Worthing College

# **G**etting **R**eady **F**or
# BTEC in Computing

| Name | | |
|---|---|---|
| **Pearson BTEC Level 3 National Certificate in Computing** | **PREPARATION REQUIRED FOR Year 1** | **Summer 2024** |

**We are delighted you have chosen to study BTEC in Computing at Worthing College.**

**Instructions:** This pack will help you make the best possible start to studying this subject.

The tasks in this pack:

- should take you **about 4 hours to complete.**
- should be handed into your teacher when teaching starts **from 9th September 2024** with your name on it for assessment.
- are also available on the internet – follow the links in the document.

**If you need help:** The tasks are designed to get a bit more difficult as you work through them as they are preparing you for studying at a higher level and to become an effective independent learner. You should try to get as far as you can working on your own but if you do need help, please email us at gettingreadyfor@worthing.ac.uk, telling us which Getting Ready For pack you are working on and what help you need. Help is available throughout the summer holidays.

| **Skills Focus for this Getting Ready for Pack** | |
|---|---|
| • The ability to choose the correct method to solve a problem.<br>• Your quality of English communication when a written answer is required.<br>• Clarity of logical communication – how well you show your workings and lay out your work.<br>• Ability to research a given programming language independently. | • Reading technical texts<br>• Effective writing<br>• Analytical skills<br>• Creative development |

Worthing College

| Summer work – BTEC Computing | | | |
|---|---|---|---|
| **Target Grade** | **Type of task** | **Task and subject specific skill reference** | **Deadline / Evidence** |
| You will need to read the **Unit 2 Learner Companion**-document which is attached to this Getting Ready for pack, and answer the questions below. | | | **8/9/24** |
| All | **Read and answer questions on lined paper.**<br><br>**Prepare handwritten responses to questions unless you are normally allowed a laptop in your exams.** | **Practice Questions – A1. Hardware in Computer Systems**<br>1. Consider you are designing a handheld gaming system. Given a choice between the following components, which would you choose? Explain your answer.<br>a) A wired network card (with an Ethernet port) or a wireless network card. [2]<br>b) A touchscreen or a standard keyboard. [2]<br>c) An energy-intensive but fast processor or a slower, low-energy processor. [2]<br>d) A retina scanner or a password-based security system. [2]<br>e) A magnetic disk or solid-state memory. [2]<br>2. Give an example of one input device and one output device, other than the components given above, that the gaming system might use. [2]<br>3. A user has a computer system with two magnetic disks for secondary storage and is trying to decide how to configure the disks.<br>Give one advantage and one disadvantage of using a RAID 0 configuration instead of a RAID 1 configuration. [2]<br><br>**Practice Questions – A2. Software in Computer Systems**<br>1. Consider you are selecting an operating system for a computer system that allows a pilot to raise or lower the wheels on an aeroplane.<br>a) Does this system require a real-time OS? Explain your answer. [2]<br>b) This system could use a graphical user interface, a command line interface or a menu-based interface. Give one reason why it may be suitable to use each type of interface. [3]<br>2. Give four roles of an OS kernel. [4]<br>3. Give an example of a piece of application software, and explain its purpose. [2]<br>4. Give an example of a piece of utility software, and explain its purpose. [4]<br>5. Give two advantages of open-source software. [2]<br><br>**Practice Questions – A3. Data Processing**<br>1. Explain the difference between data validation and data verification. [2]<br>2. Give three advantages and three disadvantages of distributing data. [6]<br>3. Other than distributing data, explain two ways you could protect a system from data loss. [4] | **8/9/24** |
| All | Cyber security Introduction | **Task 1**<br>Cyber security is how organisations and individuals protect their information assets, data, software and hardware.<br><br>Research the following types of cyber security incidents and provide details of at least one real life example of the following:<br>• Hacking<br>• Disclosure of government information<br>• Impairing the operation of a digital system | **from 9th September 2024**<br><br>**Written Report** |

| | | | |
|---|---|---|---|
| | | • Denial of service<br>• Malware<br>• Identity theft<br>In the example summarize details of the financial, reputational and legal impact.<br><br>**Task 2**<br>Independently, research a particular cyber security incident that has made the news.<br>Present your findings in a presentation containing the following headings and sub-headings:<br>• Type of threat<br>• Type of attackers(s)<br>• Motivation for the attack<br>• The target of the attack<br>• Impact of the attack (financial, reputational and legal impact) | **Presentation** |

**Notes:**
Clearly label all pages with your name and arrange them in the correct order.

## Work Experience week

All year 1 students are required to participate in a week-long work placement during their first year of study. You will be expected to locate one week's worth of work placement and submit your work experience form before October half term.

