cheap and easy to create. Another type of cabling that is less used but has been gaining popularity in the public's eye within the last few years is **fibre optic** cables. These cables are filled with glass and allow superfast transmissions of data by bouncing light off the glass via refraction meaning that data travels from one end of the cable to the other at the speed of light, which is just less 3,000,000 meters per second. This is the fastest that anything in the universe can travel, to our knowledge. This means that data is transmitted almost instantly. While this technology is very expensive, some companies such as Google, the multibillion dollar search engine company, are installing fibre optic cabling around some American towns and cities for free if you want 'today' level of internet (5 MBPS down/1 MBPS up), or you can have "up to" 1,000 MBPS up AND down with 1TB of cloud storage for $70/mo.

When backing up data, you may need to use a physical **storage device** rather than using the cloud. One main reason as to why people store data themselves is because they may not trust services such as Google and Dropbox, as their online accounts can be hacked into and their data can be copied. Also, storing data yourself allows for RAID type storage to be implemented, where the data is backed up multiple times due to the possibility that one of your storage devices may become corrupt. One commonly used storage type is the Hard Disk Drive, or HDD. This is one of the most commonly used sources of data storage as HDDs are very cheap. A 1TB HDD can cost as little as £40, meaning that you can store lots of data at a very low price. Local storage is also a one-time payment, whereas Cloud-based storage can have a recurring monthly or yearly cost, meaning that you may have to pay more for a possibly less secure system.

PII – Operating Systems

There are many different types of operating systems around. One main operating system that is used by a large amount of people is Windows. Windows is an operating system created and maintained by software giant Microsoft. Windows was created on November 20th 1985 in the form of Windows 1.0. Windows 1.0 was built to compete with Apples Lisa. Windows 1.0 wasn't a complete operating system per se, it was more of an extended version of MS-DOS, an early operating system that was command line only, similar to Command Prompt in current versions of Windows. Windows 1.0 wasn't very popular, and contained many basic features including a calculator, a calendar, a command line terminal, a notetaking software called Notepad and a graphics editor called Paint. That was the first ever iteration of Windows. In 1992, Microsoft released Windows 3.1 and since then it has gained popularity and credibility as being one of the best and easy to use operating systems on the planet. While Windows is not free, it is one of the most widely used operating systems of all time. The latest version of Microsoft Windows was released on July 15th 2015 and is called Windows 10. It features many new technologies including a personal assistant that will learn from your behavior. Windows 10 also contains both tablet and desktop support, meaning that you can customize your Windows experience however you like. Windows 10 will be the final release of the operating system but it will be constantly updated to support new technologies. Windows comes with built-in support that allows users to access basic troubleshooting fixes via the F1 key in most Windows default applications. Windows also has a decent file management system called File Explorer. With this program, users can search through all storage and external devices connected to their computer, and users with administrator access can edit their System32 files. While Windows 10 normally costs £19.99, current users of Windows 7 and above can get a free upgrade to Windows 10 up until 29th July 2016.

Moving on from Windows and to its direct competitor; Mac OS. Mac OS was launched on January 24th 1984 and was given the name "System". At the time the software was distinguishable from all the other operating systems around due to its usage of a graphical user interface, or GUI. Mac OS is noted as one of the first operating systems to use a GUI, rather than a command line interface. The first version of Mac OS, System 1, and in fact all versions of the software up to System 4 could only run one application at a time. Despite this flaw, Mac OS was praised for its easiness to use. After Mac OS 9 was released in late 1999, the operating system was rebranded as "Mac OS X" and would later be called just "OS X" All versions of Mac OS X have code names, with the public beta being called Kodiak and the latest version (OS X v10.11) is called El Capitan. The latest version of OS X was released on September 30th 2015. Apple products are notorious for their high priced products and Apple Mac devices are no exception, with the cheapest being £749 and the most expensive being £3299. Apple have support centres both online and offline. As a result, users can either search their problems in Apple's Knowledgebase or go into a store and talk to an Apple Genius, a store worker whom is proficient in Apple's software.

