CHALIMBANA UNIVERSITY

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DIRECTORATE OF DISTANCE EDUCATION

EDU 1201: INFORMATION AND COMMUNICATION TECHNOLOGY -GENERIC

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LUSAKA

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TABLE OF CONTENT

Acknowledgement:

On behalf of Chalimbana University, the Directorate of distance education we would like to sincerely thank the author and editors of this module. We hope you will be able to continue to render your services when called up on in the near future.

AIM OF THE MODULE

Pre Requisite: None

Background and Rationale

Information Communication Technology is a course tailored to create in students an understanding of pedagogical techniques and new technologies that promote effective and interactive teaching and learning using the immediate environments and beyond while keeping abreast with emerging trends. It also aims to enable students acquire skills in education media production, ICT and the integration of these resources in the teaching and learning. Students will have an understanding of basic theoretical elements and practical skills in ICT and Education media and Technology in order to fit into the emerging trends.

Learning Outcomes

At the end of the course students will be expected to:

- Use new technologies/common ICTs for teaching and learning
- Use locally available resources in teaching and learning
- Demonstrate the use of Graphic materials
- Demonstrate fundamental of computer skills
- Exhibit skills relevant to application packages
- Apply concepts of ICT in a classroom situation
- Show ability to use ICT in teaching and learning
- Demonstrate ability to adapt to emerging trends in ICT in the education fraternity

COURSE CONTENT

1.0. UNIT 1 - INFORMATION AND COMMUNICATIONS TECHNOLOGY (ICT)

1.2. Overview Information and Communications Technology (ICT)
1.3. Hardware
1.4. Computer Peripherals
    1.4.1. Things to Consider when purchasing hardware
1.5. Software and applications
    1.5.1. Things to Consider when purchasing Software
1.6. Computers, Servers and Terminals
1.7. Data and Information

2.0. UNIT 2 – NETWORKING

1.0. UNIT 1 – INFORMATION AND COMMUNICATIONS TECHNOLOGY (ICTs)

1.1. Objectives

At the end of this unit you will be able to know about:

- What constitute Information and Communications Technology (ICT)
- The difference between Hardware and Software
- Identify the basic elements required in a computer system.
- The different types of Computers
- What data and information is and how they differ from each other

1.2. Information and Communications Technology (ICT)

1.2.1. Meaning and Definition

ICT is technology that supports activities involving information. Such activities include gathering, processing, storing and presenting data. Increasingly these activities also involve collaboration and communication. Hence IT has become ICT: information and communication technology.

Some underlying principles

Technology does not exist in isolation

- ICT contributes at various points along a line of activity
- ICT is used in activities – the ICT use depends on the activities
- The key outputs of educational activities are context are knowledge, experience and products.
- The output should be useful to the users (self and others)

What constitute ICT's?

- A collection of tools and devices used for particular tasks, e.g, publishing, course delivery, and transaction processing.
- An organised set of equipment (like a 'workshop') for working on information and communication

- Components of integrated arrangements of devices, tools, services and practices that enable information to be collected, processed, stored and shared with others

- Components in a comprehensive system of people, information and devices that enables learning, problem solving and higher order collaborative thinking, that is, ICT as key elements underpinning a (sharable) workspace.

Let's focus on the three words behind ICT:

- **INFORMATION**
- **COMMUNICATIONS**
- **TECHNOLOGY**

A good way to think about ICT is to consider all the uses of digital technology that already exist to help individuals, businesses and organisations use information.

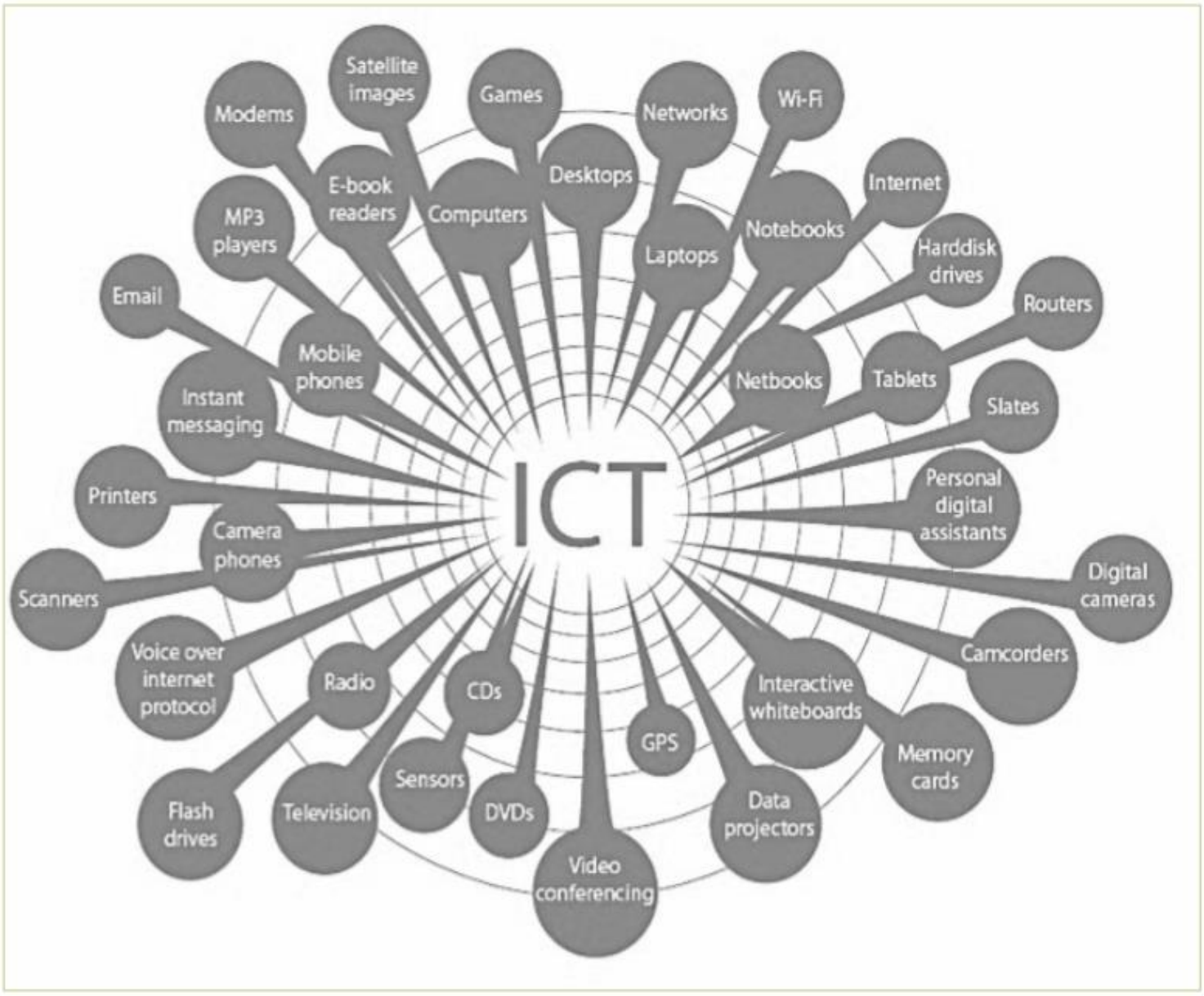
ICT covers any product that will store, retrieve, manipulate, transmit or receive information electronically in a digital form. For example, personal computers, digital television, email, robots.

Definition

Information Communication Technology (ICT) is a term that describes types of technology that are used specifically for communications. It is like Information Technology, but ICT focuses more on technologies that deal with communication, like cell phones, the Internet and wireless networks, among other things.

ICT develops, implements and supports the technology-based services that support the core functions of any business. UNESCO Bangkok (2012) illustrates the components of ICT as follows:

FIGURE 1: COMPONENTS OF ICT



1.3. The Computer System

A computer can be viewed as a system, which consists of a number of interrelated components that work together with the aim of converting data into information. To attain information, data is entered through input unit, processed by central processing unit (CPU), and displayed through output unit. In addition, computers require memory to process data and store output. All these parts (the central processing unit, input, output, and memory unit) are referred to as **hardware** of the computer.

There are several computer systems in the market with a wide variety of makes, models, and peripherals. In general, a computer system comprises the following components:

i) Input Unit: This unit accepts instructions and data.

ii) Central Processing Unit (CPU): This unit performs processing of instructions and data inside the computer.

iii) Output Unit: This unit communicates the results to the user.

iv) Memory/Storage Unit: This unit stores temporary and final results.

1.4.1 Input devices accept data and instructions from the user or from another computer system (such as a computer on the internet). The most common input device is the **Keyboard** which accepts characters and commands from the user. Another important input device is the **mouse**, which allows the user to select options from on-screen menus. A variety of other input devices work with computers such as;

- Trackball and trackpad which are variations of the mouse which enable a user to draw or point on the screen
- A scanner to copy printed pages of text or graphic into a computer's memory.
- Digital Camera to record still images for viewing and editing on the computer.
- Microphone, enables a user to input their voice or music as data.
- Barcode Reader
- Joystick
- Light Pen

These are teased out and illustrated below for better understanding. Take note that the list is not exhaustive.

1.4.1.1 Keyboard

Keyboard is the most common and very popular input device which helps to input data to the computer. The layout of the keyboard is like that of traditional typewriter, although there are some additional keys provided for performing additional functions.

Keyboards are of two sizes 84 keys or 101/102 keys, but now keyboards with 104 keys or 108 keys are also available for Windows and Internet.

The keys on the keyboard are as follows −

S.No	Keys & Description
1	**Typing Keys** These keys include the letter keys (A-Z) and digit keys (09) which generally give the same layout as that of typewriters.
2	**Numeric Keypad** It is used to enter the numeric data or cursor movement. Generally, it consists of a set of 17 keys that are laid out in the same configuration used by most adding machines and calculators.
3	**Function Keys** The twelve function keys are present on the keyboard which are arranged in a row at the top of the keyboard. Each function key has a unique meaning and is used for some specific purpose.
4	**Control keys**

	These keys provide cursor and screen control. It includes four directional arrow keys. Control keys also include Home, End, Insert, Delete, Page Up, Page Down, Control(Ctrl), Alternate(Alt), Escape(Esc).
5	**Special Purpose Keys** Keyboard also contains some special purpose keys such as Enter, Shift, Caps Lock, Num Lock, Space bar, Tab, and Print Screen.

1.4.1.2 Mouse

Mouse is the most popular pointing device. It is a very famous cursor-control device having a small palm size box with a round ball at its base, which senses the movement of the mouse and sends corresponding signals to the CPU when the mouse buttons are pressed.

Generally, it has two buttons called the left and the right button and a wheel is present between the buttons. A mouse can be used to control the position of the cursor on the screen, but it cannot be used to enter text into the computer.

Advantages

- Easy to use
- Not very expensive
- Moves the cursor faster than the arrow keys of the keyboard.

1.4.1.3 Joystick

Joystick is also a pointing device, which is used to move the cursor position on a monitor screen. It is a stick having a spherical ball at its both lower and upper ends. The lower spherical ball moves in a socket. The joystick can be moved in all four directions.

The function of the joystick is similar to that of a mouse. It is mainly used in Computer Aided Designing (CAD) and playing computer games.

1.4.1.4 Light Pen

Light pen is a pointing device similar to a pen. It is used to select a displayed menu item or draw pictures on the monitor screen. It consists of a photocell and an optical system placed in a small tube.

When the tip of a light pen is moved over the monitor screen and the pen button is pressed, its photocell sensing element detects the screen location and sends the corresponding signal to the CPU.

1.4.1.5 Track Ball

Track ball is an input device that is mostly used in notebook or laptop computer, instead of a mouse. This is a ball which is half inserted and by moving fingers on the ball, the pointer can be moved.

Since the whole device is not moved, a track ball requires less space than a mouse. A track ball comes in various shapes like a ball, a button, or a square.

1.4.1.6 Scanner

Scanner is an input device, which works more like a photocopy machine. It is used when some information is available on paper and it is to be transferred to the hard disk of the computer for further manipulation.

Scanner captures images from the source which are then converted into a digital form that can be stored on the disk. These images can be edited before they are printed.

1.4.1.7 Digitizer

Digitizer is an input device which converts analog information into digital form. Digitizer can convert a signal from the television or camera into a series of numbers that could be stored in a

computer. They can be used by the computer to create a picture of whatever the camera had been pointed at.

Digitizer is also known as Tablet or Graphics Tablet as it converts graphics and pictorial data into binary inputs. A graphic tablet as digitizer is used for fine works of drawing and image manipulation applications.

1.4.1.8 Microphone

Microphone is an input device to input sound that is then stored in a digital form.

The microphone is used for various applications such as adding sound to a multimedia presentation or for mixing music.

1.4.1.9 Magnetic Ink Card Reader (MICR)

MICR input device is generally used in banks as there are large number of cheques to be processed every day. The bank's code number and cheque number are printed on the cheques with a special type of ink that contains particles of magnetic material that are machine readable.

This reading process is called Magnetic Ink Character Recognition (MICR). The main advantages of MICR is that it is fast and less error prone.

1.4.1.10 Optical Character Reader (OCR)

OCR is an input device used to read a printed text.

OCR scans the text optically, character by character, converts them into a machine readable code, and stores the text on the system memory.

1.4.1.11 Bar Code Readers

Bar Code Reader is a device used for reading bar coded data (data in the form of light and dark lines). Bar coded data is generally used in labelling goods, numbering the books, etc. It may be a handheld scanner or may be embedded in a stationary scanner.

Bar Code Reader scans a bar code image, converts it into an alphanumeric value, which is then fed to the computer that the bar code reader is connected to.

1.4.1.12 Optical Mark Reader (OMR)

OMR is a special type of optical scanner used to recognize the type of mark made by pen or pencil. It is used where one out of a few alternatives is to be selected and marked.

It is specially used for checking the answer sheets of examinations having multiple choice questions.

1.5 Output devices return processed data to the user or to another computer system. The most common output devices are;

- The monitor
- Printer
- Speakers
- Headphones
- Modem
- Fax

Let us walk through some of these output devices keeping in mind that there could be others that have not been captured here. It is your role as a student to add to this list after conducting thorough research.

1.5.1 Monitors

Monitors, commonly called as **Visual Display Unit** (VDU), are the main output device of a computer. It forms images from tiny dots, called pixels that are arranged in a rectangular form. The sharpness of the image depends upon the number of pixels.

There are two kinds of viewing screen used for monitors.

- Cathode-Ray Tube (CRT)
- Flat-Panel Display

Cathode-Ray Tube (CRT) Monitor

The CRT display is made up of small picture elements called pixels. The smaller the pixels, the better the image clarity or resolution. It takes more than one illuminated pixel to form a whole character, such as the letter 'e' in the word help.

A finite number of characters can be displayed on a screen at once. The screen can be divided into a series of character boxes - fixed location on the screen where a standard character can be placed. Most screens are capable of displaying 80 characters of data horizontally and 25 lines vertically.

There are some disadvantages of CRT −

- Large in Size
- High power consumption

Flat-Panel Display Monitor

The flat-panel display refers to a class of video devices that have reduced volume, weight and power requirement in comparison to the CRT. You can hang them on walls or wear them on your wrists. Current uses of flat-panel displays include calculators, video games, monitors, laptop computer, and graphics display.

The flat-panel display is divided into two categories −

- **Emissive Displays** − Emissive displays are devices that convert electrical energy into light. For example, plasma panel and LED (Light-Emitting Diodes).
- **Non-Emissive Displays** − Non-emissive displays use optical effects to convert sunlight or light from some other source into graphics patterns. For example, LCD (Liquid-Crystal Device).

1.5.2 Printers

Printer is an output device, which is used to print information on paper.

There are two types of printers −

- Impact Printers
- Non-Impact Printers

Impact Printers

Impact printers print the characters by striking them on the ribbon, which is then pressed on the paper.

Characteristics of Impact Printers are the following −

- Very low consumable costs
- Very noisy
- Useful for bulk printing due to low cost
- There is physical contact with the paper to produce an image

These printers are of two types −

- Character printers
- Line printers

1.5.2. Character Printers

Character printers are the printers which print one character at a time.

These are further divided into two types:

- Dot Matrix Printer(DMP)
- Daisy Wheel

1.5.2.1 Dot Matrix Printer

In the market, one of the most popular printers is Dot Matrix Printer. These printers are popular because of their ease of printing and economical price. Each character printed is in the form of pattern of dots and head consists of a Matrix of Pins of size (5*7, 7*9, 9*7 or 9*9) which come out to form a character which is why it is called Dot Matrix Printer.

Advantages

- Inexpensive
- Widely Used
- Other language characters can be printed

Disadvantages

- Slow Speed
- Poor Quality

Daisy Wheel

Head is lying on a wheel and pins corresponding to characters are like petals of Daisy (flower) which is why it is called Daisy Wheel Printer. These printers are generally used for word-processing in offices that require a few letters to be sent here and there with very nice quality.

Advantages

- More reliable than DMP
- Better quality
- Fonts of character can be easily changed

Disadvantages

- Slower than DMP
- Noisy
- More expensive than DMP

1.5.2.2 Line Printers

Line printers are the printers which print one line at a time.

These are of two types −

- Drum Printer
- Chain Printer

1.5.2.3 Drum Printer

This printer is like a drum in shape hence it is called drum printer. The surface of the drum is divided into a number of tracks. Total tracks are equal to the size of the paper, i.e. for a paper width of 132 characters, drum will have 132 tracks. A character set is embossed on the track. Different character sets available in the market are 48 character set, 64 and 96 characters set. One rotation of drum prints one line. Drum printers are fast in speed and can print 300 to 2000 lines per minute.

Advantages

- Very high speed

Disadvantages

- Very expensive
- Characters fonts cannot be changed

1.5.2.4 Chain Printer

In this printer, a chain of character sets is used, hence it is called Chain Printer. A standard character set may have 48, 64, or 96 characters.

Advantages

- Character fonts can easily be changed.
- Different languages can be used with the same printer.

Disadvantages

- Noisy

1.5.3 Non-impact Printers

Non-impact printers print the characters without using the ribbon. These printers print a complete page at a time, thus they are also called as Page Printers.

These printers are of two types −

- Laser Printers
- Inkjet Printers

Characteristics of Non-impact Printers

- Faster than impact printers
- They are not noisy
- High quality
- Supports many fonts and different character size

1.5.3.1 Laser Printers

These are non-impact page printers. They use laser lights to produce the dots needed to form the characters to be printed on a page.

Advantages

- Very high speed
- Very high quality output
- Good graphics quality
- Supports many fonts and different character size

Disadvantages

- Expensive
- Cannot be used to produce multiple copies of a document in a single printing

1.5.3.2 Inkjet Printers

Inkjet printers are non-impact character printers based on a relatively new technology. They print characters by spraying small drops of ink onto paper. Inkjet printers produce high quality output with presentable features.

They make less noise because no hammering is done and these have many styles of printing modes available. Color printing is also possible. Some models of Inkjet printers can produce multiple copies of printing also.

Advantages

- High quality printing
- More reliable

Disadvantages

- Expensive as the cost per page is high
- Slow as compared to laser printer

Note: Some types of hardware can act as both input and output devices such as a touch screen, communication devices such as **modems** which enable computers to communicate through telephone lines or cable television systems and **Network Interface Cards(NICs)** which let users connect a group of computers to share data and devices. It is worthwhile at this point to look at history of computers

History of computers

Computers were preceded by many devices which mankind developed for their computing requirements. The history of computers is often discussed with reference to the different generations of computing devices. In computing, the word generation is described as a stage of technological development or innovation. According to the technology used, there are five (5) generations of computers.

1. **First Generation (1940 – 56): Vacuum Tubes**

These computers were vacuum tubes/thermionic valve based machines. They used vacuum tubes for circuitry and magnetic drums for memory. A magnetic drum is a metal cylinder coated with magnetic iron-oxide material on which data and programs can be stored. Input was based on punched cards and paper tape and output was displayed in the form of printouts. They relied on binary coded language (Language of 0's and 1's) to perform operations and were able to solve only one problem at a time. Each machine was fed with a different binary codes and hence were difficult to program. This resulted in lack of versatility and speed. Examples: **ENIAC, EDVAC and UNIVAC**

Characteristics

- Based on vacuum tube technology
- Fastest computing devices of their times (Computation time was in milliseconds
- Were very large and required a lot of space for installation
- Since a lot of vacuum tubes were used, they generated a large amount of heat.
- Non-portable and very slow equipment's

- Lacked versatility and speed
- Were unreliable and prone to frequent hardware failures. Hence constant maintenance was required.
- Were very expensive and used a large amount of electricity.
- Since machine language was used, these computers were difficult to program and use.

2. **Second Generation (1956 – 63): Transistors**

These used transistors, which were superior to vacuum tubes. A transistor is made up of semiconductor material like germanium and silicon. It usually had three leads and performed electrical functions such as voltage, current or power amplification with low power requirements. Since transistors are small in physical size, computers became smaller, faster, cheaper, energy-efficient and more reliable than their predecessors. Magnetic cores were used as primary memory and magnetic disks as secondary storage devices. However, they still relied on punch cards for input and printouts or output.

One of the major developments includes the programming language from machine language to assembly language. Assembly language used mnemonics (abbreviations) for instructions rather than numbers, for example ADD for addition and MULT for multiplication. As a result, programming became less cumbersome. Early high-level programming languages such as COBOL and FORTRAN also came into existence in this period.

Examples: **PDP-8, IBM 1401 and IBM 7090.**

Characteristics

- Based on Transistor technology.
- Smaller compared to first generation computers
- Computational time of these was reduced to microseconds from milliseconds
- More reliable and less prone to hardware failure. Hence such computers required less frequent maintenance.
- Were more portable and generated less amount of heat.
- Assembly language was used to program computers, hence programming became more time-efficient and less cumbersome.

3. **Third Generation (1964 – Early 1970s): Integrated Circuits**

Integrated circuit was the trait of third generation computers. Also called an **IC,** an integrated circuit consists of a single chip (usually silicon) with many components such as transistors and resistors fabricated on it. IC's replaced several individually wired transistors. This made computers smaller in size, reliable and efficient.

Instead of punched cards and printouts, users interacted with third generation computers through keyboards and monitors and interfaced with operating system. This allowed the device to run many different applications at one time with a central program that monitored the memory.

Examples: **NCR 395 and B6500.**

Characteristics:

- Based on Integrated Circuit (IC) technology
- Were able to reduce computational time from microseconds to nanoseconds
- Were easily portable and more reliable than second generation
- Consumed less power and generated less heat.
- Computers were smaller
- Hardware rarely failed, maintenance cost was quite low.
- Extensive use of high-level languages became possible.
- Manual assembling of individual components was not required, so it reduced the large requirement of labor cost.

4. **Fourth Generation (Early 1970s – Till Date): Microprocessors**

This was an extension of third generation technology. Although it was still based on integrated circuits, they were made readily available because the development of the microprocessor. The intel 4004 chip, which was developed in 1971, took the integrated circuit one step further by locating all the components of a computer (CPU, Memory and Input and Output Controls) on a miniscule chip. A microprocessor is built onto a single piece of silicon, known as a chip.

This generation led to an era of Large Scale Integration (LSI) and Very Large Scale Integration

(VLSI) technology. LSI technology allowed thousands of transistors to constructed on one small slice of silicon material whereas VLSI squeezed hundreds of thousands of components on to a single chip. Ultra-large scale Integration (ULSI) increased that number into millions.

Fourth generation computers became more powerful, compact, reliable and affordable leading to the rise of the personal computer revolution. This generation also saw the development of the Graphical User Interfaces (GUIs), mouse ad handheld devices. Despite many advantages, this generation required complex and sophisticated technology for the manufacturing of CPU and other components.

Examples: **Apple II, Altair 8800 and CRAY-1**

Characteristics:

- Fourth generation computers are microprocessor-based systems
- These computers are very small.
- They are the cheapest among all other generations
- Portable and quite reliable
- They generate negligible amount of heat
- Hardware failure is negligible, so minimum maintenance is required
- The production cost is very low.
- GUI and pointing devices enable users to learn to use the computer quickly.
- Interconnection of computers leads to better communication and resource sharing.

5. **Fifth Generation (Present and Beyond): Artificial Intelligence**

- The dream of creating a human-like computer that would be capable of reasoning and reaching through a series of "What-if-then" analyses existed since the beginning of computer technology. The starting point for fifth generation of computers has been set in the early 1990's. The process of developing fifth generation of computers is still in the development stage. However, the expert system concept is already in use. The **expert system** is defined as a computer information system that attempts to mimic the thought process and reasoning of experts in specific areas. Three characteristics can be identified with the fifth generation computers, which are;

i) **Mega Chips:** Fifth generation computers will use ***Super Large Scale Integrated (SLSI)*** chips, which will result in the production of microprocessor having millions of electronic components on a single chip. In order to store instructions and information, fifth generations computers require a great amount of storage capacity. Mega chips may enable the computer to approximate the memory capacity.

ii) **Parallel Processing:** Most computers way back and some these days use(d) to access and execute only one instruction at a time. This is called **serial processing**. However, a computer using parallel processing accesses several instructions at once and works on them at the same time through the use of multiple central processing units.

iii) **Artificial Intelligence (AI):** It refers to a series of related technologies that tries to simulate and reproduce human behavior, including thinking, speaking and reasoning. AI comprises a group of related technologies; expert systems (ES), natural language processing (NLP), speech recognition, vision and robotics.

1.4. Hardware

A computer is an automatic, programmable, electronic data processing device. Computers take information (called **data**), process it into information that is useful to people, and show the results of the processing. Any computer-regardless of its type is controlled by programmed instructions which give the machine a purpose.

Computers consist of two parts, **hardware** and **software**. We refer to the physical parts of a computer as its hardware. Hardware includes the plastic and metal parts that you normally handle. It also includes electronic components and storage devices. Software refers to computer programs: sequences of instructions for the computers processor that control everything that the computer does. Without software, a computer would be useless. The word software was invented as an opposite to hardware. It distinguishes the programs from a computer's hardware.

1.4.1. Parts of the Computer

Computers are complex machines, with much of the processing and work being done at a microscopic level. But did you know that inside a computer are several parts that you can see or identify with ease? These computer components are what make any machine run and affect its performance.