**Placement Dates:**

| | |
|---|---|
| L2/L3 students on double /triple qualifications: | 1 week course-specific placement, expected placement dates will be confirmed by the course leaders at the beginning of September. |
| Students with 2 or more single subjects: | 1 week placement during the Easter holidays or w/c 23 June 2025 |

You can find the work experience form HERE
More information and guidance can be found HERE

Computing

Pearson BTEC | Level 3 Nationals


BTEC LEVEL 3 NATIONALS IN COMPUTING

# Learner Companion

## Unit 2: Fundamentals of Computer Systems

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# Contents

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# Teacher's Introduction

This companion has been written specifically for the BTEC Level 3 Nationals in Computing qualification (first teaching from September 2016). The theory notes and practice questions cover the essential knowledge and understanding prescribed in the BTEC Unit 2 specification.

**About Unit 2: Fundamentals of Computer Systems**

Unit 2 (90 GLH) is assessed using a 1-hour and 45-minute (80-mark) written examination, which is set and marked by Pearson. There are two opportunities for assessment each year – in January and May/June.

Unit 2 is a mandatory unit in the Certificate (180 GLH), Extended Certificate (360 GLH), Foundation Diploma (510 GLH), Diploma (720GLH), and Extended Diploma (1080 GLH).

Each of the six *Learning Aims* (A–F) is given its own section in the resource. These are as follows:

- Ⓐ *Hardware and Software*
- Ⓑ *Computer Architecture*
- Ⓒ *How Data is Represented by Computer Systems*
- Ⓓ *How Data is Organised on Computer Systems*
- Ⓔ *How Data is Transmitted by Computer Systems*
- Ⓕ *The Use of Logic and Data Flow in Computer Systems*

**Remember!**

Always check the exam board website for new information, including changes to the specification and sample assessment material.

Within each section there are student notes covering the specification content and structure. These notes include descriptions of theory, supported with examples, diagrams and images where appropriate.

Questions are interspersed throughout the guide to test and develop understanding. Suggested answers are included at the back of this resource.

*NB The intention of these is to save the teacher time, rather than to offer a comprehensive set of definite answers. In some cases, there are equally valid alternative answers to those that have been given.*

*C Standring, March 2019*

# Ⓐ *Hardware and Software*

**In this chapter you will learn:**

- ⓘ about the different types of computer system and how they use hardware
- ⓘ how computers use operating systems and different types of software
- ⓘ how computers are used to process data and the impact of sharing data across computer systems

## A1. Hardware in Computer Systems

### Computer Systems

**BTEC specification reference:**

☑ types of computer systems

Desktops and laptops aren't the only types of computer. Computers come in many different forms and are being used more often and in more devices, from phones to games consoles to even some modern vacuum cleaners and other home appliances. As one computer can be used for a completely different purpose from another, different computers require different *hardware* components to function.

This is especially true of *multifunctional devices*, such as desktop computers, which can be used for many different purposes and so need hardware components that allow them to perform a wide variety of functions.

**Hardware –** The physical components that allow computers to fulfil their purpose.

**Multifunctional devices –** Computers that can be used for many different tasks.

#### Personal Computers

Personal Computers (PCs), including desktops and laptops, are probably the most recognisable type of computer and are used for a wide variety of everyday tasks. Desktops and laptops are used for many of the same tasks and so use many of the same components.

However, because laptops need to be portable, they are generally designed to consume less power and have more wireless features.

#### Mobile Devices

While devices such as smartphones and tablets perform many of the same functions as desktops and laptops, they are designed to be much more mobile. Much like laptops, they have many wireless features and are built to consume as little power as possible, but as they are even smaller and thinner they also need to produce as little heat as possible as there is not much space for cooling the internal components, which is necessary to keep them from malfunctioning.

