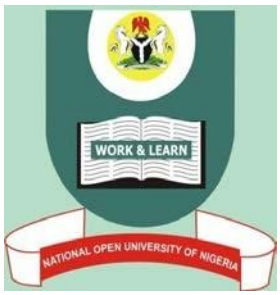
CIT 202:
APPLICATION OF COMPUTER IN BUSINESS





NATIONAL OPEN UNIVERSITY OF NIGERIA

COURSE GUIDE

CIT 202
APPLICATION OF COMPUTER IN BUSINESS

Course Developer	Gerald C. Okeke Eco Communication Inc. Ikeja, Lagos
Course Editor/Coordinator	Adegbola, Abimbola Eunice National Open University of Nigeria
Programme Leader	Dr. O.J. Onwe National Open University of Nigeria



NATIONAL OPEN UNIVERSITY OF NIGERIA

National Open University of Nigeria
Headquarters
14/16 Ahmadu Bello Way
Victoria Island
Lagos

Abuja Office
No. 5 Dar es Salaam Street
Off Aminu Kano Crescent
Wuse II, Abuja
Nigeria

e-mail: centralinfo@nou.edu.ng
URL: www.nou.edu.ng

Published by
National Open University of Nigeria 2008

Printed 2008

ISBN: 978-058-198-7

All Rights Reserved

CONTENTS **PAGE**

Introduction.....1
Course Objectives.....1
Credit Units.....2
Study Units..... 2
Course Assessment..... 2

Introduction

This course is designed to avail managers in business, governance and education with what computer is and its applications in carrying out their every day assignments. This course goes on to acquaint them with the basic component parts of a personal computer and the types available. The emphasis is for them to understand the application of computer in information technology and in information communications technology that translates to effectiveness and efficiency in business and people management.

Course Objectives

The following are the major objectives of this course

Define a computer and know the major characteristics of a computer
Know the different classes and categories of computer
1. Define hardware and know the basic components of computer hardware
6.0 Identify and differentiate the types of software available
*0Identify the four basic cycles the computer undergoes during data processing
6.0 Define and trace the history of operating systems
Identify and differentiate types of operating systems commonly available
Define and identify the major types of application systems
3 Enumerate the benefits of database management system.
Identify the benefits associated with SDLC
Know the levels of users involvement in the development of information system
1. Know the major functions of networks to a business
Know to what extent the Internet has impacted the social life of people
Understand the application of the Internet in marketing
1. Know the various forms of attack computer is exposed to
Know what are the characteristics of a healthy job
Identify the ways computer system impact on health and safety of workers

Know the roles ICT has played thus far in the reduction of poverty in developing countries.
Answer the question of the future of ICT.

Credit Units

This course attracts 3 credit units

Study Units

The study units of this course are as follows:

Module 1

Unit 1	Introduction to Computer
Unit 2	Computer Hardware
Unit 3	Computer Software
Unit 4	Basic Computer Operations
Unit 5	Operating Systems

Module 2

Unit 1	Computer Application Systems
Unit 2	Database Management System
Unit 3	Systems Development Life Cycle
Unit 4	Computer Networks
Unit 5	The Internet

Module 3

Unit 1	Computer Security
Unit 2	Health and Safety
Unit 3	Information Communication Technology

Course Assessment

6.0 Assignments = 30%
7.0 Examination = 70%

Course Code	CIT 202
Course Title	APPLICATION OF COMPUTER IN BUSINESS
Course Developer	Gerald C. Okeke Eco Communication Inc. Ikeja, Lagos
Course Editor/Coordinator	Adegbola, Abimbola Eunice National Open University of Nigeria
Programme Leader	Dr. O.J. Onwe National Open University of Nigeria



NATIONAL OPEN UNIVERSITY OF NIGERIA

National Open University of Nigeria
Headquarters
14/16 Ahmadu Bello Way
Victoria Island
Lagos

Abuja Office
No. 5 Dar es Salaam Street
Off Aminu Kano Crescent
Wuse II, Abuja
Nigeria

e-mail: centralinfo@nou.edu.ng
URL: www.nou.edu.ng

Published by
National Open University of Nigeria 2008

Printed 2008

ISBN: 978-058-198-7

All Rights Reserved

CONTENTS PAGE

Module 1 …… 1

Unit 1 Introduction to Computer……. 1
Unit 2 Computer Hardware……... 13
Unit 3 Computer Software…… 27
Unit 4 Basic Computer Operations……... 37
Unit 5 Operating Systems……. 54

Module 2 …… 68

Unit 1 Computer Application Systems……. 68
Unit 2 Database Management System…….. 78
Unit 3 Systems Development Life Cycle……. 89
Unit 4 Computer Networks……... 101
Unit 5 The Internet…… 113

Module 3 …… 126

Unit 1 Computer Security……. 126
Unit 2 Health and Safety…….. 138
Unit 3 Information Communication Technology……. 149

MODULE 1

Unit 1 Introduction to Computer
Unit 2 Computer Hardware
Unit 3 Computer Software
Unit 4 Basic Computer Operations
Unit 5 Operating Systems

UNIT 1 INTRODUCTION TO COMPUTER

CONTENTS

1.0 Introduction
2.0 Objectives
3.0 Main Content
3.1 Classes of Computers
3.1.1 Microcomputers
3.1.2 Minicomputers
3.1.3 Mainframe Computers
3.2 Mainframes vs. Supercomputers
3.3 Classes by Function
3.3.1 Servers
3.3.2 Workstation
3.3.3 Portable Data Entry Terminals
3.3.4 Embedded Computer Systems
3.4 Supercomputer
4.0 Conclusion
5.0 Summary
6.0 Tutor-Marked Assignment
7.0 References/Further Readings

1.0 INTRODUCTION

There are several definitions to computer, so there is no one single definition of a computer. However, in this unit we will try to give a generalized and all round satisfactory definition of computer. A computer is a fast operating machine that can be used for the home and business to enhance productivity. In other words, a computer is a collection of electronic parts, or hardware that have a set of electronic instructions called software. All computers perform the same basic functions; they enable you to store and manipulate information.

Typically any machine called a computer displays the following characteristics:

The ability to perform calculation at very high speed.
Ability to take in information and to store that information for future retrieval or use.
The ability to take in and store sequence of instructions called program which must be written in the language of computer.
The ability to obey sequence of program instructions provided the program is stored within the computer.
The ability to use simple logical rules to make decisions for their own internal control, or for the control of some external activity e.g. to take over the role of calculator operator.
The ability to communicate with other systems.
The ability to exploit a complex internal structure of a microelectronics circuitry in a variety of ways.

2.0 OBJECTIVES

At the end of this unit you are expected to:

define a computer and know the major characteristics of a computer
know the different classes and categories of computer
differentiate mainframe computer from supercomputer
define the different types of computer based on size and functions.

3.0 MAIN CONTENT

3.1 Classes of Computers

A few years ago computers were easily classified as **mainframe**, **minicomputer** or **microcomputer**. Mainframe computers were physically large and powerful systems capable of supporting hundreds of users. They had relatively large amount of RAM (e.g. 1-2 Mb) and disk storage (e.g. 100 to 400 Mb). Minicomputers were smaller less powerful machines than mainframes, but were still multi-user machines. Microcomputers were small humble machines with 8-bit or 16-bit processors, 16Kb to 256Kb of RAM and 5 to 10 Mb of disk storage, used mainly for games and basic word processing. Developments in microprocessor technology however means that today's desktop microcomputer will easily have more RAM and disk storage than the above mentioned mainframe, as well as having a more powerful CPU. Minicomputers today are really no more than very powerful microcomputers. The differences between such a machine and a desktop model may more likely be in the software that is being used as opposed to the hardware, for example, a multi-user operating system such as Unix, would typically be used, as opposed to the Windows systems of PCs. Mainframe computers are still powerful machines (physically

much smaller than their ancestors) with hundreds of megabytes of RAM and terabytes of disk storage. They have very powerful CPU's that allow them cope with large numbers of users. **Supercomputer** is the term used for the most powerful computer available at any time. These are typically tailored for very fast processing of what are known as **number crunching** applications. Such applications require a tremendous number of arithmetic calculations to be carried out. Weather forecasting is the classic example of such an application, where equations taking account of huge numbers of observations have to be solved. Other applications are to be found in astro-physics and some branches of chemical analysis and modelling. Supercomputers at the moment can carry out trillions of operations per second! The Cray is perhaps the most well known supercomputer, named after its designer, Seymour Cray.
The different classes of computers based on sizes are as follow:

3.1.1 Microcomputers

Microcomputers are the most common type of computers in existence today, whether at work in school or on the desk at home. The term "Microcomputer" was introduced with the advent of single chip large scale integrated circuit computer processors. The term "microcomputer" itself, is now practically an anachronism.

A **microcomputer** is a computer with a microprocessor as its central processing unit. Another general characteristic of these computers is that they occupy physically small amounts of space when compared to mainframe and minicomputers. Many microcomputers (when equipped with a keyboard and screen for input and output) are also personal computers (in the generic sense).

These computers include:

Desktop Computers

A **desktop computer** is a personal computer (PC) in a form intended for regular use at a single location, as opposed to a mobile laptop or portable computer. Prior to the wide spread of microprocessors a computer that could fit on a desk was considered remarkably small. Today the phrase usually indicates a particular style of computer case. Desktop computers come in a variety of styles ranging from large vertical tower cases to small form factor models that can be tucked behind an LCD monitor. In this sense, the term 'desktop' refers specifically to a horizontally-oriented case, usually intended to have the display screen placed on top to save space on the desk top. Most modern desktop computers have separate screens and keyboards. A specialized

form of desktop case is used for home theatre systems, incorporating front-panel mounted controls for audio and video.

Personal Digital Assistants (More Commonly Known As PDA'S)

A **Personal Digital Assistant (PDA)** is a handheld computer, also known as **small** or **palmtop computers**. Newer PDAs also have both color screens and audio capabilities, enabling them to be used as mobile phones (smartphones), web browsers, or portable media players. Many PDAs can access the Internet, intranets or extranets via Wi-Fi, or Wireless Wide-Area Networks (WWANs). Many PDAs employ touch screen technology.

Palmtop Computers

A **subnotebook** (also **ultraportable laptop** or **minilaptop** computer) is a small and lightweight portable computer, with most of the features of a standard laptop computer but smaller. The term is often applied to systems that run full versions of desktop operating systems such as Windows or Linux, rather than specialized software such as Windows CE, Palm OS or Internet Tablet OS. The term "ultra-mobile PC" (UMPC) is also frequently used to refer to such machines, although this also refers to a small form-factor tablet PC platform.

Subnotebooks are smaller than laptops but larger than handheld computers and UMPCs. They often have smaller-sized screens, usually measuring from 7 inches (17.7 cm) to 13.3 inches (33.78 cm), and a weight from less than 1 kg (2.2 lbs) up to about 2 kg (4.4 lbs). The savings in size and weight are usually achieved partly by omitting ports or having removable media/optical drives; subnotebooks are often paired with docking stations to compensate.

Subnotebooks were seen as niche computing products and have rarely sold in large numbers until the 2007 introduction of the Asus Eee PC and the OLPC XO-1, known as ultra low-cost PC (ULPC or ULCPC), which are inexpensive in comparison to both existing machines in that form factor, and computers in general.

Laptop and Notebook Computers

A **laptop computer** or simply **laptop** (also **notebook computer**, **notebook** and **notepad**) is a small mobile computer, typically weighing 3 to 12 pounds (1.4 to 5.4 kg), although older laptops may weigh more. Laptops usually run on a single main battery or from an external AC/DC adapter that charges the battery while also supplying power to the computer itself even in the event of a power failure. This very powerful

main battery should not be confused with the much smaller battery nearly all computers use to run the real-time clock and backup BIOS configuration into the CMOS memory when the computer is without power.

Laptops contain components that are similar to their desktop counterparts and perform the same functions, but are miniaturized and optimized for mobile use and efficient power consumption, although typically less powerful for the same price. Laptops usually have liquid crystal displays and most of them use different memory modules for their random access memory (RAM), for instance, SO-DIMM in lieu of the larger DIMMs. In addition to a built-in keyboard, they may utilize a touchpad (also known as a trackpad) or a pointing stick for input, though an external keyboard or mouse can usually be attached.

3.1.2 Minicomputers

The term "Mini computer" was coined at the time when most computers were cabinet sized like Mainframe Computers. Mini computers were much smaller, less powerful, and much less expensive than Mainframe Computers. The first Mini computers generally only performed one task at a time, while bigger computers ran multi-tasking operating systems, and served multiple users. Mini computers were typified by small word sizes such as 8 or 16 bits whereas larger machines had larger word sizes.

Minicomputer (colloquially, **mini**) is a largely obsolete term for a class of multi-user computers that lies in the middle range of the computing spectrum, in between the largest multi-user systems (mainframe computers) and the smallest single-user systems (microcomputers or personal computers). Formerly this class formed a distinct group with its own hardware and operating systems notably having smaller address space (notice the cited numbers of bits in a data word, ranging from 8 to 24 bits commonly around 16-bits). While the distinction between mainframe computers and smaller computers remains fairly clear, contemporary middle-range computers are not well differentiated from personal computers, being typically just a more powerful but still compatible version of a personal computer. More modern terms for minicomputer-type machines include midrange systems (IBM parlance), workstations (Sun Microsystems and general UNIX/Linux parlance), and servers.

3.1.3 Mainframe Computers

The term Mainframe computer was created to distinguish the traditional, large, institutional computer intended to service multiple users from the smaller, single user machines. These computers are capable of handling

and processing very large amounts of data easily and quickly. A mainframe speed is so fast that it is measured in millions of tasks per milliseconds (MTM). While other computers became smaller, Mainframe computers stayed large to maintain the ever growing memory capacity and speed. Mainframe computers are used in large institutions such as government, banks and large corporations. These institutions were early adopters of computer use, long before personal computers were available to individuals. "Mainframe" often refers to computers compatible with the computer architectures established in the 1960s. Thus, the origin of the architecture also affects the classification, not just processing power.

Mainframes (often colloquially referred to as **Big Iron**) are computers used mainly by large organizations for critical applications, typically bulk data processing such as census, industry and consumer statistics, ERP, and financial transaction processing.

The term probably originated from the early mainframes, as they were housed in enormous, room-sized metal boxes or frames. Later the term was used to distinguish high-end commercial machines from less powerful units.

Today in practice, the term usually refers to computers compatible with the IBM System/360 line, first introduced in 1965 (IBM System z10 is the latest incarnation). Otherwise, large systems that are not based on the System/360 are referred to as either "servers" or "supercomputers". However, "server", "supercomputer" and "mainframe" are not synonymous (see client-server).

Some non-System/360-compatible systems derived from or compatible with older (pre-Web) server technology may also be considered mainframes. These include the Burroughs large systems, the UNIVAC 1100/2200 series systems, and the pre-System/360 IBM 700/7000 series. Most large-scale computer system architectures were firmly established in the 1960s and most large computers were based on architecture established during that era up until the advent of Web servers in the 1990s (Interestingly, the first Web server running anywhere outside Switzerland ran on an IBM mainframe at Stanford University as early as 1990. See History of the World Wide Web for details).

There were several minicomputer operating systems and architectures that arose in the 1970s and 1980s, but minicomputers are generally not considered mainframes (UNIX arose as a minicomputer operating system; Unix has scaled up over the years to acquire some mainframe characteristics).

Many defining characteristics of "mainframe" were established in the 1960s, but those characteristics continue to expand and evolve to the present day.

3.2 Mainframes vs. Supercomputers

The distinction between supercomputers and mainframes is not a hard and fast one, but supercomputers generally focus on problems which are limited by calculation speed while mainframes focus on problems which are limited by input/output and reliability ("throughput computing") and on solving multiple business problems concurrently (mixed workload). The differences and similarities include:

Both types of systems offer parallel processing. Supercomputers typically expose it to the programmer in complex manners, while mainframes typically use it to run multiple tasks. One result of this difference is that adding processors to a mainframe often speeds up the entire workload transparently.

Supercomputers are optimized for complicated computations that take place largely in memory, while mainframes are optimized for comparatively simple computations involving huge amounts of external data. For example, weather forecasting is suited to supercomputers, and insurance business or payroll processing applications are more suited to mainframes.

Supercomputers are often purpose-built for one or a very few specific institutional tasks (e.g. simulation and modeling). Mainframes typically handle a wider variety of tasks (e.g. data processing, warehousing). Consequently, most supercomputers can be one-off designs, whereas mainframes typically form part of a manufacturer's standard model lineup.

Mainframes tend to have numerous ancillary service processors assisting their main central processors (for cryptographic support, I/O handling, monitoring, memory handling, etc.) so that the actual "processor count" is much higher than would otherwise be obvious. Supercomputer design tends not to include as many service processors since they don't appreciably add to raw number-crunching power.

3.3 Classes by Function

3.3.1 Servers

Server usually refers to a computer that is dedicated to the task of storing and retrieving large amounts of data. For example, a large computer dedicated to a database may be called a "database server". "File servers" manage a large collection of computer files. "Web servers" process web pages and web applications. This tends to distinguish them from "mainframes", which were generally intended to handle a variety of tasks. In some instances, a computer that was once considered a mainframe, is given the role of Server. This is because the actual data processing is taken over by individual personal computers. Many smaller servers are actually personal computers that have been dedicated to the task of storing data for other personal computers. In other instances, many small computers (essentially specialised personal computers) are designed to work in concert as a single server.

3.3.2 Workstation

Workstations are computers that are intended to serve one user and may contain special hardware enhancements not found on a personal computer. They run operating systems that are normally associated with mainframe computers, usually one of the variants of the UNIX operating system.

3.3.3 Portable Data Entry Terminals

Portable data entry terminals (more commonly known as PDET's) are handheld devices that are used to record or capture data away from the mainframe computer that they are linked to. Examples of PEDTs include:

Barcode readers Gas Meter
Optical mark readers (as in lottery ticket readers)
Optical character recognition
Scanner Graphics
tablet Magnetic stripe
reader

3.3.4 Embedded computer systems

Embedded computers are general purpose CPUs that are a part of a machine or device. This computer runs a program that is stored in read only memory (ROM) and is only intended to operate a specific machine

or device. Practically all consumer electronics (including electric toothbrushes), automobiles and industrial machines contain embedded computers today. They are intended to operate this single machine or a single function of that machine. Embedded systems are typically required to operate continuously without being reset or rebooted, and once employed in their task the software usually cannot be modified. An automobile may contain a number of Embedded systems; however, a washing machine and a DVD player would contain only one. The CPUs used are slower and less expensive than those found in a personal computer, but they generally only have to conduct a single function.

3.5 Supercomputer

A supercomputer is focused on performing one task involving intense numerical calculations such as weather forecasting and solving scientific problems. The distinction between supercomputers and mainframes can be difficult to define at times. Supercomputers tend to be custom built and focus on processing power to do one task. Mainframes, while providing a lot of processing power, focus more on data throughput and generally perform many data handling operations involving minor computations.

Computer sizes		
Larger	Super · Minisuper · Mainframe · Mini · Supermini · Server	
Micro	Personal · Workstation · Home · Desktop · SFF	
Mobile	Cart / Portable / Desktop replacement computer · Laptop · Subnotebook (Netbook) · Tablet (Ultra-Mobile PC) · Portable / Mobile data terminal · Electronic organizer · E-book reader · Pocket computer · Handheld game console · Wearable computer	 
	PDAs / IAs: Handheld PC · Pocket PC · Smartphone · PDA phone · PMPs · DAPs	
	Calculators Graphing	
Others	Embedded system · Wireless sensor network · Microcontroller · Smartdust · Nanocomputer	

4.0 CONCLUSION

The advent of computer has brought about significant changes in all areas of human endeavour. Starting from the early days of the first form of computer to the present age of mobile computers there has been consistency in improving the functions of computer. The computer power has been on the increase while size has been on the decline, that is, there is gradual miniaturization of computer. Of note is the obvious changes in the size of mainframe computers.

5.0 SUMMARY

There are several definitions to computer, so here is no one single definition of a computer. However, in this unit we tried to give a generalized and all round satisfactory definition of computer. A computer is a fast operating machine that can be used for home and business to enhance productivity.

A few years ago computers were easily classified as **mainframe**, **minicomputer** or **microcomputer**. Mainframe computers were physically larger and powerful systems capable of supporting hundreds of users.

A **desktop computer** is a personal computer (PC) in a form intended for regular use at a single location, as opposed to a mobile laptop or portable computer
The term Mainframe computer was created to distinguish the traditional, large, institutional computer intended to service multiple users from the smaller, single user machines.

Mainframes (often colloquially referred to as **Big Iron**) are computers used mainly by large organizations for critical applications, typically for bulk data processing such as census, industry and consumer statistics, ERP, and financial transactions processing.

The distinction between supercomputers and mainframes is not a hard and fast one, but supercomputers generally focus on problems which are limited by calculation speed while mainframes focus on problems which are limited by input/output and reliability

Server usually refers to a computer that is dedicated to the task of storing and retrieving large amounts of data.

Embedded computers are general purpose CPUs that are a part of a machine or device.
A supercomputer is focused on performing one task involving intense numerical calculations such as weather forecasting and solving scientific problems.

6.0 TUTOR-MARKED ASSIGNMENT

1. Mention 5 characteristics of a computer
2. Briefly compare and contrast super computers and mainframe computers

7.0 REFERENCES/FURTHER READINGS

Kahney, Leander. "Grandiose Price for a Modest PC". *Wired*. Lycos

Proof of "micro" as a once-common term: (i) Direct reference: Jack Kibble-White, Jack "Stand by for a Data-Blast", Off the Telly. Article written December 2005.

Usage in the titles of Christopher Evans' books "The Mighty Micro" (ISBN 0-340-25975-2) and "The Making of the Micro" (ISBN 0-575-02913-7). Other books include Usborne's "Understanding the Micro" (ISBN 0-86020-637-8), a children's guide to microcomputers.

An early use of the term "personal computer" in 1962 predates microprocessor-based designs. *(See "Personal Computer: Computers at Home" reference below)*. A "microcomputer" used as an embedded control system may have no human-readable input and output devices. "Personal computer" may be used generically or may denote an IBM PC compatible machine.

"Personal Computer: Computers at Home", Wikipedia article section.

.

UNIT 2 COMPUTER HARDWARE

CONTENTS

1.0 Introduction
2.0 Objectives
3.0 Main Content
    3.1 Processing Devices
    3.2 Storage Devices
    3.3 Input Devices
    3.4 Output Devices
4.0 Conclusion
5.0 Summary
6.0 Tutor-Marked Assignment
7.0 References/Further Readings

1.0 INTRODUCTION

A computer system is made up of both **hardware** and **software**. Software is another term for computer program. Software controls the computer and makes it do useful work. Without software a computer is useless, akin to a car without someone to drive it. Hardware refers to the physical components that make up a computer system. These include the computer's processor, memory, monitor, keyboard, mouse, disk drive, printer and so on. In this notes we will take a brief look at the functions of the different hardware components. In addition we shall describe some of the essential software required for the operation of a computer system.

The hardware are the parts of a computer including the Central Processing Unit (CPU) and related microchips and micro-circuitry, keyboard, monitor, case and drives (floppy, hard, CD, DVD, optical, tape, etc...). Other extra parts called peripheral components or devices include mouse, printer, modem, scanner, digital camera and cards (sound, colour, video) etc. Together they are often referred to as a personal computer or PC.

2.0 OBJECTIVES

At the end of this unit you are expected to:

define hardware and know the basic components of computer hardware
identify processing devices
define CPU and computer memory

know the different types of storage devices and their storage capacities
identify and differentiate input and output devices.

3.0 MAIN CONTENT

3.1 Processing Devices

Central Processing Unit (CPU)

Though the term relates to a specific chip or the processor, a CPU's performance is determined by the rest of the computer's circuitry and chips.