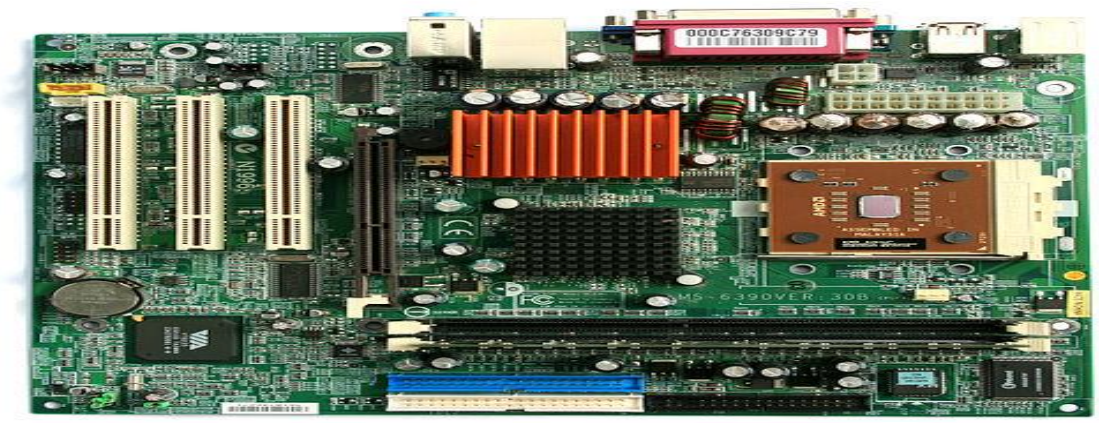
You don't have to be an IT expert to learn the basics of what computer parts do and what they look like. Let's review some of the standard computer components and you'll hopefully learn something today!

Housing

The housing is the part of your computer that holds all the parts that make the computer operate. In a desktop tower, the housing does not include a monitor, keyboard or mouse. An all-inclusive computer houses both a monitor and the components that make the computer function, but does not include a mouse or keyboard. A laptop includes the monitor, keyboard, mouse (or mouse alternative) and the components that make the computer function

Motherboard

The motherboard is an important computer component because it's what everything else connects to! The motherboard is a decently sized circuit board that lets other components communicate. A motherboard has ports that face outside a PC's case, so you can charge your computer, plug in a monitor, or connect a mouse. In other words, the motherboard is the part of your computer that wires all of the other parts together. It is a printed circuit board and includes the CPU and memory. Every component of your computer connects directly into the motherboard. It typically includes expansion options for high-end graphic displays and additional devices. Motherboard specifications are designed around which CPU your computer uses. For example, if your computer uses an Intel processor, you need an Intel-compatible motherboard.



A computer's motherboard also contains slots for expansions, so you can add additional accessory ports if you wish. The motherboard also stores low-level information like the system time even when the computer is turned off.

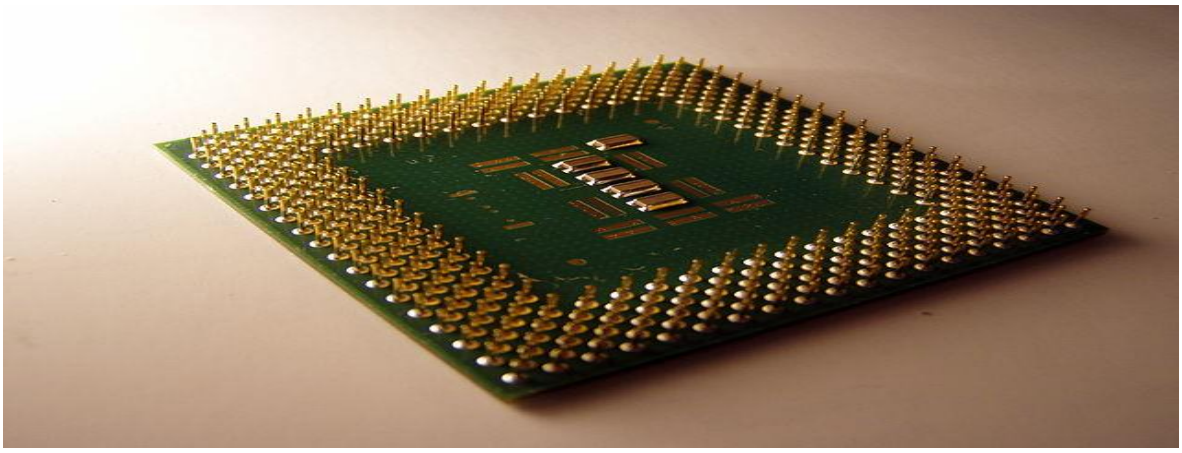
Power Supply

True to its name, the power supply powers all other components of the machine. It usually plugs into the motherboard to power the other parts. The power supply connects to either an internal battery (on a laptop) or a plug for an outlet (on a desktop).

Central Processing Unit (CPU)

A CPU, sometimes referred to as a computer's brain, is the workhorse of the machine. It

performs the calculations needed by a system, and can vary in speed. The work that a CPU does generates heat, which is why your computer has a fan inside. A more powerful CPU is necessary for intense computer work like editing high-definition video or programming complex software.



Random-access Memory (RAM)

RAM is temporary memory. Whenever you open up a Microsoft Word window, your computer places it in RAM, and when you close the window, that RAM is freed. Since RAM is volatile, its contents are lost if the machine loses power. This is why you lose a Word document when the power goes out if you didn't save it. The more RAM you have, the more programs you can run at once. A common cause of slow computers is a lack of sufficient RAM.

Hard Disk Drive / Solid State Drive

Since RAM is temporary, your computer needs a place to store data permanently. That's where the hard drive comes in. The traditional hard drive consists of several spinning platters with an arm that physically writes data to the disk. However, these drives are slow and are starting to be replaced by the faster solid-state drives.

Solid-state drives consist of flash memory, like your smartphone or flash drive. They are much faster than traditional hard disk drives, though cost more for the increased efficiency. Both types of drives come in various sizes to suit different needs.

Replacing a hard drive with a solid state drive is one of the best computer upgrades you can make — the speed difference is amazing.

Video Card

A video card is a dedicated unit for handling the output of images to a display. Video cards have their own dedicated RAM for performing these functions. A high-end video card is required to process extremely intense visual functions, such as computer drafting by engineers. Like many components, many types of video cards are available with varying power and prices.

An alternative to a video card is integrated graphics, which occurs when the system borrows regular RAM for graphics processing. Typically integrated graphics are attached to the CPU, especially on laptops. Integrated graphics is sufficient for normal computing use and is less expensive than a dedicated card, but won't work for intense editing jobs or high-end games.

Optical Drives

Though less common than they used to be, many machines still have an optical drive for reading CDs and DVDs. These can be used to listen to music or watch movies, place information onto a blank disc, or install software from a disc. Since most software nowadays is installed from the internet instead of using discs, these aren't as important as they once were, especially on laptops.

Input and Output Devices

Depending on your particular computer, you can connect a variety of devices to send information into it or out of it. Common input devices include mice (touchpads on laptops), keyboards, and webcams, while output devices consist of monitors, printers, and speakers. Removable media such as flash drives and SD cards can also be used to transfer data

1.4.2. Computer Peripherals

Computer peripherals are devices used to input information and instructions into a computer for storage or processing and to out the processed data. In addition, devices that enable the transmission and reception of data between computers are often classified as peripherals.

Peripherals are commonly divided into three kinds: input devices, output devices, and storage devices (which partake of the characteristics of the first two). An input device converts incoming data and instructions into a pattern of electrical signals in binary code that are comprehensible to a digital computer. An output device reverses the process, translating the digitized signals into a form intelligible to the user. At one time punched-card and paper-tape readers were extensively used for inputting, but these have now been supplanted by more efficient devices.

We have already discussed Input devices but they include typewriter-like keyboards; handheld devices such as the mouse, trackball, joystick, trackpad, and special pen with pressure-sensitive pad; microphones, webcams, and digital cameras. They also include sensors that provide information about their environment temperature, pressure, and so forth to a computer. Another direct-entry mechanism is the optical laser scanner (e.g., scanners used with point-of-sale terminals in retail stores) that can read bar-coded data or optical character fonts.

Equally, output devices have already been teased out in this module. However, and for the purposes of revision, output equipment includes video display terminals, ink-jet and laser printers, loudspeakers, headphones, and devices such as flow valves that control machinery, often in response to computer processing of sensor input data. Some devices, such as video display terminals and USB hubs, may provide both input and output. Other examples are devices that enable the transmission and reception of data between computers e.g., modems and network interfaces.

1.5. Software and application

Software refers to computer programs: sequences of instructions for the computers processor that control everything that the computer does. Without software, a computer would be useless. The word software was invented as an opposite to hardware. It distinguishes the programs from a computer's hardware.

There are two types of software:

System Software consists of the programs and related data needed to manage the computer hardware. It provides a uniform environment in which application programs can run. It also provides tools for "housekeeping" and monitoring tasks. There are three basic types of System Software

- **Operating System –** It tells the computer how to use its own components. Examples of Operating systems include Windows, Macintosh OS and Linux. An operating system is essential for any computer/device because it acts as an interpreter between the hardware, application programs and the user.
- **Network Operating System –** Allows computers to communicate and share data across a network while controlling network operations and overseeing the networks security.
- **Utility-** program that makes the computer system eaiser to use or performs highly specialized functions such as managing disks, troubleshooting hardware problems and other tasks that the operating system itself may not be able to do.

Application software consists of the programs that allow us to use the computer to do something useful. Many, though by no means all, computers are general purpose. We use application software to apply them to a particular application task. Such applications range from playing games to word processing to monitoring the conditions of patients in a hospital. Many applications are available for many purposes and for people of all ages. Some major categories of these applications are;

- Word processing software for creating text-based documents such as news letters or brochures
- Spreadsheets for creating numeric-based documents such as budgets or balance sheets.

- Database management software for building and manipulating large sets of data.
- Graphics programs for designing illustrations or manipulating photographs, movies or animation.
- Entertainment software and education software, many of which are interactive multimedia events
- Games, some of which are single player and many which can be played by several people over a network or the internet
- Web design tools and Web browsers, and other internet applications such as e-mail programs

1.5.1. Things to Consider when purchasing Software

- Computability with operating system
- Cost
- User friendliness
- Availability of technical information from the manufacturer

1.6. Data and Information

Data

Data is defined as the collection of facts and details like text, figures, observations, symbols or simply description of things, event or entity gathered with a view to drawing inferences. It is the raw fact, which should be processed to gain information. It is the unprocessed data that contains numbers, statements and characters before it is refined by the researcher

The term data is derived from Latin term ‘datum’ which refers to ‘something given’. The concept of data is connected with scientific research, which is collected by various schools, organizations, government departments, institutions and non-government agencies for a variety of reasons.

Information

Information is described as that form of data which is processed, organized, and specific and structured, which is presented in the given setting. It assigns meaning and improves the

reliability of the data, thus ensuring understandability and reduces uncertainty. When the data is transformed into information, it is free from unnecessary details or immaterial things, which has some value to the researcher.

The term information discovered from the Latin word ‘informare’, which refers to ‘give form to’. Raw data is not at all meaningful and useful as information. It is refined and cleaned through purposeful intelligence to become information. Therefore data is manipulated through tabulation, analysis and similar other operations which enhance the explanation and interpretation.

Key Differences between Data and Information

The points given below are substantial, so far as the difference between data and information is concerned:

1. Raw facts gathered about a condition, event, idea, entity or anything else which is bare and random, is called data. Information refers to facts concerning a particular event or subject, which are refined by processing.
2. Data are simple text and numbers, while information is processed and interpreted data.
3. Data is in an unorganized form, i.e. it is randomly collected facts and figures which are processed to draw conclusions. On the other hand, when the data is organized, it becomes information, which presents data in a better way and gives meaning to it.
4. Data is based on observations and records, which are stored in computers or simply remembered by a person. As against this, information is considered more reliable than data, as a proper analysis is conducted to convert data into information by the researcher or investigator.
5. The data collected by the researcher, may or may not be useful to him, as when the data is gathered, it is not known what they are about or what they represent? Conversely, information is valuable and useful to the researcher because it is presented in the given context and so readily available to the researcher for use.

6. Data is not always specific to the need of the researcher, but information is always specific to his requirements and expectations, because all the irrelevant facts and figures are eliminated, during the transformation of data into information.
7. When it comes to dependency, data does not depend on information. However, information cannot exist without data.

Data Validation

Data validation is a process that ensures the delivery of clean and clear data to the programs, applications and services using it. It checks for the integrity and validity of data that is being inputted to different software and its components. Data validation ensures that the data complies with the requirements and quality benchmarks.

Data validation is also known as input validation.

Value and cost of information

In general, the more accurate information is the more useful and therefore valuable it is. Inaccurate information can be very costly to a school or an organization in terms of both operational errors and incorrect decision making. The level of accuracy required is highly dependent on the type of information and how it is used. For some information, 100% accuracy may be required (e.g. aircraft maintenance data, patients records or banking records), while for other information 80% may be good enough for practical purposes (e.g. employee home phone numbers). You should aim at capturing as accurate data as possible in your school and particularly your class. Do not misinform the public about the figures of your school.

For decision making purposes, often just knowing the accuracy of information is as important as having accurate information. If decision-makers know how accurate (or inaccurate) the information they are working with is, they can incorporate a margin for error into their decisions. Have you realized that in this life, most resources are depletable? The more you use them the less you have. However information is self-generating—the more you use it, the more you have. This is because new or derived information is often created as a result of summarising, analysing or combining different information sources together. The original information remains and the derived information is added to the existing asset base.

Please note that of all the corporate resources (people, finances, assets, information); information is probably the least well managed. If most organizations managed their finances as badly as their information, they would probably be out of business. The amount of duplication, lack of standardization and lack of attention to quality of information would probably not be tolerated for other assets. However one explanation for why information is so poorly managed is not well understood. Laws of information need to be understood in order to manage information effectively, in the same way that it is necessary to understand laws of human behaviour to manage people effectively, or laws of economics to manage finances effectively. As already mentioned, you should endeavour to manage your school information better.

2.0. UNIT 2 – NETWORKING

1.10 Data Communication / Transmission

Data communication is the exchange of data between two devices using some form of wired or wireless transmission medium. It includes the transfer of data, the method of transfer and the preservation of the data during the transfer process. To initiate data communication, the communicating devices should be a part of an existing communication system. For data communication to be effective, the following three fundamental characteristics should be considered:

i) **Delivery:** The system must deliver data to the correct or the intended destination.
ii) **Accuracy:** The system must deliver data accurately (error free).
iii) **Timeliness:** The system must deliver data in a timely manner without enough time lags.

1.10.1 Components of Data Transmission / Communication

There are five basic components in data communication system.

i) **Message:** It is the information that is to be communicated.

ii) **The sender:** is the device that sends the message.

iii) **Receiver:** The receiver is the device that receives the message.

iv) **Medium:** The transmission medium is the physical path that communicates the message from sender to receiver.

v) **Protocol:** Protocol refers to a set of rules that coordinates the exchange of information. Both sender and receiver should follow the same protocol to communicate data. Without the protocol, the sender and receiver cannot communicate with each other; just as a person speaking English cannot be understood by a person who speaks only Hindi.

1.10.2 Data Transmission Mode

Data transmission mode refers to the direction of signal flow between two linked devices. There are three types of transmission modes: *simplex, half-duplex,* and *full-duplex*.

i) ***Simplex*** **-** Simplex transmission is unidirectional. The information flows in one direction across the circuit, with no capability to support response in the other direction. Only one of the communicating devices transmits information, the other can only receive it. Television transmission can be considered as an example of simplex mode of transmission where the satellite only transmits the data to the television, vice versa is not possible.

ii) ***Half-duplex*** **-** In half-duplex mode, each communicating device can receive and transmit information, but not at the same time. When one device is sending, the other can only receive at that point of time. In half-duplex transmission mode, the entire capacity of the transmission medium is taken over by the device, which is transmitting at that moment. For example, two-way radio was the first to use half-duplex where one party spoke and the other party listened.

iii) ***Full-duplex*** **-** Full-duplex transmission mode, also known as the **duplex mode**, allows both communicating devices to transmit and receive data simultaneously. A full-duplex mode can be compared to a two-way road with traffic flowing in both directions. A standard voice telephone call is a full-duplex call because both parties can talk at the same time and be heard.

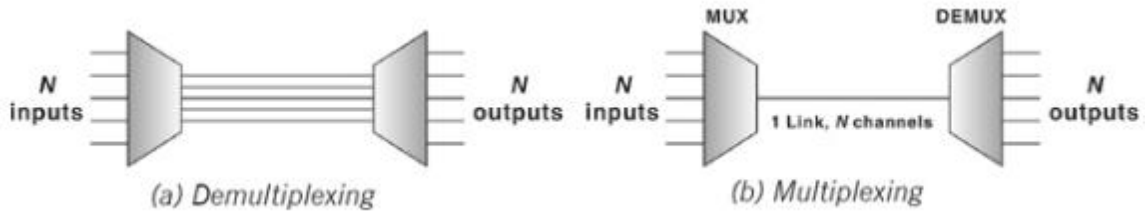
1.10.3 Multiplexing

In a network environment, it is common that the transmission capacity of a medium linking two devices is greater than the transmission needs of the connected devices. Hence, the medium can be shared so that it can be used fully. This can be done by multiplexing. Multiplexing is a technique used for sending several signals simultaneously over a common medium. An analogy of multiplexing can be made with a multilane highway. Just as a multilane highway can carry increased volumes of traffic in multiple lanes at higher speeds and at relatively low incremental cost per lane, higher-capacity circuit can carry multiple conversations in multiple channels at relatively low incremental cost per channel.

Multiplexers

In a multiplexed system, several devices share the capacity of one link called **common medium**. The figure shows the three devices on the left communicating to the devices on the right through the common medium. The communication device that multiplexes (combines) several signals from

the devices on the left for transmission over the common medium is called a **multiplexer** (**MUX**). At the receiving end, a **demultiplexer**(**DEMUX**) completes the communication process by separating multiplexed signals from a transmission line and distributing it to the intended receiver.



Signals are multiplexed using two basic techniques: *Frequency Division Multiplexing* (*FDM*) and *Time Division Multiplexing* (*TDM*).

- ***Frequency Division Multiplexing*** **-** Frequency division multiplexing (FDM) is used when the bandwidth of the transmission medium between the multiplexer and demultiplexer is much greater than the requirements from any one stream being multiplexed.
- ***Time Division Multiplexing*** - Time division multiplexing (TDM) divides the main signal into time-slots, with each time-slot carrying a separate signal. It is used for digital communication and can be applied when the data rate capacity of the transmission medium is greater than the data rate required by the sending and receiving devices.

Switching

On a network, switching means routing traffic by setting up temporary connections between two or more network points. This is done by devices located at different locations on the network, called switches (or exchanges). In a switched network, some switches are directly connected to the communicating devices while others are used for routing or forwarding information. Switching traditionally employs three methods: circuit switching, packet switching, and message switching. Out of these, only circuit and packet switching are in use nowadays, message switching has been phased out in general communications.

Circuit Switching

When a device wants to communicate with another device, circuit switching technique creates a fixed-bandwidth channel, called a **circuit**, between the source and the destination. This circuit is

reserved exclusively for a particular information flow, and no other flow can use it. Other circuits are isolated from each other, and thus their environment is well controlled.

Packet Switching

Circuit switching was designed for voice communication. For example, in voice communication such as a telephonic conversation, once a circuit is established it remains busy for the duration of the conversation session. Packet switching introduces the idea of breaking data into packets, which are discrete units of potentially variable length blocks of data. Apart from data, these packets also contain a header with control information like the destination address, priority of the message, and so on. These packets are passed by the source point to its local Packet Switching Exchange (PSE). When the PSE receives a packet, it inspects the destination address contained in the packet. Each PSE contains a navigation directory specifying the outgoing links to be used for each network address. On receipt of each packet, the PSE examines the packet header information and then either removes the header or forwards the packet to another system. If the channel is not free, then the packet is placed in a queue until the channel becomes free. As each packet is received at each transitional PSE along the route, it is forwarded on the appropriate link mixed with other packets. At the destination PSE, the packet is finally passed to its destination. Note that not all packets travelling between the same two points, even those from a single message, will necessarily follow the same route. Therefore, after reaching their destination, each packet is put into order by a Packet Assembler and Disassembler (PAD).

Message Switching

Message switching technique employs the 'store and forward' mechanism. In this mechanism, a special device (usually a computer system with large memory storage) in the network receives the message from a communicating device and stores it into its memory. Then it finds a free route and sends the stored information to the intended receiver. In this kind of switching, a message is always delivered to one device where it is stored and then rerouted to its destination.

1.11 COMMUNICATION NETWORKS

Computer networking is the process of inter connecting two or more computers so that the users can communicate with each other, share resources and overcome other limitations of stand-alone systems. The network can be established with a variety of combinations of computers such as a

network of only microcomputers, microcomputers and one or more minicomputers, and a set of microcomputers connected to a mainframe computer. The computers in a typical network are autonomous in the sense that they have processing capability independent of the network.

1.11.1 Types of Networks

Computer networks are classified according to their reach and complexity. The three basic types of networks are LANs (local area networks), which connect computers, printers, and other computer equipment for an office, several adjacent offices, an entire building or a campus; MANs (metropolitan area networks), which span a greater distance than LANs and usually have more complicated networking equipment for midrange communications; and WANs (wide area networks), which connect systems in an entire nation, continent, or worldwide. Some people also include a fourth category: PANs (personal area networks), which encompass connections between personal digital devices such as a computer and its keyboard or mouse, or a mobile phone and a hands-free headset

LANs

A computer network within a building, or a campus of adjacent buildings, is called a local area network, or LAN. LANs are usually established by a single organization with offices within a radius of roughly 5–6 kilometers (3–4 miles). LANs are set up by organizations to enhance communications among employees and to share IT resources. Households might set up LANs to share a broadband link to the Internet and to transmit digital music, pictures, and video from one part of a home to another.

In office LANs, one computer is often used as a central repository of programs and files that all connected computers can use; this computer is called a server. Connected computers can store documents on their own disks or on the server, can share hardware such as printers, and can exchange email. When a LAN has a server, the server usually has centralized control of communications among the connected computers and between the computers and the server itself.

MANs

A metropolitan area network (MAN) usually links multiple LANs within a large city or metropolitan region and typically spans a distance of up to 50 kilometers (about 30 miles). For example, the LAN in a chemistry lab might be linked to a research hospital’s LAN and to a

pharmaceutical company's LAN several miles away in the same city to form a MAN. The individual LANs that compose a MAN might belong to the same organization or to several different organizations. The high-speed links between LANs within a MAN typically use fiber optic or wireless broadband connections

WANs

A wide area network (WAN) is a far-reaching system of networks. One WAN is composed of multiple LANs or MANs that are connected across a distance of more than approximately 48 kilometers (or 30 miles). Large WANs might have many constituent LANs and MANs on different continents.The simplest WAN is a dial-up connection to a network provider's services over basic telephone lines. A more complex WAN is a satellite linkup between LANs in two different countries. The most well-known WAN is the Internet. WANs can be public or private. The telephone network and the Internet are examples of public WANs. A private WAN might use either dedicated lines or satellite connections.

PANs

A personal area network (PAN) is a wireless network designed for handheld and portable devices such as smartphones and tablet or laptop computers, and is intended for use by only one or two people. Transmission speed is slow to moderate, and the maximum distance between devices is generally 10 meters (33 feet).

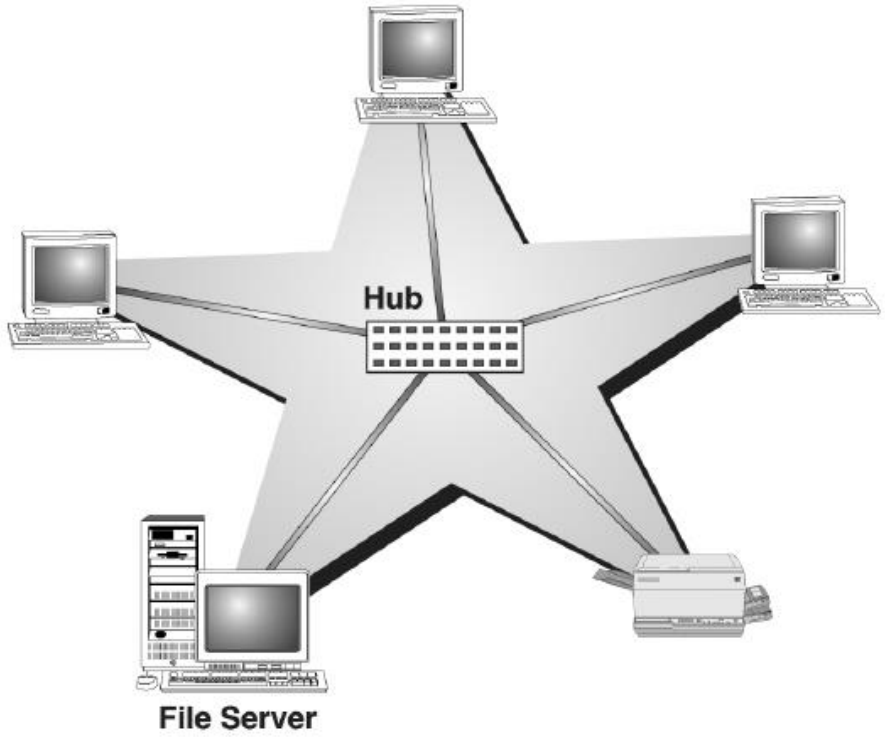
1.12 Network Topology

The design of network requires selection of a particular topology and an architecture for the interconnection of network components. Topology refers to the way the computers are physically connected into the network. There are five basic topologies: Bus, Ring, Star, Tree, and Mesh. There are two main types of processing set ups. Centralized, decentralized and hybrid processing.

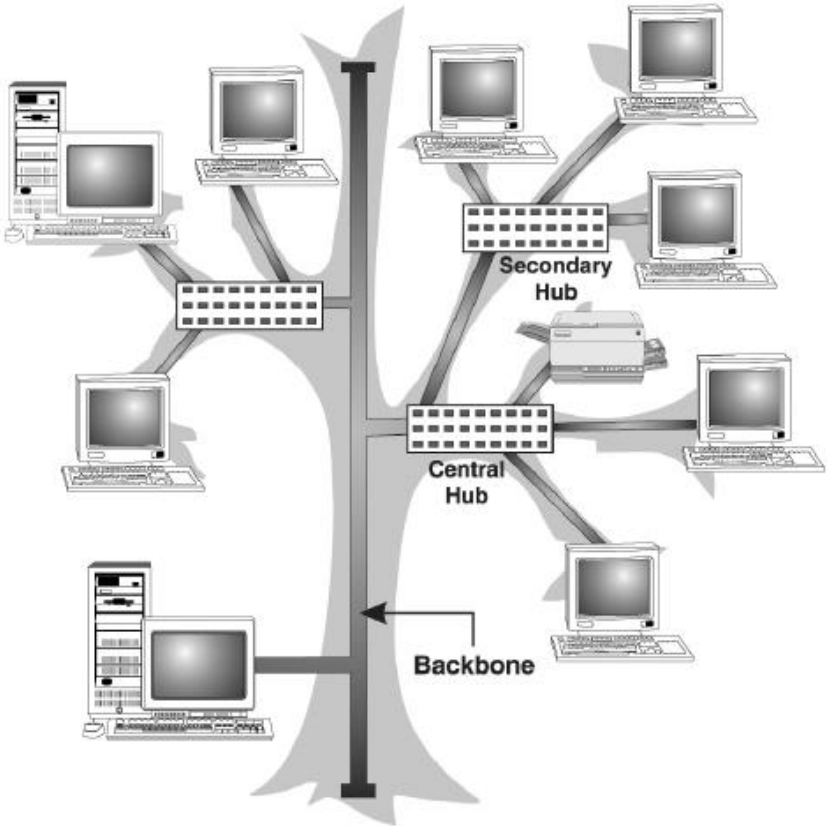
Centralization

- Star Topology - In star topology, devices are not directly linked to each other but they are connected via a centralised network component known as hub or concentrator. The hub acts as a central controller and if a node wants to send data to another node, it boosts up the message and sends the message to the intended node. This topology commonly uses

twisted pair cable; however, coaxial cable or fibre optic cable can also be used.