#### Servers

A server is a computer connected to a network so that multiple users can have shared access to files or resources. Servers are commonly used to run websites and create shared *drives* on a school or business network, as these can be used by many different people at any time.

**Drive –** A single collection of files. Each drive is usually a separate storage device, but drives can be made up of several storage devices, and a single storage device can be split into multiple drives.

The hardware used for servers is very similar to desktop computer towers; however, because they are usually only accessed over a network, they don't require keyboards or monitors to interact with them. They often have many Ethernet ports to allow them to connect to the network and to other servers.

## Components

**BTEC specification reference:**

- ☑ the purpose, features and uses of internal components
- ☑ the hardware used in computer systems
- ☑ how features of hardware can affect their performance and the performance of computer system

Computer systems are made up of a combination of internal components and peripheral devices. Internal components, like the CPU, RAM and ROM, are the hardware devices that are built into a computer for it to perform the basic tasks that it was designed for. As many computers are multifunctional devices, they make use of peripheral devices, like plug-in keyboards and wireless printers, so that components can be added or removed depending on what the user needs the computer to be able to do.

**Peripheral Device –** An external device that connects to a computer to allow it to perform additional tasks.

Most input and output devices are peripheral devices, but some are built-in to the computer, such as touchscreens on smartphones, or keyboard on laptops. Built-in components are often of a lower quality so that the overall price of the device can be kept cheap.

### Processors

The computer's processor, also known as the Central Processing Unit (CPU), is responsible for executing commands and doing all of the actual computing. Every time a processor ticks, it performs an operation. The speed at which the processor ticks is known as the clock speed and is measured in hertz (Hz), so the higher the clock speed is, the faster the processor will run. A typical computer could have a clock speed of 3 GHz, meaning that it can perform three billion operations every second.

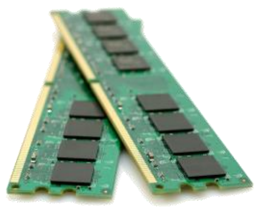
Another factor that affects the speed of the CPU is the number of *cores* it has. Different processor cores can perform different operations at the same time, meaning that a CPU with two cores will run almost twice as fast as a processor with a single core. Two cores are not exactly twice as fast as a single core because there is some overhead involved in the cores communicating with each other, and not all operations can be done at the same time.

**Core –** A single processor in a CPU that can perform operations.

### ROM

Read Only Memory (ROM) is random access, like RAM. However, the data in ROM cannot be edited and ROM is non-volatile, so any data in ROM is kept if the computer is switched off. This makes it ideal for storing the programs that a computer needs to start up and perform basic functions.

### RAM



Random Access Memory (RAM) is used by the processor so that it can store and load the data that it needs to perform its current process. 'Random access' means that it takes the same amount of time to access any location in the memory. RAM is volatile, meaning that if the computer loses power, all data in RAM is lost.

### Input Devices

Input devices provide data to the computer, and so are used to allow users of the environment to interact with the computer. Common examples of input devices include: keyboards, mice, microphones, temperature sensors and cameras.

### Output Devices

Output devices do something when they are given data by a computer, and so are used to allow computers to interact with users or the environment. Common examples of output devices include: screens, printers, speakers and *servomechanisms*.

**Servomechanism –** A device that produces movement in some mechanism, such as a motor.

## Storage Devices

As well as RAM and ROM, computer also make use of *secondary storage* devices to store data. Secondary storage is needed because there is only a limited amount of RAM, so storing data that is not needed for the currently running process outside RAM frees up space in RAM so that more processes can be run.

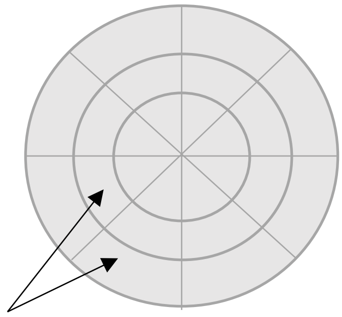
**Secondary Storage –** A hardware device that permanently stores data to provide extra space for memory.

Secondary storage is also useful because it is non-volatile, like ROM, but unlike ROM the contents of secondary storage can be edited.