Currently the Pentium chip or processor, made by Intel, is the most common CPU though there are many other companies that produce processors for personal computers. Examples are the CPU made by Motorola and AMD.

With faster processors the **clock speed** becomes more important. Compared to some of the first computers which operated at below 30 **megahertz** (MHz) the Pentium chips began at 75 MHz in the late 1990s. Speeds now exceed 3000+ MHz or 3 **gigahertz** (GHz) and different chip manufacturers use different measuring standards (check your local computer store for the latest speed). It depends on the **circuit board** that the chip is housed in, or the **motherboard**, as to whether you are able to upgrade to a faster chip. The motherboard contains the circuitry and connections that allow the various component to communicate with each other.

Though there were many computers using many different processors prior to this, I call the 80286 processor the advent of home computers as these were the processors that made computers available for the average person. Using a processor before the 286 involved learning a proprietary system and software. Most new software are being developed for the newest and fastest processors so it can be difficult to use an older computer system.

Memory

Memory can be very confusing but is usually one of the easiest pieces of hardware to add to your computer. It is common to confuse **chip memory** with **disk storage**. An example of the difference between memory and storage would be the difference between a table where the actual work is done (memory) and a filing cabinet where the finished product is stored (disk). To add a bit more confusion, the computer's

hard disk can be used as **temporary memory** when the program needs more than the chips can provide.

Random Access Memory or **RAM** is the memory that the computer uses to temporarily store the information as it is being processed. The more information being processed the more RAM the computer needs.

One of the first home computers used 64 **kilobytes** of RAM memory (Commodore 64). Today's modern computers need a minimum of 64 Mb (recommended 128 Mb or more) to run Windows or OS 10 with modern software.

RAM memory chips come in many different sizes and speeds and can usually be **expanded**. Older computers came with 512 Kb of memory which could be expanded to a maximum of 640 Kb. In most modern computers the memory can be expanded by adding or replacing the memory chips depending on the processor you have and the type of memory your computer uses. Memory chips range in size from 1 Mb to 4 Gb. As computer technology changes the type of memory changes as well making old memory chips obsolete. Check your computer manual to find out what kind of memory your computer uses before purchasing new memory chips.

3.2 Storage Devices

Among the most important part of computer systems are the devices that allow you to save the product of your labour. The physical component or materials on which data are stored are called storage media. A storage device is a piece of hardware that permanently store information. Unlike electronic memory, a storage device retains information when electric power is turned off.

Disk and Storage

Disks are used to store information. All information on computers are stored in **files**. The size of a file is measured in **bytes**.
A **byte** is **approximately** one character (letter 'a', number '1', symbol '?' etc....).

A byte is made up of **8 bits**. A bit is simply an **on** or an **off** signal which passes through the computers circuitry. Every piece of software can be broken down into a series of on or off signals or it's **Binary Code**.

About a thousand bytes is a **kilobyte** (Kb).
About a million bytes is a **megabyte** (Mb).
About a billion bytes is a **gigabyte** (Gb).

About a trillion bytes is a **Terabyte**
One Terabyte is a **Petabyte**
One Petabyte is an **Exabyte**

Note: I say 'about' because everything in computers must be divisible by 8 so a kilobyte is actually 1,024 bytes. The reason for this goes beyond the scope of an introductory level document but as it can cause some confusion I thought it should be mentioned.

Disk are a common way of transporting information such as bringing files home from work or sharing files. **Floppy disks** have become less useful as file sizes increase and **Compact disks** (CDs) and Digital Video Devices (DVDs) are becoming more popular. Most software are sold on CDs. Internal **Hard disks** are the most common storage device.

Compact disks or CDs can store large amounts of information. One disk will store 650 Mb or about 70 or 80 minutes of music. One type is a CD-ROM which stands for **Compact Disk Read Only Memory**. Another type is a CD-RW which stands for **Compact Disk - Read/Write**. CD drives can copy information or **burn** information on to a blank CD. Common **Read Only CD** blanks can only be written to once though more expensive **Read/Write CD's** can be used over and over again.

DVD disks can store 4.5 Gb on standard disk, 8 Gb on a dual layer disk and 16 Gb on a blue-ray disk. **DVD recorders** allow you to store large files, such as movies, on a single disk.

Hard disks store the majority of information on today's modern computer. My first hard disk stored 52 Mb, 12 more than my colleague's 40 Mb. Today the standard hard disk stores 30 Gb or more (this number is constantly increasing). Like a floppy disk information can be stored and deleted as necessary. As files get larger the speed that hard disks can read and write become more important.

Floppy disk or diskette comes in two basic sizes; 5.25 inch and 3.5 inch. Both have a low and high density version though 3.5 inch high density disks are the most common. However, many modern computers are being sold without floppy disk drives.

Disk size	Amount of storage	Approximate printed 8.5 x 11 inch pages
3.5 high density	1.44 Mb	720 pages
CD	650 Mb	a small library
DVD	4.5 Gb	a feature length movie
DVD dual layer	8 Gb	a long feature length movie with extras

There are many other storage devices including **tapes**, **Panasonic's LS120 3.5 inch diskettes**, **Iomega's Zip & Jazz disks**, **VCR tape** and many others. Innovation in storage technology is currently advancing rapidly.

Information is stored in an **electromagnetic** form much like a cassette or video tape.

Note: Keep disks away from strong electric or magnetic fields including x-rays. Beware of high electromagnetic areas in the room such as televisions, speakers, high tension wires, etc. Use disks only at room temperature and keep them out of direct sunlight. If possible avoid passing electromagnetic storage devices through airport x-rays. In theory information stored on a disk will last indefinitely but the physical storage device will wear out with usage and time so be sure to **back up** (copy) your important files to a second disk.

Removable Storage and/or Disk Drives

All **disks** need a **drive** to get information off - or **read** and put information on the disk - or **write**. Each drive is designed for a specific type of disk whether it is a CD, DVD, hard disk or floppy. Often the term 'disk' and 'drive' are used to describe the same thing but it helps to understand that the disk is the **storage device** which contains computer files - or **software** - and the drive is the mechanism that runs the disk.

USB Flash Drives

USB Flash Drives or thumb drives work slightly differently as they use memory cards to store information on. Digital cameras also use Flash memory cards to store information, in this case photgraphs. **Flash drives** or thumb drives range from 512 Mb to 8 Gb in capacity.

Tape Storage

Tape storage is **cheap** with a **large capacity** e.g. 50Mb upwards for a typical tape. Video tapes can store 2Gb to 8Gb (billion bytes). The disadvantage of tape as a storage medium, is that tape is a **sequential storage medium**. This means that to access the nth item of information, you have to skip over the first n-1 items; in the same fashion as fast forwarding to play music from the middle of an audio tape cassette. This makes tape very slow to access in comparison with disks. Typically, tape storage is used to keep a **backup** of the information stored on a disk. Thus, in the event of a loss of information from disk, you can retrieve it from your tape backup. Tape is also used to transfer information (data and software) between computers. Tape is especially popular in large computer installations where large amounts of data have to be kept for years. On personal computers it is more common to use disks as a form of backup storage and as a means of transferring information between computers.

3.3 Input Devices

Input devices are the computer hardware that accept data and instructions from a user. Input devices have been built in many forms to help in communicating with the computer. The most common input devices are the keyboard and the mouse.

Keyboard

The keyboard and mouse are the most widely used input devices at the moment. The QWERTY keyboard, so called because the keys 'q','w','e','r','t' and 'y' are adjacent, is the commonest form of keyboard. But other types of keyboard are available, some being specially designed for people with special needs. It should be noted that the layout of keys on the QWERTY keyboard owes its origins to typewriter designers who were actually trying to slow down the speed at which a typist could type. The reason was that the old lever-based typewriters were liable to levers getting interlocked if two keys were pressed in rapid succession. Typewriter designers laid out the keys in a fashion that made it difficult to type quickly, the QWERTY layout being the product of this design. Because so many people trained on such keyboards, the layout still remains with us today, many years after the engineering problem which it was designed to alleviate disappeared. It is worth noting that in some non-English speaking countries the layout is slightly different giving rise to QWERTZ and AZERTY keyboard layouts.

The keyboard is used to type information into the computer or **input** information. There are many different keyboard layouts and sizes with the most common for Latin based languages being the QWERTY layout (named for the first 6 keys). The standard keyboard has 101 keys. Notebooks have embedded keys accessible by **special** keys or by pressing key combinations (CTRL or Command and P for example). **Ergonomically** designed keyboards are designed to make typing easier.

Some of the keys have special uses, these are referred to as **command keys**. The three most common are the Control or CTRL, Alternate or Alt and the Shift keys though there can be more (the Windows key for example or the Command key). Each key on a standard keyboard has one or two **characters**. Press the key to get the lower character and hold Shift to get the upper.

Mouse

The mouse is used as a pointing device and to select options from menus. A tracker ball is used for the same purposes as a mouse and is popular on laptop computers.

Most modern computers today are run using a mouse controlled pointer. Generally if the mouse has two buttons the left one is used to **select** objects and text and the right one is used to **access menus**. If the mouse has one button (Mac for instance) it controls all the activity where a mouse with a third button can be used by specific software programs.

One type of mouse has a round ball under it that rolls and turns the two wheels which control the direction of the pointer on the screen. Another type of mouse uses an optical system to track the movement of the mouse.

Light Pen

Which can be used to point at a monitor, serving a similar function as a mouse. A touch sensitive screen is a method of input based on touching a specially designed screen in particular places. It is typically used in an application such as a tourist information system , where information can be obtained by touching menu options displayed on the screen.

Optical Character Recognition (OCR)

A very common requirement for business is the processing of payments. Take an insurance company, for example, here, very many customers return payment for their insurance with some form of printed statement from the company. In order to automate processing such payments, a

form of input called **optical character recognition** (OCR) was developed. An OCR device can scan a document and recognise characters. Originally, text had to be printed in a special OCR font for OCR to operate but nowadays OCR can handle almost any font. The advantage of OCR for companies is that when statements are returned with payments, they can be scanned in and the customer accounts automatically credited. A less sophisticated but similar device is an optical mark reader which can scan a specially designed form and recognise the presence of marks in particular positions. One use for such a device is in lottery games machines where a user marks numbers on a pre-printed form which is then read by an OCR reader connected to a lottery computer.

Magnetic Ink Character Recognition (MICR) is similar to OCR but this time the characters are not scanned optically. Instead they are scanned magnetically as they have been printed with magnetised ink, each character having a very distinct shape. This is used on cheques by banks, to encode bank account numbers.

Barcode Scanners are very popular input devices in supermarkets and stores. These devices scan barcodes which identify products. This is a form of OCR. The barcode is translated to a number which can be used by the computer to identify the product and look up its price in a database. In addition the software can keep track of stock levels by recording the number of sales of each item.

Image Scanners

These are devices which scan an image (document, photograph) and produce a digital version of the image i.e. the image is stored as a sequence of binary numbers. Special software can then display the digital version of the image on a monitor. They effectively "photocopy" the image into the computer. This type of technology is very useful for storing legal documents, application forms and anywhere there is a requirement to access the contents of an original document very quickly. The term **document image processing** (**DIP**) is used to describe the application of this technique and it is becoming an important application in insurance and banking organisations.

Cards

A whole range of cards are available such as ATM and credit cards which encode information magnetically. These cards can be read by card readers and allow you carry out various transactions such as paying for goods or obtaining cash.

Voice Input is perhaps the most exciting form of computer input. While some devices and applications are available, a good deal of work remains to be done before we will easily be able to use computer software without the need for a keyboard and mouse.

3.3 Output Devices

Output devices return processed data that is information back to the user. In other words output devices allow the computer to 'talk' to us. Some of these output devices are discussed below.

Monitors

The monitor shows information on the screen when you type. This is called **outputting** information. When the computer needs more information it will display a message on the screen, usually through a **dialog box**. Monitors come in many types and sizes from the simple monochrome (one colour) screen to full colour screens.

Most desktop computers use a monitor with a **cathode tube** and most notebooks use a **liquid crystal display** (LCD) monitor.

To get the full benefit of today's software with full colour graphics and animation, computers need a color monitor with a display or **graphics card**.

Printers

The printer takes the information on your screen and transfers it to paper or a **hard copy**. There are many different types of printers with various levels of quality. The three basic types of printer are; **dot matrix**, **inkjet**, and **laser**.

Dot matrix printers work like a typewriter transferring ink from a ribbon to paper with a series or 'matrix' of tiny pins.
Ink jet printers work like dot matrix printers but fires a stream of ink from a cartridge directly onto the paper.
Laser printers use the same technology as a photocopier using heat to transfer toner onto paper.

Modem

A modem is used to translate information transferred through telephone lines or cable.

The term stands for **modulate and demodulate** which changes the signal from **digital**, which computers use, to **analog**, which telephones use and then back again. A high speed connection also requires a modem but because the information is transferred digitally it isn't required to change the signal from digital to analog but is used to create the connection between your computer and the computer you are connecting with.

Modems are measured by the speed that the information is transferred. The measuring tool is called the **baud rate**. Originally modems worked at speeds below 2400 baud but today analog speeds of 56,000 are common. Cable, wireless or digital subscriber lines (DSL) modems can transfer information much faster with rates of 300,000 baud and up.

Modems also use **Error Correction** which corrects for transmission errors by constantly checking whether the information was received properly or not and **Compression** which allows for faster data transfer rates. Information is transferred in **packets**. Each packet is checked for errors and is re-sent if there is an error.

Anyone who has used the Internet has noticed that at times the information travels at different speeds. Depending on the amount of information that is being transferred the information will arrive at it's destination at different times. The amount of information that can travel through a line is limited. This limit is called **bandwidth**.

There are many more variables involved in communication technology using computers, much of which is covered in the section on the **Internet**.

Scanners

Scanners allow you to transfer pictures and photographs to your computer. A scanner 'scans' the image from the top to the bottom, one line at a time and transfers it to the computer as a series of **bits** or a **bitmap**. You can then take that image and use it in a paint program, send it out as a fax or print it. With optional **Optical Character Recognition** (OCR) software you can convert printed documents such as newspaper articles to text that can be used in your word processor. Most scanners use **TWAIN** software that makes the scanner accessable by other software applications.

Digital cameras

Digital cameras allow you to take digital photographs. The images are stored on a memory chip or disk that can be transferred to your computer. Some cameras can also capture sound and video.

Case

The case houses the microchips and circuitry that run the computer. Desktop models usually sit under the monitor and tower models beside. They come in many sizes, including desktop, mini, midi, and full tower. There is usually room inside to expand or add components at a later time. By removing the cover off the case you will find plate covered, empty slots that allow you to add cards. There are various types of slots including IDE, ASI, USB, PCI and Firewire slots.

Notebook computers may have room to expand depending on the type of computer. Most notebooks also have connections or ports that allow expansion or connection to exterior, peripheral devices such as monitor, portable hard-drives or other devices.

Cards

Cards are components added to computers to increase their capability. When adding a peripheral device make sure that your computer has a slot of the type needed by the device.

Sound Cards allow computers to produce sound like music and voice. The older sound cards were 8 bit then 16 bit then 32 bit. Though human ear can't distinguish the fine difference between sounds produced by the more powerful sound card they allow for more complex music and music production.

Colour Cards allow computers to produce colour (with a colour monitor of course). The first colour cards were 2 bit which produced 4 colours [CGA]. It was amazing what could be done with those 4 colours. Next came 4 bit allowing for 16 [EGA and VGA] colours. Then came 16 bit allowing for 1064 colours and then 24 bit which allows for almost 17 million colours. And now 32 bit is standard allowing monitors to display almost a billion separate colours.

Video Cards allow computers to display video and animation. Some video cards allow computers to display television as well as *capture* frames from video. A video card with a digital video camera allows computer users to produce live video. A high speed or network connection is needed for effective video transmission.

Network cards allow computers to connect together to communicate with each other. Network cards have connections for cable, thin wire or wireless networks. For more information see the section on Networks.

Cables

Cables connect internal components to the **Motherboard**, which is a board with series of electronic path ways and connections allowing the CPU to communicate with the other components of the computer.

3.4 Connecting a Printer to a Computer

Computers are connected to printers by cables using plugs and sockets. The sockets are usually called **interfaces** or **ports.** Since we use these ports to send information, into or out of, a computer, they are also called **input/output ports** or **I/O ports**. The cable used to connect the printer to the computer is often called a **line**.

There are two types of cable which may be used. One is called a **serial** cable and the other a **parallel** cable. The parallel cable is made up of many lines running in parallel, hence its name. A different interface (socket) is required for each. So you have a **serial interface** for a serial line and a **parallel interface** for a parallel line. Most computers and printers have both types of interface, allowing you to use which ever one you please. The serial line and interface are made up according to an international standard referred to as the RS232 standard. Hence a serial line and the interface for a serial line (i.e. a serial interface) are often referred to as an **RS232 line** and an **RS232 interface.**

4.0 CONCLUSION

Every thing about the computer industry has experienced rapid changes. The hardware component of computer has been experiencing improvement both in capacity, durability and reduction in size. The flash drive is a better expression of the improvement. Though small in size yet it stores so much data, even comparable to some hard disks. Generally the hardware industry has been on the increase.

5.0 SUMMARY

A computer system is made up of both **hardware** and **software**. Software is another term for computer program. Software controls the computer and makes it do useful work.

Among the most important part of computer systems are the devices that allow you to save the product of your labour. The physical

component or materials on which data are stored are called storage media

Hard Disks store the majority of information on today's modern computer. My first hard disk stored 52 Mb, 12 more than my colleague's 40 Mb. Today the standard hard disk stores 30 Gb or more (this number is constantly increasing).

USB Flash Drives or thumb drives work slightly differently as they use memory cards to store information on. Digital cameras also use Flash memory cards to store information, in this case photographs. **Flash Drives** or thumb drives range from 512 Mb to 8 Gb.

Input devices are the computer hardware that accepts data and instructions from a user. Input devices have been built in many forms to help in communicating with the computer. The most common input devices are the keyboard and the mouse.

The Mouse is used as a pointing device and to select options from menus. A tracker ball is used for the same purposes as a mouse and is popular on laptop computers.
Output devices return processed data, that is information back to the user. In other words output devices allow the computer to 'talk' to us.

A **Modem** is used to translate information transferred through telephone lines or cable. The term stands for **modulate and demodulate** which changes the signal from **digital**, which computers use, to **analog**, which telephones use and then back again.

Scanners allow you to transfer pictures and photographs to your computer.

Computers are connected to printers by cables using plugs and sockets. The sockets are usually called **interfaces** or **ports**

6.0 TUTOR-MARKED ASSIGNMENT

1. List 5 types of computer input devices
2. Briefly discuss tape storage

7.0 REFERENCES/FURTHER READINGS

Grass Root Design, 2004: *Introduction to Computer-A Beginners Guide*.

Whyte, R. 1995*: How Computers Work*, Ziff Davies Press.

UNIT 3 COMPUTER SOFTWARE

CONTENTS

1.0 Introduction
2.0 Objectives
3.0 Main Content
    3.1 Relationship to Computer Hardware
    3.2 Types
    3.3 Program and Library
    3.4 Three Layers
    3.5 Operations
    3.6 License
    3.7 Patents
    3.8 Ethics and Rights for Software Users
4.0 Conclusion
5.0 Summary
6.0 Tutor-Marked Assignment
7.0 References/Further Readings

1.0 INTRODUCTION

The software is the information that the computer uses to get the job done. Software needs to be accessed before it can be used. There are many terms used for the process of accessing software including **running**, **executing**, **starting up**, **opening**, and others.

Also, **Software** refers to parts of the computer which do not have a material form, such as programs, data, protocols, etc. When software is stored in hardware that cannot easily be modified (such as BIOS ROM in an IBM PC compatible), it is sometimes called "firmware" to indicate that it falls into an uncertain area somewhere between hardware and software.

In addition, **Software** is a general term used to describe a collection of computer programs, procedures and documentation that perform some tasks on a computer system. The term includes application software such as word processors which perform productive tasks for users, system software such as operating systems, which interface with hardware to provide the necessary services for application software, and middleware which controls and co-ordinates distributed systems.

"Software" is sometimes used in a broader context to mean anything which is not hardware but which is *used* with hardware, such as films, tapes and records.

Computer programs allow users to complete tasks. A program can also be referred to as an application and the two words are used interchangeably.

Examples of software programs or applications would be the Operating System (DOS, Windows 9x/Millenium/XP, O/S2, UNIX, MacOS 9.x/10.x and various others), Wordprocessor (typing letters), Spreadsheet (financial info), Database (inventory control and address book), Graphics program, Internet Browser, Email and many others.

Generally speaking, any documents that you create, graphics you design, sound you compose, files you make, letters you write, emails you send or anything that you create on your computer are referred to as software. All software are stored in files.

Software maybe stored on a disk or tape, whether that disk is a floppy, hard disk, CD, tape or one of the several other storage devices available.

There are millions of different pieces of software available for almost every conceivable need. Software are available commercially through stores and mail order and also available on the Internet. They are also available through an Open Source license which allows anyone to use the Open Source software free of charge as long as the license is maintained. If you can't find the application that you need software development companies can custom design software for you, to match your specific need(s).

The largest software companies offer packages of software or suites that include many of the programs that the average person or business needs. Software packages or suites contain programs that work together and share information, making it easier to combine that information in versatile ways. For example when writing a letter you can get the mailing address from an address book, include a letterhead from a graphics program, include a financial chart from a spreadsheet and combine this collection of information in the body of the letter.

2.0 OBJECTIVES

At the end of this unit you are expected to:

define computer software
differentiate software from hardware
identify and differentiate the types of software available
know the three layers of software that exist
know the operations of a typical software
answer questions about license

3.0 MAIN CONTENT

3.1 Relationship to Computer Hardware

Computer software is so called to distinguish it from computer hardware, which encompasses the physical interconnections and devices required to store and execute (or run) the software. At the lowest level, software consists of a machine language specific to an individual processor. A machine language consists of groups of binary values signifying processor instructions which change the state of the computer from its preceding state. Software is an ordered sequence of instructions for changing the state of the computer hardware in a particular sequence. It is usually written in high-level programming languages that are easier and more efficient for humans to use (closer to natural language) than machine language. High-level languages are compiled or interpreted into machine language object code. Software may also be written in an assembly language, essentially, a mnemonic representation of a machine language using a natural language alphabet. Assembly language must be assembled into object code via an assembler.

The term "software" was first used in this sense by John W. Tukey in 1958. In computer science and software engineering, computer software is all computer programs. The theory that is the basis for most modern software was first proposed by Alan Turing in his 1935 essay *Computable numbers with an application to the Entscheidungs problem*

3.2 Types

Practical computer systems divide software systems into three major classes: system software, programming software and application software, although the distinction is arbitrary, and often blurred.

System software helps run the computer hardware and computer system. It includes operating systems, device drivers, diagnostic tools, servers, windowing systems, utilities and more. The purpose of systems software is to insulate the applications programmer as much as possible from the details of the particular computer complex being used, especially memory and other hardware features, and such accessory devices as communications, printers, readers, displays, keyboards, etc.

Programming software usually provides tools to assist a programmer in writing computer programs, and software using different programming languages in a more convenient way. The tools include text editors, compilers, interpreters, linkers, debuggers, and so on. An Integrated development environment (IDE) merges those tools into a software bundle, and a programmer may not need to type multiple commands for

compiling, interpreting, debugging, tracing, and etc., because the IDE usually has an advanced *graphical user interface,* or GUI.

Application software allows end users to accomplish one or more specific (non-computer related) tasks. Typical applications include industrial automation, business software, educational software, medical software, databases, and computer games. Businesses are probably the biggest users of application software, but almost every field of human activity now uses some form of application software

From another perspective the three basic types of software are; commercial, shareware and open source software. Some software are also released into the public domain without a license.

Commercial software come prepackaged and are available from software stores and through the Internet.