- Tree Topology - A tree topology combines characteristics of linear bus and star topologies. It consists of groups of star-configured workstations connected to a bus backbone cable. Not every node plugs directly to the central hub. The majority of nodes connect to a secondary hub that, in turn, is connected to the central hub. Each secondary hub in this topology functions as the originating point of a branch to which other nodes connect



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Decentralization

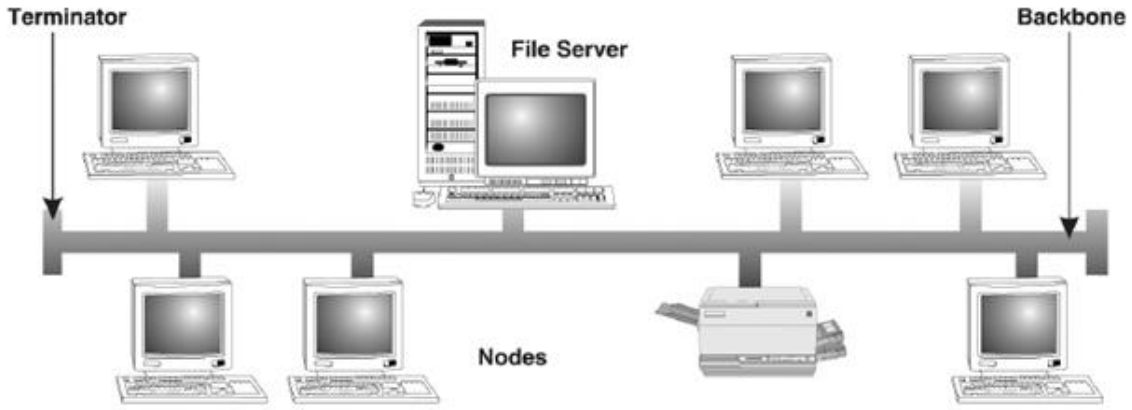
- Mesh Topology - In a mesh topology, every node has a dedicated point-to-point link to every other node. Messages sent on a mesh network can take any of several possible paths from source to destination. A fully connected mesh network has n(n-1)/2 physical links to link n devices. For example, if an organisation has 5 nodes and wants to implement a mesh topology, 5(5-1)/2, that is, 10 links are required. In addition, to accommodate that many links, every device on the network must have n-1 communication (input/output) ports.

Hybrids

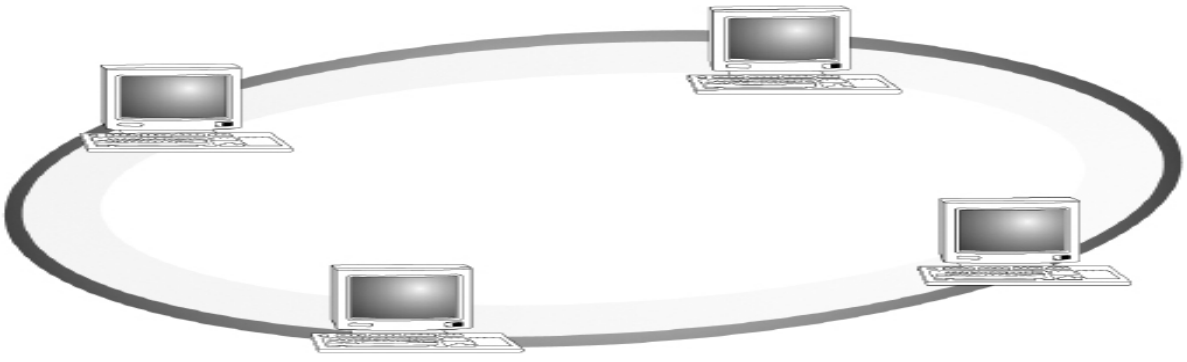
Hybrid networks use a combination of any two or more topologies in such a way
that the resulting network does not have one of the standard forms. Two common examples for Hybrid network are: *star ring network* and *star bus network.*

- Bus Topology - Bus topology uses a common bus or backbone (a single cable) to connect all devices with terminators at both ends. The backbone acts as a shared communication medium and each node (file server, workstations, and peripherals) is attached to it with an interface connector. Whenever a message is to be transmitted on the network, it is passed

back and forth along the cable, past the stations (computers) and between the two terminators, from one end of the network to the other. As the message passes each station, the station checks the message's destination address. If the address in the message matches the station's address, the station receives the message. If the addresses do not match, the bus carries the message to the next station, and so on.



- Ring Topology - In ring topology, computers are placed on a circle of cable without any terminated ends since there are no unconnected ends. Every node has exactly two neighbours for communication purposes. All messages travel through a ring in the same direction (clockwise or counter-clockwise) until it reaches its destination. Each node in the ring incorporates a repeater. When a node receives a signal intended for another device, its repeater regenerates the bits and passes them along the wire.



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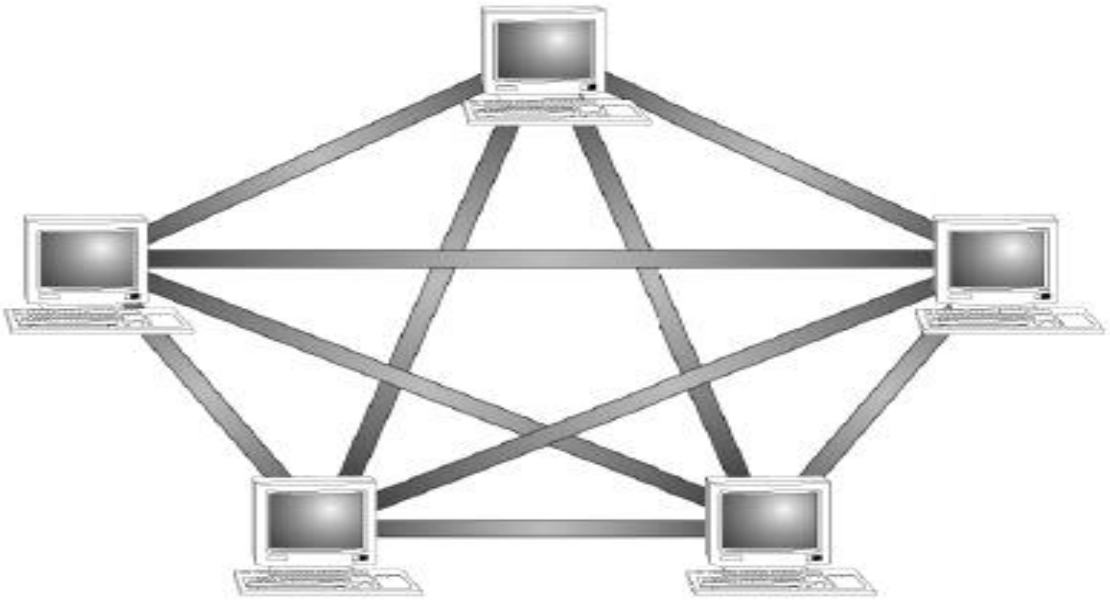


A collection of networks started by and for the US military to enable them to 'survive' a nuclear war. Later adopted by the educational system, and now exploited by the commercial world.

THE Internet

The Internet is a global network of interconnected networks. The unique thing about the Internet is the sheer amount of information which you can access from it. Whatever your interest, you can search for and find information on the most obscure topics. For research the Internet is an incredibly valuable tool. Whether you are gathering information about a rival company on the other side of the world, or are looking for information about your family tree, you will find there is plenty of information available. If you publish material on the Web, it can be accessed by everyone on the Web (providing they can find it.). As a marketing tool, this has interesting possibilities. It is possible for a small company to sell products and services worldwide, without the need for a single sales-person. These days the problem is often not finding information

but rather dealing with the sheer amount of information which is available. Also, you have no idea how accurate or up to date a lot of the information you access really is. More information about search engines: http://www.searchenginewatch.com.

An E-mail

Email allows you to send a message to another person almost instantly, anywhere in the world. It requires both computers to be connected to the Internet. As well as sending a text message, files can be sent as email attachments.

A web application is any computer program that performs a specific function by using a web browser as its client. The application can be as simple as a message board or a contact form on a website or as complex as a word processor or a multi-player mobile gaming app that you download to your phone.

What is a search engine?

A search engine is a web-based tool that enables users to locate information on the World Wide Web. Popular examples of search engines are Google, Yahoo!, and MSN Search. Search engines utilize automated software applications (referred to as robots, bots, or spiders) that travel along the Web, following links from page to page, site to site. The information gathered by the spiders is used to create a searchable index of the Web.

How do search engines work?

Every search engine uses different complex mathematical formulas to generate search results. The results for a specific query are then displayed on the SERP. Search engine algorithms take the key elements of a web page, including the page title, content and keyword density, and come up with a ranking for where to place the results on the pages. Each search engine's algorithm is unique, so a top ranking on Yahoo! does not guarantee a prominent ranking on Google, and vice versa. To make things more complicated, the algorithms used by search engines are not only closely guarded secrets, they are also constantly undergoing modification and revision. This means that the criteria to best optimize a site with must be surmised through observation, as well as trial and error — and not just once, but continuously.

Gimmicks less reputable SEO firms tout as the answer to better site rankings may work at best for only a short period before the search engine's developers become wise to the tactics and change their algorithm. More likely, sites using these tricks will be labeled as spam by the search engines and their rankings will plummet.

Search engines only "see" the text on web pages, and use the underlying HTML structure to determine relevance. Large photos, or dynamic Flash animation mean nothing to search engines, but the actual text on your pages does. It is difficult to build a Flash site that is as friendly to search engines; as a result, Flash sites will tend not to rank as high as sites developed with well coded HTML and CSS (Cascading Style Sheets — a complex mechanism for adding styles to website pages above and beyond regular HTML). If the terms you want to be found by do not appear in the text of your website, it will be very difficult for your website to yield high placement in the SERPs.

Is the web site genuine?

When you purchase from a company such as amazon.com, you know that the company is well respected, is unlikely to go bust tomorrow, and above all will not attempt to 'run off with your money'. But what about when you purchase online from a company you have never heard of? Look for clues. Is there a client list on the site? How long has the company been trading. Are full contact details provided? If in doubt ring the phone numbers provided on the site and try to decide whether the company sounds genuine. Ask for references from other customers. Just because you see trade association logos on a site, do not assume that the use of these logos is genuine. There are organisations now whose sole purpose is to verify that other web sites belong to honest companies.

Social media platforms have revolutionized the way we communicate. They have sparked democratic uprisings in the Middle East and fuelled the recent IPO of a nearly $70 billion company. Although social media's rise has been sudden — Facebook is a little more than eight years old and Twitter just six — it didn't occur in a vacuum. Before Facebook and Twitter, before MySpace and Friendster, there were Usenet newsgroups, AOL chat rooms and online bulletin boards. Yet the roots of social media go even deeper. Decades before the rise of the Internet, we

can see evidence of the drive to shape both private communications and mass media into platforms for social connection. Several of these earlier instances — despite being based on very different technologies — share many of the characteristics of modern social media, such as using "handles" or aliases to represent identity, adopting "in crowd" lingo, and blurring the boundaries between private and public conversations. Perusing the 'Personals'

In The Victorian Internet, author Tom Stand age recounts the tale — apparently gleaned from the 1849 publication Anecdotes of the Telegraph — of a marriage ceremony conducted over the telegraph. With the bride in Boston and the groom in New York, telegraph operators transmitted the couple's vows and the words of the magistrate performing the ceremony over the wires. Thus, the world's first electronic communications network was called into service to connect people in an intimate way.

THE PRE-FACEBOOK ERA

a. Skype

Skype was one of the first social networking mediums that surfaced. Skype is a proprietary Voice over IP service and software application. Skype was first released in 2003 written by Estonian developers Ahti Heinla, Priit Kasesalu, and Jaan Tallinn, who had also originally developed Kazaa. It developed into a platform with over 600 million users and was bought by Microsoft in 2011 for $8.5 billion. The service allows users to communicate with peers by voice using a microphone, video by using a webcam, and instant messaging over the Internet. Phone calls may be placed to recipients on the traditional telephone networks. Calls to other users within the Skype service are free of charge, while calls to landline telephones and mobile phones are charged via a debit-based user account system. Skype has also become popular for its additional features, including file transfer, and videoconferencing. Competitors include SIP and H.323-based services, such as Linphone and Google Voice. Registered users of Skype are identified by a unique Skype Name, and may be listed in the Skype directory. Skype allows these registered users to communicate through both instant messaging and voice chat. Voice chat allows telephone calls between pairs of users and conference calling, and uses a proprietary audio codec. Skype's text chat client allows group chats, emoticons, storing chat history and editing of previous messages. Offline messages were implemented in a beta of version 5, but removed after a few weeks without

notification. The usual features familiar to instant messaging users — user profiles, online status indicators, and so on — are also included.

The Online Number, a.k.a. SkypeIn, service allows Skype users to receive calls on their computers dialed by conventional phone subscribers to a local Skype phone number. A Skype user can have local numbers in any country, with calls to the number charged at the same rate as calls to fixed lines in the country.

Skype supports conference calls up to 25 people at a time. Skype also supports video chat, including screen sharing, between two people for free. Group video calling is available for Premium subscribers between a maximum of 10 people. Skype does not provide the ability to call emergency numbers.

Skype is a hybrid peer-to-peer and client–server system. It makes use of background processing on computers running Skype software. Skype's original proposed name (Sky Peer-to-Peer) reflects this fact. Some network administrators have banned Skype on corporate, government, home, and education networks, citing reasons such as inappropriate usage of resources, excessive bandwidth usage, and security concerns.

b. Mxit

Another method of social networking evolved from a mobile application named Mxit.

Mxit (pronounced "mix it") is a free instant messaging application developed by Mxit Lifestyle (Pty) Ltd. in South Africa that runs on multiple mobile and computing platforms. Along with its own standard protocol, it can connect to Yahoo, ICQ, Google Talk, Facebook, AIM, or Windows Live Messenger contacts as well.

According to a 2011 study by consultancy World Wide Worx, Mxit currently has about 10 million active subscribers, making it the largest mobile social network in Africa. Mxit allows users to send and receive one-on-one text and multimedia messages to and from other users, and in general chat rooms. Mxit also supports gateways to other instant messaging platforms such as MSN Messenger, ICQ and Google Talk. Mxit does not charge for one-on-one messages though mobile operators may charge for data usage. There are also a number of pay-services, including chatrooms. Mxit was first released as a mobile phone IM client. Available on a variety of phones, Mxit requires Java and internet connectivity via CSD, GPRS, 3G or wifi to run. Tailored versions

have also been released for the Apple iPhone (via the iTunes App Store), Android, BlackBerry OS and Windows Mobile devices. Mxit Lifestyle have also released a Windows client, Mxit EVO PC. Mxit features some of the standard functions of a modern instant messaging client, such as a contact list, file transfers and photo sharing via a cell phone's built-in camera. Mxit also supports profile photos, tabbed conversations and message formatting. Contacts are added by entering their cell phone number and, as of recently, a username. Users are able to change their presence and mood via a menu on the client. Further features include support for themes, emoticons, and group chat, called MultiMX.

THE IMPACT OF FACEBOOK ON SOCIAL NETWORKING

After several years of Mxit being the only means of social networking, a phenomenon called Facebook surfaced. Facebook is a social networking service launched in February 2004, owned and operated by Facebook, Inc. As of September 2012, Facebook had millions of active users, more than half of them using Facebook on a mobile device. Users must register before using the site, after which they may create a personal profile, add other users as friends, and exchange messages, including automatic notifications when they update their profile. Additionally, users may join common-interest user groups, organized by workplace, school or college, or other characteristics, and categorize their friends into lists such as "People from Work" or "Close Friends". Facebook was founded by Mark Zuckerberg with his college roommates and fellow Harvard University students Eduardo Saverin, Andrew McCollum, Dustin Moskovitz and Chris Hughes. The website's membership was initially limited by the founders to Harvard students, but was expanded to other colleges in the Boston area, the Ivy League, and Stanford University. It gradually added support for students at various other universities before opening to high school students, and eventually to anyone aged 13 and over. According to a May 2011 Consumer Reports survey, there are 7.5 million children under 13 with accounts and 5 million under 10, violating the site's terms of service. A January 2009 Compete.com study ranked Facebook as the most used social networking service by worldwide monthly active users. Entertainment Weekly included the site on its end-of-the-decade "best-of" list, saying, "How on earth did we stalk our exes, remember our co-workers' birthdays, bug our friends, and play a rousing game of

Scrupulous before Facebook?" Critics, such as Facebook Detox, state that Facebook has turned into a national obsession in the United States, resulting in vast amounts of time lost and encouraging narcissism. Quant cast estimates Facebook has 138.9 million monthly unique U.S. visitors in May 2011. According to Social Media Today, in April 2010 an estimated 41.6% (129.5 million) of the U.S. population had a Facebook account. Nevertheless, Facebook's market growth started to stall in some regions, with the site losing 7 million active users in the United States and Canada in May 2011.

The name of the service stems from the colloquial name for the book given to students at the start of the academic year by some university administrations in the United States to help students get to know each other. Facebook allows any users Computer and Information who declare them to be at least 13 years old to become registered users of the site. Over the past years we've seen a major increase in the number of new Facebook users. Indeed this online social ensnare is an addiction that has caused people to cross the line from social networking to social dysfunction. The site is addictive because it gives people "intermittent reinforcement" – in other words that vague feeling of interest and hope one gets when opening Facebook that someone might have posted something of interest, or liked something you wrote, or the girl you fancied at school has sent a friend request, and you therefore get to see pictures of her, hopefully a tired and impoverished single mother of three who clearly made a mistake in turning you down. Or maybe that's just me. Those over the age of 50 have also not been able to escape from it. In part due to the fact that anyone could join, and in part due to the fact that Facebook really is a good way to reconnect with and stay connected to friends, Facebook has become the dominant social network of the times.

THE INTRODUCTION OF FLICKR, MYSPACE AND GOOGLE

a. Flickr

Flickr (stylized as flickr) is an image hosting and video hosting website, web services suite, and online community that was created by Ludicorp in 2004 and acquired by Yahoo! in 2005. In addition to being a popular website for users to share and embed personal photographs, the service is widely used by bloggers to host images that they embed in blogs and social media. Yahoo reported in June 2011 that Flickr had a total of 51 million registered members and 80

million unique visitors. In August 2011 the site reported that it was hosting more than 6 billion images and this number continues to grow steadily according to reporting sources. Photos and videos can be accessed from Flickr without the need to register an account but an account must be made in order to upload content onto the website. Registering an account also allows users to create a profile page containing photos and videos that the user has uploaded and also grants the ability to add another Flickr user as a contact. For mobile users, Flickr has an official app for iOS, Android, and Windows Phone 7 operating systems.

b. Myspace

Myspace is a social networking service owned by Specific Media LLC and pop music singer and actor Justin Timberlake. Myspace was launched in August 2003 and is headquartered in Beverly Hills, California. In June 2012, Myspace had 25 million unique U.S. visitors. Myspace was founded in 2003 and was acquired by News Corporation in July 2005 for $580 million. From 2005 until early 2008, Myspace was the most visited social networking site in the world, and in June 2006 surpassed Google as the most visited website in the United States. In April 2008, Myspace was overtaken by Facebook in the number of unique worldwide visitors, and was surpassed in the number of unique U.S. visitors in May 2009, though Myspace generated $800 million during the 2008 fiscal year. Since then, the number of Myspace users has declined steadily in spite of several redesigns. Although we removed groups, Myspace is still the perfect destination to stay connected."In early 2006, Myspace introduced Myspace IM, an instant messenger that uses one's Myspace account as a screen name. A Myspace user logs in to the client using the same e-mail associated with his or her Myspace account. Unlike other parts of MySpace, Myspace IM is stand-alone software for Microsoft Windows. Users who use Myspace IM get instant notification of new Myspace messages, friend requests, and comments. Myspace IM was added as a default feature of Myspace by the end of 2009. In early 2007, Myspace introduced MySpaceTV, a service similar to the YouTube video sharing website. Myspace has been showing videos as early as 2006, but it has changed it name to MySpaceTV for a while. In 2009, MySpaceTV reverted back to Myspace Video once again. Myspace Video continues to be not as popular as other video sharing sites such as YouTube, but many sites had partnered with Myspace such as Hulu to promote their media to the Myspace community. There were a variety of environments in which users could

access Myspace content on their mobile phone. American mobile phone provider Helio released a series of mobile phones in early 2006 that could utilize a service known as Myspace Mobile to access and edit one's profile and communicate with, and view the profiles of other members. Additionally, UIEvolution and Myspace developed a mobile version of Myspace for a wider range of carriers, including AT&T, Vodafone and Rogers Wireless. In April 2007, Myspace launched a news service called Myspace News which displays news from RSS feeds that users submit. It also allows users to rank each news story by voting for it. The more votes a story gets, the higher the story moves up the page. Full service classifieds listing offered beginning in August 2006. It has grown by 33 percent in one year since inception. Myspace Classifieds was launched right at the same time the site appeared on the internet. In 2008, Myspace introduced an API with which users could create applications for other users to post on their profiles. The applications are similar to the Facebook applications. In May 2008, Myspace had added some security options regarding interaction with photos and other media. Many applications that are popular on Myspace had spin off versions on Facebook. The Myspace app Mafia Wars has become a Facebook sensation as well. On the other hand, Facebook applications such as Bumper Stickers and Farmville have been used in MySpace and were popular as well. Many application partnerships such as Zygna and Slide has been responsible from creating third party apps for use on both Myspace and Facebook, along with for use in the iTunes app store. Launched April 29, 2008, ksolo.myspace.com is a combination of Myspace and kSolo, which allows users to upload audio recordings of them singing onto their profile page. Users' friends are able to rate the performances. A video feature is not yet available, but Tom Anderson, Myspace co-founder and president, states that it is in the works. Myspace Polls is a feature on Myspace that was brought back in 2008 to enable users to post polls on their profile and share them with other users. MySpace uses an implementation of Telligent Community for its forum system.

In 2009, Myspace also added a new status update feature. If a Myspace user has a Twitter account, the tweet will also update the Myspace status. (Facebook also has a similar feature.) It does, however, require that the two accounts be synched up together.

c. Google +

Google+ (pronounced and sometimes written as Google Plus, sometimes abbreviated as G+) is a multilingual social networking and identity service owned and operated by Google Inc. It was launched on June 28, 2011. As of December 2012, it has a total of 500 million registered users of whom 235 million are active on a monthly basis. Unlike other conventional social networks which are generally accessed through a single website, Google has described Google+ as a "social layer" consisting of not just a single site, but rather an overarching "layer" which covers many of its online properties. In the "Stream," which occupies the middle of three columns on the page, users see updates from those in their Circles? There is an input box which allows users to enter a post. Along with the text entry field there are icons to upload and share photos and videos. The Stream can be filtered to show only posts from specific Circles. "Circles" enable users to organize people into groups for sharing across various Google products and services. Although other users may be able to view a list of people in a user's collection of Circles, they cannot view the names of those Circles. The privacy settings also allow users to hide the users in their Circles as well as who has them in their Circle. Organization is done through a drag-and-drop interface. This system replaces the typical friend's list function used by sites such as

Facebook. After adding a user to a Circle, it isn't until they are notified and have manually drag-and-dropped the other user to one of their circles that they are mutually in each other's Circles. Since September 26, 2011 users can share Circles; it's a one-time share, so if the creator of the Circle updates the members, people's shared copies won't be updated.

Another function of Circles is to control the content of one's Stream. A user may click on a Circle on the left side of the page and the Stream portion of the page (the center) will contain only posts shared by users in that Circle. For the unsegmented Stream (includes content from all of a user's Circles), each Circle has a "slider" configuration item with four positions: nothing, some things, most things, and everything. The nothing position requires the user to select (click on) the Circle name explicitly to see content from users in that Circle. The 'everything setting' as its name implies filters nothing out from people in that Circle. The remaining two positions control the quantity of posts which appear in one's main Stream, but the algorithm controlling what shows has not been disclosed. The default "Circles" are Friends, Family, Acquaintances, and Following,

and can be renamed at any time. The "Following" Circle is described as "People you don't know personally, but whose posts you find interesting."

"Hangouts" are places used to facilitate group video chat (with a maximum of 10 people participating in a single Hangout at any point in time). Only Google+ users can join the "Hangout" if they happen to possess the unique URL of the Hangout. On August 18, 2011 Google added a new addition to "Hangouts" - clicking on the Share button under any YouTube video reveals an icon that suggests watching the video with friends in a Google+ hangout. Hangouts On-Air give users the ability to create instant webcasts over Google+. The broadcasts can also be recorded for later retrieval. This feature, announced on September 20, 2011, is currently limited to some videocast personalities. Hangouts with Extras, currently in a preview state, will allow users to share documents, share a scratchpad and share their screens with other users. "Messenger" (formerly: Huddle) is a feature available to Android, iPhone, and SMS devices for communicating through instant messaging within Circles. Additionally, users can now share photos in Messenger between their Circles. "Instant Upload" is specific to mobile devices; it stores photos or videos in a private album for sharing later. "Sparks" is a front-end to Google Search, enabling users to identify topics they might be interested in sharing with others. "Featured interests" sparks are also available, based on topics others globally are finding interesting. Sparks is accessed as a pull-down from search results and helps to keep users informed of the latest updates on the topics of their interest. "Games" (social gaming) had 16 games when launched on August 11, 2011, which has since been expanded to 44.[citation needed] Unlike Facebook games, Google+ games are located under a games tab, which gives games less visibility, and have notifications that are separate from the rest of a user's notifications. Google+ has a "+1 button" to allow people to recommend sites and parts of sites, similar in use to Facebook's Like button. Google recently announced that since introducing this +1 button, it is now being served more than 5 billion times per day. With the implementation of the +1 button, Google hopes to make search results more "germane". This will not directly affect search rankings.