### Magnetic Hard Disk

Magnetic storage disks are rigid disks covered in a magnetised surface. A read-write head can detect or change the magnetic polarity of the disk surface to read or edit the data at that location of the disk. The data on the disk is split up into sectors, with each sector having the same storage capacity. To access data at a particular sector, the disk spins, and the read-write head extends or retracts until it is above the correct part of the disk.

As physical movement is required for the computer to access a certain part of the data, magnetic disk storage is not random access.



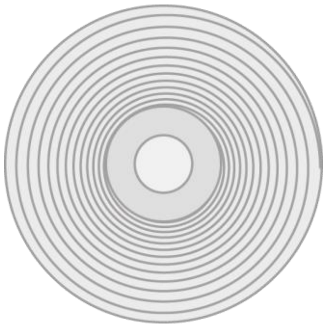
**Sectors**
Magnetic hard disks are split into sectors, with each sector containing a set amount of data.

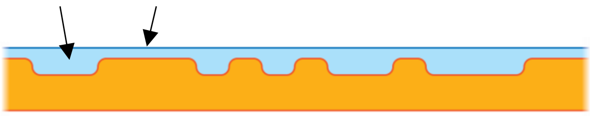
### Optical Disc

Optical discs (including all variations of CD, DVD and Blu-ray) are similar to magnetic disks, but, instead of using a magnetised surface, data is recorded as pits and lands to represent the zeros and ones. Instead of sectors organised on concentric tracks, optical discs use a spiral track.

In read-only optical discs, such as CD-ROMs, the pits and lands are moulded into the disc surface before a protective layer is placed over it. A laser is used to read the disc surface, which, based on the light reflected back, is converted into binary code. With some writable optical discs, such as CD-R, instead of using pits and lands, an organic dye is used, and read and write lasers change the translucency of the surface of the disc to interpret the data appropriately.

**Spiral Track**
Optical discs have a spiral track that spans from the centre to the outer edges.






Rewritable discs, such as CD-WR, work almost identically to these, except they use an alloy instead of a dye and the write lasers change the reflective nature through liquefaction of this alloy.

### Solid-state Memory

Solid-state memory (such as in USB flash drives) uses electrical circuits to store data. Unlike in magnetic disks and optical discs, no moving parts are required for solid-state memory, so it is random access. Solid-state Drives (SSD) are made up of semiconductors and offer non-volatile memory, meaning that data is not lost when there is no power. The lack of moving parts also makes solid-state memory more durable and less susceptible to failing.

Despite the advantages of SSDs over magnetic hard disk drives (HDDs), HDDs are still commonly used because they are less expensive for the amount of storage they provide.

## Choosing Components

**BTEC specification reference:**
- ☑ factors affecting the choice, use and performance of internal components
- ☑ factors affecting the choice of hardware

There are several factors that you need to take into consideration when deciding what components a computer will need:

- **User needs –** You need to consider what the computer will be used for. For example, if the device is going to be used on the move, you will want more wireless features, and if the device will need to take pictures, it should have a built-in camera.
- **User experience –** Users want their devices to feel good to use. Input devices shouldn't be awkward to use, so a smartphone shouldn't need to have a keyboard plugged in to type. Output devices should be appropriate, so if a user needs to be alerted by a device when they're not using it, there should be speakers that will get their attention if they aren't looking at the screen.
- **Compatibility –** Most computers use USB ports to connect to peripheral devices because users don't want to buy adapters or new peripherals whenever they get a new device.
- **Cost –** Users can only spend so much money on a device, and it might be unnecessary to use the fastest processor or highest storage capacity.
- **Efficiency –** It is important that the device is efficient in terms of speed and, for mobile devices, power consumption. For example, portable gaming devices need to have the processing power to run games but also need to avoid using too much power to extend their battery life.
- **Implementation –** Especially within organisations, you must consider how long it will take to install and test new components, as well as how easy it will be for users to adapt to the new system.
- **Productivity –** Input devices not only affect how easy a computer is to use, but also how efficiently it can be used. For example, adding a mouse as well as a keyboard to a computer allows users to navigate menus faster.
- **Security –** Security measures that use biometric devices such as retina or fingerprint scanners can make it harder for unauthorised users to gain access to a computer.