Shareware are software developed by individuals and small companies that cannot afford to market their software world wide or by companies that want to release demonstration versions of their commercial products. You will have an evaluation period in which you can decide whether to purchase the products or not. Shareware software often are disabled in some way and have notices attached to explain the legal requirements for using the products.

Open Source software are created by generous programmers and released into the public domain for public use. There is usually a copyright notice that must remain with the software product. Open Source software are not public domain in that the companies or individuals that develop the software retain ownership of the programs but the software can be used freely. Many popular Open Source applications are being developed and upgraded regularly by individuals and companies that believe in the Open Source concept.

3.3 Program and Library

A program may not be sufficiently complete for execution by a computer. In particular, it may require additional software from a software library in order to be complete. Such a library may include software components used by stand-alone programs, but which cannot work on their own. Thus, programs may include standard routines that are common to many programs, extracted from these libraries. Libraries may also *include* 'stand-alone' programs which are activated by some computer event and/or perform some function (e.g., of computer 'housekeeping') but do not return data to their calling program. Libraries may be called by one to many other programs; programs may

call zero to many other programs.

3.4 Three Layers

Starting in the 1980s, application software has been sold in mass-produced packages through retailers Users often see things differently than programmers. People who use modern general purpose computers (as opposed to embedded systems, analog computers, supercomputers, etc.) usually see three layers of software performing a variety of tasks: platform, application, and user software.

Platform Software

Platform includes the firmware, device drivers, an operating system, and typically a graphical user interface which, in total, allow a user to interact with the computer and its peripherals (associated equipment). Platform software often comes bundled with the computer. On a PC you will usually have the ability to change the platform software.

Application Software

Application software or Applications are what most people think of when they think of software. Typical examples include office suites and video games. Application software ares often purchased separately from computer hardware. Sometimes applications are bundled with the computer, but that does not change the fact that they run as independent applications. Applications are almost always independent programs from the operating system, though they are often tailored for specific platforms. Most users think of compilers, databases, and other "system software" as applications.

User-written Software

End-user development tailors systems to meet users' specific needs. User software includes spreadsheet templates, word processor macros, scientific simulations, and scripts for graphics and animations. Even email filters are a kind of user software. Users create these software themselves and often overlook how important they are. Depending on how competently the user-written software has been integrated into purchased application packages, many users may not be aware of the distinction between the purchased packages, and what has been added by fellow co-workers.

3.5 Operations

Computer software has to be "loaded" into the computer's storage (such

as a *hard drive*, *memory*, or *RAM*). Once the software has loaded, the computer is able to *execute* the software. This involves passing instructions from the application software, through the system software, to the hardware which ultimately receives the instruction as machine code. Each instruction causes the computer to carry out an operation – moving data, carrying out a computation, or altering the control flow of instructions.

Data movement is typically from one place in memory to another. Sometimes it involves moving data between memory and registers which enable high-speed data access in the CPU. Moving data, especially large amounts of it, can be costly. So, this is sometimes avoided by using "pointers" to data instead. Computations include simple operations such as incrementing the value of a variable data element. More complex computations may involve many operations and data elements together.

Instructions may be performed sequentially, conditionally, or iteratively. Sequential instructions are those operations that are performed one after another. Conditional instructions are performed such that different sets of instructions execute depending on the value(s) of some data. In some languages this is known as an "if" statement. Iterative instructions are performed repetitively and may depend on some data value. This is sometimes called a "loop." Often, one instruction may "call" another set of instructions that are defined in some other program or module. When more than one computer processor is used, instructions may be executed simultaneously.

A simple example of the way software operates is what happens when a user selects an entry such as "Copy" from a menu. In this case, a conditional instruction is executed to copy text from data in a 'document' area residing in memory, perhaps to an intermediate storage area known as a 'clipboard' data area. If a different menu entry such as "Paste" is chosen, the software may execute the instructions to copy the text from the clipboard data area to a specific location in the same or another document in memory.

Depending on the application, even the example above could become complicated. The field of software engineering endeavors to manage the complexity of how software operates. This is especially true for software that operates in the context of a large or powerful computer system.

Currently, almost the only limitation on the use of computer software in applications is the ingenuity of the designer/programmer. Consequently, large areas of activities (such as playing grand master level chess) formerly assumed to be incapable of software simulation are now routinely programmed. The only area that has so far proved reasonably secure from software simulation is the realm of human art— especially, pleasing music and literature. Kinds of software by operation: computer program as executable, source code or script, configuration.

3.6 License

Software license gives the user the right to use the software in the licensed environment, some software come with the license when purchased off the shelf, or an OEM license when bundled with hardware. Other software come with free software licences, granting the recipient the rights to modify and redistribute the software. Software can also be in the form of freeware or shareware.

3.7 Patents

The issue of software patents is controversial. Some believe that they hinder software development, while others argue that software patents provide an important incentive to spur software innovation. See software patent debate.

3.8 Ethics and Rights for Software Users

Being a new part of society, the idea of what rights users of software should have is not very developed. Some, such as the free software community, believe that software users should be free to modify and redistribute the software they use. They argue that these rights are necessary so that each individual can control their computer, and so that everyone can cooperate, if they choose, to work together as a community and control the direction that software progresses in. Others believe that software authors should have the power to say what rights the user will get.

Table 1: List of computer software

Operating system	Unix/BSD	UNIX System V, AIX, HP-UX, Solari (SunOS), IRIX, List of BSD operating systems
	GNU/Linux	List of Linux distributions, Comparison of Linux distributions
	Microsoft Windows	Windows 95, Windows 98, Window NT, Windows 2000, Windows XP Windows Vista, Windows CE
	DOS	86-DOS (QDOS), PC-DOS, MS-DOS, FreeDOS
	Mac OS	Mac OS classic, Mac OS X
	Embedded and real-time	List of embedded operating systems
	Experimental	Amoeba, Oberon/Bluebottle, Plan 9 from Bell Labs
Library	Multimedia	DirectX, OpenGL, OpenAL
	Programming library	C standard library, Standard template library
Data	Protocol	TCP/IP, Kermit, FTP, HTTP, SMTP
	File format	HTML, XML, JPEG, MPEG, PNG
User interface	Graphical user interface (WIMP)	Microsoft Windows, GNOME, KDE, QNX Photon, CDE, GEM
	Text user interface	Command line interface, shells

Application	Office suite	Word processing, Desktop publishing Presentation program, Database management system, Scheduling & Time management, Spreadsheet, Accounting software
	Internet Access	Browser, E-mail client, Web server, Mail transfer agent, Instant messaging
	Design and manufacturing	Computer-aided design, Computer-aided manufacturing, Plant management Robotic manufacturing, Supply chain management
	Graphics	Raster graphics editor, Vector graphic editor, 3D modeler, Animation editor, 3D computer graphics, Video editing, Image processing
	Audio	Digital audio editor, Audio playback Mixing, Audio synthesis, Computer music
	Software Engineering	Compiler, Assembler, Interpreter Debugger, Text Editor, Integrated development environment, Performance analysis, Revision control, Software configuration management
	Educational	Edutainment, Educational game, Serious game, Flight simulator
	Games	Strategy, Arcade, Puzzle, Simulation First-person shooter, Platform, Massively multiplayer, Interactive fiction
	Misc	Artificial intelligence, Antivirus software, Malware scanner Installer/Package management systems File manager

4.0 CONCLUSION

The software industry is a big business, not only because of the several types of software available but because of the innate nature of human beings to always want to see improvement in whatever they do. New software, or an improvement on the existing ones, has become the order of the day and is a big business. This is the reason why this sector of the computer industry has produced a one time richest man in the world in person of Bill Gates. Virtually there is software for all areas of human life, both mainstream and customized software.

5.0 SUMMARY

The software is the information that the computer uses to get the job done. Software needs to be accessed before it can be used. There are many terms used for the process of accessing software including **running**, **executing**, **starting up**, **opening**, and others.

Computer software is so called to distinguish it from computer hardware, which encompasses the physical interconnections and devices required to store and execute (or run) the software.
Practical computer systems divide software systems into three major classes: system software, programming software and application software, although the distinction is arbitrary, and often blurred.

A program may not be sufficiently complete for execution by a computer. In particular, it may require additional software from a software library in order to be complete.

Starting in the 1980s, application software has been sold in mass-produced packages through retailers.

Computer software has to be "loaded" into the computer's storage (such as a *hard drive*, *memory*, or *RAM*). Once the software has loaded, the computer is able to *execute* the software.

Software license gives the user the right to use the software in the licensed environment, some software come with the license when purchased off the shelf, or an OEM license when bundled with hardware.

Being a new part of society, the idea of what rights users of software should have is not very developed. Some, such as the free software community, believe that software users should be free to modify and redistribute the software they use

6.0 TUTOR-MARKED ASSIGNMENT

1. Mention 5 types of computer software
2. Briefly discuss Open Source software

7.0 REFERENCES/FURTHER READINGS

Wordreference.com: "WordNet® 2.0". Princeton University, Princeton, NJ.

Software..(n.d.). *Dictionary.com Unabridged (v 1.1)*. Retrieved 2007-04-13, from Dictionary.com website:

http://dictionary.reference.com/browse/software

John Tukey, 85, Statistician; Coined the Word 'Software', *New York Times*, Obituaries, 2000-07-28.

Hally, Mike (2005:79). *Electronic brains/Stories from the dawn of the computer age*. British Broadcasting Corporation and Granta Books, London. ISBN 1-86207-663-4.

"Software Top 100: the world's largest software companies". The Top 100 research foundation.

UNIT 4 BASIC COMPUTER OPERATIONS

CONTENTS

1.0 Introduction
2.0 Objectives
3.0 Main Content
- 3.1 How Computers Work/Basic Computer Process
- 3.2 Using Software
- 3.3 Printing
- 3.4 Exit or Quit
- 3.5 Menus
- 3.6 Installing New Software
- 3.7 Backing up Files
- 3.8 Compression and Decompression
- 3.9 The Desktop
- 3.10 Programs and Features

4.0 Conclusion
5.0 Summary
6.0 Tutor-Marked Assignment
7.0 References/Further Readings

1.0 INTRODUCTION

Computer undergoes basic processes at the start of its operations. It is only when such a process is completed that the computer can proceed to subsequent phases of its functions.

2.0 OBJECTIVES

At the end of this unit you are expected to:

identify the four basic cycles the computer undergoes during data processing
know how to create a folder and documents
know how to print a document

know how to save a document
identify the component of menu
know the process of installing software and backing up a file.
identify the components of the desktop.

3.0 MAIN CONTENT

3.1 How Computers Work/Basic Computer Process

Input: Information and programs are entered into the computer through Input devices such as the keyboard, disks, or through other computers via network connections or modems connected to the Internet. The input device also retrieves information off disks.

Output: Output Devices display information on the screen (monitor) or the printer and sends information to other computers. They also display messages about what errors may have occurred and brings up message or dialog box asking for more information to be inputed. The output device also saves information on the disk for future use.

Processing: The CPU or central processing unit is sometimes called the Control Unit and directs the operation of the input and output devices. The Coprocessor or the Arithmetic-Logic Unit does arithmetic and comparisons. The memory or RAM temporarily stores information (files and programs) while you are using or working on them. The BIOS or basic input/output system controls the dialogue between the various devices.

3.2 Using Software

Software is anything created and/or stored on a computer or computer storage device (like a disk). The work that is produced using an application or program is also software and is usually referred to as a file or a document.

Files and Documents

Once you have typed or created a new document or file on your computer, you will have to decide what to do with it. You could print it right away using a Print command and then Exit or Quit your program without saving it, but most of the time you will want to Save your document for future use.

The computer saves its information on a disk, most often the hard disk, and the users determine where and when the file or document is saved.



Folders and Directories

On the disk are directories or collection of folders. These directories or folders could be compared to a filing cabinet. All files are stored in a directory. Most hard disks have many directories or folders and files can be stored in any of them.

Directories can have sub-directories and sub-sub-directories many levels down. The directory immediately below the current directory is called the child directory. The directory immediately above the current one is called the parent directory. The top of the directory structure is called the root directory.

When a user adds or installs a new program on the computer the installation process will usually create a new directory or folder to store the application's files.

Users can create and delete directories or folders as the need arises. Older version of DOS requires that the directory be emptied of files before it can be deleted. When removing a directory always check before deleting it to make sure that it doesn't contain files you need.

You can easily move files from one folder or directory to another using menu commands, drag & drop using the mouse or a file utility. It is important to understand your computer's directory structure as a file can be misplaced if it is saved in the wrong directory.

One of the main problems new users have is creating a filing system. Modern operating systems address the 'filing problem' by automatically creating a (My) Documents folder. By saving files or documents in this folder you will always know where to look for your files. Create sub-folders within this folder for your main projects. Examples could be a separate folder for your correspondence called Letters or a folder for images called Graphics or Pictures. The main Documents folder can also be renamed to whatever name you want it to be called. If you are not using Windows 9x simply create your own folder and sub-folders to save your documents in.

Saving Files or Documents

In order to save a new document or file you must first choose the Save command. Most modern software place this command in a menu which you access with the mouse button or Alt key. Each file must be given a filename so it can be found easily the next time it is needed.

Computers using DOS 6.X or older version must follow the 8.3 rule: a filename can only be 1 to 8 characters long followed by a 1 to 3 character extension separated by a dot (period or full stop).

Modern operating systems allow computer users to use filenames up to 256 characters. Mac users, Windows 9X & NT/2000 and UNIX/LINUX (along with a few others) use long file names but names using over 32 characters get unwieldy. It is better to use a directory or folder to help describe them and keep common files together.

Many modern software programs (applications) add their own extension to filenames. These extensions allow operating systems to recognize certain filenames and associate (match) them to the program that created it.

As well as choosing a filename, users must choose a directory and/or disk to store the file in. Make sure that you are consistent and use a logical structure. Once you are sure you know where the file is going to be stored press Enter on the keyboard or press the left mouse button over the word Save or Okay to store the document on a disk, in the directory with the filename you have chosen. Some software programs will automatically save files in specific directory that is created when the program is installed (default settings). You can easily change these settings permanently using the applications Preferences or temporarily at the point of saving the file.

Some common rules are:

All files are saved on a disk or storage device.
A disk is usually broken up into directories and sometimes into partitions.
A directory or folder is a way of keeping like files in a common area.

A partitioned disk, though physically a single disk, is treated like separate disks and given a separate drive letter (and/or name).

It is possible to save or move files anywhere that your computer can access. This includes disk (or other storage devices) on your computer,

to any directory or sub-directory on your computer or on a **network** that your computer is connected to. Always make sure that you have chosen the correct directory and filename before pressing Enter or choosing Save.

3.3 Printing

The promise of a paperless office has not happened though conservation is catching on and it is possible to reduce paper consumption by using your computer more effectively. Having said that many computers are attached to printers and there are many reasons to print out documents that you create on your computer. Most software programs and applications allow the user to print the information that is created in the program.

When choosing a printer considers the peripheral equipment that you will need as well as the actual printer. Peripherals include paper, ribbons or ink cartridges, toner and occasionally print heads.

You may have to adjust some of the settings for the printer to get the output you want. Density adjustments determine how much ink is placed on the paper or how many dots per inch (DPI). Draft quality will print quicker but creates a fainter copy (less dense). Modern Software has a Preview option which shows what the page will look like when it is printed. Portrait prints the document up and down. Landscape prints the document on it's side. Most software allows the user to adjust the margin width or the blank space at the top, bottom, left and right edge of the paper.



3.4 Exit or Quit

It is important to Exit or Quit a program, application and the operating system before shutting off the computer. It is a good idea to Quit a program when you are finished with it as it takes up memory. Exiting a program should free up the memory that the program was using. Having a number of programs running simply uses up resources that may be needed in another project.

Exiting properly also saves the program settings so that when you return to the application many changes that were made will still be active.

3.5 Menus



Menus are the most common way of interacting or controlling your software. Though each program has it's own menu, modern software

developers have begun establishing some standardization in how they create their menus. Many programs have a menu called File which controls things like Opening, Saving and Printing your file and Exiting the program. Many also have an Edit menu which contains the main editing commands like Cut, Copy and Paste.



The items on the menu are Commands or the features of the program. You choose the command that you want with the keyboard, mouse, trackball or touchpad. Commands control the operation of the software.

Menu bars are usually positioned at the top of the screen and are accessed by moving the cursor to the menu and pressing the button (left button if there are two). This displays a pull down menu with a number of commands or features. Depending on how the program works either let go of the button and move to the command you want then press the button again to choose it or while holding down the button, move to the command and let go to choose it.

Menus can also be controlled through the keyboard. The most common way of accessing the menu through the keyboard is by pressing the Alt key and using the Arrow or Cursor Movement keys to move through the menu items, then pressing Enter to choose the item you want. Many menu items can also be accessed using Hot key combinations. One common keyboard combination is to first tap the Alt key and then press letter key for the command you want.

Menus are created in a hierarchy. Some menu items branch out to give even more choices. Some menu items open Dialog Boxes that allow you to choose from a number of different options.

Dialog boxes allow computer users to select different options. Some dialog boxes have 2 or more Tabs which can be clicked to choose more options. Once the options have been chosen press Okay to apply the options. Some dialog boxes have an Apply button which will apply the options that you have chosen without closing the dialog box. Choose Cancel to close the dialog box without applying the changes selected. Note that options set with the Apply button cannot be canceled this way. Modern software places the most popular commands on a toolbar for easier access. Simply click the left mouse button over the menu item to access a particular command. These tool bars can usually be customized and often allow the user to move or Tear Off the menu and drag them to a preferred location or Dock on the screen. Menus can also be customized by adding or removing commands.

Windows has a context sensitive menu that is activated with the right button. When the right mouse button is click over an object on the screen or area of the screen, a specific menu with commands related to that object will be displayed. Click the left mouse button on the command to choose it.

3.6 Installing New Software

Most software sold today have automated install sequence that are activated with the press of a button. The installation process will create a directory, if necessary, to store the files related to the new program, uncompress and copy the files to the directory and often adds itself to the desktop (Start) menu. Many installation processes will also copy files to other parts of the computer and register themselves with the operating system by updating the registry. Some programs will associate themselves to a certain filename extension.

Older software may not have this option. The installation procedure is the same though. First create a folder or drawer to store the program and it's related files in. This makes it easy to find them and minimizes file clutter in the main directory. Copy the files from the installation disk to the folder that you will be running the program from. A lot of Software is compressed and you may need to uncompress it before you can use it. You then can create a new item, create a short cut to the program or add it to your desktop menu or utility program.

3.7 Backing up Files

Computer errors and software failures happen occasionally so it is important to backup your files and documents.

One simple way to backup your files is to copy them to a disk. If there are only a few small files a floppy disk will work but if you are backing up lots of large files a CD burner, a second hard drive or tape backup may be needed. You can use a software program to automate backups or do it manually. A manual backup usually involves dragging the files or folders to the backup disk or tape to create the duplicate backup.

Store your backup files in a safe place out of the sun and away from electro-magnetic devices such as speakers and wires with strong electrical currents.
Every file that you create and plan to keep should be backed up. This includes word processing documents, financial information, databases, photos, etc...

Some less obvious files that also need to be backed up are E-mail, Internet Favorites or Bookmarks, and Address Books. Check the help files in your email program on how to back up E-mail. Generally each folder name in your E-mail program is a file containing the individual E-mail messages and copying these files to the backup disk or tape will be sufficient. Software preferences such as customized menus and settings can also be backed up. Check your software's help files to find out where these files are located.

A newer software version may be installed on the computer before ever needing the backups so make sure that the newer programs can handle the older file format.

When to backup is an individual choice. A company should have a backup policy which explains how and when data should be backed up. It all depends on how important the information is and how difficult it would be to duplicate it in the event of a system failure. If the information is critical an automatic backup system that duplicates the documents immediately may be needed (a Redundant Arrays of Inexpensive Disks (RAID) system is an example). If the files are not critical a weekly backup may be all that is needed. It is impossible to determine when a system failure will occur so it is better to be cautious.

The backed up data can then be used as an archive, to recover from a system failure or to transfer data to a new computer system. Simply copy the files to the correct folder to restore them. Backup software will have an automatic recovery feature that will restore the backed up file automatically.

3.8 Compression and Decompression

Most software you buy or get off the Internet are Compressed. Computers store information in bytes which are made up of **on** or **off** signals. The software applications that uses these files need to have all the **on** and **off** signals (bytes) in place but when the files are stored they can be modified to take up less space on the storage disk or tape.

There are commercial and shareware programs that will compress and decompressed files for you. The most popular form of data compression is called zip or stuffit but there are others available as well.

Programs are also available to compress and decompress your files as you or the application you are using requires them. This can be a way of making more space available on a hard drive. Windows comes with a program that will compress part of your hard disk. Be sure to read the documentation before embarking on a project like compressing a hard drive.

3.9 The Desktop

The Desktop offers many features that make using your computer easier. You can easily start programs or applications, copy and move files from one place to another and drag and drop files and program where you want them on the computer or even on to a program's icon to open a file. Open and Save menus are streamlined to allow all applications to have the same basic features plus program specific features.

Operating systems are often backwardly compatible with older systems so that older programs will run. Usually when new programs are created they are designed to work with the newest operating system to allow them to use all the newest features.

Desktop



Menu

The Start Button or Apple menu starts programs, opens documents, and accesses most parts of the system. Windows Program and Apple Dock menus can be customized as needed.

Program or Dock displays a list of the programs that are installed through Windows and available to use.
Documents displays a list of the last 15 documents used allowing the user to open them directly from this menu.

Settings displays system components, such as printers, control panel and taskbar.
Find/Search has search abilities to find files, folders and phrases in documents on your computer.
Help displays help topics broken up into contents, index and find components.
Run allows you to start a program from a command line.
Shut down shuts down the computer, restarts the computer or logs you off a network.
Favorites and **Active Desktop** is an option available to Windows 98+ (or Internet Explorer 4x) users.

Taskbar **(Windows) or Dock (Apple)**



displays the program running and windows open

- to bring a program or window to the front single click on the item on the taskbar or dock.
- right click in Windows and click hold in Apple to display a menu for the item.

right click an open area or click hold the separator for a Taskbar or Dock menu.
the Window system tray on the right of the Taskbar displays indicators for certain tasks. (for instance a printer icon will appear when the printer is engaged)
click and drag the Taskbar to the top, bottom, left or right and choose Dock properties to place Dock on left, right or bottom.
drag the Taskbar to extend it and the Dock to make it bigger.
drag an icon to the Dock or Taskbar to add an alias or shortcut and drag the icon off to remove it.
the Dock and Taskbar can be hidden until needed.
use Start/Settings/Taskbar to customize the Start menu properties and choose Apple/Dock to change the Dock properties.

Control Panel & System Preferences

used to change system settings like screen savers, time, screen colours.
also used to add and remove programs, fonts add and make changes to hardware and software settings.

Computer

displays all the components of the computer including disk drives and networks.
all parts of the computer can be accessed through My Computer's hierarchical structure.
double click on any icon to view the contents of a disk, folder or run a program

Windows and Finder

All programs, folders, tasks and most other operations open in a window.





Windows are used to:

share common attributes through out the entire system.
contain menus for **File**, **Edit**, **View** and **Help** which change depending on the task.