Similar to other Google applications, Google+ provides integration with other Google applications like Gmail, Calendar, Documents, etc. A "Data Liberation" option provides the ability to download one's content from Google+. "Search in Google+" allows users to search for content within

Google+. Users type what they're looking for into the Google+ search box, and Google will return relevant people and posts, as well as popular content from around the web. Hashtags, which involve the prepending of a number sign to the beginning of a word or CamelCase, are hyperlinked to the most recent or highest-trending search results within Google+ containing the term. This, a feature which gained notoriety as a microblogging practice on Twitter, was implemented as a Google+ feature on October 12, 2011. Auto completion came on January 17, 2012. "New Features for Google+ Mobile" Since the launch of Google+, Google has been adding and improving many features. On September 30, 2011, the company released a list of changes and additions to Google+ mobile which include:

Improved SMS support so that users in the US and India can now post to Google+, receive notifications, and respond to group messages via SMS. They have also made it easier to +mention someone from a mobile device. Now, to +mention another user, one simply writes + [their name] inside a post or comment. In order to comments more easily, users are now able to +1 them directly from their iOS devices. They also introduced this feature to the Android app in December 2011. Users are now able to edit their profile photos from a mobile device.

Google has now made it simple to organize Google+ notifications from a mobile device. This feature allows users to select which notifications are important to them and which are not so that their mobile devices are not inundated with superfluous notifications.

SMARTPHONES

A smartphone is a mobile phone built on a mobile operating system, with more advanced computing capability and connectivity than a feature phone. The first smartphones combined the functions of a personal digital assistant (PDA) with a mobile phone. Later models added the functionality of portable media players, low end compact digital cameras, pocket video cameras, and GPS navigation units to form one multi-use device. Many modern smartphones also include high-resolution touchscreens and web browsers that display standard web pages as well as mobile-optimized sites. High-speed data access is provided by Wi-Fi and mobile broadband. In recent years, the rapid development of mobile app markets and of mobile commerce has been drivers of smartphone adoption. The mobile operating systems (OS) used by modern smartphones include Google's Android, Apple's iOS, Nokia's Symbian, RIM's BlackBerry OS, Samsung's Bada, Microsoft's Windows Phone, Hewlett-Packard's webOS, and embedded Linux

distributions such as Maemo and MeeGo. Such operating systems can be installed on many different phone models, and typically each device can receive multiple OS

Software updates over its lifetime. A few other upcoming operating systems are Mozilla's Firefox OS and Canonical Ltd.'s Ubuntu Phone.

For several years, the demand for smartphones has outpaced the rest of the mobile phone market. According to a 2012 survey, around half of the U.S. mobile consumers own smartphones and could account around 70% of all U.S. mobile devices by 2013. In the 25–34 age range smartphone ownership is reported to be at 62%. NPD Group reports that the share of handset sales that were smartphones in Q3, 2011 reached 59% for consumers 18 and over in the U.S. The European mobile market, as measured by active subscribers of the top 50 networks is 860 million. According to an Olswang report in early 2011, the rate of smartphone adoption is accelerating: as of March 2011 22% of UK consumers had a smartphone, with this percentage rising to 31% amongst 24- to 35-year-olds. In China, smartphones represented more than half (51%) of handset shipments in the second quarter of 2012. In profit share, worldwide smartphones far exceeds the share of non-smartphones. According to a November 2011 research note from Canaccord Genuity, Apple Inc. holds 52% of the total mobile industry's operating profits, while only holding 4.2% of the global handset market. HTC and RIM similarly only make smartphones and their worldwide profit shares are at 9% and 7%, respectively. Samsung, in second place after Apple at 29%, makes both smartphones and feature phones but doesn't report a breakdown separating their profits between the two kinds of devices. Up to the end of November 2011, camera-equipped smartphones took 27% of photos, a significant increase from 17% in 2010. For many people, smartphones have replaced Point-and-shoot cameras. A study conducted in September 2012 concluded that 4 of 5 smartphone owners (85.9M U.S. users) are actually using the device to shop.

WHATSAPP

WhatsApp Messenger, an application which allows unlimited free text-messaging between users, is gradually killing mobile operators just like what Skype did to international calling on landlines. Thousands of Ghanaians, frustrated by poor quality of service rendered by the country’s six cellular networks, are making WhatsApp Messenger their medium of choice as they look for more personal contact with friends and relatives separated by thousands of miles.

To the annoyance of some cell phone providers in Ghana and many parts of the world, WhatsApp has become a kind of quasi replacement for the old fee-based mobile SMS, which is regarded by many analysts as one of the biggest cash cows of the telecoms industry. Reuters reported that in Spain for instance, the three biggest mobile operators are teaming up to launch a service they hope will help them better compete with WhatsApp, which is luring customers with the promise of free messages. Mobile operators such as Vodafone, Orange and Joyn had planned to offer free messaging, enhanced call features and in some cases free calls. When reached for comments, the Corporate Relations Manager of Airtel Ghana, Kwame Poku Gyan told Economic Tribune: "We do not have any evidence to show that the use of WhatsApp has affected our revenue inflows or our operations for that matter negatively. "He continued: "Since WhatsApp is a data application, it offers us an opportunity to drive revenue via data." Last month, WhatsApp quietly announced that two billion messages were sent by its users in a single day. Since launching in July 2009, WhatsApp has slowly grown by word-of-mouth and the same simple viral mechanism that fuelled Skype: both sender and receiver must own the app. The ability to send messages between any kinds of smartphone gives WhatsApp an advantage over BlackBerry Messenger and Apple's iMessage, which are restricted to owners of similar devices. Because WhatsApp Messenger uses the same internet data plan that one uses for email and web browsing, there is no cost to message and stay in touch friends. In addition to basic messaging WhatsApp users can create groups, send each other unlimited images, video and audio media messages. The co-founder of WhatsApp Jan Koum told the media recently that: "We always concentrated on SMS as the user experience. This allowed us to separate ourselves from companies like Skype, Yahoo or MSN because they always had a

Desktop-first approach."

LINKEDIN

LinkedIn Corporation is a social networking website for people in professional occupations. Founded in December 2002 and launched on May 5, 2003, it is mainly used for professional networking. As of January 2013, LinkedIn reports more than 200 million registered users in more than 200 countries and territories. The site is available in English, French, German, Italian, Portuguese, Spanish, Dutch, Swedish, Romanian, Russian, Turkish, Japanese, Czech, Polish, Korean, Indonesian, and Malay. Quantcast reports LinkedIn has 21.4 million monthly unique U.S.

visitors and 47.6 million globally. In June 2011, LinkedIn had 33.9 million unique visitors, up to 63 percent from a year earlier and surpassing MySpace. One purpose of the site is to allow registered users to maintain a list of contact details of people with whom they have some level of relationship, called Connections. Users can invite anyone (whether a site user or not) to become a connection. However, if the invitee selects "I don't know" or "Spam", this counts against the inviter. If the inviter gets too many of such responses, the account may be restricted or closed. This list of connections can then be used in a number of ways: A contact network is built up consisting of their direct connections, the connections of each of their connections (termed second-degree connections) and also the connections of second-degree connections (termed third-degree connections). This can be used to gain an introduction to someone a person wishes to know through a mutual contact. Users can upload their resume or design their own profile in order to showcase work and community experiences. It can then be used to find jobs, people and business opportunities recommended by someone in one's contact network. Employers can list jobs and search for potential candidates. Job seekers can review the profile of hiring managers and discover which of their existing contacts can introduce them. Users can post their own photos and view photos of others to aid in identification. Users can now follow different companies and can get notification about the new joining and offers available. Users can save (i.e. bookmark) jobs that they would like to apply for.

1.13 Unit Summary

This unit discussed networking and data transmission among others. Illustrations, diagrams and relevant figures have been employed for easy understanding of the domain under discussion. Unit activities below have deliberately been made highly interactive and student centred. We appeal to all our students to go through these video lectures in order to attain optimal skills acquisition.

1.14 Unit Activity

1. Follow this link and do the practical activities https://www.youtube.com/watch?v=aW3qCcH6Dao
2. Chapter4 page93-94, Review Exercises," An Overview of Networking" by Glen E. Clarke and Ed Tetz

3.0. UNIT 3 – COMPUTER APPLICATIONS

3.1. WORD PROCESSING

Commonly used Vocabulary in word processing

- Draft view
- Full Screen Reading view
- insertion point
- landscape orientation
- Outline view
- portrait orientation
- Print Layout view
- Quick Access Toolbar
- Ribbon
- status bar
- Toolbar
- view buttons
- Web Layout view
- word processing

- word wrap
- Zoom

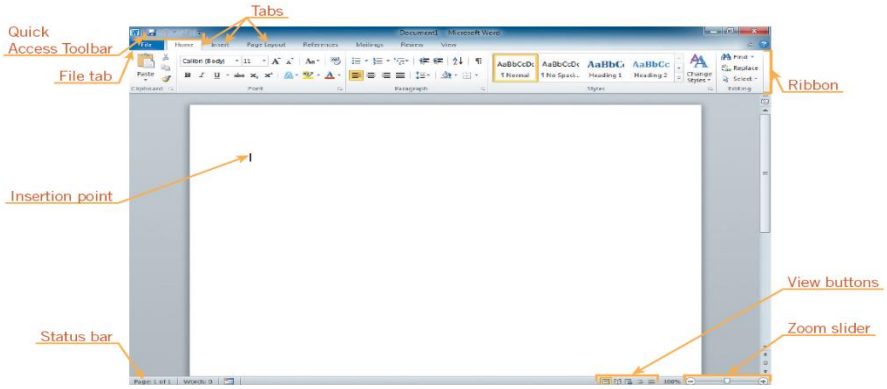
Word Processing Explained

- Word processing is the use of computer software to enter and edit text.
- You can easily create and edit documents, such as:
    - Letters
    - Reports
    - Newsletters with pictures and graphics

Starting Word

- Click the **Start** button on the taskbar.
- Click **All Programs** on the Start menu.
- Click the Microsoft Office folder.
- Click Microsoft Office Word 2010

Opening Screen in Word



Word Programme Window

ELEMENT	FUNCTION
Ribbon	Contains commands for working with the document, organized by tabs.
Quick Access Toolbar	Contains buttons (icons) for common commands.
Insertion point	Shows where text will appear when you begin typing.
Status bar	Displays information about the current document and process.
View buttons	Allows you to change views quickly.
Zoom slider	Allows you to increase or decrease the size of the document on-screen.

Document Views

VIEW	DESCRIPTION
Print Layout	Shows how a document will look when it is printed
Full Screen Reading	Shows text on the screen in a format that is easy to read and hides the Ribbon
Web Layout	Simulates the way a document will look when it is viewed as a Web page; text and graphics appear the way they would in a Web browser
Outline	Displays headings and text in outline form so you can see the structure of your document and reorganize easily
Draft	Displays only the text of a document without showing the arrangement of the text; if your document includes any pictures, they would not appear

Inserting Text and Understanding Word Wrap

- To enter text in a document, begin typing.
- When you reach the right margin, the text continues on the next line. This feature is called **word wrap**.
- When you press the Enter key, a blank line is inserted automatically, and you start a new paragraph.

Navigating a Word Document

- To enter or edit text, use the mouse or keyboard to reposition the insertion point.
    - **Mouse**: Move the mouse until the insertion point is where you want it to appear.
    - **Keyboard**: There are many options of keys to use, including arrows, Page Down, Page Up and shortcuts.

Keyboard shortcuts for moving the insertion point

PRESS	TO MOVE THE INSERTION POINT
Right arrow	Right one character
Left arrow	Left one character
Down arrow	To the next line
Up arrow	To the previous line
End	To the end of the line
Home	To the beginning of the line
Page Down	To the next page
Page Up	To the previous page
Ctrl+right arrow	To the beginning of the next word
Ctrl+left arrow	To the beginning of the previous word
Ctrl+End	To the end of the document
Ctrl+Home	To the beginning of the document

Using Backspace and Delete

- There are two ways to delete characters:
    - **Backspace key**: Deletes the character to the left of the insertion point
    - **Delete key**: Deletes the character to the right of the insertion point.

Saving a Document

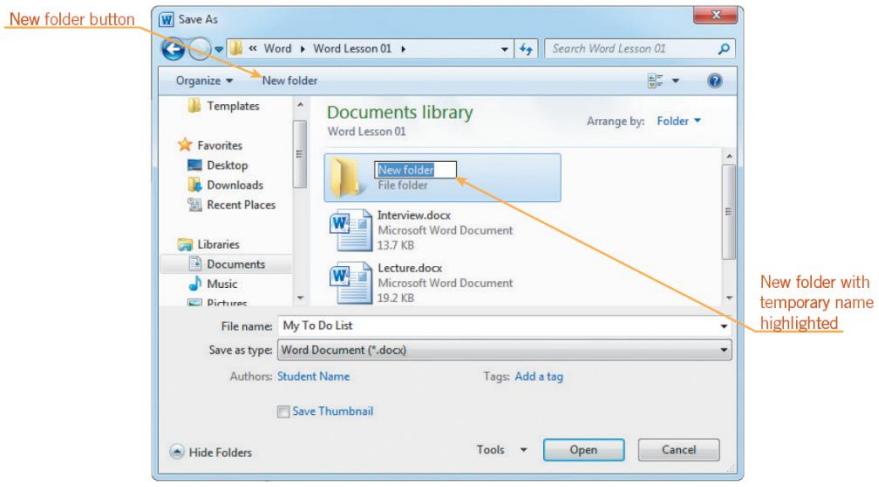
- To save a document for the first time:

- Click the Save button on the Quick Access Toolbar.
- Click the File tab, and then on the navigation bar, click the Save or Save As command.

- **Save command**: Copies over previous version
- **Save As command**: Used to save a document under a different name or location.

Creating a Folder

- Folders help you organize files.
- Create a new folder in the Save As dialog box.



Locating and Opening an Existing Document

- To open documents click the File tab, then on the navigation bar, click
  - **Open** to open an existing document.
  - **Recent** to open a recent document.
  - **New** to open a new, blank document.

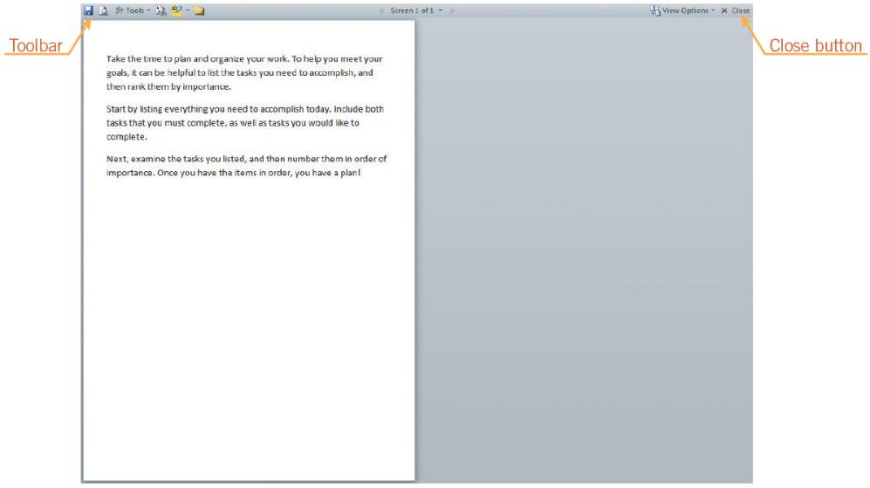
Zooming a Document

- You can use the Zoom feature to magnify and reduce your document on screen.
- A zoom percentage of 100% shows the document at its normal size.

- The easiest way to change the zoom percentage is to drag the Zoom slider at the bottom-right of the screen.

Switching to Full Screen Reading View

- Full Screen Reading View removes the Ribbon and the status bar from the screen.
    - The Ribbon is replaced by a small toolbar
- To use this view, click the View tab on the Ribbon, then in the Document Views group, click the Full Screen Reading button.
- Document in Full Screen Reading view



Selecting a Page Orientation

- Documents printed in **portrait orientation** are longer than they are wide.
- Documents printed in **landscape orientation** are wider than they are long
- By default, Word is set to print pages in portrait orientation.

Previewing and Printing a Document

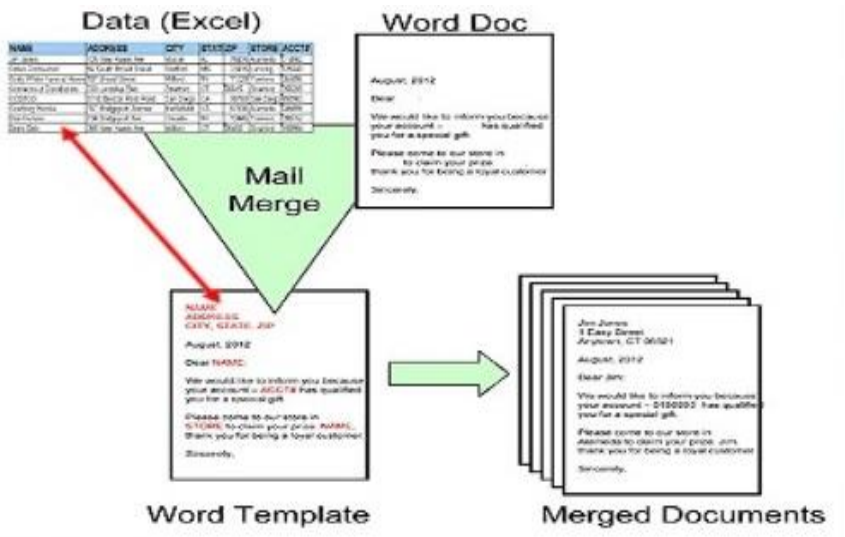
- Use the Print tab in Back stage view to preview a document before printing.
- Use the Print tab to change print settings.
- To print a document, click the Print button in the center pane on the Print tab in Back stage view.

Exiting Word

- To close the document without exiting Word, click the File tab, and then on the navigation bar, click the Close command.
- To exit Word, click the Close button in the upper-right corner of the document window.

Mail Merge

Mail merge is used to create a set of documents for many people. Each document has the same information, but the content is personalized.



STEP 1: Create Excel file

- One row for each student
- One column for each bit of data
- Label each column

For example, in the sample Excel workbook,

- Add data for another student.
- Add data about the homework completion rate for all ECE students.

STEP 2: Create Word document

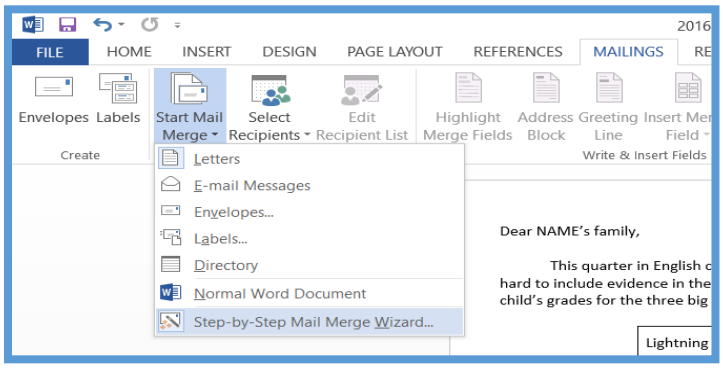
- Write and format letter as usual
- Put a placeholder word where you want the personalized information to go (ex: “NAME”, “SCORE”)

For example, in the sample Word document,

- Add a sentence below the table that will include personalized information about each student’s homework completion.

STEP 3: Mail merge

- Mailings > Start Mail Merge > Step-by-Step Mail Merge Wizard



Summary of mail merge steps (in Word)

1) Select document type: Letters
2) Select starting document: Use the current document
3) Select recipients: Use an existing list
    a) Browse: select Excel file
    b) May want to sort or filter
4) Write your letter: insert merge fields
5) Preview your letter
6) Complete the merge: Edit individual letters

3.2. SPREAD SHEET-EXCEL

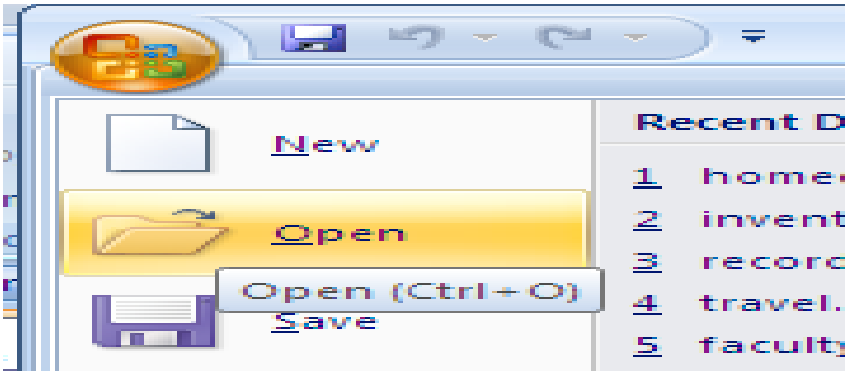
Key Terms Used in Spread Sheets

- **A spreadsheet (worksheet):** A spreadsheet (worksheet): a piece of paper in which data can be manipulated by the computer stored in rows and columns. A workbook (Excel file) has multiple sheets
- Each sheet may have multiple pages.
- Record and organize information in a row (record)-and-column (field) format.
- Make calculations and simple statistical analyses across a row or a column.
- Create charts based on the data displayed in a spreadsheet.

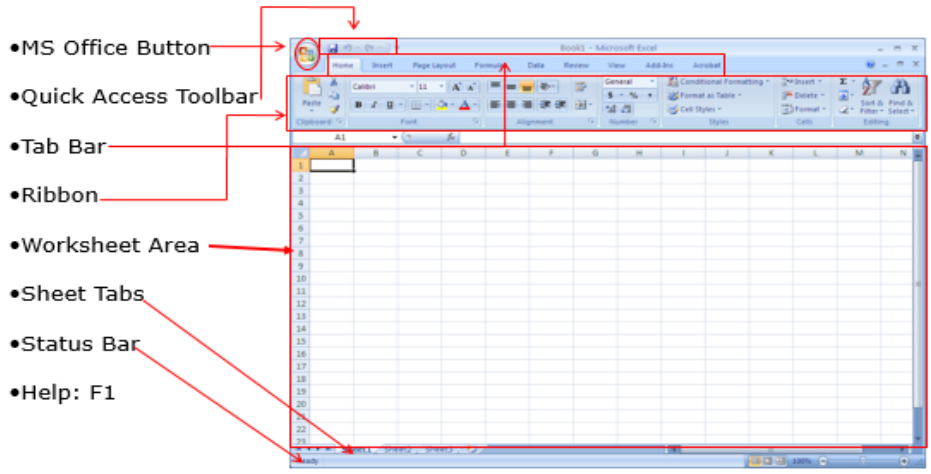
- **A workbook refers to an Excel document**. You will sometimes hear it called a "spreadsheet."
- In Default, each workbook has 3 "sheets" associated with it. You can rename these sheets to something more fitting to your purpose (e.g. Term 1, Term 2, Term3…)
- You can add sheets if you'd like to.
- Your workbook is the ENTIRE file and the file name should reflect the function the file serves.
- Termly_Results.xlsx
- Inventory.xlsx

Excel Workbook Window

- Open the MS-Excel
- Start-All Programs-Microsoft Office – Microsoft Office Excel 2007 for example
- This creates a new workbook.
- Open an Excel workbook – double-click on the practice file named "homeexpense.xlsx"
- Open an Excel workbook in Excel

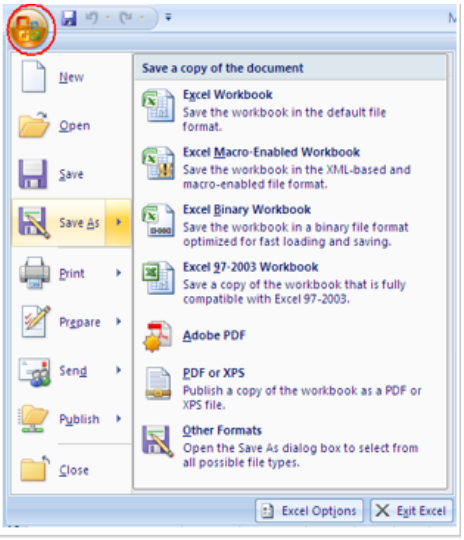
- Click on Office Button and select Open.
- Locate the file via file folders.
- Double-click on the file.
- 

Excel Window

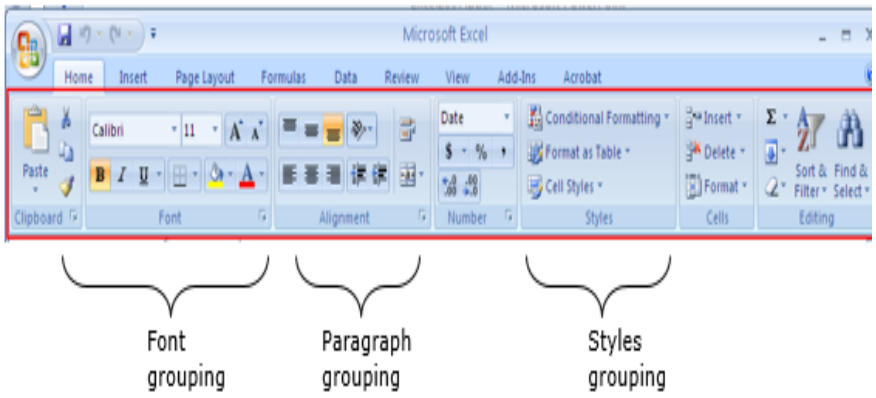


Microsoft Office Button

- Performs many of the functions that were located in the **File** menu of older (or Excel 2010) versions.
  - New, Open, Save, Save As, Print, Send, Close, etc.
- File Format
  - Save As
    - Excel Workbook, .xlsx
      - Smaller size with new Office 2007 features.
    - Excel 97 – 2003 Workbook
    - Other Formats: web page, .csv



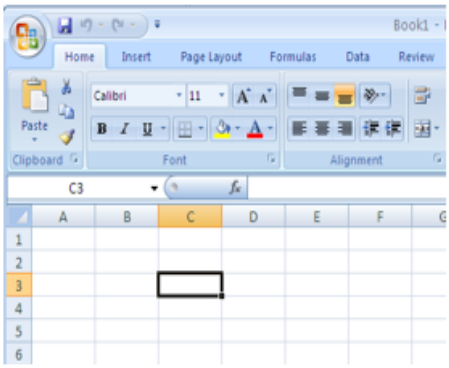
Ribbon



- Each "tab" (such as "**Home**", "Insert"...) will open a ribbon with several command items each in similar groupings.
- Home: has the common formatting tools, clipboard, fonts, paragraphs, number, Styles, Cells, and Editing.

Workbook

- The workbook is comprised of:
  - Rows (labeled numerically)
  - Columns (labeled alphabetically)
  - Cells



- A cell is labeled with both a numerical and alphabetical value.
  - Naming convention:
    C3 is active as
    Indicated by the 
- Tab Key: navigate cells.