### Common Components in Mobile Devices

| | |
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| **Internal Components** | While the storage capacity of mobile devices is greatly increasing over time, they have much less storage than most modern PCs. Mobile devices also use less powerful processors, which produce less heat, use less power, take up less space and cost less. |
| **Touchscreen Monitors** | Most of the interaction with these mobile devices is done via touchscreen, as keypad buttons either make them bulky or take up screen space. |
| **SD/Micro-SD Readers** | Disk drives and USB ports are impractically large, and so SD cards are the primary removable storage used by mobile devices. Removable storage is especially important for mobile devices due to their limited storage capacity. |
| **Batteries** | As with laptops, batteries allows mobile devices to be used on the go. |
| **Built-in Cameras/Microphones** | As the primary purpose of mobile devices is for communication, microphones and cameras are essential. The quality of the camera is usually more important for these mobile devices than it is for laptops. |
| **Wireless Cards** | Wireless cards allow mobile devices to connect to Wi-Fi, cellular networks and Bluetooth devices. These are particularly useful for mobile devices, as there are usually no ports to allow peripheral devices to be connected. |
| **Internal Sensors** | Most mobile devices contain a wide variety of different sensors that can detect how quickly the device is moving, how it is rotated, the surrounding temperature and much more. |

### Common Components in PCs

| | |
|---|---|
| **Internal Components** | While laptops generally have less powerful processors and less memory than desktops, the fact that both laptops and desktops have powerful power packs and are not as small as other devices allows them to use very powerful processors and large amounts of storage. |
| **Keyboard** | One of the most commonly used devices to allow users to operate their PC. |
| **Mouse** | An additional input device used by PCs that allows for faster navigation of menus and finer control. |
| **Trackpad** | Used by laptops instead of a mouse, as a laptop is designed to be used when there is not necessarily enough surface space for a mouse. |
| **Monitor** | Provides a display for users to see the visual output of their PC. |
| **Removable Storage Ports** | Components such as disk drives and SD card readers allow users to back up their files and transfer files between computers. |
| **USB Ports** | Allow the computer to utilise a wide variety of different accessories. |
| **HDMI Ports** | Allow the computer to connect to a high-definition display device, such as a monitor or TV. |
| **Ethernet Ports** | Allow the computer to connect to a wired network, used more often by desktops than laptops. |
| **Wireless Network Card** | Allow the computer to connect to a wireless network, used more often by laptops than desktops. |
| **Batteries** | Used by laptops to allow them to be used while not plugged in to a power source. |
| **Built-in Cameras/Microphones** | As laptops are more likely to be taken to different places, they often come with cameras and microphones built in to allow for video calling. |

## Data Storage and Recovery Systems

**BTEC specification reference:**

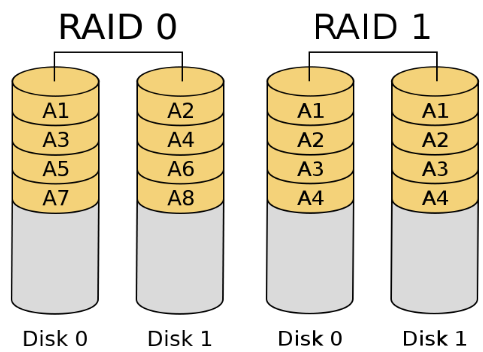
☑ data storage and recovery systems

People and organisations often need a way of sharing and backing up their data. This is particularly important to organisations, which will often have many employees who need access to shared files and which have a lot of data that would cause many issues if it was lost.

### RAID

A redundant array of independent disks (RAID) system is a way of configuring multiple storage disks to act as a single drive for file storage. There are many levels of RAID, which use the multiple disks in different ways. RAID 0 stores different data on each disk, meaning that if you have two 1 TB disks, they can be configured as a single 2 TB drive. RAID 1 mirrors the data on multiple disks, so two 1 TB disks will act as a single 1 TB drive.

While this halves the available storage, it means that if one disk fails, no data is lost. RAID 5 uses at least three disks that store different data, as well as some recovery data across the devices so that data can be recovered if a disk fails without reducing storage space as much as RAID 1. The more disks in this configuration, the closer the drive's storage will be to the combined storage total of the disks.




Using two disks, a RAID 0 configuration stores completely different data on each disk, while a RAID 1 configuration uses one disk to exactly replicate all of the data on the other.