File

open, rename, delete or change properties of files and folders
Send To used to open files in a specified program
create "Shortcuts"

Edit

move, copy and paste files and folders

Undo the last change

View

change how files are displayed
toggles Toolbar and Status bar (Microsoft)
sorts files by choosing column name
can be set system wide

Help

displays help topics for active application

Toolbar: displays icon menu of main options
Status bar: shows current status of the window (Microsoft)
Shortcuts & Aliases

can be created anywhere that is convenient to access a program, file or folder
select item and choose Create Shortcut or Make Alias then drag or move it to where it is needed
use the right mouse button to drag the item to the target and choose Create Shortcut Here from the menu that appears (Microsoft)
when you delete a Shortcut or Alias the original application and its icon remain intact

Favorites: collection of short cuts to documents, programs and websites

3.10 Programs and Features

Some Features

Long file names - document names can now use names up to 255 characters including spaces using any character except \ / : * ? " < > |
Plug and Play - many hardware devices like CDs, tape drives, upgrade cards, etc. will automatically be detected and can be automatically installed on the system
32 bit Preemptive Multitasking - allows users to leave a task running while working on another
Right Mouse button - used to display event specific or context sensitive menus (Microsoft)
Drag and Drop feature allows files or other information to be dragged from one area and dropped in a new location or into another application.
Active Windows - make your Desktop behave like a web site (Microsoft).

Software Update - automates updating software through the Internet.
System Information or Profile - provides information about the computer system

Using Help 

to get help about a specific procedure click the help button in the top right corner of the screen.
Contents list general topics grouped by subject.
Index list specific topics accessed by scroll bars or typing the topic.
Find creates an index of words in Help and allows searches by word or phrase.
click **Help Topics** to return to the Help menu.
Troubleshooters will step you through a series of steps to solve computer problems (Microsoft).

Microsoft Explorer Bar 

Folder, Search, Favorites, Radio and History information are displayed on the left side of the window
click a folder or link to display contents on the right
click plus to expand or show the sub-folders and minus to hide them

Using Old DOS Programs 

many older DOS program will run under Windows.
the PIF editor is replaced with a Properties dialogue box.
note that some DOS programs cannot run in a windows and require a full screen

Using Older Software in MAC OS 10.x

When Apple OS 10.x tries to open an older version of a program it will run it in Classic mode

Switching between tasks (programs/applications/folders)

depending on your system's resources you can have many programs running at once and easily switch from one to another using various methods.
while holding down Alt, tap the Tab key to cycle through a menu of running tasks.
click on the taskbar or dock icon of the task you want to bring to the front.

Hints and Shortcuts

The right mouse button is a great feature of the Windows operating system and can be a real time saver. Right click on;

an empty space of the desktop to change Desktop Properties, My Computer to display or modify your computer's properties, Network Neighborhood to display and modify your network properties,
Start menu item to modify it,
An icon to work with it, etc.

On a Mac, hold the mouse button down to display a context menu.

Different Methods of Opening Documents and Programs

Open a program and use the Open command in the File menu
Use the Documents command in the Start or Apple menu to open a recently used document
Use the Find command in the Start menu or the Sherlock program on a Mac
Double click on an icon in a Folder
Right click and choose Open
Choose Start, Run and type the application (and path).

Creating Folders 

Use the New Folder option in the File menu (or right click) to create a folder in the active window.

Moving and Deleting Files

Use Drag & Drop to drag the file or folder from one folder to another.

- With the right button a menu will appear allowing you to
-- Copy or Move the file or folder (Windows).
- Files on the same disk are moved (hold Ctrl to copy).
- Files on another disk are copied (hold Ctrl to move).

Use the Edit menu to Cut the file and Paste it in the destination folder
Hold down Shift while deleting a file to by pass the Recycle Bin and permanently delete files.

Multiple Selection

To select files sequentially click on the first file and move to the last file, hold down shift and click on the last file in the sequence.
To select files non-sequentially click on the first file and hold Ctrl while clicking the rest.
The two methods can be used in combination.

Organizing your Files and Icons

It is important to develop a filing system early. Create a folder on your Desktop to store your data. Create sub-folders within that folder to sort the various documents, images, sounds and other files that you create and use. A new folder can be created easily and given a logical name which will help organize data.

My Documents or Documents is the default folder created by the operating system and can be used as it is or renamed.

Troubleshooting

Both Windows and Mac have a number of tools built in to assist in solving computer problems.
Choosing Help allows Windows users to access Troubleshooting Wizards that provide step-by-step suggestions.
System Information under System Tools provide valuable information and access to other system tools in Window
System Profiler under Application, Utilities provide information about the Mac.
Running a Disk Scan occasionally or on a schedule can solve many simple errors.

4.0 CONCLUSION

The basic sequence of computer operations has not changed and may not likely change in the near future. All machines classified as computer must receive data in the form of input, process the data, output or store the data as the case may be. However, the hardware components that drive the basic computer operations has continually experienced positive changes. We now have faster processors, better input devices, better hard disk and more convenient monitors.

5.0 SUMMARY

Computer undergoes basic processes at the start of its operations, it is only when such processes are completed that the computer can proceed to subsequent phases of its functions.

Software is anything created and/or stored on a computer or computer storage device (like a disk). The work that is produced using an application or program is also software and is usually referred to as a file or a document.

The promise of a paperless office has not yet happened though conservation is catching on and it is possible to reduce paper consumption by using your computer more effectively.

It is important to Exit or Quit a program, application and the operating system before shutting off the computer.

Menus are the most common way of interacting or controlling your software. Though each program has it's own menu, modern software developers have begun establishing some standardization in how they create their menus.

Most software sold today have automated install sequence that are activated with the press of a button.

Computer errors and software failures happen ocasionally so it is important to backup your files and documents.

Most software you buy or get off the Internet is Compressed. Computers store information in bytes which are made up of **on** or **off** signals.

The Desktop offers many features that make using your computer easier. You can easily start programs or applications, copy and move files from one place to another and drag and drop files and programs where you want them on the computer or even on to a program's icon to open a file.

Many backup options are done automatically by the computer which will provide various options to recover them in a crisis but a hard drive error can happen at any time and without warning.

6.0 TUTOR-MARKED ASSIGNMENT

1. Mention the 4 basic processing steps of computer
2. Describe different methods of opening documents and programs on a personal computer

7.0 REFERENCES/FURTHER READINGS

Grass Root Design, (2004). *Introduction to Computer-A Beginners Guide.*

Whyte, R. (1995). *How Computers Work*. Ziff Davies Press.

UNIT 5 OPERATING SYSTEMS

CONTENTS

1.0 Introduction
2.0 Objectives
3.0 Main Content
    3.1 History
    3.2 Types of Operating Systems
    3.3 Categories of Operating Systems
    3.4 Features and Technology
    3.5 Functions of Operating Systems
    3.6 Meaningfulness of Work
    3.7 Social Relationships
4.0 Conclusion
5.0 Summary
6.0 Tutor-Marked Assignment
7.0 References/Further Readings

1.0 INTRODUCTION

An **Operating System** (commonly abbreviated *OS* and *O/S*) is the software component of a computer system that is responsible for the management and coordination of activities and the sharing of the resources of the computer. The operating system acts as a host for application programs that are run on the machine. As a host, one of the purposes of an operating system is to handle the details of the operation of the hardware. This relieves application programs from having to manage these details and makes it easier to write applications. Almost all computers, including hand-held computers, desktop computers, supercomputers, and even modern video game consoles, use an operating system of some type. Some of the oldest models may however use an embedded OS, that may be contained on a compact disk or other storage device.

Operating systems offer a number of services to application programs and users. Applications access these services through application programming interfaces (APIs) or system calls. By invoking these interfaces, the application can request a service from the operating system, pass parameters, and receive the results of the operation. Users may also interact with the operating system by typing commands or using a graphical user interface (GUI, commonly pronounced “gooey”). For hand-held and desktop computers, the GUI is generally considered part of the operating system. For large multi-user systems, the GUI is generally implemented as an application program that runs outside the operating system.

Common contemporary operating systems include Microsoft Windows, Mac OS X, Linux and Solaris. Microsoft Windows has a significant majority of market share in the desktop and notebook computer markets, while servers generally run on Linux or other Unix-like systems. Embedded device markets are split amongst several operating systems.

2.0 OBJECTIVES

At the end of this unit you are expected to:

define and trace the history of operating systems
identify and differentiate types of operating systems commonly available
categorize operating systems
identify the technical constituents of a typical operating system
know the major functions of operating systems.

3.0 MAIN CONTENT

3.1 History

The first computers did not have operating systems. By the early 1960s, commercial computer vendors were supplying quite extensive tools for streamlining the development, scheduling, and execution of jobs on batch processing systems. Examples were produced by UNIVAC and Control Data Corporation, amongst others.

MS-DOS provided many operating systems like features, such as disk access. However many DOS programs bypassed it entirely and ran directly on hardware.

The operating systems originally deployed on mainframes, and, much later, the original microcomputer operating systems, only supported one program at a time, requiring only a very basic scheduler. Each program was in complete control of the machine while it was running. Multitasking (timesharing) first came to mainframes in the late 1960s.

In 1969-70, UNIX first appeared on the PDP-7 and later the PDP-11. It soon became capable of providing cross-platform time sharing using preemptive multitasking, advanced memory management, memory protection, and a host of other advanced features. UNIX soon gained popularity as an operating system for mainframes and minicomputers alike.

IBM microcomputers, including the IBM PC and the IBM PC XT could run Microsoft XENIX, a UNIX-like operating system from the early

1980s. XENIX was heavily marketed by Microsoft as a multi-user alternative to its single user MS-DOS operating system. The CPUs of these personal computers could not facilitate kernel memory protection or provide dual mode operation, so Microsoft XENIX relied on cooperative multitasking and had no protected memory.
The 80286-based IBM PC AT was the first computer technically capable of using dual mode operation, and providing memory protection.

Classic MAC OS, and Microsoft Windows 1.0-3.11 supported only cooperative multitasking (Windows 95, 98, & ME supported preemptive multitasking only when running 32 bit applications, but ran legacy 16 bit applications using cooperative multitasking), and were very limited in their abilities to take advantage of protected memory. Application programs running on these operating systems must yield CPU time to the scheduler when they are not using it, either by default, or by calling a function.

Windows NT's underlying operating system kernel was designed by essentially the same team as Digital Equipment Corporation's VMS, a UNIX-like operating system which provided protected mode operation for all user programs, kernel memory protection, preemptive multi-tasking, virtual file system support, and a host of other features.

Classic AmigaOS and Windows 1.0-Me did not properly track resources allocated by processes at runtime. If a process had to be terminated, the resources might not be freed up for new programs until the machine was restarted.

The AmigaOS did have preemptive multitasking.

3.2 Types of Operating Systems

Microsoft Windows

The Microsoft Windows family of operating systems originated as an add-on to the older MS-DOS operating system for the IBM PC. Modern versions are based on the newer Windows NT kernel that was originally intended for OS/2. Windows runs on x86, x86-64 and Itanium processors. Earlier versions also ran on the DEC Alpha, MIPS, Fairchild (later Intergraph) Clipper and PowerPC architectures (some work was done to port it to the SPARC architecture).

As of June 2008, Microsoft Windows holds a large amount of the worldwide desktop market share. Windows is also used on servers, supporting applications such as web servers and database servers. In

recent years, Microsoft has spent significant marketing and research & development money to demonstrate that Windows is capable of running any enterprise application, which has resulted in consistent price/performance records (see the TPC) and significant acceptance in the enterprise market.

The most widely used version of the Microsoft Windows family is Windows XP, released on October 25, 2001.

In November 2006, after more than five years of development work, Microsoft released Windows Vista, a major new operating system version of Microsoft Windows family which contains a large number of new features and architectural changes. Chief amongst these are a new user interface and visual style called Windows Aero, a number of new security features such as User Account Control, and few new multimedia applications such as Windows DVD Maker.

Microsoft has announced that a new version codenamed Windows 7 will be released in late 2009 - mid 2010

Plan 9

Ken Thompson, Dennis Ritchie and Douglas McIlroy at Bell Labs designed and developed the C programming language to build the operating system Unix. Programmers at Bell Labs went on to develop Plan 9 and Inferno, which were engineered for modern distributed environments. Plan 9 was designed from the start to be a networked operating system, and had graphics built-in, unlike Unix, which added these features to the design later. Plan 9 has yet to become as popular as Unix derivatives, but it has an expanding community of developers. It is currently released under the Lucent Public License. Inferno was sold to Vita Nuova Holdings and has been released under a GPL/MIT license.

The **Unix-like** family is a diverse group of operating systems, with several major sub-categories including System V, BSD, and Linux. The name "UNIX" is a trademark of The Open Group which licenses it for use with any operating system that has been shown to conform to their definitions. "Unix-like" is commonly used to refer to the large set of operating systems which resemble the original Unix.

Unix-like systems run on a wide variety of machine architectures. They are used heavily for servers in business, as well as workstations in academic and engineering environments. Free software Unix variants, such as GNU, Linux and BSD, are popular in these areas. The market share for Linux is divided between many different distributions. Enterprise class distributions by Red Hat or Novell are used by

corporations, but some home users may use those products. Historically home users typically installed a distribution themselves, but in 2007 Dell began to offer the Ubuntu Linux distribution on home PCs and now Walmart offers a low end computer with GOS v2..Linux on the desktop is also popular in the developer and hobbyist operating system development communities.

Market share statistics for freely available operating systems are usually inaccurate since most free operating systems are not purchased, making usage under-represented. On the other hand, market share statistics based on total downloads of free operating systems are often inflated, as there is no economic disincentive to acquire multiple operating systems. So users can download multiple systems, test them, and decide which they like best.

Some Unix variants like HP's HP-UX and IBM's AIX are designed to run only on that vendor's hardware. Others, such as Solaris, can run on multiple types of hardware, including x86 servers and PCs. Apple's Mac OS X, a hybrid kernel-based BSD variant derived from NeXTSTEP, Mach, and FreeBSD, has replaced Apple's earlier (non-Unix) Mac OS.

Unix interoperability was sought by establishing the POSIX standard. The POSIX standard can be applied to any operating system, although it was originally created for various Unix variants.

Mac OS X

Mac OS X is a line of proprietary, graphical operating systems developed, marketed, and sold by Apple Inc., the latest of which is pre-loaded on all currently shipping Macintosh computers. Mac OS X is the successor to the original Mac OS, which had been Apple's primary operating system since 1984. Unlike its predecessor, Mac OS X is a UNIX operating system built on technology that had been developed at NeXT through the second half of the 1980s and up until Apple purchased the company in early 1997.

The operating system was first released in 1999 as Mac OS X Server 1.0, with a desktop-oriented version (Mac OS X v10.0) following in March 2001. Since then, five more distinct "end-user" and "server" editions of Mac OS X have been released, the most recent being Mac OS X v10.5, which was first made available in October 2007. Releases of Mac OS X are named after big cats; Mac OS X v10.5 is usually referred to by Apple and users as "Leopard".

The server edition, Mac OS X Server, is architecturally identical to its desktop counterpart but usually runs on Apple's line of Macintosh server

hardware. Mac OS X Server includes workgroup management and administration software tools that provide simplified access to key network services, including a mail transfer agent, a Samba server, an LDAP server, a domain name server, and others.

3.3 Categories of Operating Systems

Real-time operating systems

A real-time operating system (RTOS) is a multitasking operating system intended for applications with fixed deadlines (real-time computing). Such applications include some small embedded systems, automobile engine controllers, industrial robots, spacecraft, industrial control, and some large-scale computing systems.
An early example of a large-scale real-time operating system was Transaction Processing Facility developed by American Airlines and IBM for the Sabre Airline Reservations System.

Embedded Systems

Embedded systems use a variety of dedicated operating systems. In some cases, the "operating system" software is directly linked to the application to produce a monolithic special-purpose program. In the simplest embedded systems, there is no distinction between the OS and the application.

Embedded systems that have fixed deadlines use real-time operating systems such as VxWorks, eCos, QNX, and RTLinux.

Some embedded systems use operating systems such as Palm OS, Windows CE, BSD, and Linux, although such operating systems do not support real-time computing.

Windows CE shares similar APIs to desktop Windows but shares none of desktop Windows' codebase.

3.4 Features and Technology

An operating system is a collection of technologies which are designed to allow the computer to perform certain functions. These technologies may or may not be present in every operating system, and there are often differences in how they are implemented. However as stated above most modern operating systems are derived from common design ancestors, and are therefore basically similar.

Boot-Strapping

In most cases, the operating system is not the first code to run on the computer at startup (boot) time. The initial code executing on the computer is usually loaded from firmware, which is stored in read only memory (ROM). This is sometimes called the BIOS or **boot ROM**.

Program Execution

An operating system's most basic function is to support the running of programs by the users. On a multiprogramming operating system, running programs are commonly referred to as processes. Process management refers to the facilities provided by the operating system to support the creation, execution, and destruction of processes, and to facilitate various interactions, and limit others.

Interrupts

Interrupts are central to operating systems as they allow the operating system to deal with the unexpected activities of running programs and the world outside the computer. Interrupt-based programming is one of the most basic forms of time-sharing, being directly supported by most CPUs. Interrupts provide a computer with a way of automatically running specific code in response to events. Even very basic computers support hardware interrupts, and allow the programmer to specify code which may be run when that event takes place.

Protected Mode and Supervisor Mode

Modern CPUs support something called dual mode operation. CPUs with this capability use two modes: protected mode and supervisor mode, which allow certain CPU functions to be controlled and affected only by the operating system kernel. The term is used here more generally in operating system theory to refer to all modes which limit the capabilities of programs running in that mode, providing things like virtual memory addressing and limiting access to hardware in a manner determined by a program running in supervisor mode. Similar modes have existed in supercomputers, minicomputers, and mainframes as they are essential to fully supporting UNIX-like multi-user operating systems.

Memory Management

Among other things, a multiprogramming operating system kernel must be responsible for managing all system memory that are currently in use by programs. This ensures that a program does not interfere with

memory already used by another program. Since programs share time, each program must have independent access to memory.

Cooperative memory management, used by many early operating systems assumes that all programs make voluntary use of the kernel's memory manager, and do not exceed their allocated memory. This system of memory management is almost never seen anymore, since programs often contain bugs which can cause them to exceed their allocated memory. If a program fails it may cause memory used by one or more other programs to be affected or overwritten. Malicious programs, or viruses may purposefully alter another program's memory or may affect the operation of the operating system itself. With cooperative memory management it takes only one misbehaved program to crash the system.

Virtual Memory

The use of virtual memory addressing (such as paging or segmentation) means that the kernel can choose which memory each program may use at any given time, allowing the operating system to use the same memory locations for multiple tasks.

If a program tries to access memory that isn't in its current range of accessible memory, but nonetheless has been allocated to it, the kernel will be interrupted in the same way as it would if the program were to exceed its allocated memory.

Multitasking

Multitasking refers to the running of multiple independent computer programs on the same computer, giving the appearance that it is performing the tasks at the same time. Since most computers can do at most one or two things at one time, this is generally done via time sharing, which means that each program uses a share of the computer's time to execute.

An early model which governed the allocation of time to programs was called cooperative multitasking. In this model, when control is passed to a program by the kernel, it may execute for as long as it wants before explicitly returning control to the kernel. This means that a malfunctioning program may prevent any other programs from using the CPU.

The philosophy governing preemptive multitasking is that of ensuring that all programs are given regular time on the CPU. This implies that all programs must be limited in how much time they are allowed to

spend on the CPU without being interrupted. To accomplish this, modern operating system kernels make use of a timed interrupt. A protected mode timer is set by the kernel which triggers a return to supervisor mode after the specified time has elapsed. (See above sections on Interrupts and Dual Mode Operation.)

Disk Access and File Systems

Access to files stored on disks is a central feature of all operating systems. Computers store data on disks using files, which are structured in specific ways in order to allow for faster access, higher reliability, and to make better use out of the drive's available space. The specific way files are stored on a disk is called a file system, and enables files to have names and attributes. It also allows them to be stored in a hierarchy of directories or folders arranged in a directory tree.

Device Drivers

A device driver is a specific type of computer software developed to allow interaction with hardware devices. Typically this constitutes an interface for communicating with the device, through the specific computer bus or communications subsystem that the hardware is connected to, providing commands to and/or receiving data from the device, and on the other end, the requisite interfaces to the operating system and software applications. It is a specialized hardware-dependent computer program which is also operating system specific that enables another program, typically an operating system or applications software package or computer program running under the operating system kernel, to interact transparently with a hardware device, and usually provides the requisite interrupt handling necessary for any necessary asynchronous time-dependent hardware interfacing needs.

Networking

Currently most operating systems support a variety of networking protocols, hardware, and applications for using them. This means that computers running dissimilar operating systems can participate in a common network for sharing resources such as computing, files, printers, and scanners using either wired or wireless connections. Networks can essentially allow a computer's operating system to access the resources of a remote computer to support the same functions as it could if those resources were connected directly to the local computer. This includes everything from simple communication, to using networked file systems or even sharing another computer's graphics or sound hardware.

Security

A computer being secure depends on a number of technologies working properly. A modern operating system provides access to a number of resources, which are available to software running on the system, and to external devices like networks via the kernel.

The operating system must be capable of distinguishing between requests which should be allowed to be processed, and others which should not be processed. While some systems may simply distinguish between "privileged" and "non-privileged", systems commonly have a form of requester *identity*, such as a user name. To establish identity, there may be a process of *authentication*. Often a username must be quoted, and each username may have a password. Other methods of authentication, such as magnetic cards or biometric data, might be used instead. In some cases, especially connections from the network, resources may be accessed with no authentication at all (such as reading files over a network share).

In addition to the allow/disallow model of security, a system with a high level of security will also offer auditing options. These would allow tracking of requests for access to resources (such as, "who has been reading this file?"). Internal security or security from an already running program is only possible if all possibly harmful requests are carried out through interrupts to the operating system kernel. If programs can directly access hardware and resources, they cannot be secured.

File System Support in Modern Operating Systems

Support for file systems is highly varied among modern operating systems although there are several common file systems that almost all operating systems include support and drivers for.

Special Purpose File Systems

FAT file systems are commonly found on floppy discs, flash memory cards, digital cameras, and many other portable devices because of their relative simplicity. Performance of FAT compares poorly to most other file systems as it uses overly simplistic data structures, making file operations time-consuming, and makes poor use of disk space in situations where many small files are present. ISO 9660 and Universal Disk Format are two common formats that target Compact Discs and DVDs. Mount Rainier is a newer extension to UDF supported by Linux 2.6 kernels and Windows Vista that facilitates rewriting to DVDs in the same fashion as has been possible with floppy disks.

Journalized File Systems

File systems may provide journaling, which provides safe recovery in the event of a system crash. A journaled file system writes some information twice: first to the journal, which is a log of file system operations, then to its proper place in the ordinary file system. Journaling is handled by the file system driver, and keeps track of each operation taking place that changes the contents of the disk. In the event of a crash, the system can recover to a consistent state by replaying a portion of the journal.

Graphical User Interfaces

Most modern computer systems support graphical user interfaces (GUI), and often include them. In some computer systems, such as the original implementations of Microsoft Windows and the Mac OS, the GUI is integrated into the kernel.

While technically a graphical user interface is not an operating system service, incorporating support for one into the operating system kernel can allow the GUI to be more responsive by reducing the number of context switches required for the GUI to perform its output functions. Other operating systems are modular, separating the graphics subsystem from the kernel and the Operating System.

Many computer operating systems allow the user to install or create any user interface they desire.

Graphical user interfaces evolve over time. For example, Windows has modified its user interface almost every time a new major version of Windows is released, and the Mac OS GUI changed dramatically with the introduction of Mac OS X in 2001.

3.5 Functions of Operating Systems

In the process of going through the technology of operating systems in Units 3.3 above some specific functions of the operating systems had been mentioned. In this sub unit we will examine the four primary functions of an operating system.

1. **Providing User Interface**: Provides either a command line interface or a graphic user interface for the user to communicate with the computer. In other words, the operating system communicates with the computer user or operator by means of terminals and through the use of monitor command process. There are two broad categories of interfaces: command-line interface and graphic user interface.

2. **Managing the Hardware:** Operating systems control and manage hardware resources. For example the OS manages the selection and operation of devices used for input, output, and storage. In other words, the OS serves as the intermediary between programs and hardware. Regardless of the type of user interface, the OS intercepts commands to use memory and other devices, keeping track of what program has access to what devices and so on.