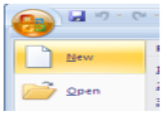
Creating of a Workbook

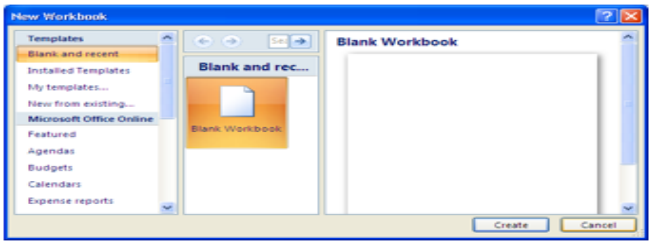
- Create a new workbook.
- Save it with a file name.
- Enter data: column headings, row headings, and data.
- Format data: column headings, row headings, and data.
- Save the file.

New Workbook

You have a blank workbook when you open Excel.

- Or click on **Office Button** and select **New**.
- Click on **Create** button.

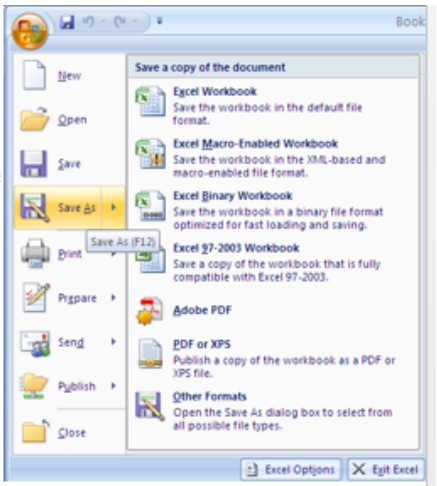




Save a Workbook

Click on **Office Button** and select **Save** or **Save As**.

- **Save**: save the workbook as .xlsx. This format is Excel 2007 compatible. It cannot be opened in previous version of Excel unless you have an Office 2007 converter installed.
- **Save As**:
  - Excel Workbook - .xlsx
  - Excel 97 – 2003 Workbook - .xls
  - Other Formats - .CSV and others.



Example of Creating a Workbook

- You should always enter headings to columns and rows to identify what the numbers represent.
- Practice: make a workbook of ECE course results.

Name	Pre-Mathematics	Pre-Science	Pre-Religious Education	Pre-English	Total Marks
Kasonde Mwape					
Jane Bwalya					
Catherine Phiri					
Joseph Banda					
Wendy Mulenga					

Data Entry

- To move HORIZONTALLY across cells, hit TAB.
- To move VERTICALLY, hit ENTER.
- Practice:
- Enter column heading and row heading.

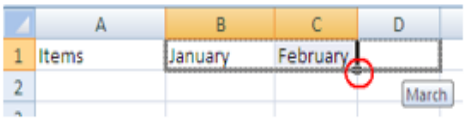
- Enter data.

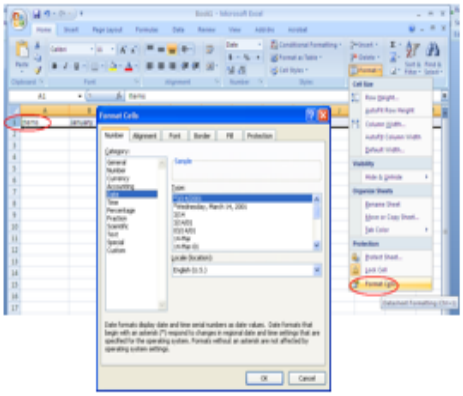
Autofill – Fill in Months

AutoFill Enter the months of the year, the days of the week, multiples of 2 or 3, or other data in a series. You type one or more entries, and then extend the series.

- **Fill in the months of the year**
  - Type in the first 2 months.
  - Change the cell type to Date type.
    - Select the row of the months by clicking on the row tab such as "1". Go to **Format** and select **Format Cells**... (bottom).
    - Select **Date** and click on **OK.**

•Highlight the cells of the two months and drag the bottom right corner to expand the cells with the rest of the months.





Types of Data

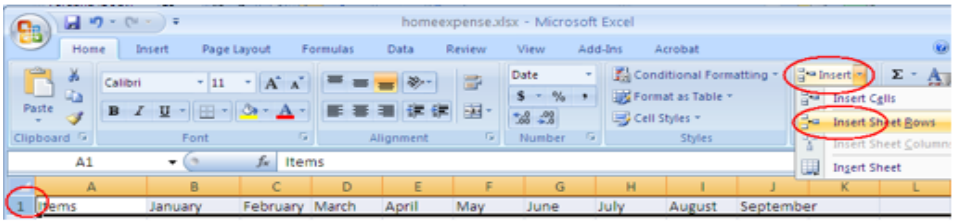
- You can enter numerical or text data in a cell.
- Enter numbers in cells. You may need to change the cell format to numbers.
  - Highlight number cells in the practice file, go to **Forma**t and select **Cell Format**. Select Number and click on OK.
- If you see ######, you need to expand your column so the data fits.
  - Double click on the line between the two column headings to auto-fit.
  - Drag the border between two columns.
- Change numbers to Currency with $ sign.
  - Highlight all number cells and click on $ icon.

- To enter fractions, leave a space between the whole number and the fraction. For example, 1 1/8.
- To enter a fraction only, enter a zero first. For example, 0 1/4. If you enter 1/4 without the zero, Excel will interpret the number as a date, January 4.

Insert a Row/Column

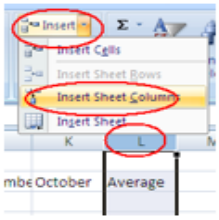
Insert a row:

- Select the row you would like to insert above
  - Clicking on the row number tab.
- In **Home** tab, go to **Insert** and select **Insert Sheet Rows**.

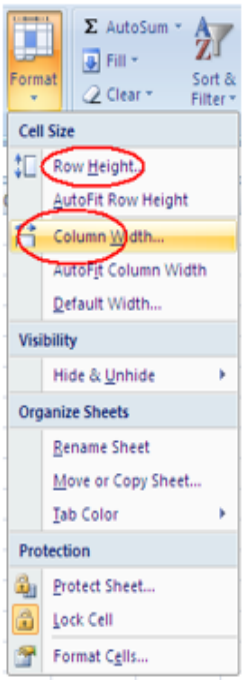


Insert a column:

- Select the column you would like to insert next to it
  - Clicking on the column letter tab such as L.
- In **Home** tab, go to **Insert** and select **Insert Sheet Column**.



Change Column Width or Row Height



Column Width

- Drag the border between two columns to adjust a column width.
- Adjust column width for a group of columns
  - Highlight the columns you want to adjust their width.
  - In **Home** tab, go to **Format** and select **Column Width**...
  - Enter a number of characters for column width. Click on OK.

Row Height

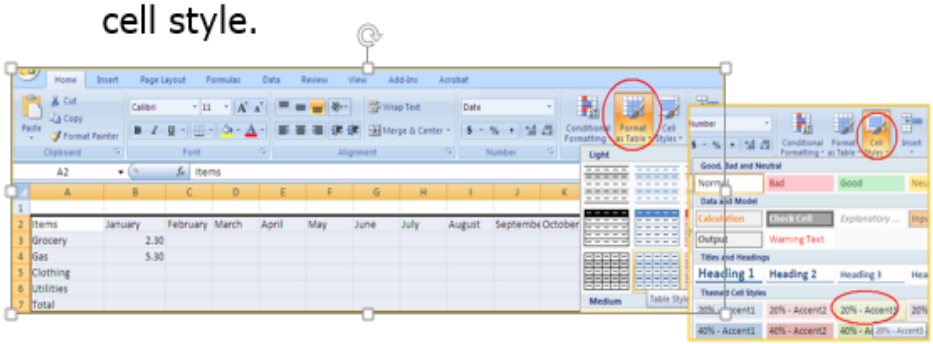
- Drag the border between two rows to adjust a row width.
- Adjust row width for a group of rows
  - Highlight the rows you would like to change their height.
  - In **Home** tab, go to **Format** and select **Row Height**.
  - Enter a number of the row height and click on **OK**.
    - One point=.035 cm

Format a Worksheet

- Change the font size, color, and the background of a cell or group of cells.
- Select the cells you'd like to change. Then select a formatting tool.
- To show cell borders, highlight the cells and select a border.

Table Styles and Cell Styles

- Table Styles
  - Highlight the Excel table (all cells), go to **Format as Table** icon. Select a table style.
- Cell Styles
  - Highlight cells, go to **Cell Styles**, select a cell style.



Excel - Header and Footer

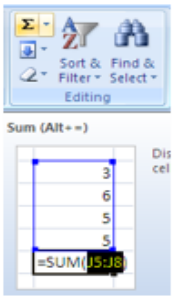
- In **Insert** tab, click on **Header & Footer** icon.

- Type in a header in the Header box.

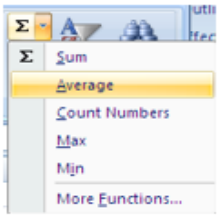
- Click on **Go to Footer** icon. Click on **File Name** icon to insert the file name in the Footer box.
- To go back to the Normal view of the spreadsheet, click on **View** tab and select **Normal**.

Basic Calculating Functions – Total, Average

Excel has mathematical functions for you to use.

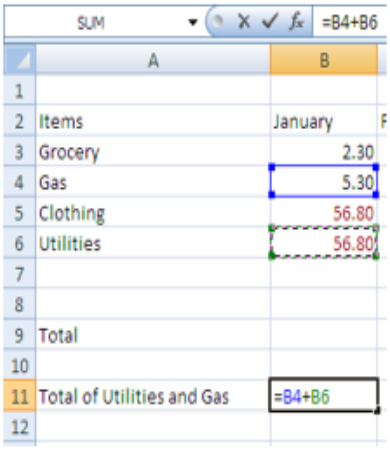


- **Total**
  - Click on the Cell that displays a total.
  - In **Home** tab, click on the sum function icon.
  - Highlight the cells included in the total and hit Enter key.
- **Average**
  - Click on the cell that displays an average.
  - In **Home** tab, click on the little down arrow in the sum function icon and select **Average**.
  - Highlight the cells included in the average and hit Enter key.



Creating Basic Formula

You conduct a mathematical calculation in Excel by typing a simple formula into a cell. An Excel formula always begins with an equal sign (=).



Math **operators**

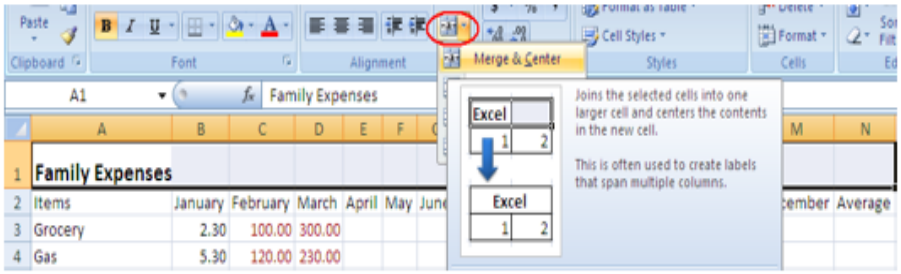
- Addition: +
- Subtraction:-
- Multiplication:*
- Division:/

Example: Gas + Utilities

- Click on the cell that displays the expense of Gas and Utilities.
- Enter =.
- Click on the Gas cell for January.
- Enter +.
- Click on the Utilities cell for January
- Hit Enter key.

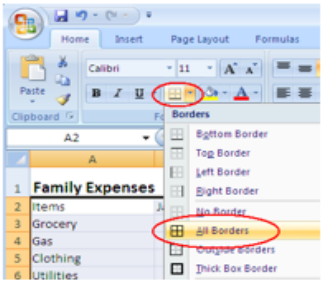
Merge and Center

- You may want to add a title for an Excel table.
- Insert a row above the column heading row.
- Type the title in the first cell of the title row.
- Highlight the cells you would like to display the table title.
- Click on **Merge and Center** icon.



Print an Excel Sheet

- As default, there are no borders around cells.
- For printing, there are two ways to print boarders around cells.
  - Gridlines: This way adds gridlines around the cells in the table.
    - Click on **Page Layout** tab.
    - Click on **Page Setup** group.
    - Click on **Sheet** tab.
    - Check **Gridlines**. Click on **OK**.
  - Add borders: This way adds borders around the cells you selected.
    - Highlight the cells you want to have borders.
    - In **Home** tab, click on the down arrow next to the border icon and select a choice of borders.
    - You have flexibility of selecting a variety of borders.



3.3. Microsoft PowerPoint Presentation

Follow a complete and comprehensive lecture on powerpoint presentation on this youtube link (https://www.youtube.com/watch?v=VUqIDs5MZxM)

3.4. Database

First, we'd better get clear with the most important term here: "database." Because it's one of these words that's often casually misused, even in conversation between programmers. Someone will say their database is Oracle, or it's SQL Server, or it is MySQL, or DB2, or PostgreSQL, or MongoDB, and so on. But let's avoid some confusion. These aren't databases. They are database management systems, often shortened to DBMS. And there's a big difference between your database management system and your database. The database is your data and your rules about that data. The database management system, the DBMS, is the program or the set of programs that surround and manage it, to make sure your rules are applied.

A Database is a shared collection of logically related data and its description. The database is a single, possibly large repository of data that can be used simultaneously by many departments and users. Instead of disconnected files with redundant data, all data items are integrated with a minimum amount of duplication. The database is no longer owned by one department but is a shared corporate resource. The database holds not only the organization's operational data, but also a description of this data. For this reason, a database is also defined as a ***self-describing collection of integrated records***.

A database allows you to store information related to a specific topic in an organized way. It's great when you need to store a searchable collection of data/information in a computer system. Databases are used in a lot of systems today. Almost every web shop has a database with their products; almost every site with a lot of users uses a database to store user information. A database is constructed of one or more, usually more, **tables**. And it's a table that is the most basic, most fundamental building block of a database. Because all your data goes into a table. And each table describes a formalized, repeating list of data. Visually, it's often shown like a

spreadsheet. These tables consist of **columns** and **rows**. Rows, going from left to right. Columns, like the columns holding up a building, running up and down.

If you have multiple tables in a database, each different table is containing repeating information, repeating rows, but always about the same kind of thing. So you might have one table with all your customer information in it, another table with all your order information, another table with all your employees, and another with all your locations.

From the definition of a database we should explain "logically related." When we analyze the information needs of an organization, we attempt to identify entities, attributes, and relationships. An **entity** is a distinct object (a person, place, thing, concept, or event of the real world) in the organization that is to be represented in the database. An **attribute** is a property that describes some aspect of the object that we wish to record, and a **relationship** is an association between entities.

Database Management System (DBMS)

The DBMS is the software that interacts with the users' application programs and the database. Typically, a DBMS provides the following facilities:

- It allows users to define the database, usually through a **Data Definition Language (DDL).** The DDL allows users to specify the data types and structures and the constraints on the data to be stored in the database.
- It allows users to insert, update, delete, and retrieve data from the database, usually through a **Data Manipulation Language (DML).** Having a central repository for all data and data descriptions allows the DML to provide a general inquiry facility to this data, called a query language. The provision of a query language alleviates the problems with file-based systems where the user has to work with a fixed set of queries or there is a proliferation of programs, causing major software management problems. The most common query language is the Structured Query Language (SQL, pronounced "S-Q-L", or sometimes "See-Quel"), which is now both the formal and de facto standard language for relational DBMSs.
- It provides controlled access to the database. For example, it may provide:

- A security system, which prevents unauthorized users accessing the database;
- An integrity system, which maintains the consistency of stored data;
- A concurrency control system, which allows shared access of the database;
- A recovery control system, which restores the database to a previous consistent state following a hardware or software failure;
- A user-accessible catalog, which contains descriptions of the data in the database.

Application Programmes

A computer program that interacts with the database by issuing an appropriate request (typically an SQL statement) to the DBMS.

Users interact with the database through a number of **application programs** that are used to create and maintain the database and to generate information. These programs can be conventional batch applications or, more typically nowadays, online applications. The application programs may be written in a programming language or in higher-level fourth-generation language.

Database management systems fall into broad categories, different types of DBMS. And the most common, by far, is what's called a "relational" database management system, or RDBMS. Things like Oracle, SQL Server, DB2, MySQL, they all fall into this category. Other types of database management system include hierarchical database systems, network database systems, object-oriented database systems, and, more recently, several that fall in the category of NoSQL database systems.

Components of DBMS

DBMS have several components, each performing very significant tasks in the database management system environment. Below is a list of components within the database and its environment.

i. Hardware – DBMS and the applications require hardware to run. Consists of a set of physical electronic devices such as computers, I/O devices, storage devices, etc., this provides the interface between computers and the real world systems.

ii. Software - The software component comprises the DBMS software itself and the application programs, together with the operating system, including network software if the DBMS is being used over a network. This set of programs used to access data, control and manage the overall database

iii. Data - DBMS exists to collect, store, process and access data, the most important component. The database contains both the actual or operational data and the metadata, "The data about data." The structure of the database is called the **schema.**

iv. Procedures - Procedures refer to the instructions and rules that govern the design and use of the database. The users of the system and the staff who manage the database require documented procedures on how to use or run the system. These may consist of instructions on how to Log on to the DBMS, use a particular DBMS facility or application program, Start and stop the DBMS, Make backup copies of the database etc.

v. People – These are the people involved of the system.

Advantages of Database

1. **Control of data redundancy** - traditional file-based systems waste space by storing the same information in more than one file. The database approach attempts to eliminate the redundancy by integrating the files so that multiple copies of the same data are not stored.
2. Data consistency by eliminating or controlling redundancy, we reduce the risk of inconsistencies occurring. If a data item is stored only once in the database, any update to its value has to be performed only once and the new value is available immediately to all users. If a data item is stored more than once and the system is aware of this, the system can ensure that all copies of the item are kept consistent.

3. **Sharing of data -** Typically, files are owned by the people or departments that use them. On the other hand, the database belongs to the entire organization and can be shared by all authorized users. In this way, more users share more of the data.
4. **Improved data integrity** - Database integrity refers to the validity and consistency of stored data. Integrity is usually expressed in terms of constraints, which are consistency rules that the database is not permitted to violate. Constraints may apply to data items within a single record or to relationships between records.
5. **Improved security** - Database security is the protection of the database from unauthorized users. Without suitable security measures, integration makes the data more vulnerable than file-based systems. However, integration allows the DBA to define database security, and the DBMS to enforce it. This security may take the form of user names and passwords to identify people authorized to use the database. The access that an authorized user is allowed on the data may be restricted by the operation type (retrieval, insert, update, delete).
6. **Increased concurrency** - In some file-based systems, if two or more users are allowed to access the same file simultaneously, it is possible that the accesses will interfere with each other, resulting in loss of information or even loss of integrity. Many DBMSs manage concurrent database access and ensure that such problems cannot occur.
7. **Improved backup and recovery services** - Many file-based systems place the responsibility on the user to provide measures to protect the data from failures to the computer system or application program. This may involve performing a nightly backup of the data. In the event of a failure during the next day, the backup is restored and the work that has taken place since this backup is lost and has to be re-entered. In contrast, modern DBMSs provide facilities to minimize the amount of processing that is lost following a failure.

Disadvantages of database

1. **Complexity** - The provision of the functionality that we expect of a good Database makes the database extremely complex. Database designers and developers, data and database administrators, and end-users must understand this

functionality to take full advantage of it. Failure to understand the system can lead to bad design decisions, which can have serious consequences.

2. **Size** The complexity and breadth of functionality makes the DBMS an extremely large piece of software, occupying many megabytes of disk space and requiring substantial amounts of memory to run efficiently.
3. **Greater impact of a failure** - The centralization of resources increases the vulnerability of the system. Because all users and applications rely on the availability of the DBMS, the failure of certain components can bring operations to a halt.

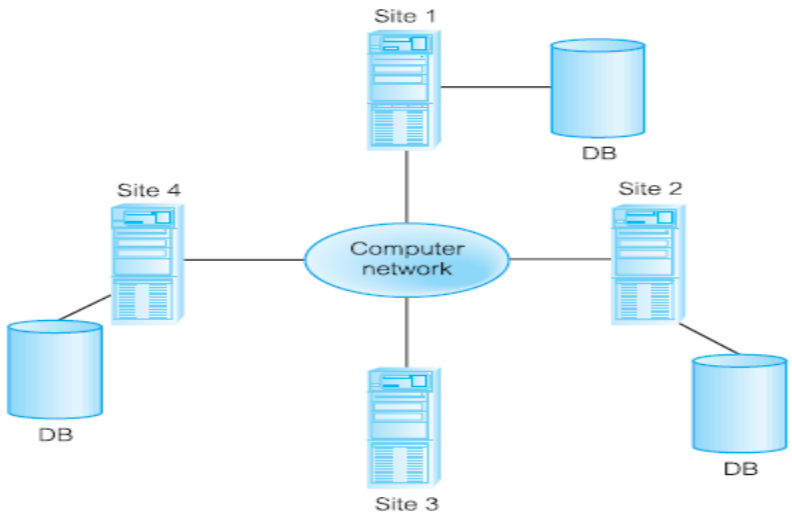
Centralized Database

A centralized database is where a single database is located at 1 site on a network. A centralized database system, is a system with a single logical database located at one site under the control of a single DBMS. A centralized database can be accessed over a computer network.

Distributed Database

A major motivation behind the development of database systems is the desire to integrate the operational data of an organization and to provide controlled access to the data. With the development of computer networks, a decentralized approach mirrors an organizational structure of many companies, which are logically distributed into divisions, departments, projects, and so on, and physically distributed into offices, plants, or factories, where each unit maintains its own operational data. The development of a distributed DBMS that reflects this organizational structure, makes the data in all units accessible, and stores data proximate to the location where it is most frequently used, should improve the ability to share the data and should improve the efficiency with which we can access the data.

A distributed Database is a logically interrelated collection of shared data (and a description of this data), physically distributed over a computer network while a Distributed DBMS is a software system that permits the management of the distributed database and makes the distribution transparent to users.



A **distributed database management system (DDBMS)** has a single logical database. The database is split into a number ***of fragments*** where each fragment is stored on one or more computers ***(replicas)*** under the control of a separate DBMS, with the computers connected by a communications network. Each site is capable of independently processing user requests that require access to local data (that is, each site has some degree of local autonomy) and is also capable of processing data stored on other computers in the network. The users are able to access the distributed database via applications. Applications are classified as those that do not require data from other sites ***(local applications)*** and those that do require data from other sites ***(global applications)***. We require a DDBMS to have at least one global application. A DDBMS therefore has the following characteristics:

- a collection of logically related shared data;
- data split into a number of fragments;
- fragments may be replicated;
- fragments/replicas are allocated to sites;
- sites are linked by a communications network;
- data at each site is under the control of a DBMS;
- DBMS at each site can handle local applications, autonomously;
- Each DBMS participates in at least one global application.

From the definition of the DDBMS, the system is expected to make the distribution transparent (invisible) to the user. Thus, the fact that a distributed database is split into fragments that can be stored on different computers and perhaps replicated should be hidden from the user. The objective of transparency is to make the distributed system appear like a centralized system. This is sometimes referred to as the fundamental principle of distributed DBMSs. This requirement provides significant functionality for the end-user but, unfortunately, creates many additional problems that have to be handled by the DDBMS.

Creating a Database

The process of creating a database differs significantly from product to product. In multi-user systems, the authority to create a database is usually reserved for the DBA. In a single-user system, a default database may be established when the system is installed and configured and others can be created by the user as and when required. The ISO standard does not specify how databases are created, and each dialect generally has a different approach. According to the ISO standard, relations and other database objects exist in an **environment**. Among other things, each environment consists of one or more **catalogs**, and each catalog consists of a set of **schemas**. A schema is a named collection of database objects that are in some way related to one another (all the objects in the database are described in one schema or another). The objects in a schema can be tables, views, domains, assertions, collations, translations, and character sets. All the objects in a schema have the same owner and share a number of defaults. The standard leaves the mechanism for creating and destroying catalogs as implementation-defined, but provides mechanisms for creating and destroying schemas.

Having created the database structure, we may now create the table structures for the base relations to be stored in the database. The database can have one or more tables. First you must determine what kind of data will be stored in each table. In other words, you must define each table by the following three step process:

1. Name the field

2. Specify the field type
3. Specify the field size.

For example, an Employee table, we are going to go very granular as possible, meaning as individual as possible. So not just one column for name, but separate columns for first name and last name. One reason for this is because may do something different with that piece of data and you want to get to it by itself. It is much easier to sort all employees by surname, or find out how many customers you have in a particular city if you are storing that data independently, rather than if it has to be extracted out of some larger value.

Employee

FirstName			
LastName			
DateHired			
SalaryGrade			
AddressLine1			
AddressLine2			
City			
State			
Zip			
Email			
Photo			
(etc.)			

Next we are doing to decide what kind of data is going to be stored in each of these columns. What is the datatype for each column, is it text, or character data? Or is it numeric? Is it a date, a time? Or even binary data like an image or a piece of audio or video.

Some SQL Datatypes are:

DATA TYPE	DECLARATIONS				
boolean	BOOLEAN				
character	CHAR	VARCHAR			
bit†	BIT	BIT VARYING			
exact numeric	NUMERIC	DECIMAL	INTEGER	SMALLINT	BIGINT
approximate numeric	FLOAT	REAL	DOUBLE PRECISION		
datetime	DATE	TIME	TIMESTAMP		
interval	INTERVAL				
large objects	CHARACTER LARGE OBJECT		BINARY LARGE OBJECT		

Most database systems will require you to be much more specific about your columns. It wants to know these specifics so it can be efficient about storing and indexing them and for it to enforce your rules.

Employee

FirstName	character		
LastName	character		
DateHired	date		
SalaryGrade	integer		
AddressLine1	character		
AddressLine2	character		
City	character		
State	character(2)		
Zip	character		
Email	character		
Photo	binary		
(etc.)			

Each table should have a primary key, a value that uniquely identifies an individual row where there can be no duplicates and no confusion. So if we have an employee ID, it should take us to only one employee row. When creating a database schema, we need to say which column contains that primary key for each of our tables. Define this column as an integer, and also add an option to make it automatically increment and then specified as the primary key, or the identifier. And this way, when adding a new row, we don't have to say what this value is. The database will automatically generate it for us and it will always be a unique value in the table. Creating a table is achieved by using the CREATE TABLE statement, which has the following syntax;

CREATE **TABLE** TableName

(columnName dataType [**NOT NULL**] **[UNIQUE]**

[PRIMARY KEY (list Of Columns),]

{[UNIQUE (list Of Columns)] [, . . .]}

{[FOREIGN KEY (list Of Foreign Key Columns));

For our employee table it will look like this:

```
Create Table Employee
(Employee Id INTEGER PRIMARY KEY,
First Name VARCHAR(32) NOT NULL,
Last Name VARCHAR(32) NOT NULL,
Department VARCHAR(32) NOT NULL,
Salary INTEGER);
```

4.0. UNIT 4 - INFORMATION SYSTEMS (IS)

4.1. Introduction

4.2. Objectives

Upon successful completion of this chapter, you will be able to:

- define what an information system is by identifying its major components;
- Know some examples of common systems used in education sector
- The difference between stand-alone systems and enterprise systems
- What you need to put into consideration when purchasing an IS

4.3. Information System (IS)

Information system refer to an integrated set of components for collecting, storing, and processing data and for providing information, knowledge, and digital products. Business firms and other organizations including education service providers rely on information systems to carry out and manage their operations, interact with their customers and suppliers, and compete in the marketplace. Information systems are used to run inter-organizational supply chains and electronic markets. For instance, Schools use information systems to deliver lessons to the students and pupils, to manage their human resources, and to reach their potential customers with online advertisement.