Another operating system that is used, albeit not as widely, is Linux and all of its distributions. Linux is an open source operating system, meaning that it is 100% free and can

be modified free of charge. As a result, there are many different types of Linux available, including Debian, Ubuntu, Kali, Fedora, GNOME and Sugar. Due to the fact that there are many different distributions of Linux and the fact that it is open source, one can create their own Linux variant and can therefore customize Linux to their liking. Two operating systems maintained by Google are built on Linux, namely Android and Chrome OS. Linux Kernel was first developed in 1991 by Linus Torvalds and was based upon another UNIX-like system: MINIX, an operating system that was distributed for educational use only. In 2013, Google Android gained 75% of the smartphone market and in 2014, Ubuntu claimed that it has 22 million users. One of the downsides to using Linux is that there is not much support. If you wish to be a power Linux user, then you will need to learn the operating system yourself.

PIII – Security, Backups and Disk Fragmentation

Once you have chosen the operating system that you are going to use, you should also bear in mind that you may need programs to keep your computer safe and to remove viruses and other outside attacks if and when they appear. As a result, you will need to install some type of virus protection at some point. If you are running Windows Vista or Windows 7, you can install Microsoft Security Essentials for free. In Windows 8 and above, Microsoft Security is installed automatically and has been renamed to Windows Defender. If you are using OS X then you may want to use ClamXav, a paid anti-virus software that costs £19.99 for two personal licences and, if you are a student in fulltime education then you may wish to purchase two copies of ClamXam for only £13.99.

In all modern versions of Windows, you can run a defragmentation program that will free up your disk space by moving things around. As a result, your computer will run faster as programs do not require as much time to find the files that are required. Another thing that it does is allows you to store more things due to the more storage. While waiting for your disk to defragment, you could start to remove unnecessary files like such as your internet history on unused browsers and cookies from websites you no longer visit.

Every now and then, a disk defragment may not be enough. Sometimes you may have to format your drives completely. You may wish to do this if you start running seriously low or if some of your hard drive becomes corrupted. If your hard drive isn't completely corrupted, then you may be able to recover some data and transfer it to a secondary drive. Once you have done that you may wish to overwrite your old hard drive via an external program such as HxD to change all the data values on the drive to 0, effectively removing all files and corrupted data.

PIV – List of Components Used

The following is a list of hardware components use in most computers:

- A Processor
- A Motherboard
- A Power Supply Unit
- A Fan
- A Heat Sink
- USB Ports
- RAM
- ROM
- Network Cards
- Graphics Cards
- A Mouse
- A Keyboard
- A Monitor
- Wired Cabling
- A Hard Disk Drive

The following is a list of software components that I would recommend in most computers:

- A BIOS
- An Operating System (Windows predominantly, due to its compatibility)
- Malware Bytes
- Windows Security Essentials/Windows Defender
- A Web Browser (Internet Explorer/Edge are known as bad browsers; I would recommend Google Chrome or Mozilla Firefox)
- Microsoft Office/OpenOffice
- Notepad++/Atom/Sublime Text Editor (Used to replace Microsoft's Notepad)
- PrintScr (Used to upload screenshots to the web easily)
- Rainmeter (Add shortcuts and more information to your desktop)

MI – Comparisons of Operating Systems

Going back to the three operating systems I mentioned earlier I will now compare all of them and summarize their strengths and weaknesses. To start off we have Microsoft's Windows, one of the most used operating systems on the planet. It is easy to use, highly compatible and has the middle ground when it comes to price, at a reasonable £19.99. Windows 10 is the latest version of Windows and is being constantly updated with new features and bug fixes. Our second operating system in Apple's OS X. Like Windows, OS X is being constantly updated and it is very easy to use and is quite a good looking OS due to

Apple's well known use of whites and greys to make their operating systems and products to look smart and sleek. OS X cannot be bought without purchasing an Apple computer along with it and, as a result, makes it the most expensive out of the three with the cheapest model being £749. The third and final operating system is Linux, a free, open-source operating system used by geeks everywhere. It is not a very easy system to use, especially when using a command line interface only. I would only recommend Linux if you either have a very small budget or if you are sufficiently proficient with computing.