3. **Managing the File System:** Operating systems group data together into logical compartments for storage on disk. These groups of data are called files. Files may contain programs instructions or data created or used by a program. The OS maintains the list of files on a disk.

4. **Supporting Programs:** Another major function of an OS is to provide services to other programs. Often these services are similar to that the operating system provides directly to users. For example when you want your word processing program to retrieve a document, the word processor will list the files in the directory that you specify.

4.0 CONCLUSION

Although the first computers did not have operating systems, today operating system remains the intermediary between the hardware and the user. Its operation is primary to the effectiveness of computer operations. It is the fundamental software in any computer. Without it the piece of hardware cannot work effectively. The functionality of operating systems has always been on the increase. As the industry grows generally, this subsector of the software industry is equally growing.

5.0 SUMMARY

An **operating system** (commonly abbreviated *OS* and *O/S*) is the software component of a computer system that is responsible for the management and coordination of activities and the sharing of the resources of the computer.

The Microsoft Windows family of operating systems originated as an add-on to the older MS-DOS operating system for the IBM PC. Modern versions are based on the newer Windows NT kernel that was originally intended for OS/2. Windows runs on x86, x86-64 and Itanium processors. Earlier versions also ran on the DEC Alpha,MIPS, Fairchild (later Intergraph) Clipper and PowerPC

architectures (some work was done to port it to the SPARC architecture).

A real-time operating system (RTOS) is a multitasking operating system intended for applications with fixed deadlines (real-time computing). Such applications include some small embedded systems, automobile engine controllers, industrial robots, spacecraft, industrial control, and some large-scale computing systems.

An operating system's most basic function is to support the running of programs by the users.

An operating system is a collection of technologies which are designed to allow the computer to perform certain functions. These technologies may or may not be present in every operating system, and there are often differences in how they are implemented.

Operating systems provide either a command line interface or a graphic user interface for the user to communicate with the computer. In other words, the operating system communicates with the computer user or operator by means of terminals and through the use of monitor command process.

6.0 TUTOR-MARKED ASSIGNMENT

1. Enumerate 5 types of operating systems.
2. Briefly discuss the Memory management function of an operating system.

7.0 REFERENCES/FURTHER READINGS

Auslander, Marc A.; Larkin, David C.; Scherr, Allan L.. "*The evolution of the MVS Operating System*". IBM J. Research & Development. http://www.research.ibm.com/journal/rd/255/auslander.pdf

Deitel, Harvey M.; Deitel, Paul; Choffnes, David. *Operating Systems*. Pearson/Prentice Hall. ISBN 978-0-13-092641-8.

Bic, Lubomur F.; Shaw, Alan C. (2003). *Operating Systems*. Pearson: Prentice Hall.

Stallings (2005). *Operating Systems, Internals and Design Principles*. Pearson: Prentice Hall.

Silberschatz, Avi; Galvin, Peter; Gagne, Greg (2008). *Operating Systems Concepts*. John Wiley & Sons. ISBN 0-470-12872-0.

MODULE 2

Unit 1 Computer Application Systems
Unit 2 Database Management System
Unit 3 Systems Development Life Cycle

Unit 4 Computer Networks
Unit 5 The Internet

UNIT 1 COMPUTER APPLICATION SYSTEMS

CONTENTS

1.0 Introduction
2.0 Objectives
3.0 Main Content
    3.1 Word Processing
    3.2 Database
    3.3 Spreadsheet
    3.4 Graphics (Graphic Images, Sounds & Animation)
    3.5 Desktop Publishing
4.0 Conclusion
5.0 Summary
6.0 Tutor-Marked Assignment
7.0 References/Further Readings

1.0 INTRODUCTION

Application programs or software consists of programs that perform specific tasks such as writing a letter, tracking payroll information, producing a chart and so on. There are several general purpose application programs as well as customized application systems. Emphasis in this unit is on the general purpose application systems.

2.0 OBJECTIVES

At the end of this unit you are expected to:

define and identify the major types of application systems

know the major components and functions of word processing

know the major components and functions of spreadsheet

know the major components and functions of graphic application software

know the major components and functions of database management software

know the major components and functions of desktop publishing software

3.0 MAIN CONTENT

3.1 Word Processing

The keyboard of a word processor is similar to that of a typewriter, but its capabilities extend far beyond the typewriter's. For example, you don't have to press the Return or Enter key at the end of every line - in word processing, the line "wraps around" when it reaches the margin you have set and allows you to continue typing without stopping, you only press Enter (or Return) when you want to start a new paragraph or insert blank lines. If you make a mistake while typing use backspace or delete to erase it.

There are many commercial word processing programs including Open Office, Writer, Microsoft Word, Corel WordPerfect and others.

Windows comes with **WordPad** to edit and format documents and **NotePad** to edit text. Mac OS X comes with **TextEdit** or **SimpleText** in previous version. Open Office is an Open Source office application that can be downloaded for free at openoffice.org.



Editing functions such as inserting, deleting, moving, and copying characters, words, lines, and even blocks of text are fast and easy with only a few keystrokes. Advanced programs will number pages, repeat material in the same place on every page automatically, and check the spelling of every word in your document. You print your document only after it looks exactly the way you want it to. Finally, copies of your documents can be stored on a disk, enabling you to retrieve, edit, and print them at any time.

The text appears at the cursor. Use the space bar to place spaces between words. Use backspace to erase to the left of the cursor and delete to

erase to the right of the cursor. Use Enter (or Return) to move the cursor down a line.

Word processors allow you to type your text in **Bold**, *Italics* or Underline. This is useful when you wish to highlight some word or line in a document. To activate Bold, Italics or Underline click the icon button on the Toolbar, type the text that you wish to have highlighted then press Toolbar icon again when you are finished. The indicator on the Toolbar will appear highlighted as long as the highlight style is on.

The text can also be modified by changing the Font. A font is the shape and size of a character of text. The three main types are serif (with tails); sans-serif (without tails); and script (similar to handwriting). Text colours can also be changed.

Text can also be indented and tab settings added which modify where the text is placed on the page. Rather than press the space bar more than once set tabs where you want the cursor to move to.
The page can be modified by changing the margins, adding headers or footers (repeating text on each page), page numbering, graphic images and various other ways.

The Insert key toggles between Insert and Typeover. Sometimes an indicator on the bottom of the screen will display the typing mode you are in. Normally, any text after the cursor will be pushed across the screen (inserted) as new characters are typed in. With Typeover on, the new character will just replace the old character at the cursor.

Editing text is quite easy once you get use to it. **Select** text that you want to modify with the mouse or by holding down Shift and using the arrow keys. Holding Control (CTRL) will select text one word at a time.

Once you have the text selected use **Cut** (Ctrl-X) to cut the text off the page and into a **clipboard**. Use **Copy** (Ctrl-C) to transfer a copy of the selected text to the clipboard. Use **Paste** (Ctrl-V) to paste the text into the document at the cursor. The Windows clipboard will only hold a single selection of text which is replaced with each new cut or copy.

If you make a mistake most modern programs have an **Undo** feature (Crtl-Z). Many also have a **Redo** feature.

Most word processors will check your spelling and many have **thesauruses** and will check your **grammar**. Don't rely on the editing tools to replace a good proof reading though! (as this editor tends to do.).

3.2 Database

A Database is a collection of information stored in a way that makes it easy to retrieve, modify and search. A database can be stored in a single file with all the information stored together in a single table which is called a flat database or stored in multiple tables with some common access information referred to as a relational database.

There are many commercial database programs including Microsoft Access , Corel Paradox, FileMaker, IBM DB and others. There are also Open Source databases such as OpenOffice.org  Base and MySQL.

Each person or item in a database has it's own **Record**. Each piece of information about that person or record are stored in **Fields**. All the information in all the records makes up the Database.

Each Field can have information typed into it. Use the **Tab** key to move forward through the Field and the **Shift-Tab** to move backwards. Many databases also allow users to use the arrow keys to move around as well. Though many fields only allow a single line of input some allow multiple lines. When the cursor reaches the bottom of a field with multiple lines the text will scroll upwards to show any information that is below the line of sight. If there is more text in the field than there is room on the screen use the arrow keys to move the cursor through the text.

It is possible to mask individual fields to make data entry easier. For instance the field for phone numbers can be formatted to only allow numbers to be entered.

There are many different ways to use information in a database. In order to use it you can search for and display information using various filters to allow or disallow certain records to display. This is referred to as a query.

The data can be arranged to create reports and print the information in a specific format.

It is crucial that the information typed into a Database or information updated be saved before leaving the program. Many data errors can be traced back to power-failures or accidental computer shut downs.

The data can also be used by other programs for things like invoicing and form letters. The data from a database can be merged with forms created in other programs for a wide range of uses.

When setting up a database make sure to take a bit of time to decide what fields are needed and how they relate to other information. For instance, if an address is required does it need to be broken down into a number of fields such as street, apartment, city, etc? Does the street need to be broken down into house number, street name, street type, etc? Does a phone number need a separate field for the area code? Taking time to decide what is needed before beginning a database project is better than spending many frustrating hours modifying the data in the future.

3.3 Spreadsheet

Spreadsheets are used to work with financial information. Spreadsheet charts are laid out in numbered rows and lettered columns. Where the row and column intersect is called a cell. The cell is referred to by the letter and number of the intersection called the cell address. The first cell in a chart is at the intersection of column A and row 1 and is referred to as Cell A1.

Some commercial Spreadsheets are Microsoft Excel, Corel QuatroPro, Lotus 123 and others. OpenOffice.org Calc is an Open Source office program that is free to download and use. Tax and accounting software are also spreadsheets but are designed to provide tools and utilities which help get the specific job done.

When working with numbers in a spreadsheet, refer to the cell addresses when creating mathematical formulas. This is because any changes you make to a single cell will be automatically updated without having to reenter the numbers in the rest of the cells.

	A	B	C
1			
2			
3			

Use the plus sign (+) to add; the minus (-) sign to subtract; the asterix (*) to multiply; and the back slash (/) to divide.

Spreadsheets use formulas to create simple to complex mathematical equations. A sheet can be built to handle the financial needs of businesses.

Most of the standard editing features are available in the spreadsheet such as Bold, Italics, Underline, Move, Copy and Paste.

Information from a spreadsheet can be displayed in chart form.

Most spreadsheet programs include **templates** to handle many of the average financial needs of a home user or small business. These templates can be modified or customized to personalize them for your own needs.

Most modern spreadsheet programs allow users to work on many sheets at once and access information from any of the sheets in the **workbook** group.

3.4 Graphics (Graphic Images, Sounds & Animation)

Computer graphics are anything that can be displayed on the screen except the text and sometimes even text falls into the graphics category if it is saved in a graphics format.

Commercial graphics programs include;


Corel PhotoPaint


Corel Draw


Macromedia Fireworks




Macromedia Freehand

Adobe Photoshop


Adobe Illustrator


LView


ULead

...and many others

There are basically two types of computer graphics, **bitmapped** and **vector/structured**.

Bitmapped graphics are images that are mapped to the **monitor or screen**. The screen is made up of tiny dots called **pixels**. These dots can display various colours depending on the type of computer hardware and software you have. Using shades of red, green and blue (**RGB**) an image can be displayed on the screen by mapping different colours to the screen in different sequences.

Vector graphics use **objects** created from mathematical formulas to represent things like **lines**, **curves**, **fills**, **line thickness**, etc., to create the image.

Each type of graphic has it's own advantages and disadvantages.
Older versions of HTML were only able to recognize bitmapped



graphics so most graphics created for the Internet, using standard **HTML**, were created or converted to **bitmap formats**. The newest version of HTML or XHTML is able to display vector graphics but not all browsers are able to display these graphics.
Within each of the two main types there are dozens of different formats.

Graphics formats are distinguished by their filename extensions.

The three main bitmapped format graphics used on the Internet are **.gif**, **.jpeg** (**.jpg**) and **.png**. There are many others including **.bmp**, **.tiff** (**.tif**), **.pcx**, **.ppm**, **.tga** and a host of others.

Some of the structured formats are **.ai**, **.cmx**, **.eps**, **.wpg**, **.cgm** and a host of others.

Bitmapped graphics can be created and modified in a paint program and vector or structured graphics can be created and modified in a draw program.

The main tools in a graphics program allow you to select a section of a picture, erase part of a picture, fill a defined area, select a colour, magnify a section, draw free hand, draw with various tools such as a straight line; a curved line; a rectangle; an oval; and a polygon. You can also modify a drawing by changing the size, colour, placement, and, depending on the program, hundreds of other modifications.

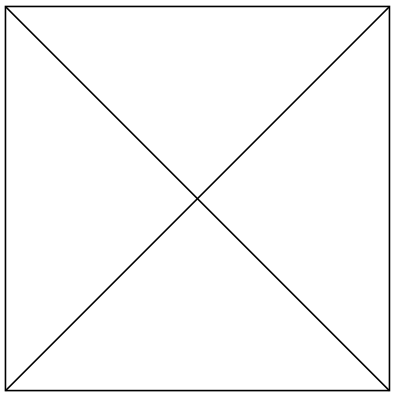
Sound

Moving Picture Experts Group (MPEG) or .mpg is multimedia format that is attempting to create a standardization among the various formats available. MPEG has made it possible to place audio content on your website without having it sound tiny and hollow or taking an extreme amount of time to download. There are many different formats for sound including; Microsoft's .wav, Sun's .au & .snd, RealNetwork's RealAudio, .ra(*), and various others.

You may have heard .mid files play when visiting various websites. Musical Instruments Digital Interface (MIDI) files are basically sound tracks which use a collection of sounds contained in the .mid file to play a tune.

To create a sound file you will need an audio program. You can then record with a microphone or off of a prerecorded medium. Your computer will need to have a sound card properly installed and a speaker to hear your recording. You can save the sound file to play back later.

Animation



With the advent of faster computers comes animation. Though it has been around for years the modern computer has made it possible to include animation in programs without causing them to slow down (much). As with every multimedia format there are a number of types.

You may have seen .gif animations on a website. A GIF animation is a series of separate images or frames that display one after the other to give the impression of movement. Other formats are Audio Visual Interleave's .avi, the earlier mentioned mpg, Microsoft's Media Player .wmv, Apple's Quick Time .qt, .aif(*) & .mov, RealNetwork's RealVideo .rm(*), Macromedia's Flash creates Shockwave .swf, and JavaScript as well as various others.

There are various animation or multimedia players available for a free download off the Internet.



To create animations, sounds or graphics you will need a program that has the capabilities you want. Visit the various multimedia company websites to read up on their product to see if they can do what you want. (Hint: to find a company website type "www.'*replace this with the companies name*'.com"). Most companies offer free trials that you can download from their website.

You should also be aware that most media contents placed on the Internet are considered published materials and therefore copyrighted unless explicitly stated otherwise.

3.5 Desktop Publishing

Desktop publishing (dtp) uses both word processing and graphics to produce publications and presentations.

Some common dtp programs are MS Publisher  and Quark Express. Both Adobe and Corel have a number of programs that work like dtp programs. OpenOffice.org Draw  is an OpenSource free option.

Desktop publishing programs layout their documents in a series of slides that can contain text, graphics and dynamic content. Content is added to each slide in a series which can be printed or saved as a slide presentation. Sound and music can also be added to the presentation.

4.0 CONCLUSION

Just like the computer operating systems sub sector of the computer industry, the application software has been on the increase both in terms of new products and improvements on the existing ones. The sophistication of the word processing has increased. The advent of animation software has brought more life and interactivity to computing. Desktop publishing has continually demystify book publishing. The time lag in book publishing has been cut down drastically by desktop publishing software. The business opportunity of application systems remain on the increase.

5.0 SUMMARY

Application programs or software consists of programs that perform specific tasks such as writing a letter, tracking payroll information, producing a chart and so on.

The keyboard of a word processor is similar to that of a typewriter, but its capabilities extend far beyond the typewriter's. For example, you don't have to press the Return or Enter key at the end of every line - in word processing, the line "wraps around" when it reaches margins you have set and allows you to continue typing without stopping.

A Database is a collection of information stored in a way that makes it easy to retrieve, modify and search. A database can be stored in a single file with all the information stored together in a single table which is called a flat database or stored in multiple tables with some common access information referred to as a relational database.

Spreadsheets are used to work with financial information. Spreadsheet charts are laid out in numbered rows and lettered columns. Where the row and column intersect is called a cell. The cell is referred to by the letter and number of the intersection called the cell address. The first cell in a chart is at the intersection of column A and row 1 and is referred to as Cell A1.]

Computer graphics are anything that can be displayed on the screen except the text and sometimes even text falls into the graphics category if it is saved in a graphics format.

Desktop publishing (dtp) uses both word processing and graphics to produce publications and presentations.

7.0 TUTOR-MARKED ASSIGNMENT

1. Briefly discuss a database.
2. Mention 5 commercial graphic programs.

8.0 REFERENCES/FURTHER READINGS

Codd, E.F. (1970). "A Relational Model of Data for Large Shared Data Banks". Communications of the ACM 13 (6): 377–387.

UNIT 2 DATABASE MANAGEMENT SYSTEM

CONTENTS

1.0 Introduction
2.0 Objectives
3.0 Main Content
    3.1 Description
    3.2 DBMS Benefits
    3.3 Features and Capabilities of DBMS
    3.4 Types
    3.5 List of Database Management Systems Software
4.0 Conclusion
5.0 Summary
6.0 Tutor-Marked Assignment
7.0 References/Further Readings

1.0 INTRODUCTION

A database management system (DBMS) is computer software designed for the purpose of managing databases based on a variety of data models.

2.0 OBJECTIVES

At the end of this unit you are expected to:

define a database management system
give a description of the database management structure
enumerate the benefits of database management system.
describe the features and capabilities of a typical DBMS
identify and differentiate the different types and models of DBMS

3.0 MAIN CONTENT

3.1 Description

DBMSs are complex set of software programs that control the organization, storage, management, and retrieval of data in a database. DBMSs are categorized according to their data structures or types, sometimes DBMSs are also known as Data base Managers. A DBMS includes:

i. A modeling language to define the schema of each database hosted in the DBMS, according to the DBMS data model.
The four most common types of organizations are the hierarchical, network, relational and object models. Inverted lists

and other methods are also used. A given database management system may provide one or more of the four models. The optimal structure depends on the natural organization of the application's data, and on the application's requirements (which include transaction rate (speed), reliability, maintainability, scalability, and cost).

The dominant model in use today is the ad hoc one embedded in SQL, despite the objections of purists who believe this model is a corruption of the relational model, since it violates several of its fundamental principles for the sake of practicality and performance. Many DBMSs also support the Open Database Connectivity API that supports a standard way for programmers to access the DBMS.

ii. Data structures (fields, records, files and objects) optimized to deal with very large amounts of data stored on a permanent data storage device (which implies relatively slow access compared to volatile main memory).

ii. A database query language and report writer to allow users to interactively interrogate the database, analyze its data and update it according to the users privileges on data.

It also controls the security of the database.

Data security prevents unauthorized users from viewing or updating the database. Using passwords, users are allowed access to the entire database or subsets of it called *subschemas*. For example, an employee database can contain all the data about an individual employee, but one group of users may be authorized to view only payroll data, while others are allowed access to only work history and medical data.

If the DBMS provides a way to interactively enter and update the database, as well as interrogate it, this capability allows for managing personal databases. However, it may not leave an audit trail of actions or provide the kinds of controls necessary in a multi-user organization. These controls are only available when a set of application programs are customized for each data entry and updating function.

iv. A transaction mechanism, that ideally would guarantee the ACID properties, in order to ensure data integrity, despite concurrent user accesses (concurrency control), and faults (fault tolerance).

It also maintains the integrity of the data in the database.

The DBMS can maintain the integrity of the database by not allowing more than one user to update the same record at the same time. The DBMS can help prevent duplicate records via unique index constraints; for example, no two customers with the same customer numbers (key fields) can be entered into the database.

The DBMS accepts requests for data from the application program and instructs the operating system to transfer the appropriate data.

When a DBMS is used, information systems can be changed much more easily as the organization's information requirements change. New categories of data can be added to the database without disruption to the existing system.

Organizations may use one kind of DBMS for daily transaction processing and then move the detail onto another computer that uses another DBMS better suited for random inquiries and analysis. Overall systems design decisions are performed by data administrators and systems analysts. Detailed database design is performed by database administrators.

Database servers are specially designed computers that hold the actual databases and run only the DBMS and related software. Database servers are usually multiprocessor computers, with RAID disk arrays used for stable storage. Connected to one or more servers via a high-speed channel, hardware database accelerators are also used in large volume transaction processing environments.

DBMSs are found at the heart of most database applications. Sometimes DBMSs are built around a private multitasking kernel with built-in networking support although nowadays these functions are left to the operating system.

3.2 DBMS Benefits

Improved strategic use of corporate data
Reduced complexity of the organization's information systems

environment
Reduced data redundancy and inconsistency
Enhanced data integrity
Application-data independence
Improved security
Reduced application development and maintenance costs
Improved flexibility of information systems
Increased access and availability of data and information
Logical & Physical data independence
Concurrent access anomalies.
Facilitate atomicity problem.
Provides central control on the system through DBA.

3.3 Features and Capabilities of DBMS

A DBMS can be characterized as an "attribute management system" where attributes are small chunks of information that describe something. For example, "colour" is an attribute of a car. The value of the attribute may be a color such as "red", "blue" or "silver".

Alternatively, and especially in connection with the relational model of database management, the relation between attributes drawn from a specified set of domains can be seen as being primary. For instance, the database might indicate that a car that was originally "red" might fade to "pink" in time, provided it was of some particular "make" with an inferior paint job. Such higher clarity relationships provide information on all of the underlying domains at the same time, with none of them being privileged above the others.

Throughout recent history specialized databases have existed for scientific, geospatial, imaging, document storage and like uses. Functionality drawn from such applications has lately begun appearing in mainstream DBMSs as well. However, the main focus there, at least when aimed at the commercial data processing market, is still on descriptive attributes on repetitive record structures.

Thus, the DBMSs of today roll together frequently-needed services or features of attribute management. By externalizing such functionality to the DBMS, applications effectively share code with each other and are relieved of much internal complexity. Features commonly offered by database management systems include:

Query Ability

Querying is the process of requesting attribute information from various perspectives and combinations of factors. Example: "How many 2-door

cars in Texas are green?"

A database query language and report writer allow users to interactively interrogate the database, analyze its data and update it according to the users privileges on data. It also controls the security of the database.

Data security prevents unauthorized users from viewing or updating the database. Using passwords, users are allowed access to the entire database or subsets of it called subschemas. For example, an employee database can contain all the data about an individual employee, but one group of users may be authorized to view only payroll data, while others are allowed access to only work history and medical data.

If the DBMS provides a way to interactively enter and update the database, as well as interrogate it, this capability allows for managing personal databases. However it may not leave an audit trail of actions or provide the kinds of controls necessary in a multi-user organization. These controls are only available when a set of application programs are customized for each data entry and updating function.

Backup and Replication

Copies of attributes need to be made regularly in case primary disks or other equipment fails. A periodic copy of attributes may also be created for a distant organization that cannot readily access the original. DBMSs usually provide utilities to facilitate the process of extracting and disseminating attribute sets.

When data is replicated between database servers, so that the information remains consistent throughout the database system and users cannot tell or even know which server in the DBMS they are using, the system is said to exhibit replication transparency.

Rule Enforcement

Often one wants to apply rules to attributes so that the attributes are clean and reliable. For example, we may have a rule that says each car can have only one engine associated with it (identified by Engine Number). If somebody tries to associate a second engine with a given car, we want the DBMS to deny such a request and display an error message. However, with changes in the model specification such as, in this example, hybrid gas-electric cars, rules may need to change. Ideally such rules should be able to be added and removed as needed without significant data layout redesign.

Security

Often it is desirable to limit who can see or change which attributes or groups of attributes. This may be managed directly by an individual, or by the assignment of individuals and privileges to groups, or (in the most elaborate models) through the assignment of individuals and groups to roles which are then granted entitlements.