Many major companies are built entirely around information systems. These include eBay, a largely auction marketplace; Amazon, an expanding electronic mall and provider of cloud computing services; Alibaba, a business-to-business e-marketplace; and Google, a search engine company that derives most of its revenue from keyword advertising on Internet searches.

Governments deploy information systems to provide services cost-effectively to citizens. Digital goods such as electronic books, video products, and software and online services, such as gaming and social networking, are delivered with information systems. Individuals rely on information systems, generally Internet-based, for conducting much of their personal lives: for socializing, study, shopping, banking, and entertainment.

4.4. Components of Information Systems (IS)

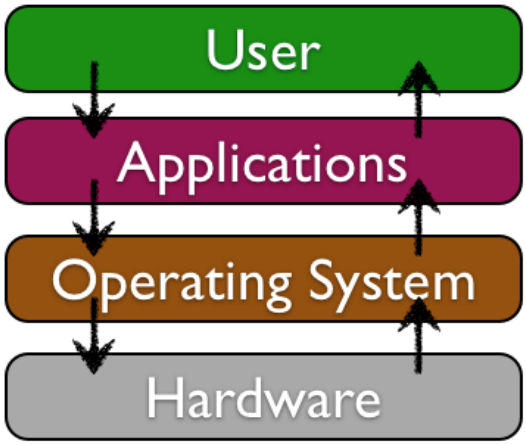
The main components of information systems are computer hardware and software, telecommunications, databases, data and data warehouses, human resources, and procedures. The hardware, software, and telecommunications constitute information technology (IT), which is now ingrained in the operations and management of organizations.

4.4.1. Computer Hardware

Today throughout the world even the smallest firms, as well as many households, own or lease computers. Individuals may own multiple computers in the form of smartphones, tablets, and other wearable devices. Large organizations typically employ distributed computer systems, from powerful parallel-processing servers located in data centres to widely dispersed personal computers and mobile devices, integrated into the organizational information systems. Sensors are becoming ever more widely distributed throughout the physical and biological environment to gather data and, in many cases, to effect control via devices known as actuators. Together with the peripheral equipment such as Hard disks, input-output devices, and telecommunications gear these constitute the hardware of information systems. The cost of hardware has steadily and rapidly decreased, while processing speed and storage capacity have increased vastly.

4.4.2. Computer software

Computer software falls into two broad classes: system software and application software. The principal system software is the operating system. It manages the hardware, data and program files, and other system resources and provides means for the user to control the computer, generally via a graphical user interface (GUI). Application software is programs designed to handle specific tasks for users.



4.4.3. Data

You can think of data as a collection of facts. For example, your street address, the city you live in, and your phone number are all pieces of data. Like software, data is also intangible. By themselves, pieces of data are not really very useful. But aggregated, indexed, and organized together into a database, data can become a powerful tool for businesses. In fact, all of the definitions presented at the beginning of this chapter focused on how information systems manage data. Organizations collect all kinds of data and use it to make decisions. These decisions can then be analyzed as to their effectiveness and the organization can be improved.

4.4.4. Telecommunications

Telecommunications are used to connect, or network, computer systems and portable and wearable devices and to transmit information. Connections are established via wired or wireless media. Wired technologies include coaxial cable and fibre optics. Wireless technologies, predominantly based on the transmission of microwaves and radio waves, support mobile computing.

4.4.5. Databases and data warehouses

Many information systems are primarily delivery vehicles for data stored in databases. A database is a collection of interrelated data organized so that individual records or groups of records can be retrieved to satisfy various criteria. Typical examples of databases include employee records and product catalogs. Databases support the operations and management functions of an enterprise. Data warehouses contain the archival data, collected over time, that can be mined for information

in order to develop and market new products, serve the existing customers better, or reach out to potential new customers. Anyone who has ever purchased something with a credit card in person, by mail order, or over the Web is included within such data collections.

4.4.6. Human resources and procedures

Qualified people are a vital component of any information system. Technical personnel include development and operations managers, business analysts, systems analysts and designers, database administrators, programmers, computer security specialists, and computer operators. In addition, all workers in an organization must be trained to utilize the capabilities of information systems as fully as possible. Billions of people around the world are learning about information systems as they use the Web.

Procedures for using, operating, and maintaining an information system are part of its documentation. For example, procedures need to be established to run a payroll program, including when to run it, who is authorized to run it, and who has access to the output. In the autonomous computing initiative, data centres are increasingly run automatically, with the procedures embedded in the software that controls those centres.

4.5. Classification of Information System

In any given organization information system can be classified based on the usage of the information. Therefore, an information system in an organization can be divided into operations support system and management support system.

4.5.1. Operations support system

In an organization, data input is done by the end user which is processed to generate information products i.e. reports, which are utilized by internal and or external users. Such a system is called operation support system. The purpose of the operation support system is to facilitate business transaction, control production, support internal as well as external communication and update organization central database. The operation support system is further divided into a transaction-processing system, processing control system and enterprise collaboration system.

4.5.2. Transaction Processing System (TPS)

In manufacturing organization, there are several types of transaction across department. Typical organizational departments are Sales, Account, Finance, Plant, Engineering, Human Resource and Marketing. Across which following transaction may occur sales order, sales return, cash receipts, credit sales; credit slips, material accounting, inventory management, depreciation accounting, etc. These transactions can be categorized into batch transaction processing, single transaction processing and real time transaction processing.

4.5.3. Process Control System

In a manufacturing organization, certain decisions are made by a computer system without any manual intervention. In this type of system, critical information is fed to the system on a real-time basis thereby enabling process control. This kind of systems is referred as process control systems.

4.5.4. Enterprise Collaboration System

In recent times, there is more stress on team effort or collaboration across different functional teams. A system which enables collaborative effort by improving communication and sharing of data is referred to as an enterprise collaboration system.

4.5.5. Management Support System

Managers require precise information in a specific format to undertake an organizational decision. A system which facilitates an efficient decision making process for managers is called management support system. Management support systems are essentially categorized as management information system, decision support system, and expert system and accounting information system. Management information system provides information to manager facilitating the routine decision-making process. Decision support system provides information to manager facilitating specific issue related solution.

4.5.6. Stand-Alone Applications or Software

Stand-alone software is any software application that does not come bundled with, or require, another software package in order to run. Essentially, it's software that can stand on its own without help from the internet or another computer process. You would typically install stand-alone software on your computer's hard drive, instead of using it as online software that runs via your internet browser.

4.5.7. Different Types of Stand-Alone Software

Stand-alone software has certain defining characteristics. The following represent a few examples:

i. **Software that runs on its own without an internet connection** - Anti-virus software or financial software (like Microsoft Money) which can be installed on your computer after inserting an installation disc into your computer or laptop disc drive or portable disc drive. This helps you scan for viruses without the chance of an online virus re-infecting your computer. Having Microsoft Money installed on your computer means you can enter transactions at any time, without the need to be logged in to an internet connection.

ii. **Software that isn't part of a bundle**. Many times, software comes with computer hardware or electronic devices that you would use alongside your computer, such as a scanner. The software could serve as a full interface, such as a desktop program that works with a USB-enabled label printer. Otherwise, the software might consist only of a group of files used to install drivers and other files needed to make a peripheral piece of equipment, such as a laser printer, work with your computer. Conversely, a bundle typically means several types of software programs sold together, like the ones you receive already installed as a bundle when you purchase a new computer.

iii. **A program that runs separately from all other computer processes**. This type of program doesn't rely on any other software in order to function. The most common example of this software type is your computer's operating system. While the operating system contains a large number of interrelated files, it runs on its own without needing any online files or other companion software.

iv. **A portable application that doesn’t need to be installed on your computer.** An example is a software program that runs on its own using a disc or flash drive. When not in use, you can easily eject the disc or flash drive. You can keep the program self-contained, and it conveniently doesn't take up space on your hard drive. You might keep a program for virus removal on a separate flash drive so that you can use it if your computer stops functioning due to a bad virus. You might also keep the software on your flash drive that can "rescue" your computer by booting it from the flash drive instead of a potentially damaged hard drive.

Not all stand-alone software needs to be installed on your hard drive or run from an external device, such as a flash drive or disc. You can run certain small or simple software by running its executable file directly from the file location on your computer. Simply copy the executable file from an external source, save it any place on your computer, then double-click on it with your cursor to run the program.

Advantages Standalone Applications

One advantage of a standalone computer is damage control. For example, if something goes wrong, only the standalone will be affected. Simplicity is another advantage, because it takes a lot less expertise to manage one computer than it does to setup or troubleshoot several. Standalone computers can also be more convenient. For example, printing on a network may require you to walk some distance from the computer to the printer. Inversely, any peripherals on a standalone have to be in arm's reach. Finally, a standalone does not affect other computer users. With a network, one user may waste space by watching movies or listening to music. In turn, everyone else using the network may see slower computer performance.

Disadvantages of Standalone Applications

Standalone computers have drawbacks. First of all, users are restricted to a single computer. On a network, users can access their files from any connected computer. Second, the same software cannot be installed simultaneously. While a network allows everything to be changed at once, a standalone requires that any new programs must be set up one-by-one, which is much more time-consuming. Third, it is much cheaper to connect every computer to one printer than

to buy a printer for each standalone computer. Finally, standalones are harder to monitor. On a network, certain software can be used to simultaneously view each user's activity.

4.6. Enterprise Systems

Enterprise systems are software applications that have cross-organizational capabilities as opposed to department or group-specific programs. They allow for collaboration and communication across the organization through collection of data that is accessible and usable by multiple departments. For example, an integrated enterprise system will generally handle more than one operation for a company to facilitate its business and management reporting needs.

An enterprise system, also known as enterprise resource planning (ERP) system, is a cross-functional information system that provides organization-wide coordination and integration of the key business processes and helps in planning the resources of an organization. With the help of enterprise resource planning systems, information can flow seamlessly across the firm.

An ERP system is driven by the ERP software suite-a set of integrated software modules–and a common centralized database. The software modules support the basic business processes under different functional areas, and the database stores data from and feeds the data to various applications supporting the internal business activities.

Some examples of business processes supported by ERP software include accounts payable, general ledger, cash management and forecasting, personnel administration, payroll, time management, inventory management, product pricing, billing, etc. Initially, ERP software was designed for automating a firm’s internal ‘back-office’ business processes, but now, it can also communicate with customers, suppliers, and other business partners.

4.7. Examples of Education Management Information Systems

4.7.1. Moodle

- Moodle is the world’s open source learning platform. It was designed to empower educators to improve our world in delivering training and education to the people.

- Moodle allows educators, of any kind, to create a private space online, filled with tools that easily create courses and activities, all optimised for collaborative learning.
- Moodle was first released as an open-source platform in 2001. Today it is empowering millions of educators and learners to improve our world, in every country.
- Moodle's open source project is managed by a dedicated team at Moodle HQ with a head office in Perth (Australia) and satellite offices around the world. Being an open source project, Moodle is a collaborative effort and is supported by a strong global community.

Moodle Features

i. True Open Source

Moodle is the world's open source learning platform. True to our value, our processes, code and development are truly open. Download Moodle today or get a free MoodleCloud site to start your Moodle journey.

ii. Powerful, flexible and collaborative learning

Work and learn together in forums, wikis and much more. Encourage self-reflection and peer assessment with dedicated tools. Get feedback through polls and surveys.

iii. Easy communications

When enabled, users can receive automatic alerts on new assignments and deadlines, forum posts and also send private messages to one another.

iv. Accurate grading

Use custom grading scales and rubrics. Conveniently assign different markers to assignments, manage grade moderation and control when marks are released to individual learners.

v. **Easy course editing**

Create courses easily using simple editing settings that will allow you to display materials in a format best suited to your learners.

vi. **Data-driven decisions**

Moodle Analytics allow you to track compliance, course completions, and competencies which is valuable when considering employees for promotions or succession planning in general.

vii. **Full integration**

As an open-source platform, Moodle easily integrates with and complements your existing education and workplace software solutions, such as Google G-Suite, Microsoft Office, Student Information and library Systems, Xero, Salesforce and more.

viii. **Latest multimedia tools**

Moodle's built-in media support enables you to easily search for and insert video and audio files in courses - perfect for flipped learning.

ix. **Extendable & customizable**

Your Moodle learning site is extensible and customizable with over 1400 public and free plugins created by our global community. Check our Moodle plugins directory.

x. **Safe and secure**

Moodle is regularly updated with the latest security patches to help ensure your Moodle site is secure. Teach and share in a private space only you and your class can access.

4.7.2. Synergy's Education Management Information System (EMIS) is an education data collection.

This is a type of system that contains the analysis and reporting toolset targeted at the needs of education ministries, educational institutions, and policy-makers. Synergy EMIS provides results-based planning, implementation and monitoring of

education programs, enabling delivery of high quality education in a timely and cost-effective manner.

Synergy's Education Management Information System (EMIS) has the following functions:-

i. Students Data

Synergy EMIS provides teachers/lecturers with simple online, offline and mobile tools for capturing and reporting data on students' records and their progress.

ii. Teachers Data

Synergy EMIS enable students to evaluate the performance of teachers thereby facilitating the tracking of educators' performance and professional development.

iii. Institution Data

Synergy EMIS also captures information on educational institutions to manage the distribution and allocation of educational resources and services.

iv. Establish a Unified Education Data Repository

Synergy EMIS provides a centralized, secure repository for the education data that education ministries and policy-makers need most. EMIS web-based data entry capabilities enable staff to rapidly collect, organize, and store education data (both quantitative and qualitative) across numerous institutions.

v. Streamline Education Planning, Budgeting and Reporting

Policy-makers can use Synergy EMIS' performance management tools to link education budgets with performance indicators, frameworks and work plans for education programs. Synergy EMIS' analytical suite makes it easy for non-technical staff to create customized and predefined Charts, Maps and Reports to analyze, and disseminate findings on outcomes of education programs.

vi. Implement Quality Assurance Standards

Synergy EMIS helps to automate student/staff assessments and educational quality assurance (QA) processes, providing real-time feedback and data to guide improvements in provision of education.

4.7.3. Open source Education Management Information System (EMIS) - OpenEMIS v.2

i. UNESCO launched a version of OpenEMIS, a generic and open source Education Management information System (EMIS) software package issued without conditions or restrictions for use by countries.

ii. Able to run offline on desktop computers or on the web and on mobile devises, OpenEMIS facilitates the collection, processing, analysis and supports the dissemination of data on education systems. It is a tool conceived to be easily and quickly adapted to the needs of information producers and users at national and sub-national levels.

iii. It manages a broad range of information: data on student/pupil enrolment, teachers, non-teaching staff, classes, textbooks, infrastructure, finances and learning outcomes.

iv. In order to meet country requirements, OpenEMIS can handle both individual and aggregated (census) datasets for pupils, teachers and non-teaching staff.

v. OpenEMIS also provides seamless integration with DevInfo, the database system endorsed by the United Nations for tracking country progress towards the Millennium Development Goals and other national priorities.

vi. The OpenEMIS initiative is led by UNESCO and is backed by a strong technical support team equipped to assist countries with all aspects of country implementation. The OpenEMIS initiative encourages country-level capacity development and aims to help countries upgrade their local skills for managing the tool. UNESCO has a partnership with Community Systems Foundation to assist in technology transfer and EMIS deployment strategies, capacity development, and technical support.

4.7.4. SchoolBrains Software

- SchoolBrains is a Student Information System (SIS) that offers an integrated suite of modules to maintain student and personnel data. It is a cloud-based solution targeted primarily at K-12 schools and provides access to information about

schools, classrooms, students, teachers and assessments in a single dashboard.

- SchoolBrains offers features and tools that can be accessed using web services, including grade books and report cards, education plans, admissions, assessments and curriculum mapping. It has a community portal that provides a channel for direct communication between teachers and parents/guardians.

- SchoolBrains' alert mechanism helps schools improve emergency response time and communicate with students, staff and parents through voice, email and SMS text messaging. The software stores health-related records of students and staff in its nursing and health module, which can be accessed by nurses 24/7.

- SchoolBrains ensures compliance with federal and state regulatory laws and has reporting capabilities meeting the requirements of various states.

4.7.5. mySkoolApp Software

- MySkoolApp from Hex Technologies is a cloud-based and on-premise school management solution built to manage student data, daily operations and communications. The solution helps teachers, students, administrators and parents access real-time data on student performance, progress and more.

- Student management is a core module and tracks attendance, grades, class ranking, fees, contact details and other vital records. Parents are sent automatic notifications when their student is marked as absent and can login to view assignments, grades and other activities.

- The Smart Homework module lets teachers manage assignments, as well as send due date reminders to students. At the same time, the messaging module enables individual and group communications between all stakeholders via text and voice messaging.

- On the administrative side, the staff management and human resource modules store employee records, which support recruitment, payroll, leave and attendance. Other modules include library, transportation, fee, admission and exam

management.

- Support is offered via phone and email.

4.7.6. QuickSchools Software

- QuickSchools is a cloud-based school management solution designed primarily for small and mid-sized educational institutes. It can also be used by daycare, private K-12 schools, vocational programs, art schools and more. The solution enables teachers to manage attendance, gradebooks, report card and student assignments.

- QuickSchools helps administrative personnel to track teacher information and manage queries regarding admission processes. Users can also enter different fee rates for student activities and tuitions, send notices for fee payments and manage billing information. The solution allows staff members to send voice and text messages to communicate information to parents.

- QuickSchools offers a student portal that lets students view their fees, grades, progress, assignments and completed classes. It also enables teachers to customize the report card to include their grading criteria and format.

- Pricing is per student per month. Support is offered via email, phone, and live chat and through an online help desk.

4.8. Advantages and Disadvantages of IS

The competitiveness of most companies is in a large degree based on the effective use of information technologies and information systems especially. The main purpose of information systems are provide the right information to the right people at the right time. It is used to track, store, manipulate and distribute the information from gathered data to appropriate persons when necessary.

4.8.1. Advantages

i. **Communication** – with help of information technologies the instant messaging, emails, voice and video calls becomes quicker, cheaper and much efficient.

ii. **Globalization and cultural gap** – by implementing information systems we can bring down the linguistic, geographical and some cultural boundaries. Sharing the information, knowledge, communication and relationships between different countries, languages and cultures becomes much easier.

iii. **Availability** – information systems has made it possible for businesses to be open 24×7 all over the globe. This means that a business can be open anytime anywhere, making purchases from different countries easier and more convenient. It also means that you can have your goods delivered right to your doorstep with having to move a single muscle.

iv. **Creation of new types of jobs –** one of the best advantages of information systems is the creation of new and interesting jobs. Computer programmers, Systems analyzers, Hardware and Software developers and Web designers are just some of the many new employment opportunities created with the help of IT.

v. **Cost effectiveness and productivity** – the IS application promotes more efficient operation of the company and also improves the supply of information to decision-makers; applying such systems can also play an important role in helping companies to put greater emphasis on information technology in order to gain a competitive advantage. IS has a positive impact on productivity, however there are some frustrations can be faced by systems users which are directly linked to lack of training and poor systems performance because of system spread.

4.8.2. Disadvantages

i. **Unemployment and lack of job security** – implementing the information systems can save a great deal of time during the completion of tasks and some labor mechanic works. Most paperwork's can be processed immediately, financial transactions are automatically calculated, etc. As technology improves, tasks that were formerly performed by human employees are now carried out by computer systems. For example, automated telephone answering systems have replaced live receptionists in many organizations or online and personal assistants can be good example also. Industry experts believe that the internet has made job security a big issue as since

technology keeps on changing with each day. This means that one has to be in a constant learning mode, if he or she wishes for their job to be secure.

ii. **Dominant culture** – while information technology may have made the world a global village, it has also contributed to one culture dominating another weaker one. For example it is now argued that US influences how most young teenagers all over the world now act, dress and behave. Languages too have become overshadowed, with English becoming the primary mode of communication for business and everything else.

iii. **Security issues** – thieves and hackers get access to identities and corporate saboteurs target sensitive company data. Such data can include vendor information, bank records, intellectual property and personal data on company management. The hackers distribute the information over the Internet, sell it to rival companies or use it to damage the company's image. For example, several retail chains were targeted recently by hackers who stole customer information from their information systems and distributed Social Security numbers and credit card data over the Internet.

iv. **Implementation expenses** – to integrate the information system it require pretty good amount of cost in a case of software, hardware and people. Software, hardware and some other services should be rented, bought and supported. Employees need to be trained with unfamiliar information technology and software.

v. **Information systems contribute to the efficient running of organizations**. Information systems are showing the exponential growth in each decades. Today's information technology has tremendously improved quality of life. Modern medicine has benefited the most with better information system using the latest information technology. By understanding and learning what advantages and disadvantages it can bring, we have to try, believe and put an effort with our best to make that existing advantage much better and navigate the disadvantages to have a less impact on organizations and society

4.9. Things to Consider when Purchasing an IS

There are many brilliant apps and digital gismos out there that offer all kinds of features and possibilities. This can make it a bit overwhelming for customers looking to purchase

something to help them with their operations. So, we've put together 5 key things to consider when purchasing a technology system.

i. **Know what you need:** This is true for any shopping. If you go to buy groceries without a list, you can easily come back with some things you don't need and have forgotten to buy other things you do need. This is the same with purchasing a technology system. There are so many cool gadgets and ideas out there. If you don't know what you're looking for, you can easily get drawn down a rabbit hole and end up with a system that doesn't meet your requirements. So, make a list of what you want to be able to do once the system is in place (this can be functional requirements such as 'I want all my data in the same format') and during the buying process, keep referring to this list. Carrying out a pilot is also a useful way of ensuring a system really does meet your requirements.

ii. **Interoperability:** Interoperability is a term used for when technology platforms can 'speak' to one-another and automatically exchange information. For example, social media management tools, such as Hootsuite and Buffer, interoperate with Twitter, Facebook and Instagram to publish pre-written posts.

iii. **Use-ability:** This applies to the system and its output. When purchasing an IT system that will be used in the field, you need to think about how the user will be handling it, what the impact of the physical environment (such as glaring sunlight) will be, how easy it is for a technology novice, and what the risks are for data corruption and loss. But it is not only the use-ability of the tools to collect the data that must be considered. A key, and often forgotten aspect, is the use-ability of the output – the data.

iv. **The "How would I feel?" test:** Imagine that you turn up to work and your boss announces a change to the way you are paid. Instead of a monthly automatic payment being made into your bank account, you will now receive money to your phone. In addition, the company will take scans of your iris' and fingers to validate that work you submit is definitely from you before you enter the building. Oh, and that data is going to be held by a company the other side of the world. How would you feel? Technology

has the power to do amazing things, but it can also be scary and daunting. When thinking about a system and what features to implement, it is always worth considering the people who will suddenly have the system imposed on them and whether you would feel comfortable if the system was being implemented on you.

v. **Affordability:** Companies set their fees in many ways for technology systems. Often the pricing approach is influenced by whether the system is an 'off-the-shelf' model or a 'software as a service'. It is important to be clear on how the pricing for the system works and that there are no hidden costs. In our case, we charge a one-off set-up fee and then an annual fee. This is because we offer a software service, rather than an off the shelf package. In our case, we do not charge based on the number of users, but other companies do. Sometimes implementing a new system can be a significant expense, so it is also good to be aware of all the different funding sources that might be available to you. These range from donor organisations, through to universities. At GeoT, we help clients to consider different funding opportunities and work with them to make sure the system is affordable and workable for their needs.

4.10. ICT Teaching Tools

Schools use a diverse set of ICT tools to communicate, create, disseminate, store, and manage information. In some contexts, ICT has also become integral to the teaching-learning interaction, through such approaches as replacing chalkboards with interactive digital whiteboards, using students' own smartphones or other devices for learning during class time, and the "flipped classroom" model where students watch lectures at home on the computer and use classroom time for more interactive exercises.

When teachers are digitally literate and trained to use ICT, these approaches can lead to higher order thinking skills, provide creative and individualized options for students to express their understandings, and leave students better prepared to deal with ongoing technological change in society and the workplace.

ICT issues planners must consider include: considering the total cost-benefit equation, supplying and maintaining the requisite infrastructure, and ensuring investments are matched with teacher support and other policies aimed at effective ICT use.

In many countries, digital literacy is being built through the incorporation of information and communication technology (ICT) into schools. Some common educational applications of ICT include:

- **One laptop per child***:* Less expensive laptops have been designed for use in school on a 1:1 basis with features like lower power consumption, a low cost operating system, and special re-programming and mesh network functions. Despite efforts to reduce costs, however, providing one laptop per child may be too costly for some developing countries.

- **Tablets***:* Tablets are small personal computers with a touch screen, allowing input without a keyboard or mouse. Inexpensive learning software ("apps") can be downloaded onto tablets, making them a versatile tool for learning. The most effective apps develop higher order thinking skills and provide creative and individualized options for students to express their understandings.
- **Interactive White Boards or Smart Boards*:*** Interactive white boards allow projected computer images to be displayed, manipulated, dragged, clicked, or copied. Simultaneously, handwritten notes can be taken on the board and saved for later use. Interactive white boards are associated with whole-class instruction rather than student-centered activities. Student engagement is generally higher when ICT is available for student use throughout the classroom.
- **E-readers*:*** E-readers are electronic devices that can hold hundreds of books in digital form, and they are increasingly utilized in the delivery of reading material. Students both skilled readers and reluctant readers have had positive responses to the use of e-readers for independent reading. Features of e-readers that can contribute to positive use include their portability and long battery life, response to text, and the ability to define unknown words.
- **Flipped Classrooms:** The flipped classroom model, involving lecture and practice at home via computer-guided instruction and interactive learning activities in class, can allow for

an expanded curriculum. There is little investigation on the student learning outcomes of flipped classrooms. Student perceptions about flipped classrooms are mixed, but generally positive, as they prefer the cooperative learning activities in class over lecture.

ICT and Teacher Professional Development: Teachers need specific professional development opportunities in order to increase their ability to use ICT for formative learning assessments, individualized instruction, accessing online resources, and for fostering student interaction and collaboration. Such training in ICT should positively impact teachers' general attitudes towards ICT in the classroom, but it should also provide specific guidance on ICT teaching and learning within each discipline. Without this support, teachers tend to use ICT for skill-based applications, limiting student academic thinking. To support teachers as they change their teaching, it is also essential for education managers, supervisors, teacher educators, and decision makers to be trained in ICT use.

