

Computer Systems

Assignment 1

Unit 02

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Task 1

Component Explanation

Motherboard

The motherboard houses all the components of the computer and connects everything together so it can communicate and run. Motherboards also come in different form factors, such as ATX, Micro ATX, Mini ITX etc.

Central Processing Unit

The Central Processing Unit (CPU) is the brains of the computer. It does all the processing needed to run the machine. The main CPU manufacturers are currently Intel and AMD with their Tiger Lake and Zen 3 architectures.

Power Supply Unit

The Power Supply Unit (PSU) is the component that supplies power to all the components in the machine. Notable examples of PSU manufacturers are Corsair, EVGA and Seasonic.

Cooling Methods

There are many ways you can cool your machine:

- Air cooling – this uses fans to draw in fresh air over the components and then uses more fans to exhaust the heat from the components.
- Water cooling – this uses a mix of fans and water to cool the system. You fill a reservoir full of water and then use a pump to pump it around all the components that need it. It then uses fans to cool down the water as it gets hot from the heat of the components.
- AIO Water cooling – this is similar to water cooling; however, it can only cool the CPU, there is no pump or reservoir as everything is 'all-in-one'. The tubes all are pre-connected to the radiator and CPU block.
- Passive cooling – this method uses no fans at all. It uses heat sinks to move and dissipate the heat. Air cooling uses a combination of passive and air as it uses heatsinks and fans.

Hard Disk Drive / Solid-State Drive

The Hard Disk Drive (HDD) and Solid-State Drive (SSD) are long term storage devices for user files and the operating system.

Hard Disk Drive

The HDD uses magnetic plates to store data and uses a moving read-write head to read the data. They are not as fast as an SSD because of the latency of the moving parts; however, they are often cheaper and have more capacity than an SSD. HDDs are not very durable and can be easily damaged by lots of movement caused by dropping or vibrations. An example of a notable manufacturer is Western Digital with their Blue line-up of drives.

Solid State Drive

The SSD has no moving parts and stores data on NAND flash chips using floating gate transistors. They are a lot faster than HDDs as there is no moving head latency and they are much more durable because of their lack of moving parts. Whilst they are much faster than a HDD, they are also considerably more expensive to buy and often come with less capacity than HDDs. An example of a notable manufacturer is Samsung.

Ports

Ports are used to connect peripherals to the machine through standards such as USB. These are known as input / output devices. You can also connect connections such as video (with HDMI, DisplayPort, etc), ethernet (networking), power and more.

Read Only Memory

The Read Only Memory (ROM) is a small chip on the motherboard that can hold around 4-8 MB. The ROM holds information such as your BIOS settings and the instructions required to boot the machine. This memory is non-volatile meaning it will retain its data if power is lost. This is often done through a CMOS battery.

Random-Access Memory

The Random-Access Memory (RAM) holds data and instructions for currently open applications and for the operating system. It is the main memory for the machine. Unlike ROM, the RAM is volatile meaning all data will be lost if power is lost. There are 2 types of RAM:

- StaticRAM – fastest type of RAM as it uses transistors to store data
- DynamicRAM – slower access times and it needs data refreshing, using capacitors and less transistors. It is larger than SRAM.

Cache Memory

Cache memory is a small amount of memory built directly into the CPU, making it the fastest to access. It holds frequently used data/instructions so they can be executed quicker. There are 3 levels of cache: L1, L2 and L3.

Specialist Cards

Specialist cards are often devices that can plugged into PCI Express slots on your motherboard. Typical devices include GPUs (such as an RTX 3090 from NVIDIA) which handle graphics processing, NICs (such as a TP-Link PCIe Adapter) which handles networking through ethernet or WiFi.

Task 2

Purpose of the Operating System

The purpose of the operating system is to provide an interface to the hardware. It is the base for all apps and provides a user interface so you can interact with the hardware. This interface can either be a Command Line Interface (CLI) or a Graphical User Interface (GUI). The operating system is required for anything else to run and must be installed on any device before it can be used. There are many different options for operating systems – Windows 10, macOS, Linux and more!

Feature Comparison: Windows 10 vs Android

Machine and Peripheral Management

Windows 10

Windows allows you to plug peripherals through USB ports on the machine. These are managed through the OS' device drivers.

Android

You can also connect devices such as a mouse and keyboard and a display to use the device in a computer-like way.

Security

Windows 10

Windows 10 has built in firewall and antivirus software that is setup automatically, so the user has protection. This is done through Windows Defender. Windows also asks for your permission to give programs elevated access that could be used to harm your machine – this is called User Account Control.

Android

Android has a built-in anti-virus called Play Protect. This checks your apps and device for harmful behaviour at regular intervals and alerts the user if any is found. It also scans the Play Store regularly to check for any infected apps.

Android also checks the websites you visit and the calls you receive to determine if they are spam or unsafe. Like Windows, it also asks for your permission before apps can do things like access your camera, files, location, etc. It will also remove permissions from apps that you haven't used in a while to keep your data secure. Android also has built in encryption so your data cannot be accessed unless the phone is unlocked.

File Management

Windows 10

Windows 10 allows for the user to access and modify their files through the Explorer. This process powers your desktop, taskbar and file explorer. It gives you access to all files on the computer, and the ones that are not on your device through network shares. It allows you to create folders and new files such as text documents or PowerPoints.

Windows uses the New Technology File System (NTFS).

Android

On Android most of your files are separated into specific apps, such as videos and photos in the Gallery app, text files in the Notes app, etc. However, all of these are just stored in their own folders in the file system. If you wanted to access these, there is a built in Files app that lets you go through the files on your phone.

Android uses the Forth Extended File System (ext4).