Computation

There are common computations requested on attributes such as counting, summing, averaging, sorting, grouping, cross-referencing, etc. Rather than have each computer application implement these from scratch, they can rely on the DBMS to supply such calculations, all arithmetical work performed by computer is called a computation.

Change and Access Logging

Often one wants to know who accessed what attributes, what was changed, and when it was changed. Logging services allow this by keeping a record of access occurrences and changes.

Automated Optimization

If there are frequently occurring usage patterns or requests, some DBMS can adjust themselves to improve the speed of those interactions. In some cases the DBMS will merely provide tools to monitor performance, allowing a human expert to make the necessary adjustments after reviewing the statistics collected.

3.4 Types

Navigational DBMS

As computers grew in capability, this trade-off became increasingly unnecessary and a number of general-purpose database systems emerged; by the mid-1960s there were a number of such systems in commercial use. Interest in a standard began to grow, and Charles Bachman, author of one such product, **IDS**, founded the *Database Task Group* within CODASYL, the group responsible for the creation and standardization of COBOL. In 1971 they delivered their standard, which generally became known as the **Codasyl approach**, and soon there were a number of commercial products based on it availability.
The Codasyl approach was based on the "manual" navigation of a linked data set which was formed into a large network. When the database was first opened, the program was handed back a link to the first record in the database, which also contained pointers to other pieces of data. To

find any particular record the programmer had to step through these pointers one at a time until the required record was returned. Simple queries like "find all the people in Sweden" required the program to walk the entire data set and collect the matching results. There was, essentially, no concept of "find" or "search". This might sound like a serious limitation today, but in an era when the data was most often stored on magnetic tape such operations were too expensive to contemplate anyway.

IBM also had their own DBMS system in 1968, known as **IMS**. IMS was a development of software written for the Apollo program on the System/360. IMS was generally similar in concept to Codasyl, but used a strict hierarchy for its model of data navigation instead of Codasyl's network model.

Both concepts later became known as **navigational databases** due to the way data was accessed, and Bachman's 1973 Turing Award award presentation was *The Programmer as Navigator*.

IMS is classified as a hierarchical database. IDS and IDMS (both CODASYL databases) as well as CINCOMs TOTAL database are classified as network databases.

Relational DBMS

Edgar Codd worked at IBM in San Jose, California, in one of their offshoot offices that was primarily involved in the development of hard disk systems. He was unhappy with the navigational model of the Codasyl approach, notably the lack of a "search" facility which was becoming increasingly useful. In 1970, he wrote a number of papers that outlined a new approach to database construction that eventually culminated in the groundbreaking *A Relational Model of Data for Large Shared Data Banks*.

In this paper, he described a new system for storing and working with large databases. Instead of records being stored in some sort of linked list of free-form records as in Codasyl, Codd's idea was to use a "table" of fixed-length records. A linked-list system would be very inefficient when storing "sparse" databases where some of the data for any one record could be left empty. The relational model solved this by splitting the data into a series of normalized tables, with optional elements being moved out of the main table to where they would take up room only if needed.
For instance, a common use of a database system is to track information about users, their name, login information, various addresses and phone numbers. In the navigational approach all of these data would be placed in a single record, and unused items would simply not be placed in the

database. In the relational approach, the data would be *normalized* into a user table, an address table and a phone number table (for instance). Records would be created in these optional tables only if the address or phone numbers were actually provided.

Linking the information back together is the key to this system. In the relational model, some bit of information was used as a "key", uniquely defining a particular record. When information was being collected about a user, information stored in the optional (or *related*) tables would be found by searching for this key. For instance, if the login name of a user is unique, addresses and phone numbers for that user would be recorded with the login name as its key. This "re-linking" of related data back into a single collection is something that traditional computer languages are not designed for.

Just as the navigational approach would require programs to loop in order to collect records, the relational approach would require loops to collect information about any one record. Codd's solution to the necessary looping was a set-oriented language, a suggestion that would later spawn the ubiquitous SQL. Using a branch of mathematics known as *tuple calculus*, he demonstrated that such a system could support all the operations of normal databases (inserting, updating etc.) as well as providing a simple system for finding and returning *sets* of data in a single operation.

Codd's paper was picked up by two people at Berkeley, Eugene Wong and Michael Stonebraker .They started a project known as INGRES using funding that had already been allocated for a geographical database project, using student programmers to produce code. Beginning in 1973, INGRES delivered its first test products which were generally ready for widespread use in 1979. During this time, a number of people had moved "through" the group — perhaps as many as 30 people worked on the project, about five at a time. INGRES was similar to System R in a number of ways, including the use of a "language" for data access, known as QUEL — QUEL was in fact relational, having been based on Codd's own Alpha language, but has since been corrupted to follow SQL, thus violating much the same concepts of the relational model as SQL itself.

IBM itself did only one test implementation of the relational model, PRTV, and a production one, Business System 12, both now discontinued. Honeywell did MRDS for Multics, and now there are two new implementations: Alphora Dataphor and Rel. All other DBMS implementations usually called **relational** are actually SQL DBMSs.
In 1968, the University of Michigan began development of the Micro DBMS relational database management system. It was used to manage

very large data sets by the US Department of Labor, the Environmental Protection Agency and researchers from University of Alberta, the University of Michigan and Wayne State University. It ran on mainframe computers using Michigan Terminal System .The system remained in production until 1996.

SQL DBMS

IBM started working on a prototype system loosely based on Codd's concepts as **System R** in the early 1970s — unfortunately, System R was conceived as a way of proving Codd's ideas unimplementable, and thus the project was delivered to a group of programmers who were not under Codd's supervision, never understood his ideas fully and ended up violating several fundamentals of the relational model. The first "quickie" version was ready in 1974/5, and work then started on multi-table systems in which the data could be broken down so that all of the data for a record (much of which is often optional) did not have to be stored in a single large "chunk". Subsequent multi-user versions were tested by customers in 1978 and 1979, by which time a standardized query language, SQL, had been added. Codd's ideas were establishing themselves as both workable and superior to Codasyl, pushing IBM to develop a true production version of System R, known as **SQL/DS**, and, later, **Database 2** (DB2).

Many of the people involved with INGRES became convinced of the future commercial success of such systems, and formed their own companies to commercialize the work but with an SQL interface. Sybase, Informix, NonStop SQL and eventually Ingres itself were all being sold as offshoots to the original INGRES product in the 1980s. Even Microsoft SQL Server is actually a re-built version of Sybase, and thus, INGRES. Only Larry Ellison's Oracle started from a different chain, based on IBM's papers on System R, and beat IBM to market when the first version was released in 1978.

Stonebraker went on to apply the lessons from INGRES to develop a new database, Postgres, which is now known as PostgreSQL. PostgreSQL is primarily used for global mission critical applications (the .org and .info domain name registries use it as their primary data store, as do many large companies and financial institutions).
In Sweden, Codd's paper was also read and Mimer SQL was developed from the mid-70s at Uppsala University. In 1984, this project was consolidated into an independent enterprise. In the early 1980s, Mimer introduced transaction handling for high robustness in applications, an idea that was subsequently implemented on most other DBMS.

3.5 List of Database Management Systems Software

Examples of DBMSs include:

Oracle
DB2
Sybase Adaptive Server Enterprise
FileMaker
Firebird
Ingres
Informix
Microsoft Access
Microsoft SQL Server
Microsoft Visual FoxPro
MySQL
PostgreSQL
Progress
SQLite
Teradata
CSQL
OpenLink Virtuoso

4.0 CONCLUSION

Database management systems have continued to make data arrangement and storage much easier than it used to be. With the emergence of relational model of database management systems much of the big challenge in handling large database has been reduced. More database management products will be available on the market as there will be improvement in the already existing ones.

5.0 SUMMARY

A **database management system** (**DBMS**) is computer software designed for the purpose of managing databases based on a variety of data models.

A DBMS is a complex set of software programs that controls the organization, storage, management, and retrieval of data in a database.

When a DBMS is used, information systems can be changed much more easily as the organization's information requirements change. New categories of data can be added to the database without

disruption to the existing system.

Often it is desirable to limit who can see or change which attributes or groups of attributes. This may be managed directly by an individual, or by the assignment of individuals and privileges to groups, or (in the most elaborate models) through the assignment of individuals and groups to roles which are then granted entitlements.

A DBMS can be characterized as an "attribute management system" where attributes are small chunks of information that describe something. For example, "colour" is an attribute of a car. The value of the attribute may be a color such as "red", "blue" or "silver".

Querying is the process of requesting attribute information from various perspectives and combinations of factors. Example: "How many 2-door cars in Texas are green?"

As computers grew in capability, this trade-off became increasingly unnecessary and a number of general-purpose database systems emerged; by the mid-1960s there were a number of such systems in commercial use. Interest in a standard began to grow, and Charles Bachman, author of one such product, **IDS**, founded the *Database Task Group* within CODASYL.

6.0 TUTOR-MARKED ASSIGNMENT

2. Mention 10 benefits of database management systems
3. Describe briefly the backup and replication ability of database management systems.

7.0 REFERENCES/FURTHER READINGS

Codd, E.F. (1970). "A Relational Model of Data for Large Shared Data Banks". Communications of the ACM 13 (6): 377–387.

UNIT 3 SYSTEMS DEVLOPMENT LIFE CYCLE

CONTENTS

1.0 Introduction
2.0 Objectives

3.0 Main Content
3.1 Models and Methodologies
3.2 Benefits
3.3 People Involvement in Information Systems Design
3.4 Process/Stages of Information System Development
4.0 Conclusion
5.0 Summary
6.0 Tutor-Marked Assignment
7.0 References/Further Readings

10 INTRODUCTION

There are different definitions associated with systems development life cycle depending on the type of systems being developed. Some of these definitions are:

Systems development life cycle is a procedure for automating manual systems and solving problem with computer programs.
A systematic and orderly approach to solve business problems, and developing supporting resulting information systems.
A system by which systems analysts, software engineers, programmers, and end users build information systems and computer application.
A disciplined approach to developing information systems.

2.0 OBJECTIVES

This unit is designed for the student to:

define systems development life cycle from different perspectives
identify the different types of SDLC models and how they relate and differ from each other
identify the benefits associated with SDLC
know the levels of users involvement in the development of information system
identify and differentiate the various phases in SDLC.

3.0 MAIN CONTENT

3.1 Models and Methodologies

SDLC, the **S**oftware **D**evelopment **L**ife **C**ycle relates to models or methodologies that people use to develop systems, generally computer systems. Note: the acronym is sometimes thought of to represent

Software Development Life Cycle and sometimes the process/model is simply referred to as the SLC. Computer systems have become more complex and usually (especially with the advent of SOA) link multiple traditional systems often supplied by different software vendors. To manage this, a number of system development life cycle (SDLC) models have been created: waterfall, fountain, spiral, build and fix, rapid prototyping, incremental, and synchronize and stabilize.
The oldest model, that was originally regarded as "the SDLC" is the waterfall model: a sequence of stages in which the output of each stage becomes the input for the next. These stages generally follow the same basic steps but many different waterfall methodologies give the steps different names and the number of steps seems to vary between 4 and 7.

There is not a definitive correct model, but the steps can be characterized and divided as follows:

Project Planning, Feasibility Study, Initiation

To generate a high-level view of the intended project and determine the goals of the project. Funding is often mentioned/sought at this stage.

Requirements Gathering and Systems Analysis

Analyses project goals, breaking down functions that need to be created, and attempts to engage users so that definite requirements can be defined.

Systems Design

Functions and operations are described in detail, including screen layouts, business rules, process diagrams and other documentation. The output of this stage will often be the technical specification.

Build

The program code is written in this stage.

Testing

The code is tested at various levels. Unit, system and user acceptance testing are often performed. This is a very grey area as many different opinions exist as to what the stages of testing are and how much if any iteration occurs. Iteration is not generally part of the Waterfall model,

but usually some occurs at this stage.

Installation, Implementation or Deployment

The final stage of a project or the initial development, where the software is put into production and is used by the actual business.

Maintenance, Business as Usual

The life of the system which includes changes and enhancements before the decommissioning or sunset of the system.

The systems development life cycle (SDLC) is a conceptual model used in project management that describes the stages involved in an information system development project, from an initial feasibility study through maintenance of the completed application. Various SDLC methodologies have been developed to guide the processes involved, including the waterfall model (which was the original SDLC method); rapid application development (RAD); joint application development (JAD); the fountain model; the spiral model; build and fix; and synchronize-and-stabilize. Frequently, several models are combined into some sort of hybrid methodology. Documentation is crucial regardless of the type of model chosen or devised for any application, and is usually done in parallel with the development process. Some methods work better for specific types of projects, but in the final analysis, the most important factor for the success of a project may be how closely the particular plan was followed.

In general, an SDLC methodology follows the following steps: The existing system is evaluated. Deficiencies are identified. This can be done by interviewing users of the system and consulting with support personnel. The new system requirements are defined. In particular, the deficiencies in the existing system must be addressed with specific proposals for improvement. The proposed system is designed. Plans are laid out concerning the physical construction, hardware, operating systems, programming, communications, and security issues. The new system is developed. The new components and programs must be obtained and installed. Users of the system must be trained in its use, and all aspects of performance must be tested. If necessary, adjustments must be made at this stage. The system is put into use. This can be done in various ways. The new system can phased in, according to application or location, and the old system gradually replaced. In some cases, it may be more cost-effective to shut down the old system and implement the new system all at once.
Once the new system is up and running for a while, it should be exhaustively evaluated. Maintenance must be kept up rigorously at all

times. Users of the system should be kept up-to-date concerning the latest modifications and procedures.

3.1 Benefits

.

Proponents of Systems Development Life Cycle or Application Lifecycle Management claim that it:

Increases productivity, as the team shares best practices for development and deployment, and developers need focus only on current business requirements.
Improves quality, so the final application meets the needs and expectations of users.
Breaks boundaries through collaboration and smooth information flow.
Accelerates development through simplified integration
Cuts maintenance time by synchronizing application and design.
Maximizes investments in skills, processes, and technologies.
Increases flexibility by reducing the time it takes to build and adapt applications that support new business initiatives.

3.2 People Involvement in Information Systems Design

The most brilliant state-of-the art information system is a waste of time and effort unless people in the organization accept it and use it. Many information systems never work successfully in the organization even though the software operates correctly on the computer.

The main force against social inertia is involvement and commitment by participants and their managers. Low level of involvement and commitment make it more likely that the information system will never reach its full potential or will fail altogether. If commitment is low, even an information system that has been implemented somewhat successfully may be used for a while and then gradually abandoned, soon making it seem that the project never happened.

Table 1 shows some of the possible levels of **user involvement** in an information system development project, ranging from non-involvement to active ongoing participation in the project team. Non-involvement occurs if the users are unable to participate or if the system is to be imposed on them and they are not invited to participate. Non-involvement may sound like a recipe for disaster, but it sometimes works, such as when software package developed else where is the most practical basis for a new information system and when the implementation of that package is well explained. Involvement through advice or sign-off uses a small amount of users' time to provide input

that influences priorities and features and therefore reduces political problems.

Table 1: Alternative Levels of User Involvement in Systems Development

Level of Involvement	Description of Involvement at this level
Non-involvement	Users are unwilling to participate, unable to contribute, or are not invited to participate.
Involvement by advice	User advice is solicited through interviews or questionnaires, but others make decision about which features are included in the system.
Involvement by sign-off	Users approve the result produced by the project team, but are not actively involved in analyzing or designing the system.
Involvement by design team membership	Users participate actively in design activities, such as interviews of other users and creation of functional specifications and external specifications.
Involvement by project team membership, management, and project ownership	Users participate throughout the entire project, including initiation, development, implementation, and operation; a user representative manages the project; the user organization owns the project.

Unfortunately, limited involvement often leads to overlooking systems shortcomings and organizational issues that fuller participation would catch. The highest levels of involvement require ongoing participation by users in the project team. In some cases a user representative manages the project to make sure that it genuinely solves the problem. Also, limited involvement leads to inconsistent requests from different users, different needs that cannot all be supported due to resource constraints, and request features or capabilities that the analysts believe are too difficult or expensive to provide.

The importance of involvement and commitment are clear from attempts to implement the same information system in four unrelated life insurance firms, Sun Alliance Insurance Group in the United Kingdom, National Mutual in Australia, and Prudential and Lutheran Brotherhood in the United States. All sold a full line of life insurance products and had a geographically diverse field sales force with a central home office. All attempted to implement an information system developed by Applied Expert Systems to perform comprehensive financial planning in areas such as cash management, risk management, income protection, general insurance, education funding, and retirement planning.

The different results at these four companies show that a system's success is determined partially by its features and partially by the development and implementation process itself. The likelihood of success drops if this process cannot overcome the inertia of current business processes or if the implementation itself causes resistance.

3.3 Process/Stages of Information System Development

The system development life cycle is triggered either by problems, opportunities or directives.

There are many versions of the SDLC but they all share same basic approach. Some of the SDLC have five to seven phases depending on the nature of the project, whether it is a software development or development of information systems project in an organization. Typical SDLC phases are:

Planning/Feasibility Definition
Analysis Design
Implementation
Testing
Maintenance
Evaluation

3.3.1 Planning/Feasibility and Requirement Definition

Planning is the study of the ongoing environment to identifying problem solving possibilities. This is the first step in an SDLC aimed at identifying the business need of an organization. This includes the identification of a shortcoming in an existing system or an observation by anyone in the organization that a problem exists, or that needs are not been addressed. The systems developers working in consultation with those commissioning the system and its intended users (who may be two different groups of people), establish the general tasks which the system is intended to perform and constraints (budgetary, time, etc) on its production.

The outcome of this phase should include the following:

Term of Reference (TOR)
An analysis of the functional system
A summary of the requirements for the system

An outline description of the proposed system
Estimates of costs, benefits and timescales.

Based on the reports containing these points, it is possible to decide whether a system is likely to provide an adequate solution. The decision to commission to build or acquire a system must be taken by the problem owner(s). Unless they are committed to the system, it is almost certain that it will fail at the evaluation level.

3.3.2 Systems Analysis

Systems analysis is the study of the problem environment and subsequent definition and prioritization of the requirements for solving the problem. After a project has been approved for further study, the next step is to perform detailed analysis of the existing system, otherwise termed need analysis. The overall emphasis is to uncover some of the inherent problems and limitations of the existing system and to determine the extent to which the existing system is achieving the organization's goals and objectives.

Systems analysis is achieved by modeling relevant areas of business activity to produce some detailed description usually known as specification. Systems analysts start by clarifying the overall objectives of the organization and by determining which documents and information are needed to obtain desired objectives. There is a lot of movement, storage and retrieval of data.

Analysis of a small company's computer system can be straightforward. On the other hand, evaluating an existing data processing system of a large company can be long and tedious. As a result large organizations that are evaluating a major data processing system normally go through formalized evaluation procedure that involves assembling of the study team, collection of appropriate data; analysis of the data and the existing system; preparation of a report of the existing system. For small projects, the study team can be just one person. Large projects may require 20 or more people.

The data collected in this raw form from the data collection stage is usually not adequate to make a determination of the effectiveness and efficiency of the existing data processing system. This data needs to be manipulated in a form that is useable by the members of the study team. System analysis concludes with a formal report on the status of the existing system. The report contains both the strengths and weaknesses of the system. Particular attention is focused on those areas that could use improvement.

3.3.3 Systems Design

Systems design is the evaluation of alternative problem solutions, and the detailed specification of the final system. The specification produced in the analysis stage is used to construct a design for the complete system, including programs, files, records, etc.

The emphasis of systems design is to develop a new system that helps to achieve the goals and objectives of the organization and overcomes some of the shortcomings and limitations of the existing system. If the problems are minor, only small modifications are required. On the other hand, major changes may be suggested by systems analysis. Throughout design the emphasis usually shifts from the business to computer solution.

In these cases major investments in additional hardware, software and personnel may be necessary. Regardless of the complexity and scope of the new system, it is the purpose of systems design to develop the best possible system.

The final design consideration is documentation. The documentation of the new system is similar to the documentation of the existing system. The importance of good documentation cannot be over emphasized. In most cases there are both user and technical documentation. Without good documentation, the new system may never be used, and it may be virtually impossible to modify the system in the future. Poorly documented systems have resulted in mistakes that led to great losses in organisations.

3.3.4 Systems Implementation

Systems implementation is the construction or the assembly of the problem solution culminating in new environment based on the solution. After detailed design of a program or project the next logical phase in the SDLC is implementation of the designed program or project. In the case of programming, the design is turned into executable code using whatever programming language that is appropriate. On the other hand too, for the implementation of data processing system selected, a number of tasks must be completed before the system is installed and ready to operate.

This system implementation includes acquisition of software, hiring and training of the personnel, the site preparation, data preparation and installation.

3.3.5 Systems Testing

The process of systems testing takes place at several levels. This includes testing of the individual modules or units making up the system, testing the system as a whole, testing the system under normal and unusual conditions, hands-on testing by the intended end-user, etc. The 'full system' will also be a test of documentation, training and operating procedures, as well as the computerized part of the system.

3.3.6 Systems Maintenance/Support

Systems maintenance consists of making sure that the system runs in operational use and continues to do so for as long as is required. It includes correcting any errors that have remained undetected so far, improving the implementation of systems module/units where this is possible and enhancing the functionality of the system where the client or user desires this. It should be the longest of all the stages in the life cycle as far as elapsed time is concerned. The Centre for Software Maintenance estimates that 50 % and 90% of the cost of computer system is over its lifetime in maintenance.

3.3.7 Post-Implementation Review/Evaluation

During this phase, we determine whether the new system has achieved its original design goals. We also look back to see if the system was developed within the specified time and budget. Typically time and budget comparisons are made. These comparisons investigate the difference between the planned time and the cost estimates and the actual time and cost expended. This can be used to determine whether the entire project was over budgeted at any point in time.

In a five-phase systems development life cycle (for example as in figure 1), feasibility studies account for 10-20 percent of project cycle; systems analysis and design, 25-45 percent; programming, 15-30 percent; conversion and implementation 20-25 percent; and post implementation evaluation, 5 percent.