Ensuring benefits of ICT investments: To ensure the investments made in ICT benefit students, additional conditions must be met. School policies need to provide schools with the minimum acceptable infrastructure for ICT, including stable and affordable internet connectivity and security measures such as filters and site blockers. Teacher policies need to target basic ICT literacy skills, ICT use in pedagogical settings, and discipline-specific uses. Successful implementation of ICT requires integration of ICT in the curriculum. Finally, digital content needs to be developed in local languages and reflect local culture. Ongoing technical, human, and organizational supports on all of these issues are needed to ensure access and effective use of ICT.

4.11. Activity

i. *What are the five components that make up an information system?*
ii. *What are three examples of information system hardware?*
iii. *Microsoft Windows is an example of which component of information systems?*
iv. *What roles do people play in information systems?*
v. *Give 5 types of education Management Information System*
vi. *Give 10 examples of the ICT tools used in Education*

4.12. Unit Summary

In this chapter, you have been introduced to the concept of information systems. We have reviewed several definitions, with a focus on the components of information systems: technology, people, and process. We are now to a point where every company is using information systems and asking the question: Does it bring a competitive advantage? In the end, that is really what course is about. Every person in organisations should understand what an information system is and how it can be used to bring a competitive advantage. And that is the task we have before us.

5.0. UNIT 5 - SOFTWARE OR INFORMATION SYSTEM (IS) ACQUISITION METHODS

5.1. Introduction

Software acquisition includes the processes typically associated with the software engineering life cycle. However, acquisition also includes processes that fund, manage, integrate, deploy and support software systems before, during, and after their software engineering life cycle. The need to address processes for systems coordination and overall project management together is what establishes our baseline of interest in modeling and simulating software acquisition processes.

5.2. Objectives

After this lecture, you will be able to:

- Evaluate the different alternatives for acquiring Software;
- Distinguish between the different types of acquiring Software;
- Explain the purpose of picking a particular software acquisition method;
- Select the best alternative type of software acquisition.

5.3. Software Acquisition

Information systems are a major corporate asset, with respect both to the benefits they provide and to their high costs. Therefore, organizations have to plan for the long term when acquiring information systems and services that will support business initiatives. At the same time, firms have to be responsive to emerging opportunities.

On the basis of long-term plans and the requirements of various individuals from data workers to top management, essential applications are identified and project priorities are set. For example, certain projects may have to be carried out immediately to satisfy a new government reporting regulation or to interact with a new customer's information system. Other projects may be given a higher priority because of their strategic role or greater expected benefits. However the best thing to note here is understanding the different software acquisition methods and what circumstances to

consider which method to use.

Basically, there are two (02) categories of software acquisition methods

i. Proprietary Software
ii. Open Source Software

5.3.1. Proprietary software

Proprietary software is software that is owned by an individual or a company (usually the one that developed it). There are almost always major restrictions on its use, and its **source code** is almost always kept a secret.

Source code is the form in which a program is originally written by a human using a programming language and prior to being converted to machine code which is directly readable by a computer's CPU (central processing unit). It is necessary to have the source code in order to be able to modify or improve a program.

Software that is not proprietary includes free software and public domain software. Free software, which is generally the same as **Open Source Software**, is available at no cost to everyone, and it can be used by anyone for any purpose and with only very minimal restrictions.

There are two (02) major software and information systems acquisition methods:-

i. Off the shelf or Packaged Software
ii. Custom Developed or Bespoke Software

5.3.2. Off the Shelf or Packaged

As the name suggests, an off-the-shelf software is ready to use right from the very beginning. It is a product developed for the mass-market, which means it is expected to respond to the needs of as many users as possible, offering many more features than a bespoke solution would. Unfortunately, commercial software often does not meet all of your expectations.

5.3.3. Examples of off the shelf or Packaged Software

Examples of proprietary software include the following:-

- ✓ Microsoft Windows
- ✓ Adobe Flash Player
- ✓ iTunes
- ✓ Adobe Creative suite
- ✓ Corel Draw
- ✓ Google Earth
- ✓ MacOS (formerly Mac OS X and OS X)
- ✓ Skype
- ✓ WinRAR
- ✓ Oracle
- ✓ Etc.

5.3.4. Advantages of off the shelf or Packaged Software

A ready to use solution, whose initial costs are without a doubt cheaper and also there is no need to wait through the development process, may attract companies which are looking for:

i. Community support

There is no software without a bug. When you or your employees find one, you can easily google it and ask others for help as you are not the only user of the software. Maybe you find a company that has used the solution before and managed to solve the problem. However, they are not the specialists that you should contact in case of any serious malfunction.

When going bespoke, there is no need for you to search for help online. All you need to do is reach the maintenance team and they will fix the bug for you.

ii. Lower training costs

In order to work efficiently, your staff must know the software very well. As every employee should be trained on how to use the solution, ready to use products

usually go with training materials which every team member can get familiar with on their own. This will help you to save both learning time and training costs.

In case of bespoke solutions, all the employees must be trained by the company that has developed the software.

iii. Quick Installation

Packaged software is designed for quick installation and use. It needs to be remembered, however, that a packaged solution may need to be customised and may not be compatible with your current systems, both of which will cancel out the speed benefit.

iv. Mass Production

The mass-produced nature of off the shelf business software results in a low upfront cost for most off-the shelf solutions. It should be remembered that these solutions may be cheap to purchase initially, but can cost you a lot more over time due to their inefficiencies, and any ongoing maintenance and subscription fees (e.g. Software as a service - SaaS).

v. Trusted software

Trusted packaged software will have broad adoption of the exact solution you'll be using – you'll be able to look up reviews online, check forums for feedback, and perhaps even give the software a test run before purchasing. That said, a good custom software partner will have a proven track record, and will start with a standard infrastructure, offering you similar levels of confidence.

vi. Availability of reviews

In the same way that you'll be able to check reviews prior to purchasing your packaged solution, you'll also be able to access community support if any problems should arise down the track, as other users may be having the same issues.

5.3.5. Disadvantages of off the shelf or Packaged Software

A commercial solution can at the same time discourage companies from using it because of:

i. Compromise

Off-the-shelf software is designed and developed to meet the needs of as many users as possible. That is why it only contains the most popular functionalities for specific industries. Using it very often means making a compromise, as it is not possible to find all of the features you need in a single package, especially if your business is rather unique. When choosing one among many off-the-shelf solutions available, you need to decide which features you can do without.

Buying a bespoke solution, you receive a product that meets all of your requirements. In other words, you get exactly what you need.

ii. Size

Not only does off-the-shelf software lack features your company could use, it is also loaded with functionalities your business will never use. Too many features slow down the solution and thus influence your work in a negative way. In most cases, it is impossible to delete or turn off useless components, they may also complicate the usage of a product.

Individually crafted solutions are very light as they only contain the features you had asked for, simplifying your work.

iii. Needs Misalignment

The major risk in going for an off the shelf solution is that it may not meet all of your business's requirements. A piece of packaged software may cost a bit less than a custom solution, but if it's half as capable or efficient you'll soon lose all that money initially saved. You should consider the hidden cost of modifying your business processes and staffing to fit your business to the software versus fitting the software to your business.

iv. Not Scalable

Most off-the-shelf business software is rigid and difficult to modify. As your business grows or changes you'll be unable to grow or change the software with it, as you don't control the changes and upgrades. In order to get the changes you're after you'd need to convince the software company that your needs outweigh their broader product roadmap.

v. Compatibility issues

Off the shelf software often faces compatibility issues. It's highly likely that your business's operating systems, devices or other business software will clash with the packaged solution at a base level, making it either unusable or incredibly inefficient.

vi. Not Unique

By choosing an off the shelf software you're choosing a solution that is available to all of your competitors. This means that innovative and pioneering business ideas can be easily replicated by your rivals after you've put in the time and taken the risk in proving them.

5.3.6. Custom Developed or Bespoke Software

Custom developed also called bespoke software is custom or tailor-made software refer to software applications designed for a specific user or group of users within an organization. Such software is designed to address their needs precisely as opposed to the more traditional and widespread off-the-shelf software. The value of bespoke software over off-the-shelf software is that it can be designed specifically for key business or legislative objectives. This software are said to be developed in-house

5.3.7. Examples of Custom Developed or Bespoke Software

Examples of Custom Developed or Bespoke Software include the following:-

- ✓ Management Information Systems
- ✓ Enterprise resource Planning software
- ✓ eCommerce Applications

- ✓ Point of Sale
- ✓ Marketing Applications
- ✓ Accounting Applications
- ✓ Production/Manufacturing Applications
- ✓ etc.

5.3.8. Advantages of Custom Developed or Bespoke Software

As opposed to an off-the-shelf software, there is a bespoke solution that is developed especially to meet your requirements. The maintenance is without a doubt the greatest feature of going bespoke as specialists make sure your product works flawlessly. Other advantages of tailored-made software are:

i. Flexibility

Due to the agile approach of a bespoke software company, your product gains a lot of flexibility, which gives you the possibility to change your specifications over time. It allows you to engage in the development process and make sure the product you have ordered will still meet your needs after months of coding.

When buying a commercial software, you need to adjust your requirements to what you receive. If the solution no longer suits your needs, there is no other way than to buy new software.

ii. Number of users

Even though the initial costs are much higher when it comes to custom software solutions, there is a way to save money. Because you officially and legally are the owner of the intellectual property, there is no need to pay for each user of the product as your business grows.

If you use a commercial software, there is a license fee you need to pay for each employee.

iii. Uniqueness

By its very definition custom software is built for the unique challenges of your situation. It is designed specifically for your unique circumstances, and, when done well, provides an almost perfect solution to your problem.

iv. Equal to the task

What's more, it can be designed to meet every requirement that you had outlined in the evaluation phase. Rather than just labeling something 'Nice to Have', you can have it.

v. Scalable

Custom software can be easily modified and expanded, keeping in-step with your business as it, and technology, morphs and changes over years. You own the software, you can do what you need with it.

vi. Competitive advantage

Custom software also offers a competitive advantage over your competitors. It's something that they don't have – indeed, your custom solution is something that they can't have – and as long as it's well-designed you should soon see yourself getting ahead of your competition.

5.3.9. Disadvantages of custom Developed or Bespoke Software

There is no doubt that a bespoke software solution is far more expensive than the commercial one, it also takes more time to develop it while you can start using an off-the-shelf software right away. Another disadvantage is:

i. Experience

In order to receive a 100% useful bespoke solution, you need to know your business and its specifications very well. Ordering some tools without being certain your company needs them is a great waste of money. On the other hand, learning your business may be a fantastic opportunity to get to know your goals at the same time.

As commercial solutions are much cheaper and usually loaded with different functionalities, you can discover what your business needs while using them.

ii. Costly

The built-from-scratch nature and endless customization that is possible with a custom software solution does mean that you'll likely be looking at a larger upfront investment. It's important to note, however, that the solution's efficiencies will usually see this upfront investment richly rewarded in the future with a solution built perfectly to match your needs. Indeed, many off the shelf options are structured as monthly subscription packages in order to disperse the cost. The perpetual nature of this model can ultimately end up costing more than a custom solution.

iii. Takes long to develop

If you're looking for a quick fix, a custom software solution may not be for you. You'll be facing a *development phase that may take several months*, which, while eventually delivering a great solution, simply isn't feasible in certain situations. But the same could often be said for an off-the-shelf solution, as customizing and implementing software that wasn't built specifically for your business can take a surprising amount of time. It's not as easy as loading a program and getting an instant benefit.

iv. Difficult in support

Creating a custom solution *could leave you dependent on the custom software provider*. If they were to fold or become unavailable for whatever reason your business could be inconvenienced. At the same time, this small-scale, localized support is a terrific thing, as you've got the benefit of a software team that truly understands your business. It's simply a matter of choosing your partner wisely.

5.4. Other Software acquisition alternatives

5.4.1. Outsourcing

The contracting or subcontracting of noncore activities to free up cash, personnel, time, and facilities for activities in which a company holds competitive advantage. Companies having strengths in other areas may contract out data processing, legal, manufacturing, marketing, payroll accounting, or other aspects of their businesses to concentrate on what they do best and thus reduce average unit cost. Outsourcing is often an integral part of downsizing or reengineering. Also called contracting out.

5.4.2. Why outsource

The benefits of outsourcing vary greatly, depending on the applications to be outsourced and the organization's resources. However, it is a fact that in today's competitive economy, the accounting, as well as the tax and payroll functions are gaining importance every day and there are several reasons why outsourcing said functions makes sense for almost all employers, regardless the size of their company.

In this respect, it is worth mentioning that outsourcing is no longer just for large companies. Today's technology makes outsourcing more affordable and smaller companies can now benefit from an increase of efficiency and growth that outsourcing their accounting, tax and payroll functions can offer.

So what are the top reasons why outsourcing makes sense for your company, regardless its size and volume?

a) **Cost Savings** - Outsourcing will reduce your internal costs by decreasing your payroll while allowing your company to focus on its core competencies.
b) **Time Savings** - When you outsource, you don't have to spend time recruiting, hiring, training, and housing employees.
c) **Flexibility** - When you outsource, you may vary the resources from time to time in accordance with your real needs.
d) **Access to Talented Professionals** - You'll have immediate access to some of the best and brightest professionals.
e) **Improved Compliance** - Outsourcing will reduce your concern with legal compliance issues and will increase flexibility to meet changing regulatory requirements.
f) **Enhanced Accuracy** - Outsourcing will improve work accuracy in terms of given deadlines on a project.
g) **Focus on what you do best** - Outsourcing will let your team focus on your core organizational functions.

5.4.3. User Developed Software

End-user-developed software: Software written by non-IS professionals, i.e. the business users.

Advantages

- ✓ Tailored to the needs of end-users
- ✓ Often relatively fast.

Disadvantage

- ✓ May not achieve wider business objectives
- ✓ Quality may be a problem when written by non-IS professional. Maintenance may be difficult.

5.4.4. Open Source

The term "open source" refers to something people can modify and share because its design is publicly accessible. The term originated in the context of software development to designate a specific approach to creating computer programs. Today, however, "**open source**" designates a broader set of values, what we call "**the open source way**." Open source projects, products, or initiatives embrace and celebrate principles of open exchange, collaborative participation, rapid prototyping, transparency, meritocracy, and community-oriented development.

Open source software is software with source code that anyone can inspect, modify, and enhance. "**Source code**" is the part of software that most computer users don't ever see; it's the code computer programmers can manipulate to change how a piece of software, a "**program**" or "**application**" works. Programmers who have access to a computer program's source code can improve that program by adding features to it or fixing parts that don't always work correctly.

5.4.5. Why people prefer using open source software?

People prefer open source software to proprietary software for a number of reasons, including:

i. Control

Many people prefer open source software because they have more control over that kind of software. They can examine the code to make sure it's not doing anything they don't want it to do, and they can change parts of it they don't like. Users who aren't

programmers also benefit from open source software, because they can use this software for any purpose they wish not merely the way someone else thinks they should.

ii. Training

Other people like open source software because it helps them become better programmers. Because open source code is publicly accessible, students can easily study it as they learn to make better software. Students can also share their work with others, inviting comment and critique, as they develop their skills. When people discover mistakes in programs' source code, they can share those mistakes with others to help them avoid making those same mistakes themselves.

iii. Security

Some people prefer open source software because they consider it more secure and stable than proprietary software. Because anyone can view and modify open source software, someone might spot and correct errors or omissions that a program's original authors might have missed. And because so many programmers can work on a piece of open source software without asking for permission from original authors, they can fix, update, and upgrade open source software more quickly than they can proprietary software.

iv. Stability

Many users prefer open source software to proprietary software for important, long-term projects. Because programmers publicly distribute the source code for open source software, users relying on that software for critical tasks can be sure their tools won't disappear or fall into disrepair if their original creators stop working on them. Additionally, open source software tends to both incorporate and operate according to open standards.

5.4.6. The difference between open source software and other types of software?

Some software has source code that only the person, team, or organization who created it and maintains exclusive control over it can modify. People call this kind of software "proprietary" or "**closed source**" software.

- Only the original authors of proprietary software can legally copy, inspect, and alter that software. And in order to use proprietary software, computer users must agree (usually by signing a license displayed the first time they run this software) that they will not do anything with the software that the software's authors have not expressly permitted. Microsoft Office and Adobe Photoshop are examples of proprietary software.
- Open source software is different. Its authors make its source code available to others who would like to view that code, copy it, learn from it, alter it, or share it. LibreOffice and the GNU Image Manipulation Program are examples of open source software.
- As they do with proprietary software, users must accept the terms of a license when they use open source software but the legal terms of open source licenses differ dramatically from those of proprietary licenses.
- Open source licenses affect the way people can use, study, modify, and distribute software. In general, open source licenses grant computer users permission to use open source software for any purpose they wish. Some open source licenses what some people call "**copyleft**" licenses stipulate that anyone who releases a modified open source program must also release the source code for that program alongside it. Moreover, some open source licenses stipulate that anyone who alters and shares a program with others must also share that program's source code without charging a licensing fee for it.
- By design, open source software licenses promote collaboration and sharing because they permit other people to make modifications to source code and incorporate those changes into their own projects. They encourage computer programmers to access, view, and modify open source software whenever they like, as long as they let others do the same when they share their work.

5.5. Things to consider when choosing an acquisition method

- ✓ Size of the organisation

- ✓ Size of in-house IT capability
- ✓ Complexity of information system (are there special issues for the market the company operates in)
- ✓ End-user experiences
- ✓ Linkages to other applications/data sources.
- ✓ Financial Capability
- ✓ Urgency of the need

5.6. Activity 5

i. *Kindly state and explain the two categories of software and state the types of software under each category*

ii. *What is the difference between open source software and other types of software*

iii. *Explain the advantages of using bespoke software over packaged one*

5.7. Unit Summary

An organization should consider the financial implications of the decision to develop (make) versus buy. Because software vendors can allocate software development costs across many products and across multiple copies of each product, the prices they charge to recover development costs are usually less than the organization would pay to develop the package in-house. Generally, software developed in-house for a mainframe computer can cost up to 10 times more than purchased software. And, annual maintenance of in-house software is typically 50 percent of the development cost, while annual maintenance for purchased software normally costs only 25 percent of the purchase price.

6.0. UNIT 6 – PRACTICAL APPLICATION OF DATABASES

6.1. Introduction

Much of the world's data resides in databases. SQL (or Structured Query Language) is a powerful language which is used for communicating with and extracting data from databases. A working knowledge of databases and SQL is a must if you want to become a data scientist. The purpose of this unit is to introduce database concepts and help you learn and apply knowledge of various database components. It is also intended to get you started with performing SQL access in a data science environment.

6.2. Objectives

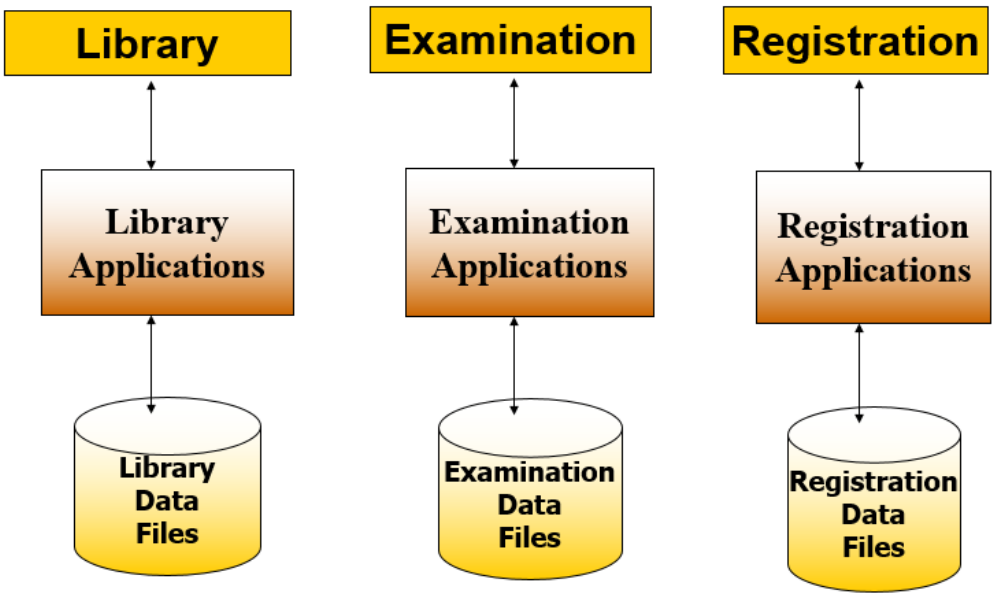
At the end of this unit you will be able to understand the following:-

- File processing system and how it differs from the Database concept
- What the database is and its use
- Components, Concepts and characteristics of the Database
- What database Management System is and how users interact with the Database

6.3. A bit of History

Computer initially used for computational, engineering purposes the later commercial applications introduced File Processing System. This was done to ease some work as compared to only doing computations on computer. A collection of application programs that perform services for the end-users such as production of reports. Each program defines and manages its own data.

In this kind of system each department has its own database where they store their departmental related documents as shown below:-



6.3.1. Disadvantages of File Processing

i. Program-Data Dependence

- ✓ File structure is defined in the program code.
- ✓ All programs maintain metadata for each file they use

ii. Duplication of Data (Data Redundancy)

- ✓ Different systems/programs have separate copies of the same data
- ✓ Same data is held by different programs.
- ✓ Wasted space and potentially different values and/or different formats for the same item.

iii. Limited Data Sharing

- ✓ No centralized control of data
- ✓ Programs are written in different languages, and so cannot easily access each other's files.

iv. Lengthy Development Times

- ✓ Programmers must design their own file formats

v. **Excessive Program Maintenance**

- ✓ 80% of information systems budget

vi. **Vulnerable to Inconsistency**

- ✓ Change in one table need changes in corresponding tables as well otherwise data will be inconsistent

6.4. The Database Approach as a solution to file processing

This type of approach has a central repository of shared data, Data in this system is managed by a controlling agent and stored in a standardized, convenient form. This requires a Database and Database Management System (DBMS) which we will see later in this unit.

6.5. Database Definition

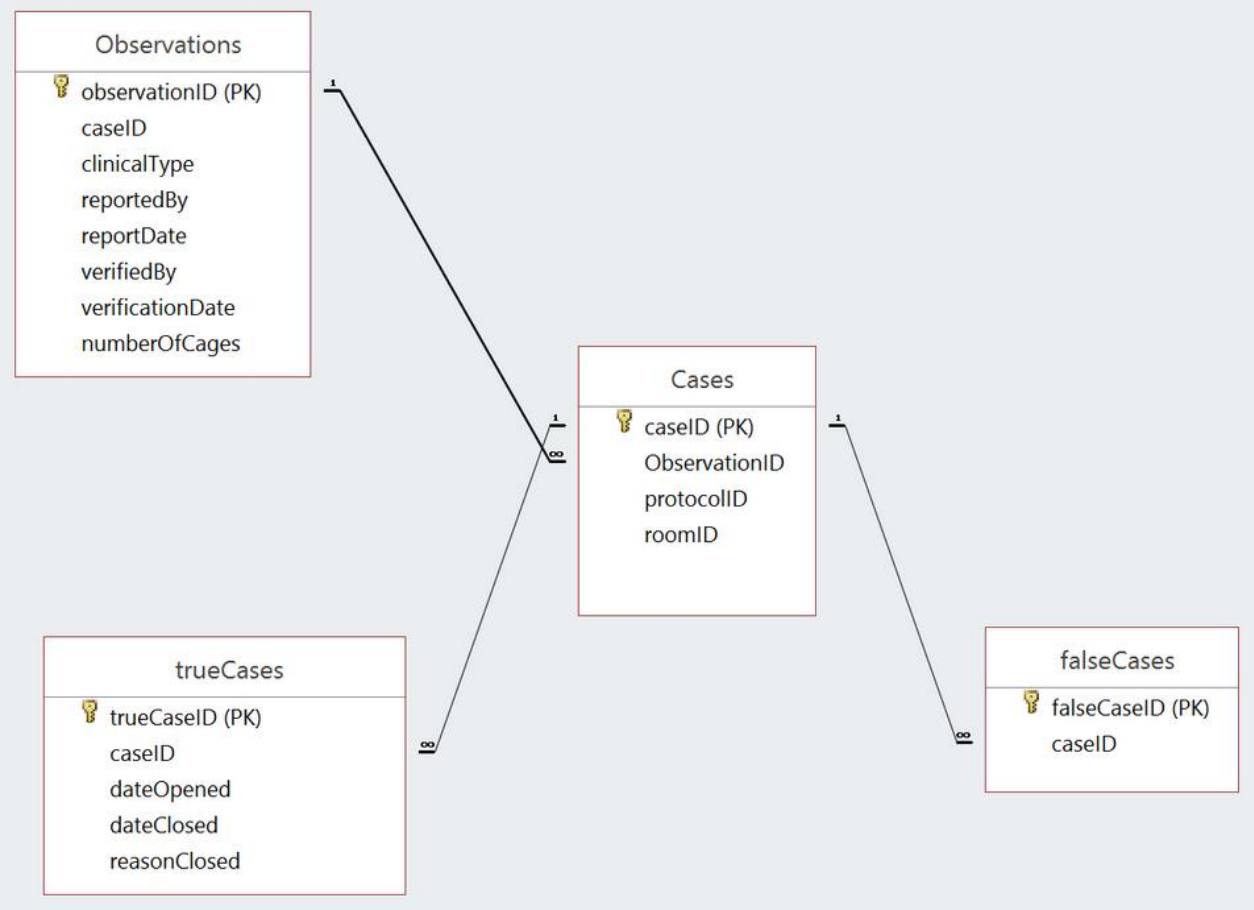
A Database is a collection of related information stored in an organised way so that specific items can be selected and retrieved quickly. Data is organized into rows, columns and tables, and it is indexed to make it easier to find relevant information. A database need not involve the use of technology. Examples of manual databases include telephone directories, address books, diaries and card index files.

6.6. Basic Concepts of a database

Below are few notable database concepts

- **Field**: The data in an electronic database are organised by fields and records. A field is a single item of information, such as a name or a quantity.
- **Record**: In an electronic database, a record is a collection of related fields. See Field.
- **Table**: In an electronic database, data are organised within structures known as tables. A table is a collection of many records.
- **A primary key**: it is a special relational database table column (or combination of columns) designated to uniquely identify all table records. A primary key's main features are: It must contain a unique value for each row of data. It cannot contain null values.

- **Foreign (secondary) key fields**: These fields are used to link tables together by referring to the primary key in another database table.
- **Relationship**: In a relational database, data can be combined from several different sources by defining relationships between tables.
- **Compound key**: In a relational database, it is possible to retrieve data from several tables at once by using record keys in combination, often known as a compound key.
- **A query**: it is a request for data or information from a database table or combination of tables.
- **Update query**: An update query can be used to change records, tables and reports held in a database management system.
- **Filter**: In a spreadsheet or database, a filter can be used to remove data from the screen temporarily. This allows users to work with a specific group of records. Filters do not alter or delete data but simply hide any unwanted items.