Device Drivers

Windows 10

Device drivers are specific to the hardware you have inside your computer. Usually, the manufacturers of the hardware distribute these drives to the users and then Windows allows you to install them.

Android

Device drivers are baked into the operating system itself and usually do not require any user input. They are often managed by the manufacturers of the device and are updated through regular android updates.

Ability to Customise

Windows 10

Once activated, Windows allows you to customise the OS' appearance through the 'Personalise' option on the desktop. This allows you to change your desktop background, accent colours, theme, lock screen and more. You can also install third party applications, such as Open Shell, to customise your experience even more.

Android

Android also allows you to customise your device in many ways. It allows you to change your wallpaper, add widgets to your home screen, install an entire new launcher to manage your home screen, use different icon packs, change notification sounds, apply themes and much more. It is also possible to 'root' your device to gain more elevated privileges to do further customisation, however this can often be dangerous to do and is not recommended.

Stability and Reliability

Windows 10

Windows 10 is very stable as it goes through many phases before it is released to the wider public. There is testing done in their 'Windows Insider Program', where there are 3 channels you can opt-into: Release Preview, Beta and Dev. Release Preview is considered the most stable and Dev is the least stable and is recommended for highly technical users and is likely to be unstable as it is the earliest builds in the development cycle. If Windows runs into an error, it throws a Blue Screen of Death which gives information about the error which you can look up to get help. The device then restarts.

Android

Android builds are often very stable as they are validated by the manufacturer and Google before they are released to the public to use. If Android ever runs into any errors, it will just restart to try to correct the error.

Support for connectivity of portable media

Windows 10

Windows 10 allows for you to connect devices to it via USB. You can connect USB drives, portable hard drives, CD readers, etc. You can manage all the files on the media, and you can format and edit them at your will.

Android

You can also connect USB drives to your Android device via USB-C (or a USB-A to C). Depending on the device, you can also connect an SD card. You can view the files through the files app.

Ease of Management

Windows 10

Windows 10 has the Settings and Control Panel app which allows you to change settings on your computer. It is laid out into sub sections so you can easily find what you need, and you can also search for individual settings. Some settings you can change are the device name, power modes and display settings.

Android

Android also has a Settings app which allows you to change the individual settings such as theme, phone name and app permissions.

Associated utilities

Windows 10

Windows 10 comes with utilities such as disk defragmentation, bit locker, disk clean-up and more. These all help your computer run more efficiently and faster, making your experience better.

Android

Android doesn't come with any utilities as it is all managed by the operating system. However, they do have an Optimization app which can help remove unneeded files and clear up memory.

Cost & Support for the user

Windows 10

Windows has 3 different editions you can buy depending on your needs:

- Windows 10 Home – \$139 – recommended for the average user, includes the base features of Windows and is perfect for home users and gamers.
- Windows 10 Pro – \$200 – recommended for more advanced users as it allows virtualisation, bit locker and enhanced security.

You can get support for Windows through the Microsoft support website, where you can email, call or live chat one of their agents who will help you with your problem. If this isn't your preferred method of communication, you can also go onto their support forum and ask community members for help.

Android

Android at its core is free. It is an open-source project maintained by Google and is installed on most non-Apple phones today. Most phone manufacturers (such as Samsung and Motorola) use their own fork of Android which allows them to give their users options and themes specific to the brand of phone they purchased.

You can get support for Android through the individual manufacturer's website. The support offered is via email or live chat. Like with Windows, there is a community support forum on the Android website where the users of Android can try and help solve your issue.

Task 3 & 4

Software Utilities

Virus Protection

The purpose of virus protection software is to detect any malicious software on the user's computer and block or delete it. This keeps the user's data safe and their computer secure.

This will help improve the computer's performance as viruses often use a lot of CPU power which will slow down your machine. Using virus protection software will block and remove these applications, which will free up CPU power and improve the performance of your computer.

Firewalls

The purpose of a firewall is to filter and block any malicious requests into a network. Specific rules can also be setup to filter requests.

This can help improve performance as it blocks any unwanted web requests to your network meaning your web requests will give results quicker as there is less traffic for it to collide with.

Clean Up Tools

The purpose of clean up tools is to remove unnecessary data that might be taking up lots of your storage space. These tools can remove data such as cookies, browser history and temporary files. This can also help protect your privacy by removing any tracking cookies or stop people from seeing your browsing history

This can help improve performance as it removes unneeded files that could be slowing down the drive the OS is running on. This then makes it quicker to load files and overall improves the performance of the machine as the OS can load the necessary files quicker.

Defragmentation

The purpose of defragmentation is to reduce the fragmentation on a Hard Disk Drive (HDD). This is because all the data for one file isn't always stored together because of the way HDDs work. Defragmentation gets all the data for each file and moves it next to each other.

This helps improve performance as it will take less time for data to be accessed by the drive as it won't have to travel as far to get the data as it will all be next to each other. This means files will load faster, ultimately speeding up the running of the OS, playing / loading of games and more.

Drive Formatting

The purpose of drive formatting is to (re)configure your drive or to prepare it for first use. When formatting your drive, you completely wipe all the data on it – this is perfect if you are setting up a new drive or operating system and don't want to keep the data from the old one. It can also be used to change the file system used as this can only be changed during a format. This is because formatting the drive ultimately is just switching the file system, which needs to wipe the drive first as NTFS would not be compatible with ext4.

This helps improve performance as drives tend to run quicker and more efficiently when there is more storage space available, and as formatting completely wipes the drive, it will have more storage meaning the system will run quicker. As it clears your drive, you can have a fresh install of your operating system and because it won't have any unneeded system files or caches, it will run much faster.