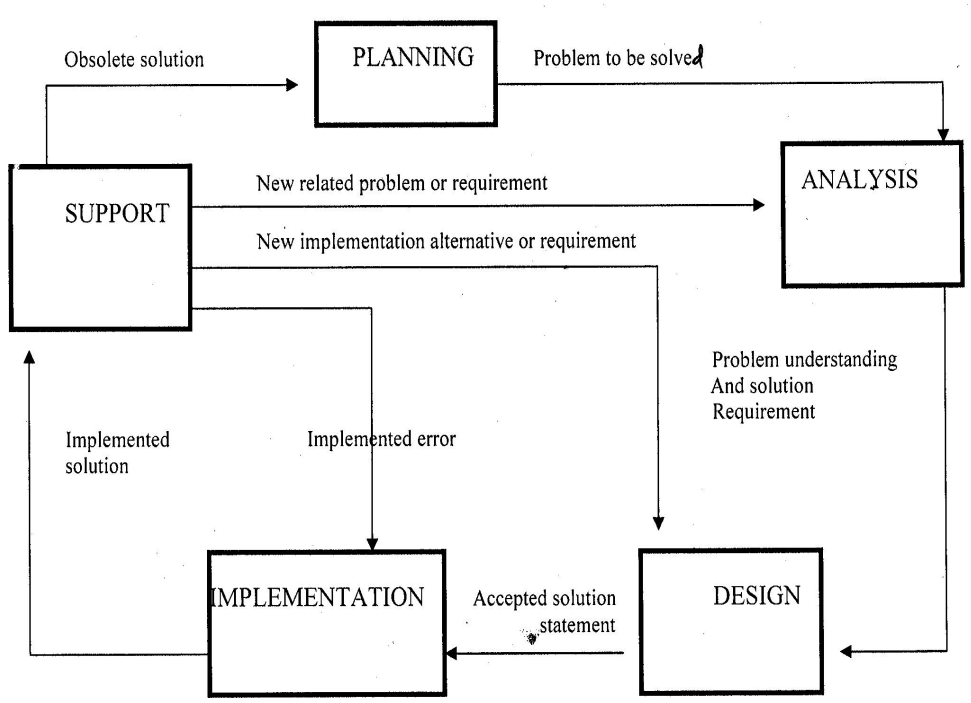
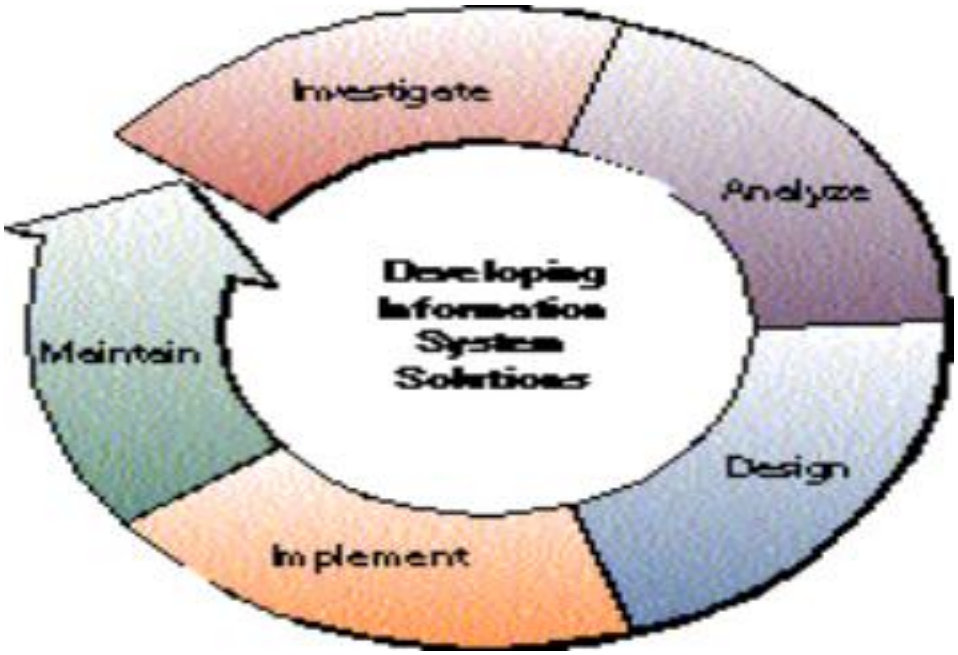


Figure 1: A 5-Phase SDLC



4.0 CONCLUSION

The systems development life cycle is a means of charting system development and controlling cost and time on project. Other ways of controlling a systems development project are available as there are different models and methodologies that are suitable to meet the specific need of businesses and organizations. We need to also note that system

development is also expensive and time consuming. And finally, users are important sources of information in system development.

5.0 SUMMARY

This unit is summarized s follows:

There are different definitions associated with systems development life cycle depending on the type of systems being developed.

SDLC, the **S**oftware **D**evelopment **L**ife **C**ycle relates to models or methodologies that people use to develop systems, generally computer systems. Note: the acronym is sometimes thought of to represent Software Development Life Cycle and sometimes the process/model is simply referred to as the SLC.

SDLC increases productivity, as the team shares best practices for development and deployment, and developers need focus only on current business requirements.

The most brilliant state-of-the art information system is a waste of time and effort unless people in the organization accept it and use it. Many information systems never work successfully in the organization even though the software operates correctly on the computer.

Planning is the study of the ongoing environment to identifying problem solving possibilities.

The system development life cycle is triggered either by problems, opportunities or directives.

6.0 TUTOR-MARKED ASSIGNMENT

1. Describe the systems implementation phase of SDLC.
2. What are the outcomes of the Planning/Feasibility and Requirement Definition of SDLC.

7.0 REFERENCES/FURTHER READINGS

"The Changing Face of Application Lifecycle Management" by Carey Schwaber, Forrester Research, Inc. August 2006.

Cummings, Haag, (2006). *Management Information Systems for the Information Age*. Toronto: McGraw-Hill Ryerson.

Computer World, 2002, Retrieved on June 22, 2006.

Management Information Systems, 2005, Retrieved on June 22, 2006.

O'Brien J.A.; *Introduction to Information Systems*, 8th Edition, ISBN: 0-256-20937-5.

UNIT 4 COMPUTER NETWORKS

CONTENTS

1.0 Introduction
2.0 Objectives
3.0 Main Content
    3.1 Network Classification
    3.2 Types of Networks
    3.3 Basic Hardware Components
    3.4 Connecting to a Network
    3.5 Security
    3.6 Use of Networks
4.0 Conclusion
5.0 Summary
6.0 Tutor-Marked Assignment
7.0 References/Further Readings

1.0 INTRODUCTION

Classified according to a wide variety of characteristics. This unit provides a general overview of some types and categories and presents the basic components of a network. A **computer network** is a group of interconnected computers. Networks may be

Most people working in office with more than a couple of computers will be using some form of **network**. As networks become easier to setup and maintain more home users are also setting up networks to share resource such as disk space, printers, Internet connections and access to software.

2.0 OBJECTIVES

At the end of this unit you are expected to:

define computer network
identify and classify the various types of networks
define network topology
identify and differentiate the basic components of a network
know the major functions of networks to a business
have basic idea of how to connect to a network.

3.0 MAIN CONTENT

3.1 Network Classification

The following list presents major categories used for classifying networks.

Scale

Computer networks may be classified according to the scale: Personal area network (PAN), Local Area Network (LAN), Campus Area Network (CAN), Metropolitan area network (MAN), or Wide area network (WAN). Also a business area network

As **Ethernet** increasingly is the standard interface for networks, these distinctions are more important to the network administrator than the user. Network administrators may have to tune the network, to correct delay issues and achieve the desired performance level.

Connection Method

Computer networks can also be classified according to the hardware technology that is used to connect the individual devices in the network such as Optical fibre, Ethernet, Wireless LAN, HomePNA, or Power line communication.

Ethernets use physical wiring to connect devices. Often they employ hubs, switches, bridges, and/or routers.

Wireless LAN technology is built-in to connect devices without wiring. These devices use a radio frequency to connect.

Functional Relationship (Network Architectures)

Computer networks may be classified according to the functional relationships which exist between the elements of the network, e.g., Active Networking, Client-server and Peer-to-peer (workgroup) architecture.

Network Topology

Computer networks may be classified according to the network topology upon which the network is based, such as Bus network, Star network, Ring network, Mesh network, Star-bus network, Tree or Hierarchical topology network, etc.
Network Topology signifies the way in which devices in the network see their logical relations to one another. The use of the term "logical"

here is significant. That is, network topology is independent of the "physical" layout of the network. Even if networked computers are physically placed in a linear arrangement, if they are connected via a hub, the network has a Star topology, rather than a Bus Topology. In this regard the visual and operational characteristics of a network are distinct; the logical network topology is not necessarily the same as the physical layout.

3.2 Types of Networks

Below is a list of the most common types of computer networks in order of scale.

Personal Area Network (PAN)

A personal area network (PAN) is a computer network used for communication among computer devices close to one person. Some examples of devices that are used in a PAN are printers, fax machines, telephones, PDAs or scanners. The reach of a PAN is typically within about 20-30 feet (approximately 6-9 metres).

Personal area networks may be wired with computer buses such as FireWire. A wireless personal area network (WPAN) can also be made possible with network technologies such as IrDA and Bluetooth.

Local Area Network (LAN)

This is network covering a small geographic area, like a home, office, or building. Current LANs are most likely to be based on Ethernet technology. For example, a library may have a wired or wireless LAN for users to interconnect local devices (e.g., printers and servers) and to connect to the internet. On a wired LAN, PCs in the library are typically connected by category 5 (Cat5) cable, running the IEEE 802.3 protocol through a system of interconnection devices and eventually connect to the internet. The cables to the servers are typically on Cat 5e enhanced cable, which will support IEEE 802.3 at 1 Gbit/s. A wireless LAN may exist using a different IEEE protocol, 802.11b or 802.11g. The staff computers (bright green in the figure) can get to the color printer, checkout records, and the academic network *and* restore the Internet. All user computers can get to the Internet and the card catalog. Each workgroup can get to its local printer. Note that the printers are not accessible from outside their workgroup.

Typical library network, in a branching tree topology and controlled access to resources.
All interconnected devices must understand the network layer (layer 3),

because they are handling multiple subnets (the different colors). Those inside the library, which have only 10/100 Mbit/s Ethernet connections to the user device and a Gigabit Ethernet connection to the central router, could be called "layer 3 switches" because they only have Ethernet interfaces and must understand IP. It would be more correct to call them access routers, where the router at the top is a distribution router that connects to the Internet and academic networks' customer access routers.

The defining characteristics of LANs, in contrast to WANs (wide area networks), include their higher data transfer rates, smaller geographic range, and lack of a need for leased telecommunication lines. Current Ethernet or other IEEE 802.3 LAN technologies operate at speeds up to 10 Gbit/s. This is the data transfer rate. IEEE has projects investigating the standardization of 100 Gbit/s, and possibly 40 Gbit/s.

Campus Area Network (CAN)

A network that connects two or more LANs but which is limited to a specific and contiguous geographical area such as a college campus, industrial complex, or a military base. A CAN may be considered a type of MAN (metropolitan area network), but is generally limited to an area that is smaller than a typical MAN. This term is most often used to discuss the implementation of networks for a contiguous area. This should not be confused with a Controller Area Network. A LAN connects network devices over a relatively short distance. A networked office building, school, or home usually contains a single LAN, though sometimes one building will contain a few small LANs (perhaps one per room), and occasionally a LAN will span a group of nearby buildings. In TCP/IP networking, a LAN is often but not always implemented as a single IP subnet.

Metropolitan Area Network (MAN)

A Metropolitan Area Network is a network that connects two or more Local Area Networks or Campus Area Networks together but does not extend beyond the boundaries of the immediate town/city. Routers, switches and hubs are connected to create a Metropolitan Area Network.

Wide Area Network (WAN)

A WAN is a data communications network that covers a relatively broad geographic area (i.e. one city to another and one country to another country) and that often uses transmission facilities provided by common carriers, such as telephone companies. WAN technologies generally function at the lower three layers of the OSI reference model: the

physical layer, the data link layer, and the network layer.

Global Area Network (GAN)

Global Area Network (GAN) specifications are in development by several groups, and there is no common definition. In general, however, a GAN is a model for supporting mobile communications across an arbitrary number of wireless LANs, satellite coverage areas, etc. The key challenge in mobile communications is "handing off" the user communications from one local coverage area to the next. In IEEE Project 802, this involves a succession of terrestrial Wireless local area networks (WLAN).

Internetwork

Two or more networks or network segments connected using devices that operate at layer 3 (the 'network' layer) of the OSI Basic Reference Model, such as a router. Any interconnection among or between public, private, commercial, industrial, or governmental networks may also be defined as an internetwork.

In modern practice, the interconnected networks use the Internet Protocol. There are at least three variants of internetwork, depending on who administers and who participates in them:

Intranet
Extranet
Internet

Intranets and extranets may or may not have connections to the Internet. If connected to the Internet, the intranet or extranet is normally protected from being accessed from the Internet without proper authorization. The Internet is not considered to be a part of the intranet or extranet, although it may serve as a portal for access to portions of an extranet.

Intranet

An **intranet** is a set of interconnected networks, using the Internet Protocol and uses IP-based tools such as web browsers and ftp tools, that is under the control of a single administrative entity. That administrative entity closes the intranet to the rest of the world, and allows only specific users. Most commonly, an intranet is the internal network of a company or other enterprise. A large intranet will typically have its own web server to provide users with browseable information.

Extranet

An **extranet** is a network or internetwork that is limited in scope to a single organization or entity but which also has limited connections to the networks of one or more other usually, but not necessarily, trusted organizations or entities (e.g. a company's customers may be given access to some part of its intranet creating in this way an extranet, while at the same time the customers may not be considered 'trusted' from a security standpoint). Technically, an extranet may also be categorized as a CAN, MAN, WAN, or other type of network, although, by definition, an extranet cannot consist of a single LAN; it must have at least one connection with an external network.

Internet

A specific internetwork, consisting of a worldwide interconnection of governmental, academic, public, and private networks based upon the Advanced Research Project Agency Network (ARPANET) developed by ARPA of the U.S. Department of Defense – also home to the World Wide Web (WWW) and referred to as the 'Internet' with a capital 'I' to distinguish it from other generic internetworks.

Participants in the Internet, or their service providers, use IP Addresses obtained from address registries that control assignments. Service providers and large enterprises also exchange information on the reachability of their address ranges through the Border Gateway Protocol (BGP).

3.3 Basic Hardware Components

All networks are made up of basic hardware building blocks to interconnect network nodes, such as Network Interface Cards (NICs), Bridges, Hubs, Switches, and Routers. In addition, some method of connecting these building blocks is required, usually in the form of galvanic cable (most commonly Category 5 cable). Less common are microwave links (as in IEEE 802.11) or optical cable ("optical fiber").

Network Interface Cards

A **network card**, **network adapter** or **NIC** (network interface card) is a piece of computer hardware designed to allow computers to communicate over a computer network. It provides physical access to a networking medium and often provides a low-level addressing system through the use of MAC addresses. It allows users to connect to each other either by using cables or wirelessly.

Repeaters

A **repeater** is an electronic device that receives a signal and retransmits it at a higher level or higher power, or onto the other side of an obstruction, so that the signal can cover longer distances without degradation. In most twisted pair ethernet configurations, repeaters are required for cable runs longer than 100 meters.

Hubs

A hub contains multiple ports. When a packet arrives at one port, it is copied to all the ports of the hub for transmission. When the packets are copied, the destination address in the frame does not change to a broadcast address. It does this in a rudimentary way, it simply copies the data to all of the Nodes connected to the hub.

Bridges

A **network bridge** connects multiple network segments at the data link layer (layer 2) of the OSI model. Bridges do not promiscuously copy traffic to all ports, as hubs do, but learn which MAC addresses are reachable through specific ports. Once the bridge associates a port and an address, it will send traffic for that address only to that port. Bridges do send broadcasts to all ports except the one on which the broadcast was received.

Bridges learn the association of ports and addresses by examining the source address of frames that it sees on various ports. Once a frame arrives through a port, its source address is stored and the bridge assumes that MAC address is associated with that port. The first time that a previously unknown destination address is seen, the bridge will forward the frame to all ports other than the one on which the frame arrived.

Bridges come in three basic types:

Local bridges: Directly connect local area networks (LANs)

Remote bridges: Can be used to create a wide area network (WAN) link between LANs. Remote bridges, where the connecting link is slower than the end networks, largely have been replaced by routers.

Wireless bridges: Can be used to join LANs or connect remote stations to LANs.

Switches

A switch is a device that performs switching. Specifically, it forwards and filters OSI layer 2 datagrams (chunk of data communication) between ports (connected cables) based on the Mac-Addresses in the packets. This is distinct from a hub in that it only forwards the datagrams to the ports involved in the communications rather than all ports connected. Strictly speaking, a switch is not capable of routing traffic based on IP address (layer 3) which is necessary for communicating between network segments or within a large or complex LAN. Some switches are capable of routing based on IP addresses but are still called switches as a marketing term. A switch normally has numerous ports with the intention that most or all of the network be connected directly to a switch, or another switch that is in turn connected to a switch.

Switches is a marketing term that encompasses routers and bridges, as well as devices that may distribute traffic on load or by application content (e.g., a Web URL identifier). Switches may operate at one or more OSI layers, including physical, data link, network, or transport (i.e., end-to-end). A device that operates simultaneously at more than one of these layers is called a multilayer switch.

Overemphasizing the ill-defined term "switch" often leads to confusion when first trying to understand networking. Many experienced network designers and operators recommend starting with the logic of devices dealing with only one protocol level, not all of which are covered by OSI. Multilayer device selection is an advanced topic that may lead to selecting particular implementations, but multilayer switching is simply not a real-world design concept.

Routers

Routers are networking devices that forward data packets between networks using headers and forwarding tables to determine the best path to forward the packets. Routers work at the network layer of the TCP/IP model or layer 3 of the OSI model. Routers also provide interconnectivity between like and unlike media (RFC 1812). This is accomplished by examining the Header of a data packet, and making a decision on the next hop to which it should be sent (RFC 1812) They use preconfigured static routes, status of their hardware interfaces, and routing protocols to select the best route between any two subnets. A router is connected to at least two networks, commonly two LANs or WANs or a LAN and its ISP's network. Some DSL and cable modems, for home (and even office) use, have been integrated with routers to allow multiple home/office computers to access the Internet through the

same connection. Many of these new devices also consist of wireless access points (waps) or wireless routers to allow for IEEE 802.11b/g wireless enabled devices to connect to the network without the need for a cabled connection.

3.4 Connecting to a Network

To connect computers, each of the computers needs a network card with a connection that allows a cable to be connected to it. Computers can be connected directly through a **bi-directional cable** or through another piece of hardware called a **hub**. The hub then connects all the computers in your local network together. Both solutions cost about the same but a hub allows more than two computers to connect. A hub can also be used to connect two **local area networks** together to create a **wide area network**.

Some form of **network software** is required. This **network protocol** software is installed through the network preferences. **NetBIOS** was commonly used though recently a secure **TCP/IP** protocol has been developed. The network protocol determines how computers become part of the network and how they are recognized. The network must have a name and you can use some creativity at this point. Each computer must also have a unique name that other computers on the network can access them with.

If all goes well this is all you need, but often, there will be a conflict that can be resolved by establishing exactly how the computer will communicate. To solve these types of conflict your network needs a set **DNS server address** and each computer in the network needs to be assigned a unique **IP address**. The addresses usually are in the range of 192.168.x.x where x means any number between 0 and 255. Once these numbers have been entered your network should be functioning with each computer able to see the other computers on the network.

You must also decide which resources you want to share. You may want to make a disk or folder available, a printer or tape backup system so that everyone can use it. You may also want to have parts of the network that are either not accessible or accessible only through a password. **File and print sharing** must be enabled on the computer that will share it's resources or host computer and then determine how it is accessed by other computers or clients.

A computer with an Internet connection can also share that connection with other computers on the network but you should check with your ISP what their policy on sharing Internet connections is. Sharing an Internet connection also raises some serious security issues. Many cable

high speed Internet connections use the **Network Neighborhood** settings to create the Internet connection and connecting your home or office network to this existing system can cause problems. Though you may want to allow a computer in another room of the house to access files or run programs on your computer you probably don't want the kid down the block to have that same access.

3.5 Security

Security on networks begins with passwords. Everyone who wishes to access the network must logon with a username and password. If someone cancels the password challenge they will be able to access the files and programs on that individual computer but can't access any of the network resources. Specific passwords for important folders or disks can also be set or access to folders or disks can be forbidden.

3.6 Use of Networks

In business, government, schools and other types of organizations, networks of all types of computers provide tremendous benefits. The major benefits among others are as follow:

2. **Share Information:** networks allow users to share information easily. For example, electronic mail system enables co-workers to send memos to each other. This accelerates the distribution of company information. Users can send written message without worrying about whether the user is currently using her computer. The Internet has provided business world especially the financial institutions with an entirely new and immense valuable form of communication.

3. **Share Resources:** Resources shared under network are;

i. **Application Programs:** It is a fact in business computing that most workers use the same program. With a network, businesses can save a lot of money by purchasing special network version of most commonly used program, rather than buying separate copies for each machine. When employees want to use a program they simply load it from a shared storage device into their own personal computer. Since a single network copy of the program can serve the needs of a large number of users simultaneously, all the program would occupy on a local hard disk.

ii. **Share Data File:** the same is true for data that multiple employees need access to at same time, for example, daily stock trade figures in a stock trading firm. Here the issue is data

integrity, rather than money. If employees keep separate copies of data on different hard disks, updating the data is very difficult. As soon as a change is made to the data on one machine, there is a discrepancy and it becomes very difficult to know which data is correct. Keeping data that is used by more than one person on shared storage devices solve the whole problem.

iii. **Shared Peripheral Devices/Hardware:** Network enables everyone in an office to utilize the maximum amount of available equipment. For example, by sharing one printer among several computers cost is reduced. If you have different computers in a work setting, network enables more people to capitalize on each computer's strength.

iv. *Even distribution of work and processing load.*

4. **Back Up** In business for example financial institutions, data can be extremely valuable. So making sure that employees back up their data is one way to address this problem. Employees gain access through a network. That way, one person can be charged with the responsibility of making regular backups of data on the shared storage device.

5. **Share Disk Space**

4.0 CONCLUSION

The need to communicate and share information with others led to the development of personal computer networks. And ever then, computer networks have brought relief to the computer industry because they have made it possible for computers to communicate themselves with ease. Computer network brought about the much heralded Internet and the relative concepts of intranet and extranet. Computer networks have really made doing business more effective and efficient. Organizations have networks scattered all over the world and are able to reach themselves easily via networks.

5.0 SUMMARY

Networks are classified according to a wide variety of characteristics. This unit provides a general overview of some types and categories and presents the basic components of a network. A **computer network** is a group of interconnected computers.

A WAN is a data communications network that covers a relatively broad geographic area (i.e. one city to another and one country to

another country) and that often uses transmission facilities provided by common carriers.

LAN is a network covering a small geographic area, like a home, office, or building. Current LANs are most likely to be based on Ethernet technology.

All networks are made up of basic hardware building blocks to interconnect network nodes, such as Network Interface Cards (NICs), Bridges, Hubs, Switches, and Routers. In addition, some method of connecting these building blocks is required, usually in the form of galvanic cable (most commonly Category 5 cable).

To connect computers each of the computers needs a network card with a connection that allows a cable to be connected to it. Computers can be connected directly through a **bi-directional cable** or through another piece of hardware called a **hub**.

Security on networks begins with passwords. Everyone who wishes to access the network must logon with a username and password. If someone cancels the password challenge they will be able to access the files and programs on that individual computer but can't access any of the network resources.

In business, government, schools and other types of organizations, networks of all types of computers provide tremendous benefits.

6.0 TUTOR-MARKED ASSIGNMENT

1. Mention 5 types of computer networks.
2. Give a brief description of campous area network.

7.0 REFERENCES/FURTHER READINGS

An example of a USB-based PAN is GeneLinkTM; USB Network (accessed 2008-02-11.

Mobile Broadband Wireless Access (MBWA).

Pountain, Dick (2001). *The New Penguin Dictionary of Computing*, New York: Penguin Books, ISBN 0-14-051-4376.

"Define switch.“ www.webopedia.com.

"Basic Components of a Local Area Network (LAN)". NetworkBits.net.

UNIT 5 THE INTERNET

CONTENTS

1.0 Introduction
2.0 Objectives
3.0 Main Content
    3.1 Language
    3.2 Internet and the Workplace
    3.3 The Internet Viewed on Mobile Devices
    3.4 Common Uses
    3.5 Internet Access
    3.6 Social Impact
    3.7 Leisure Activities
    3.8 Marketing
4.0 Conclusion
5.0 Summary
6.0 Tutor-Marked Assignment
7.0 References/Further Readings

1.0 INTRODUCTION

Internet is a specific internetwork, consisting of a worldwide interconnection of governmental, academic, public, and private networks based upon the Advanced Research Project Agency Network (ARPANET) developed by ARPA of the U.S. Department of Defense – also home to the World Wide Web (WWW), and is referred to as the 'Internet' with a capital 'I' to distinguish it from other generic internetworks.