**NAS**

Network-attached Storage (NAS) uses a server or collection of servers to store files on a network so that different users connected to that network can all have access to the shared files on those servers. NAS servers can use RAID configurations to provide a shared drive that can recover data if disks fail.

**Practice Questions – A1. Hardware in Computer Systems**

1. Consider you are designing a handheld gaming system. Given a choice between the following components, which would you choose? Explain your answer.
   a) A wired network card (with an Ethernet port) or a wireless network card. [2]
   b) A touchscreen or a standard keyboard. [2]
   c) An energy-intensive but fast processor or a slower, low-energy processor. [2]
   d) A retina scanner or a password-based security system. [2]
   e) A magnetic disk or solid-state memory. [2]

2. Give an example of one input device and one output device, other than the components given above, that the gaming system might use. [2]

3. A user has a computer system with two magnetic disks for secondary storage and is trying to decide how to configure the disks.

   Give one advantage and one disadvantage of using a RAID 0 configuration instead of a RAID 1 configuration. [2]

# A2. Software in Computer Systems

## Operating Systems

**BTEC specification reference:**

☑ operating systems:

- types of operating system
- factors affecting the choice of operating system

Because the inner workings of a computer are so complicated, it is unrealistic to rely on the user to tell the computer exactly what it needs to do every time it needs to perform an action. The operating system (OS) of a computer is a collection of software programs that acts as an interface between the user and the computer. The OS handles the computer start-up process, allows the different components of the computer to communicate, tells the processor which parts of memory it needs to use and handles many other tasks that the user is not even aware of. Different OSs are needed depending on the purpose of the computer.

### Real-time Operating Systems

Many computers need to be able to respond quickly to inputs as they are received. This is particularly important in safety-critical computer systems; for example, in a self-driving car, where the computer will need to be able to tell the car to stop immediately if it detects that the car is about to crash. Real-time OSs are in a constant cycle of waiting for input, processing input and producing output.

### Single-user Single Task

Computers that are only used by one user at a time require a single-user OS. A single-user computer can still have multiple users, but the users cannot operate the computer simultaneously, so security features such as user passwords are still necessary. Single task operating systems can only carry out a single process at a time, so a user couldn't for example use a web browser while entering information into a spreadsheet.

### Single-user Multi-tasking

As computers have become more powerful and efficient, most OSs allow for multi-tasking. Multi-tasking OSs don't actually carry out multiple processes on a single processor at once. Instead, the OS organises processes so that the processor is quickly alternating between working on the different processes. As computers can carry out so many operations so quickly, it appears as if multiple processes are running simultaneously.

### Multi-user

Not all computers are used by only one user at a time, and so they require a multi-user OS to organise how the computer gives access to the different users. Many servers are used by multiple users simultaneously, such as servers for popular websites, which will be used by many different users at the same time.

## OS Kernels

**BTEC specification reference:**

☑ operating systems:

- the role of the kernel in controlling and managing system components and tasks
- the role of the operating system in managing networking and security

Operating systems are responsible for producing the *user interface* that is used for the computer to communicate with users, but they are also responsible for controlling how the computer manages its resources, such as the memory and CPU. This unseen part of the OS is called the *kernel*.

**User Interface –** The means by which the user interacts with the computer.

**Kernel –** The part of the OS responsible for handling communication between the hardware and software components of a computer system.

### Program Execution

At any given time, there are many processes that need to run. As the processor cannot run all of the processes at the same time, there needs to be a way of deciding which process gets to use the processor when. If the processes were simply run in order, multi-tasking would be impossible, and processes couldn't be altered or stopped until they had finished running. There are many different ways a kernel can organise processes. It could give all processes a set amount of processor time and switch between each process when it's time was over, but this is not a very flexible way of organising processes. Instead, the kernel uses more complicated scheduling that takes into account the amount of time a process has been waiting, the priority of the process, how much uninterrupted time the process needs and many other factors. This constant switching of when each process can use the processor is what allows multi-tasking.

### Interrupts

The kernel is constantly running processes in the background, so there needs to be a way for the user, programs and external devices to request processor time. Between executing commands, the processor listens for requests, and if an *interrupt* signal is received, the priority of the signal will be checked to see when the process that sent the interrupt should be allowed to run.