I would rank Microsoft's Windows 10 as the best operating system out of the three due to its high levels of compatibility, relative cheapness and the fact that it is quite easy to use. I would rank Linux (and all its distributions) as second due the fact that it is free, coupled with the fact that it is packed full of features that any computer enthusiast would love to tinker with. Finally, I rank Apple's OS X as third. Even though it is very easy to use, it's price places it last as not many people have a lowball of £749 to spare. Given the current economy, I would only recommend an Apple device if you have money to spare, and would urge you to purchase a cheaper alternate if you do not. One good alternative to Apple's iPhone and iPad are Android phones, which is an operating system created by Google that is based on Linux that most non-Apple smartphones run.

MII – Suggested Hardware and Software

For a very basic computer that is used as mainly a work processor, I would recommend getting a prebuilt machine from a company such as Dell, Asus or Toshiba. These machines may be slightly higher price due to the company building it for you. If you are not the most technologically literate person or have another disability that prevents you from building a computer, such as back problems, then I would also recommend that you purchase a prebuilt machine due to the lack of technical knowledge required to set up one of these machines. This is because most prebuilt machines will already have all the hardware components and some of the software components I previously mentioned already, meaning that you will have to do very little to get your machine up and running.

If you are more technologically literate and have had built your own computer before then I would recommend creating your own PC from scratch. You can choose what parts you want with websites such as PCPartPicker.com, as websites such as this allow you to see if the parts you wish to buy are compatible with one another or not. This means that you do not waste money purchasing parts that you will never use due to incompatibility issues. If you create your own machine from scratch it will be cheaper, meaning that if you have a budget constraint then you may wish to build your own. One of the main downsides is that if you have a hard time working with hardware or simply don't have the knowledge then you may find this difficult. Another major downside is that you will have to install the operating system and other hardware yourself. This means that you will have to go through the long and slightly tedious process of installing all the software on your own and may have to update drivers so that all the programs you want to install on your computer actually work. Also, if you build your own computer it is likely to be faster than one prebuilt by a company

for the same price. This is because you don't have to pay for the premium of having it built for you. This means that you have more money to spend and, as a result, can get better parts for the same total price as the price of a prebuilt computer.

If you are up against a budget constraint, are computer literate and have built your own computer then it may be wise to install a Linux distribution as it is free and can run much faster than other operating systems such as Windows and OS X due to its lack of drivers and minimalistic design. As a rule of thumb, if you want to use Linux then be prepared to install all the drivers you want manually. Linux is faster as it a development based operating system and, as a result, it is much more optimized when compared to its competitors. If your users are not technologically literate, then I would not recommend that you use Linux due to the cost of the extra training that will be required to get 2,000 users proficient in using Linux as well as they use other operating systems that they are more used to, like Linux. If your users are all technologically literate then I would recommend Linux, especially if you are up against storage restraints due to the compactness of Linux when compared to Windows. Linux is compact as it is much more optimized, as aforementioned.

DI – Reasoning Behind Performance Improvements

A reason for using virus protection in computer systems is to prevent hackers from gaining access to your computer and doing nefarious things to it. One thing that they could do is place a Trojan on your computer. A Trojan is a type of virus that allows the hacker to generate a backdoor into your computer, effectively giving them access to all of your files. As a result of this they can steal all of your data and they can also take your bank details if you have cookies and/or browsing history. With your bank details they can commit fraud, which is a crime in most countries, and they can then steal your money and even your identity.

The reason to use a firewall to protect your internet is to prevent other users from accessing unsecure ports and to prevent viruses being sent to your computer or router via your internet connection. Your firewall is your primary defense against hackers that will attempt to attack your computer via the internet. The firewall is the front line of defense.

One thing that you may wish to purge every now and then is your cookies. Cookies are used to store data that you enter into a website, meaning that you don't have to retype in your password when you go back to the site. If you have a virus, then your cookies may be leaked so that means that people can break into your account.