An example of how key fields are used to link information from different database tables
Source*:* https://dba.stackexchange.com

6.7. Characteristics of Databases

Some of the characteristic of a good database are:

- Should be able to store all kinds of data that exists in this real world. Since we need to work with all kinds of data and requirements, database should be strong enough to store all kinds of data that is present around us.
- Should be able to relate the entities / tables in the database by means of a relation. i.e.; any two tables should be related. Let us say, an employee works for a department. This implies that Employee is related to a particular department. We should be able to define such a relationship between any two entities in the database. There should not be any table lying without any mapping.
- Data and application should be isolated. Because database is a system which gives the platform to store the data, and the data is the one which allows the database to work. Hence there should be clear differentiation between them.
- There should not be any duplication of data in the database. Data should be stored in such a way that it should not be repeated in multiple tables. If repeated, it would be unnecessary waste of DB space and maintaining such data becomes chaos.
- Multiple users should be able to access the same database, without affecting the other user. i.e.; if teachers want to update a student's marks in Results table at the same time, then they should be allowed to update the marks for their subjects, without modifying other subject marks. A good database should support this feature.
- It supports multiple views to the user, depending on his role. In a school database, Students will able to see only their reports and their access would be read only. At the same time teachers will have access to all the students with the modification rights. But the database is the same. Hence a single database provides different views to different users.
- Database should also provide security, i.e.; when there are multiple users are

accessing the database, each user will have their own levels of rights to see the database. Some of them will be allowed to see whole database, and some will have only partial rights. For example, instructor who is teaching Physics will have access to see and update marks of his subject. He will not have access for other subjects. But the HOD will have full access on all the subjects.

- Database should also support ACID property. i.e.; while performing any transactions like insert, update and delete, database makes sure that the real purpose of the data is not lost. For example, if a student's address is updated, then it should make sure that there is no duplicate data is created nor there is any data mismatch for that student.

6.8. Database Features

6.8.1. Structured Query Language (SQL)

A form of programming language that provides a standardised method for retrieving information from databases.

6.8.2. Data Warehouse

Data warehouses are large database systems containing current and historical data that can be analysed to produce information to support organisational decision making.

6.8.3. Data marts

Data marts are a smaller, departmental version of a data warehouse which may be easier to manage than a company-scale data warehouse. Data marts do not aim to hold information across an entire company, but rather focus on one department.

6.8.4. Data Mining

Data mining in its broadest sense is a process that uses statistical, mathematical, artificial intelligence and other techniques to extract useful information from large

databases. Under this wide definition most types of data analysis can be classified as data mining.

Particular data mining techniques include:

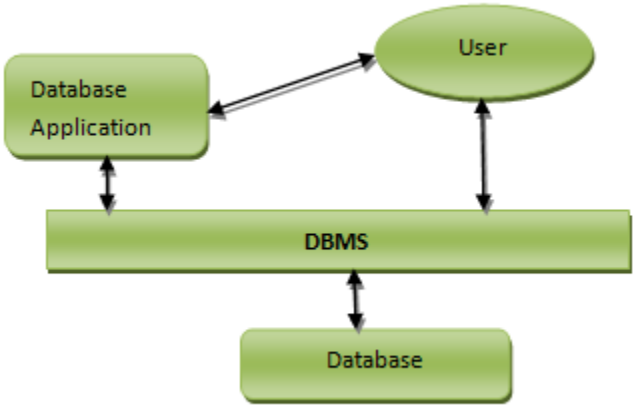
- **Identifying associations:** This involves establishing relationships about items that occur at a particular point in time.
- **Identifying sequences:** This involves showing the sequence in which actions occur, e.g. path or click-stream analysis of a web site.
- **Classification:** This involves analysing historical data into patterns to predict future behaviour.
- **Clustering:** This involves finding groups of facts that were previously unknown.
- **Modelling:** This involves using forecasting and regression analysis to predict sales.

6.9. Database Management Systems (DBMS)

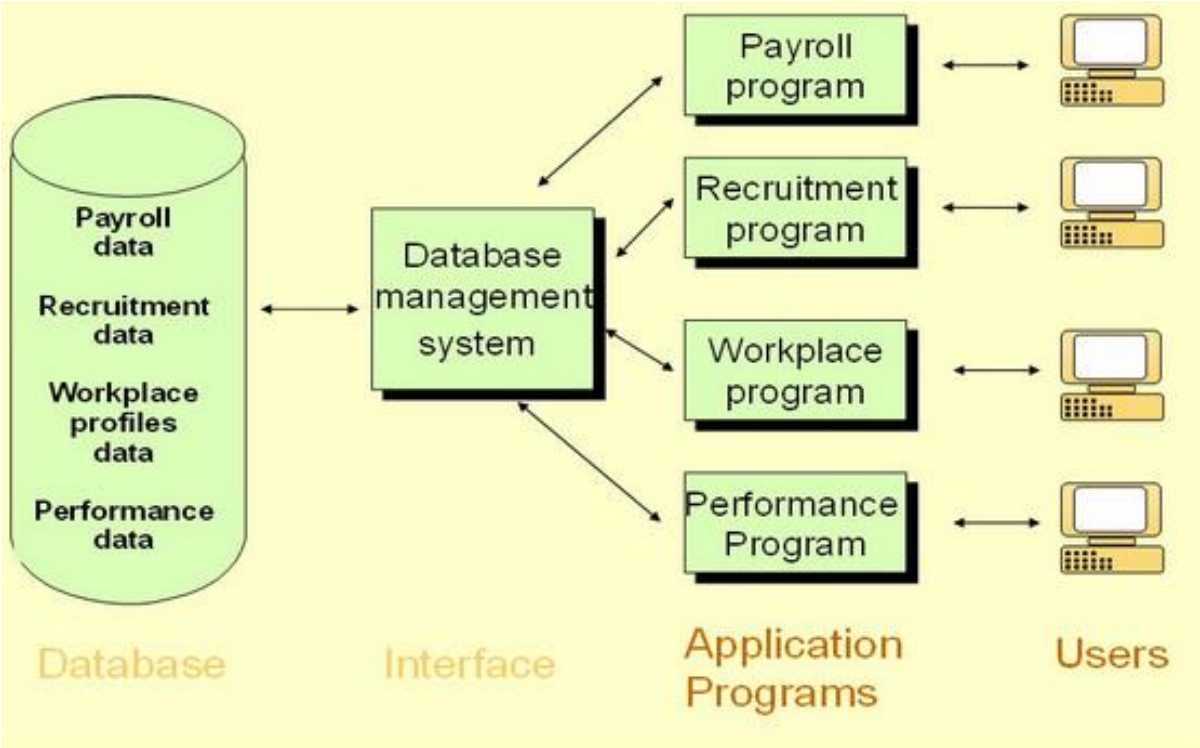
This is the software helps the user to interact with the database. It allows the users to insert, delete, update or retrieve the data. All these operations are handled by query languages like MySQL, Oracle etc.

6.10. Database Application:

It the application program which helps the users to interact with the database by means of query languages. Database application will not have any idea about the underlying DBMS.



Database Management System (DBMS) refer to a software system that is used to create, maintain, and provide controlled access to users of a database and a Database application program is a computer program that interacts with database by issuing an appropriate request (SQL statement) to the DBMS.



A Database approach System

6.10.1. Advantages of Database Management System (DBMS)

i. Improved data sharing

An advantage of the database management approach is, the DBMS helps to create an environment in which end users have better access to more and better-managed data. Such access makes it possible for end users to respond quickly to changes in their environment.

ii. Improved data security

The more users access the data, the greater the risks of data security breaches. Corporations invest considerable amounts of time, effort, and money to ensure that corporate data are used properly. A DBMS provides a framework for better enforcement of data privacy and security policies.

iii. Better data integration

Wider access to well-managed data promotes an integrated view of the organization's operations and a clearer view of the big picture. It becomes much easier to see how actions in one segment of the company affect other segments.

iv. Minimized data inconsistency

Data inconsistency exists when different versions of the same data appear in different places. For example, data inconsistency exists when a company's sales department stores a sales representative's name as "Wiza Sinyangwe" and the company's personnel department stores that same person's name as "Clement Mulenga," or when the company's regional sales office shows the price of a product as K450.95 and its national sales office shows the same product's price as K430.95. The probability of data inconsistency is greatly reduced in a properly designed database.

v. Improved data access

The DBMS makes it possible to produce quick answers to ad hoc queries. From a database perspective, a query is a specific request issued to the DBMS for data manipulation, for

example, to read or update the data. Simply put, a query is a question, and an ad hoc query is a spur-of-the-moment question. The DBMS sends back an answer (called the query result set) to the application. For example, end users, when dealing with large amounts of sales data, might want quick answers to questions (ad hoc queries) such as:

- What was the dollar volume of sales by product during the past six months?
- What is the sales bonus figure for each of our salespeople during the past three months?
- How many of our customers have credit balances of K3, 000 or more?

vi. Improved decision making

Better-managed data and improved data access make it possible to generate better-quality information, on which better decisions are based. The quality of the information generated depends on the quality of the underlying data. Data quality is a comprehensive approach to promoting the accuracy, validity, and timeliness of the data. While the DBMS does not guarantee data quality, it provides a framework to facilitate data quality initiatives.

vii. Increased end-user productivity

The availability of data, combined with the tools that transform data into usable information, empowers end users to make quick, informed decisions that can make the difference between success and failure in the global economy.

Till now we have seen different benefits of database management systems. But it has certain limitations or disadvantages. Let's find various disadvantages of database system.

6.10.2. Disadvantages of Database Management System (DBMS)

Although the database system yields considerable advantages over previous data management approaches, database systems do carry significant disadvantages. For example:

i. Increased costs

One of the disadvantages of DBMS is Database systems require sophisticated hardware and software and highly skilled personnel. The cost of maintaining the hardware, software, and personnel required to operate and manage a database system can be substantial. Training, licensing, and regulation compliance costs are often overlooked when database systems are implemented.

ii. Management complexity

Database systems interface with many different technologies and have a significant impact on a company's resources and culture. The changes introduced by the adoption of a database system must be properly managed to ensure that they help advance the company's objectives. Given the fact that database systems hold crucial company data that are accessed from multiple sources, security issues must be assessed constantly.

iii. Maintaining currency

To maximize the efficiency of the database system, you must keep your system current. Therefore, you must perform frequent updates and apply the latest patches and security measures to all components.

Because database technology advances rapidly, personnel training costs tend to be significant. Vendor dependence. Given the heavy investment in technology and personnel training, companies might be reluctant to change database vendors. As a consequence, vendors are less likely to offer pricing point advantages to existing customers, and those customers might be limited in their choice of database system components.

iv. Frequent upgrade/replacement cycles

DBMS vendors frequently upgrade their products by adding new functionality. Such new features often come bundled in new upgrade versions of the software. Some of these versions require hardware upgrades. Not only do the upgrades themselves cost money, but it also costs money to train database users and administrators to properly use and manage the new features.

6.10.3. Activity 6

i. *What is file processing system and how does it differ with the database management system?*

ii. *What are the advantages and disadvantages of DBMS?*

6.10.4. Unit Summary

For data-driven business organizations, DBMS can turn into extremely complex technology solutions that may require dedicated resources and in-house expertise. The size, cost and performance of a DBMS varies with the system architecture and use cases, and should therefore be evaluated accordingly. Also, a DBMS failure can incur significant losses to organizations that fail to maintain optimal functionality of a DBMS system.

7. UNIT 7 - SECURING INFORMATION SYSTEM

7.1. Introduction

Information Systems security is one of the biggest challenges facing organisations and the society at large in this technological age. Technology have become an integral part of everyday life in the home, businesses, government, and organizations. Information Systems have changed the way that people live their lives, conduct business, even run the government. As a result, Information Systems have become a very important aspect of everyday life because there are many uses of Information Systems that make it much easier and faster to perform certain tasks, or even to perform certain tasks simultaneously.

7.2. Objectives

By the end of this chapter, you will be able to understand the following:-

- What security is and the need for information security
- Why are information systems so vulnerable?
- What special measures must be taken to ensure the reliability, availability, and security of systems data and information?
- Understand the threats posed to information security and the more common attacks associated with those threats.
- Malware and computer viruses

7.3. Information System Security

In information System Security, is the defense of digital information and ICT assets against internal and external, malicious and accidental threats. This defense includes detection, prevention and response to threats through the use of security policies, software tools and ICT services.

The protection of information and information systems against unauthorized access or modification of information, whether in storage, processing, or transit, and against denial of service to authorized users.

Information security includes those measures necessary to detect, document, and counter such threats. Information security is composed of computer security and communications security.

It involves safe-guarding an organization's data from unauthorized access or modification to ensure its, **Confidentiality**, I**ntegrity** and **Availability** (**CIA**). The CIA is referred to as a **triple trait** in security

7.4. Information System Security as a process

Effective Information Security incorporates security products, technologies, policies and procedures. No collection of products alone can solve every Information Security issue faced by an organization.

More than just a set of technologies and reliance on proven industry practices is required, although both are important. Products, such as firewalls, intrusion detection systems, and vulnerability scanners alone are not sufficient to provide effective Information Security.

7.5. IS Security Policy and Procedure documents

An information system security policy is a well-defined and documented set of guidelines that describes how an organization manages, protects its information assets and makes future decisions about its information systems security infrastructure. On the other hand, a security procedures document accurately outlines how to accomplish a specific task.

Example

A policy may specify that antivirus software be updated on a daily basis, and a procedure will state exactly how this is to be done by providing a list of steps.

7.6. Responsibility of IS Security

Although some individuals may have “Security” in their title or may deal directly with security on a daily basis, security is everyone’s responsibility. Despite the robustness of a firewall, if a single user has hardware (e.g. a modem) or software (e.g. some File sharing software) that allows bypassing the firewall, a hacker may gain access with catastrophic results.

Security is an issue during an application's entire lifecycle. Applications must be designed to be secure, they must be developed with security issues in mind, and they must be deployed securely. Security cannot be an afterthought and be effective. System analysts, architects, and programmers must all understand the Information Security issues and techniques that are relevant to their work.

- End user awareness is critical, as hackers often directly target them.
- Users should be familiar with Security Policies and should know where the most recent copies can be obtained.
- Users must know what is expected and required of them.
- Typically this information should be imparted to users initially as part of the new hire process and refreshed as needed.

7.6.1. Causes of Information Risks

i. Human error:

- ❖ e.g. entering incorrect transactions; failing to spot and correct errors; processing the wrong information; accidentally deleting data

ii. Technical errors:

- ❖ e.g. hardware that fails or software that crashes during transaction processing a*ccidents and disasters*: e.g. floods, fire

iii. Fraud

- ❖ Deliberate attempts to corrupt or amend previously legitimate data and information

iv. Commercial espionage:

- ❖ E.g. competitors deliberately gaining access to commercially-sensitive data such as customer details; pricing and profit margin data, designs.

v. Malicious damage:

- ❖ Where an employee or other person deliberately sets out to destroy or damage data and systems for example hackers and creators of viruses.

7.7. Common Threats in Information Systems

i. Accidents

- ***Inaccurate data entry***. As an example, consider a typical relational database management system, where **update queries** are used to change records, tables and reports. If the contents of the query are incorrect, errors might be produced within all of the data manipulated by the query. Although extreme, significant problems might be caused by adding or removing even a single character to a query.
- ***Attempts to carry out tasks beyond the ability of the employee***. In smaller computer-based information systems, a common cause of accidental damage involves users attempting to install new hardware items or software applications. In the case of software applications, existing data may be lost when the program is installed or the program may fail to operate as expected.
- ***Failure to comply with procedures for the use of organisational information systems*.** Where organisational procedures are unclear or fail to anticipate potential problems, users may often ignore established methods, act on their own initiative or perform tasks incorrectly.
- ***Failure to carry out backup procedures or verify data backups*.** In addition to carrying out regular backups of important business data, it is also necessary to verify that any backup copies made are accurate and free from errors.
- ***Update query***: Used to change records, tables and reports held in a database management system.

ii. Natural disasters

- All information systems are susceptible to damage caused by natural phenomena, such as storms, lightning strikes, floods and earthquakes.
- In Japan and the United States, for example, great care is taken to protect critical information systems from the effects of earthquakes.
- Although such hazards are of less concern in much of Europe, properly designed systems will make allowances for unexpected natural disasters.

iii. **Sabotage (industrial and individual)**

- Deliberate deletion of data or applications

a. **Logic bomb**: Sometimes also known as a time bomb, a logic bomb is a destructive computer program that activates at a certain time or in reaction to a specific event.

b. **Back door**: A section of program code that allows a user to circumvent security procedures in order to gain full access to an information system.

c. **Data theft**: This can involve stealing sensitive information or making unauthorised changes to computer records.

- Accidental deletion

iv. **Unauthorised use (hacking)**

- ***Hacker***: Hackers are often described as individuals who seek to break into systems as a test of their abilities. Few hackers attempt to cause damage to systems they access and few are interested in gaining any sort of financial profit.

v. **Malware and computer viruses.**

Malware, or malicious software, is any program or file that is harmful to a computer user. **Malware** includes computer viruses, worms, Trojan horses and spyware. Malware includes the following:

- Computer viruses
- Trojans and key loggers
- Spyware.

A **virus** is a type of malware or a small infectious agent that replicates only inside the living cells of other organisms. **Viruses** can infect all types of life forms, from animals and plants to microorganisms, including bacteria and archaea. It is a computer program that is capable of self-replication, allowing it to spread from one 'infected' machine to another.

The origin of the term **computer virus** is credited to Fred Cohen, author of the 1984 book *Computer Viruses: Theories and Experiments*. However, 'natural' computer viruses were reported as early as 1974 and papers describing mathematical models of the theory of epidemics were published in the early 1950s.

A **keylogger** is just as it sounds: a program that logs keystrokes. The danger of having a keylogger virus on your computer is that it can very easily keep track of *every single keystroke* you enter through your keyboard, and this includes every password and username.

What's more, is that a ***Trojan*** keylogger is installed along with a regular program. Trojan horse viruses are malicious programs that don't actually look dangerous. They are attached to a regular, sometimes functioning program so that it doesn't seem like anything nefarious is installed to your computer.

Trojan keyloggers are sometimes called keystroke malware, keylogger viruses, and Trojan horse keyloggers.

Spyware is unwanted software that infiltrates your computing device, stealing your internet usage data and sensitive information. Spyware is classified as a type of malware (malicious software) designed to gain access to or damage your computer, often without your knowledge.

Worm: A small program that moves through a computer system randomly changing or overwriting pieces of data as it moves.

7.8. Virus security measures

- Unauthorised access to machines and software should be restricted as far as possible.

- Machines and software should be checked regularly with a virus detection program.
- All new disks and any software originating from an outside source should be checked with a virus detection program before use.
- Regular backups of data and program files must be made in order to minimize the damage caused if a virus infects the system.

7.9. Internet-related threats

- **Denial of service (DoS):** This is a form of attack on company information systems that involves flooding the company's Internet servers with huge amounts of traffic. Such attacks effectively halt all of the company's Internet activities until the problem is dealt with.
- **Brand abuse:** This describes a wide range of activities, ranging from the sale of counterfeit goods (e.g. software applications) to exploiting a well-known brand name for commercial gain.
- **Cybersquatting**: The act of registering an Internet domain with the intention of selling it for profit to an interested party. As an example, the name of a celebrity might be registered and then offered for sale at an extremely high price.
- **Cyberstalking**: This refers to the use of the Internet as a means of harassing another individual. A related activity is known as corporate stalking, where an organisation uses its resources to harass individuals or business competitors.
- **Cyberterrorism**: This describes attacks made on information systems that are motivated by political or religious beliefs.
- **Online stock fraud:** Most online stock fraud involves posting false information to the Internet in order to increase or decrease the values of stocks.
- **Social engineering:** This involves tricking people into providing information that can be used to gain access to a computer system.
- **Phishing:** A relatively new development, phishing involves attempting to gather confidential information through fake e-mail messages and web sites.

7.10. Managing Internet threats

A range of software applications are now available to assist other methods of managing threats:

- **Firewalls** – software to prevent unauthorised access to the company
- **Intrusion detection software** – monitors network to identify intruders

There is no such thing as fail-safe security for information systems. When designing security controls, a business needs to address the following factors.

i. Prevention

What can be done to prevent security accidents, errors and breaches? Physical security controls are a key part of prevention techniques, as are controls designing to ensure the integrity of data.

ii. Detection

Spotting when things have gone wrong is crucial; detection needs to be done as soon as possible - particularly if the information is commercially sensitive. Detection controls are often combined with prevention controls (e.g. a log of all attempts to achieve unauthorised access to a network).

iii. Deterrence

Deterrence controls are about discouraging potential security breaches.

iv. Data recovery

If something goes wrong (e.g. data is corrupted or hardware breaks down) it is important to be able to recover lost data and information.

v. Backup

Refers to the copying and archiving of computer data so it may be used to restore the original after a data loss event.

vi. Data encryption

Translation of data into another form, or code, so that only people with access to a secret key (formally called a decryption key) or password can read it.

vii. Frequency change of password

Change passwords frequently in order to ensure the security of your computer account. Failure to this leads to it getting familiar and eventually lead to its compromise.

7.11. Benefits of Information Security

Managing information security is often viewed as a headache by management. It is often perceived as adding costs to a business by focusing on negatives, that is, what might go wrong. However, there are many potential business benefits from getting information system security right:

- If systems are more up-to-date and secure - they are also more likely to be accurate and efficient
- Security can be used to "differentiate" a business – it helps build confidence with customers and suppliers
- Better information systems can increase the capacity of a business. For example, adding secure transaction controls.
- online ordering to a web site can boost sales enabling customers to buy 24 hours a day, 7 days a week
- By managing risk more effectively – a business can cut down on losses and potential legal liabilities

7.12. Activity 7.

i. Mention some common threats in information systems

i. Explain the terms Malware and Computer Viruses and explain their difference

ii. State and explain 5 online threats to information systems

iii. Explain some prevention measures to put in place against internet attacks

7.0. UNIT 8 – Ethics, Intellectual Property and Copyright Issues

7.1. Introduction

Information systems have had an impact far beyond the world of business. New technologies create new situations that we have never dealt with before. How do we handle the new capabilities that these devices empower us with? What new laws are going to be needed to protect us from ourselves? This unit will kick off with a discussion what ethics is, this will be followed with the types of ethics, copy right issues, intellectual property and privacy.

7.2. Objectives

Upon successful completion of this chapter, you will be able to:

- Describe what the term *information systems ethics* means;
- Explain what a code of ethics is and describe the advantages and disadvantages;
- Define the term *intellectual property* and explain the protections provided by copyright, patent, and trademark; and
- Describe the challenges that information technology brings to individual privacy.

7.3. What are ethics?

Ethics is defined as the basic concepts and fundamental principles of decent human conduct. It includes study of universal values such as the essential equality of all men and women, human or natural rights, obedience to the law of land, concern for health and safety and, increasingly, also for the natural environment.

7.4. Why are ethics important?

- Most decisions and choices made by individuals, organizations, businesses, communities and the society in general have an end result or some form of consequences.
- It is understood in the field of ethics that the first and fundamental ethical question normally asked when a person is faced with a situation is '*what should I do?*' This could be one reason why the study of ethics maybe an important thing to do.

7.5. Intellectual Property

- Intellectual property (IP) is any unique product of the mind or human intellect. Examples of IP include: music, movies, books, software, paintings, words, phrases, symbols, designs, chemical formulas, etc.

- Intellectual property rights protect the interests of creators by giving them property rights over their creations. IP is protected with laws (copyrights, patents, etc.) which enable people to earn recognition or financial benefit from what they invent or create. By striking the right balance between the interests of innovators and the wider public interest, the IP system aims to foster an environment in which creativity and innovation can flourish.

- Intellectual property relates to items of information or knowledge, which can be incorporated in tangible objects at the same time in an unlimited number of copies at different locations anywhere in the world. The property is not in those copies but in the information or knowledge reflected in them. In other words, intellectual property is distinguished from the media on which it is expressed. The physical pages of a book aren't the intellectual property. The intellectual property is in the words and their order no matter how they are expressed.

7.6. Types of Intellectual Property

The constitution gives Congress the right to make IP laws. Through legislation they have defined 4 primary forms of IP and corresponding laws for protecting each form:

7.6.1. Copyrights

Copyrights protect the expression of an idea. A copyright gives exclusive rights to reproduce, publish, or sell an original work of authorship. Copyrights protect the expression of an idea but not the idea itself. Photographs are copyrighted. Photographers have the exclusive right to reproduce their photographs (right to control the making of copies). Unless you have permission from the photographer,

you can’t copy, distribute (no scanning and sending them to others), publicly display (no putting them online), or create derivative works from photographs.

7.6.2. Patents

Patents protect ideas. A patent is a set of exclusive rights granted to an inventor to make, use or sell an invention. Most patents expire 20 years from the date of filing. To earn a patent an idea must be novel, useful and non-obvious. Business processes may also be patented (this is controversial). For example, Amazon's one-click patent is often offered as an example of what is wrong with software patents. (Q. Say you downloaded and used the LAME MP3 compression plug-in. Explain how you might have violated copyright and patents at the same time.) Patents must for something useful. Low bar for usefulness:

7.6.3. Trademarks

A trademark is used to identify a business, product or service. A trademark can be a word, phrase, symbol, logo, etc. Trademarks don't expire to the public domain unless they are "abandoned" by their owner or not protected by the owner. A trademark can lose its trademark status if the general public stops using the trademark exclusively as an adjectives. For example, you should say 'I'm going to make a Xerox copy." rather than "I'm going to make a Xerox."

Trademarks that have lost their status: aspirin, escalator, thermos. Adobe is keen on not loosing their trademark on Photoshop. They are constantly urging the public to stop saying: "I *photoshopped* that image!"

Audio may be trademarked. Harley-Davidson gave up trying to trademark the distinction sound of their motorcycles. MGM lion's roar and the NBC chimes have been trademarked.

7.6.4. Trade Secrets

A trade secret is confidential information (formula, process, device, etc.) that gives a company an advantage over their competition. Trade secrets don't expire but they must be kept secret for trade secret law to be enforceable. A trade secret can be reverse engineered where as a patent cannot.

7.7. Privacy

Privacy is the ability of an individual or group to seclude themselves, or information about themselves, and thereby express themselves selectively. The boundaries and content of what is considered private differ among cultures and individuals, but share common themes. When something is private to a person, it usually means that something is inherently special or sensitive to them. The domain of privacy partially overlaps with security (confidentiality), which can include the concepts of appropriate use, as well as protection of information. Privacy may also take the form of bodily integrity.

7.8. Activity

i. Explain the term ethics and its importance

ii. Define the following terms

- *Intellectual Property*
- *Privacy*
- *Trademark*
- *Patent*
- *Copyright*

7.9. Unit Summary

The rapid changes in information technology in the past few decades have brought a broad array of new capabilities and powers to governments, organizations, and individuals alike. These new capabilities have required thoughtful analysis and the creation of new norms, regulations, and laws. In this unit, we have understood intellectual property and privacy issues and now we can apply them to our day-to-day operations.

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