**Interrupt –** A signal sent by a device or process to request use of the CPU.

### Modes

The kernel splits access to the system into different levels or 'modes' to prevent processes from causing any accidental or intentional damage to the system. The lower the mode of the kernel, the more access the currently running process has to the system. The kernel changes the mode depending on the process being run. For example, the kernel won't normally allow a process access to the OS files to prevent a program from accidentally overwriting memory being used for the OS or intentionally deleting the OS, but the kernel will need to allow access to OS files if the OS is being updated and so will switch to a lower mode.

### Memory Management

As there is a limited amount of RAM available to the computer, it is very important that the space is used efficiently. Every memory location in RAM is either in currently use or on the *heap*. As there are so many memory locations, the kernel groups together consecutive memory locations into larger groups to reduce the overhead compared to managing each location separately. Whenever a task needs to use the RAM, the kernel decides where the instructions for that task should be loaded into RAM, and which memory locations that task can use. The kernel keeps track of which memory locations are being used by which task so that whenever a task is complete, the kernel can move all of the memory locations that task was using onto the heap so they can be used by other tasks.

**Heap –** An area of RAM that is no longer needed and can, therefore, be overwritten.

### Disk Access

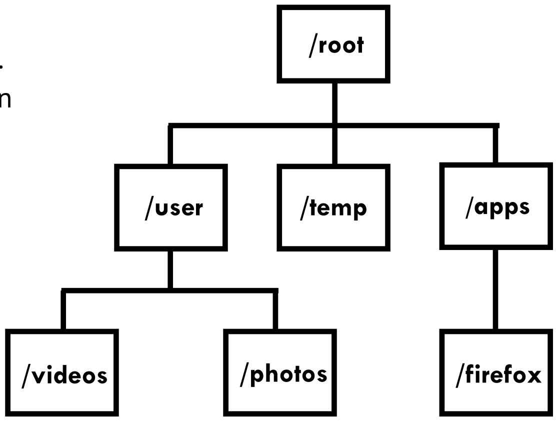
The kernel manages not only the RAM, but also the secondary storage devices. When managing magnetic disks, the computer not only needs to know the memory locations that are free to be used by each process, but also the physical location of those memory locations on the disk. This is necessary because in order to read or overwrite a particular memory location on a disk, the computer needs to spin the disk and extend or retract the read-write head so that the read-write head is above the appropriate part of the disk.

The kernel is responsible for determining the physical movement that is required to access the correct memory location. Deciding which memory locations to use is also more important with magnetic disks than with RAM because the time it takes to access a memory location on a magnetic disk depends on how much the physical components need to be moved. The kernel tries to keep data from the same program as close together on the disk as possible to reduce the movement required, and thereby increase the access speed, as much as possible.

## File Systems

It is important that files are arranged in a logical order to make it easy for users to find quickly the files that they're looking for. The OS uses folders that allow the user to group their files in an order that makes sense to them.

Every drive has a top level or root folder, and all additional folders in that drive are arranged in a hierarchy, meaning that every folder is contained within a different folder.




File systems offer an easy way for users to organise their data. All data on a drive is stored in the 'root' folder, which can contain many files or subfolders.

## Device Drivers

As there are so many different peripheral devices, and new devices are constantly being created, it would be impossible for an OS to be programmed to handle any devices that could be connected to the computer.

Instead, most peripherals use device drivers, which are pieces of software that tell the OS how to communicate with the connected device. Many peripherals automatically install drivers when they are first connected to the computer.

## Networking

Much in the same way as the OS controls when different processes are given access to the processor, it also controls when different users are given access to shared resources. For example, two users may want to use a shared network printer at the same time, so the OS will use *spooling* to queue one of the user's requests while the printer is being used by the other.

**Spooling** – Storing a list of requests to use a shared device so that each task is only passed on when the device becomes available.

## Security

A single computer can be used by more than one user, so it is important for there to be a way of stopping different users from accessing each other's files. The OS can create different user profiles on a computer that can be protected by passwords or other security measures, preventing one user from accessing or editing the data of another user.

OSs also have safety features to protect from threats from the outside, such as firewalls that decide which network traffic will be allowed through in either direction and antivirus software, which detects and handles malicious programs.