The Internet Corporation for Assigned Names and Numbers (ICANN) is the authority that coordinates the assignment of unique identifiers on the Internet, including domain names, Internet Protocol (IP) addresses, and protocol port and parameter numbers. A globally unified namespace(i.e., a system of names in which there is at most one holder for each possible name) is essential for the Internet to function. ICANN is headquartered in Marina del Rey, California, but is overseen by an international board of directors drawn from across the Internet technical, business, academic, and non-commercial communities. The US government continues to have the primary role in approving changes to the root zone file that lies at the heart of the domain name system. Because the Internet is a distributed network comprising many voluntarily interconnected networks, the Internet has no governing body. ICANN's role in coordinating the assignment of unique identifiers distinguishes it as perhaps the only central coordinating body on the global Internet, but the scope of its authority extends only to the

Internet's systems of domain names, IP addresses, protocol ports and parameter numbers.

On November 16, 2005, the World Summit on the Information Society, held in Tunis, established the Internet Governance Forum (IGF) to discuss Internet-related issues.

2.0 OBJECTIVES

At the end of this unit you are expected to:

define the term Internet
know the most common language in communicating over the Internet
identify the various uses of the Internet
answer the question of how to access the Internet
know to what extent the Internet has impacted on the social life of society
understand the application of the Internet in marketing.

3.0 MAIN CONTENT

3.1 Language

The prevalent language for communication on the Internet is English. This may be a result of the Internet's origins, as well as English's role as a lingua franca. It may also be related to the poor capability of early computers, largely originating in the United States, to handle characters other than those in the English variant of the Latin alphabet.

After English (30% of Web visitors) the most requested languages on the World Wide Web are Chinese (17%), Spanish (9%), Japanese (7%), French (5%) and German (5%).

By continent, 38% of the world's Internet users are based in Asia, 27% in Europe, 18% in North America, 10% in Latin America and the Caribbean, and 7% in Australia.

The Internet's technologies have developed enough in recent years, especially in the use of Unicode that good facilities are available for development and communication in most widely used languages. However, some glitches such as *mojibake* (incorrect display of foreign language characters, also known as *kryakozyabry*) still remain.

3.2 Internet and the Workplace

The Internet is allowing greater flexibility in working hours and location, especially with the spread of unmetered high-speed connections and Web applications.

3.3 The Internet Viewed On Mobile Devices

The Internet can now be accessed virtually anywhere by numerous means. Mobile phones, datacards, handheld game consoles and cellular routers allow users to connect to the Internet from anywhere there is a cellular network supporting that device's technology.

Within the limitations imposed by the small screen and other limited facilities of such pocket-sized devices, all the services of the Internet, including email and web browsing, may be available in these ways. Service providers may restrict the range of these services and charges for data access may be significant, compared to home usage.

3.4 Common Uses

E-mail

The concept of sending electronic text messages between parties in a way analogous to mailing letters or memos predates the creation of the Internet. Even today it can be important to distinguish between Internet and internal e-mail systems. Internet e-mail may travel and be stored unencrypted on many other networks and machines out of both the sender's and the recipient's control. During this time it is quite possible for the content to be read and even tampered with by third parties, if anyone considers it important enough. Purely internal or intranet mail systems, where the information never leaves the corporate or organization's network, are much more secure, although in any organization there will be IT and other personnel whose job may involve monitoring, and occasionally accessing, the e-mail of other employees not addressed to them.

The World Wide Web

Many people use the terms *Internet* and *World Wide Web* (or just the *Web*) interchangeably, but, as discussed above, the two terms are not synonymous.

The World Wide Web is a huge set of interlinked documents, images and other resources, linked by hyperlinks and URLs. These hyperlinks and URLs allow the web servers and other machines that store originals,

and cached copies, of these resources to deliver them as required using HTTP (Hypertext Transfer Protocol). HTTP is only one of the communication protocols used on the Internet.

Web services also use HTTP to allow software systems to communicate in order to share and exchange business logic and data.
Software products that can access the resources of the Web are correctly termed *user agents*. In normal use, web browsers, such as Internet Explorer and Firefox, access web pages and allow users to navigate from one to another via hyperlinks. Web documents may contain almost any combination of computer data including graphics, sounds, text,video, multimedia and interactive content including games, office applications and scientific demonstrations.

Through keyword-driven Internet research using search engines like Yahoo! and Google, millions of people worldwide have easy, instant access to a vast and diverse amount of online information. Compared to encyclopedias and traditional libraries, the World Wide Web has enabled a sudden and extreme decentralization of information and data. Using the Web, it is also easier than ever before for individuals and organisations to publish ideas and information to an extremely large audience. Anyone can find ways to publish a web page, a blog or build a website for very little initial cost. Publishing and maintaining large, professional websites full of attractive, diverse and up-to-date information is still a difficult and expensive proposition, however.

Many individuals and some companies and groups use "web logs" or blogs, which are largely used as easily updatable online diaries. Some commercial organisations encourage staff to fill them with advice on their areas of specialization in the hope that visitors will be impressed by the expert knowledge and free information, and be attracted to the corporation as a result. One example of this practice is Microsoft, whose product developers publish their personal blogs in order to pique the public's interest in their work.

Collections of personal web pages published by large service providers remain popular, and have become increasingly sophisticated. Whereas operations such as Angelfire and GeoCities have existed since the early days of the Web, newer offerings from, for example, Facebook and MySpace currently have large followings. These operations often brand themselves as social network services rather than simply as web page hosts.

Advertising on popular web pages can be lucrative, and e-commerce or the sale of products and services directly via the Web continues to grow. In the early days, web pages were usually created as sets of complete

and isolated HTML text files stored on a web server. More recently, websites are more often created using content management system (CMS) or wiki software with, initially, very little content. Contributors to these systems, who may be paid staff, members of a club or other organisation or members of the public, fill underlying databases with content using editing pages designed for that purpose, while casual visitors view and read this content in its final HTML form. There may or may not be editorial, approval and security systems built into the process of taking newly entered content and making it available to the target visitors.

Remote access

The Internet allows computer users to connect to other computers and information stores easily, wherever they may be across the world. They may do this with or without the use of security, authentication and encryption technologies, depending on the requirements.

This is encouraging new ways of working from home, collaboration and information sharing in many industries. An accountant sitting at home can audit the books of a company based in another country, on a server situated in a third country that is remotely maintained by IT specialists in a fourth. These accounts could have been created by home-working bookkeepers, in other remote locations, based on information e-mailed to them from offices all over the world. Some of these things were possible before the widespread use of the Internet, but the cost of private leased lines would have made many of them infeasible in practice.

An office worker away from his desk, perhaps on the other side of the world on a business trip or a holiday, can open a remote desktop session into his normal office PC using a secure Virtual Private Network (VPN) connection via the Internet. This gives the worker complete access to all of his or her normal files and data, including e-mail and other applications, while away from the office.

This concept is also referred to by some network security people as the Virtual Private Nightmare, because it extends the secure perimeter of a corporate network into its employees' homes; this has been the source of some notable security breaches, but also provides security for the workers.

Collaboration

The low cost and nearly instantaneous sharing of ideas, knowledge, and skills has made collaborative work dramatically easier. Not only can a group cheaply communicate and test, but the wide reach of the Internet

allows such groups to easily form in the first place, even among niche interests. An example of this is the free software movement in software development, which produced GNU and Linux from scratch and has taken over development of Mozilla and OpenOffice.org (formerly known as Netscape Communicator and StarOffice).

Internet "chat", whether in the form of IRC "chat rooms" or channels, or via instant messaging systems, allow colleagues to stay in touch in a very convenient way when working at their computers during the day. Messages can be sent and viewed even more quickly and conveniently than via e-mail. Extension to these systems may allow files to be exchanged, "whiteboard" drawings to be shared as well as voice and video contact between team members.

Version control systems allow collaborating teams to work on shared sets of documents without either accidentally overwriting each other's work or having members wait until they get "sent" documents to be able to add their thoughts and changes.

File Sharing

A computer file can be e-mailed to customers, colleagues and friends as an attachment. It can be uploaded to a website or FTP server for easy download by others. It can be put into a "shared location" or onto a file server for instant use by colleagues. The load of bulk downloads to many users can be eased by the use of "mirror" servers or peer-to-peer networks.

In any of these cases, access to the file may be controlled by user authentication; the transit of the file over the Internet may be obscured by encryption, and money may change hands before or after access to the file is given. The price can be paid by the remote charging of funds from, for example, a credit card whose details are also passed—hopefully fully encrypted—across the Internet. The origin and authenticity of the file received may be checked by digital signatures or by MD5 or other message digests.

These simple features of the Internet, over a worldwide basis, are changing the basis for the production, sale, and distribution of anything that can be reduced to a computer file for transmission. This includes all manner of print publications, software products, news, music, film, video, photography, graphics and the other arts. This in turn has caused seismic shifts in each of the existing industries that previously controlled the production and distribution of these products.

Internet collaboration technology enables business and project teams to

share documents, calendars and other information. Such collaboration occurs in a wide variety of areas including scientific research, software development, conference planning, political activism and creative writing.

Streaming Media

Many existing radio and television broadcasters provide Internet "feeds" of their live audio and video streams (for example, the BBC). They may also allow time-shift viewing or listening such as Preview, Classic Clips and Listen Again features. These providers have been joined by a range of pure Internet "broadcasters" who never had on-air licenses. This means that an Internet-connected device, such as a computer or something more specific, can be used to access on-line media in much the same way as was previously possible only with a television or radio receiver. The range of material is much wider, from pornography to highly specialized, technical webcasts. Podcasting is a variation on this theme, where—usually audio—material is first downloaded in full and then may be played back on a computer or shifted to a digital audio player to be listened to on the move. These techniques using simple equipment allow anybody, with little censorship or licensing control, to broadcast audio-visual material on a worldwide basis.

Webcams can be seen as an even lower-budget extension of this phenomenon. While some webcams can give full-frame-rate video, the picture is usually either small or updates slowly. Internet users can watch animals around an African waterhole, ships in the Panama Canal, the traffic at a local roundabout or their own premises, live and in real time. Video chat rooms, video conferencing, and remote controllable webcams are also popular. Many uses can be found for personal webcams in and around the home, with and without two-way sound.

YouTube, sometimes described as an Internet phenomenon because of the vast amount of users and how rapidly the site's popularity has grown, was founded on February 15, 2005. It is now the leading website for free streaming video. It uses a flash-based web player which streams video files in the format FLV. Users are able to watch videos without signing up; however, if users do sign up they are able to upload an unlimited amount of videos and they are given their own personal profile. It is currently estimated that there are 64,000,000 videos on YouTube, and it is also currently estimated that 825,000 new videos are uploaded every day.

Voice Telephony (VoIP)

VoIP stands for Voice over IP, where IP refers to the Internet Protocol that underlies all Internet communication. This phenomenon began as an optional two-way voice extension to some of the instant messaging systems that took off around the year 2000. In recent years many VoIP systems have become as easy to use and as convenient as a normal telephone. The benefit is that, as the Internet carries the actual voice traffic, VoIP can be free or cost much less than a normal telephone call, especially over long distances and especially for those with always-on Internet connections such as cable or ADSL.

Thus, VoIP is maturing into a viable alternative to traditional telephones. Interoperability between different providers has improved and the ability to call or receive a call from a traditional telephone is available. Simple, inexpensive VoIP modems are now available that eliminate the need for a PC.

Voice quality can still vary from call to call but is often equal to and can even exceed that of traditional calls.

Remaining problems for VoIP include emergency telephone number dialing and reliability. Currently, a few VoIP providers provide an emergency service, but it is not universally available. Traditional phones are line-powered and operate during a power failure; VoIP does not do so without a backup power source for the electronics.
Most VoIP providers offer unlimited national calling, but the direction in VoIP is clearly toward global coverage with unlimited minutes for a low monthly fee.

VoIP has also become increasingly popular within the gaming world, as a form of communication between players. Popular gaming VoIP clients include Ventrilo andTeamspeak, and there are others available also. The PlayStation 3 and Xbox 360 also offer VoIP chat features.

3.5 Internet Access

Common methods of home access include dial-up, landline broadband (over coaxial cable, fiber optic or copper wires), Wi-Fi, satellite and 3G technology cell phones.

Public places to use the Internet include libraries and Internet cafes, where computers with Internet connections are available. There are also Internet access points in many public places such as airport halls and coffee shops, in some cases just for brief use while standing. Various terms are used, such as "public Internet kiosk", "public access terminal",

and "Web payphone". Many hotels now also have public terminals, though these are usually fee-based. These terminals are widely accessed for various usage like ticket booking, bank deposit, online payment etc. Wi-Fi provides wireless access to computer networks, and therefore can do so to the Internet itself. Hotspots providing such access include Wi-Fi cafes, where would-be users need to bring their own wireless-enabled devices such as a laptop or PDA. These services may be free to all, free to customers only, or fee-based. A hotspot need not be limited to a confined location. A whole campus or park, or even an entire city can be enabled. Grassroots efforts have led to wireless community networks. Commercial Wi-Fi services covering large city areas are in place in London, Vienna, Toronto, San Francisco, Philadelphia, Chicago and Pittsburgh. The Internet can then be accessed from such places as a park bench.

Apart from Wi-Fi, there have been experiments with proprietary mobile wireless networks like Ricochet, various high-speed data services over cellular phone networks, and fixed wireless services.

High-end mobile phones such as smartphones generally come with Internet access through the phone network. Web browsers such as Opera are available on these advanced handsets, which can also run a wide variety of other Internet software. More mobile phones have Internet access than PCs, though this is not as widely used. An Internet access provider and protocol matrix differentiates the methods used to get online.

3.6 Social Impact

The Internet has made possible entirely new forms of social interaction, activities and organizing, thanks to its basic features such as widespread usability and access.

Social networking websites such as Facebook and MySpace have created a new form of socialization and interaction. Users of these sites are able to add a wide variety of items to their personal pages, to indicate common interests, and to connect with others. It is also possible to find a large circle of existing acquaintances, especially if a site allows users to utilize their real names, and to allow communication among large existing groups of people.

Sites like meetup.com exist to allow wider announcement of groups which may exist mainly for face-to-face meetings, but which may have a variety of minor interactions over their group's site at meetup.org, or other similar sites.

3.7 Leisure Activities

The Internet has been a major source of leisure since before the World Wide Web, with entertaining social experiments such as MUDs and MOOs being conducted on university servers, and humor-related Usenet groups receiving much of the main traffic. Today, many Internet forums have sections devoted to games and funny videos; short cartoons in the form of Flash movies are also popular. Over 6 million people use blogs or message boards as a means of communication and for the sharing of ideas.

The pornography and gambling industries have both taken full advantage of the World Wide Web, and often provide a significant source of advertising revenue for other websites. Although many governments have attempted to put restrictions on both industries' use of the Internet, this has generally failed to stop their widespread popularity. One main area of leisure on the Internet is multiplayer gaming. This form of leisure creates communities, bringing people of all ages and origins to enjoy the fast-paced world of multiplayer games. These range from MMORPG to first-person shooters, from role-playing games to online gambling. This has revolutionized the way many people interact and spend their free time on the Internet.

While online gaming has been around since the 1970s, modern modes of online gaming began with services such as GameSpy and MPlayer, to which players of games would typically subscribe. Non-subscribers were limited to certain types of gameplay or certain games.
Many use the Internet to access and download music, movies and other works for their enjoyment and relaxation. As discussed above, there are paid and unpaid sources for all of these, using centralized servers and distributed peer-to-peer technologies. Discretion is needed as some of these sources take more care over the original artists' rights and over copyright laws than others.

Many use the World Wide Web to access news, weather and sports reports, to plan and book holidays and to find out more about their random ideas and casual interests.

People use chat, messaging and e-mail to make and stay in touch with friends worldwide, sometimes in the same way as some previously had pen pals. Social networking websites like MySpace, Facebook and many others like them also put and keep people in contact for their enjoyment. The Internet has seen a growing number of Web desktops, where users can access their files, folders, and settings via the Internet.

Cyberslacking has become a serious drain on corporate resources; the average UK employee spends 57 minutes a day surfing the Web at work, according to a study by Peninsula Business Services.

3.8 Marketing

The Internet has also become a large market for companies; some of the biggest companies today have grown by taking advantage of the efficient nature of low-cost advertising and commerce through the Internet, also known as e-commerce. It is the fastest way to spread information to a vast number of people simultaneously. The Internet has also subsequently revolutionized shopping—for example; a person can order a CD online and receive it in the mail within a couple of days, or download it directly in some cases. The Internet has also greatly facilitated personalized marketing which allows a company to market a product to a specific person or a specific group of people more so than any other advertising medium.

Examples of personalized marketing include online communities such as MySpace, Friendster, Orkut, Facebook and others which thousands of Internet users join to advertise themselves and make friends online. Many of these users are young teens and adolescents ranging from 13 to 25 years old. In turn, when they advertise themselves they advertise interests and hobbies, which online marketing companies can use as information as to what those users will purchase online, and advertise their own companies' products to those users.

4.0 CONCLUSION

The Internet has indeed brought about the reality of a global village. It has brought about so much innovations and competitions in business that is healthy. Despite obvious challenges in terms of security and technology, the Internet will continue to be the dominant factor in the world of business for some time to come. The internet has impacted on all spheres of human endeavour, be it business, governance, socials, education and much more. And as the days go by, there will be improvements in the technology to deal with the emerging challenges.

5.0 SUMMARY

Internet is a specific internetwork, consisting of a worldwide interconnection of governmental, academic, public, and private networks based upon the Advanced Research Project Agency Network (ARPANET) developed by ARPA of the U.S. Department of Defense – also home to the World Wide Web (WWW), and referred to as the 'Internet' with a capital 'I' to distinguish it from

other generic internetworks.

The Internet Corporation for Assigned Names and Numbers (ICANN) is the authority that coordinates the assignment of unique identifiers on the Internet, including domain names, Internet Protocol (IP) addresses, and protocol port and parameter numbers.

The prevalent language for communication on the Internet is English. This may be a result of the Internet's origins, as well as English's role as a lingua franca.

The Internet can now be accessed virtually anywhere by numerous means. Mobile phones, datacards, handheld game consoles and cellular routers allow users to connect to the Internet from anywhere there is a cellular network supporting that device's technology.

The e-mail is a concept of sending electronic text messages between parties in a way analogous to mailing letters or memos, and it predates the creation of the Internet.

Common methods of home access include dial-up, landline broadband (over coaxial cable, fiber optic or copper wires), Wi-Fi, satellite and 3G technology cell phones.

The Internet has made possible entirely new forms of social interaction, activities and organizing, thanks to its basic features such as widespread usability and access.

The Internet has been a major source of leisure since before the World Wide Web, with entertaining social experiments such as MUDs and MOOs being conducted on university servers, and humor-related Usenet groups receiving much of the main traffic.

The Internet has also become a large market for companies; some of the biggest companies today have grown by taking advantage of the efficient nature of low-cost advertising and commerce through the Internet, also known as e-commerce.

7.0 TUTOR-MARKED ASSIGNMENT

1. Mention 5 uses of the Internet.
2. Briefly discuss the use of the Internet in marketing.

7.0 REFERENCES/FURTHER READINGS

Media Freedom Internet Cookbook by the OSCE Representative on Freedom of the Media Vienna, 2004.

Living Internet—Internet history and related information, including information from many creators of the Internet.

First Monday peer-reviewed journal on the Internet.

How Much Does The Internet Weigh? by Stephen Cass, Discover 2007

Rehmeyer, Julie J. (2007). Mapping a medusa: The Internet spreads its tentacles. Science News 171(June 23):387-388. Available at http://www.sciencenews.org/articles/20070623/fob2.asp.

Castells, M. (1996). *Rise of the Network Society*. 3 vols. Vol. 1. Cambridge, MA: Blackwell Publishers.

Castells, M. (2001). "Lessons from the History of Internet", in *The Internet Galaxy*, Ch. 1, pp 9-35. Oxford Univ. Press.

MODULE 3

Unit 1 Computer Security
Unit 2 Health and Safety
Unit 3 Information Communication Technology

UNIT 1 COMPUTER SECURITY

CONTENTS

1.0 Introduction
2.0 Objectives
3.0 Main Content
3.1 Security and Systems Design
3.2 Financial Cost
3.3 Reasons for Attack on the Internet
3.4 Vulnerabilities
3.5 Reducing Vulnerabilities
3.6 Security Measures
3.7 Difficulty with Response
3.8 Computer Viruses
4.0 Conclusion
5.0 Summary
6.0 Tutor-Marked Assignment
7.0 References/Further Readings

1.0 INTRODUCTION

Many current computer systems have only limited security precautions in place. This unit discusses **computer insecurity**; the current battlefield of computer security exploits and defenses.

2.0 OBJECTIVES

At the end of this unit you are expected to:

know the focus of current security effort
have an idea of the financial implications of computer security
differentiate computer security from other forms of security
know the various forms of attack computer is exposed to
know the reasons for embarking on computer security
identify the different forms of computer security.

3.0 MAIN CONTENT

3.1 Security and Systems Design

Most current real-world computer security efforts focus on external threats, and generally treat the computer system itself as a trusted system. Some knowledgeable observers consider this to be a disastrous mistake, and point out that this distinction is the cause of much of the insecurity of current computer systems — once an attacker has subverted one part of a system without fine-grained security, he or she usually has access to most or all of the features of that system Because computer systems can be very complex, and cannot be guaranteed to be free of defects, this security stance tends to produce insecure systems.

It should be noted that the Windows NT line of operating systems from Microsoft contain mechanisms to limit this, such as services that run under dedicated user accounts, and Role-Based Access Control (RBAC) with user/group rights, but the Windows 95 line of products lack most of these functions. Before the release of Windows 2003 Microsoft has changed their official stance, taking a more locked down approach. On 15 January 2002, Bill Gates sent out a memo on Trustworthy Computing, marking the official change in company stance. Regardless, Microsoft's operating system Windows XP is still plagued by complaints about lack of local security and inability to use the fine-grained user access controls together with certain software (esp. certain popular computer games).

3.2 Financial Cost

Serious financial damage has been caused by computer security breaches, but reliably estimating costs is quite difficult. Figures in the billions of dollars bracket have been quoted in relation to the damage caused by malware such as computer worms like the Code Red worm, but such estimates may be exaggerated. However, other losses, such as those caused by the compromise of credit card information, can be more easily determined, and they have been substantial, as measured by millions of individual victims of identity theft each year in several nations, and the severe hardship imposed on victims, wiping out all of their finances, preventing them from getting jobs, and the humiliations as if *they* were the criminals. Volumes of victims of phishing and other scams may not be known.

Individuals who have been infected with spyware or malware likely go through a costly and time-consuming process of having their computer cleaned. Spyware is considered to be a problem specific to the various Microsoft Windows operating systems, however this can be partially

explained by the fact that Microsoft controls a major share of the PC market and thus represent the most prominent target.

3.3 Reasons for Attack on the Computer System

There are many similarities (yet many fundamental differences) between computer and physical security. Just like physical security, the motivations for breaches of computer security vary between attackers, sometimes called hackers or crackers. Some are teenage thrill-seekers or vandals (the kind often responsible for defacing web sites); similarly, some web site defacements are done to make political statements. However, some attackers are highly skilled and motivated with the goal of compromising computers for financial gain or espionage. An example of the latter is Markus Hess who spied for the KGB and was ultimately caught because of the efforts of Clifford Stoll, who wrote an amusing and accurate book, **The Cuckoo's Egg**, about his experiences. For those seeking to prevent security breaches, the first step is usually to attempt to identify what might motivate an attack on the system, how much the continued operation and information security of the system are worth, and who might be motivated to breach it. The precautions required for a home PC are very different from those of banks' Internet banking system, and different again from a classified military network. Other computer security writers suggest that, since an attacker using a network need know nothing about you or what you have on your computer, attacker motivation is inherently impossible to determine beyond guessing. If true, blocking all possible attacks is the only plausible action to take.

3.4 Vulnerabilities

To understand the techniques for securing a computer system, it is important to first understand the various types of "attacks" that can be made against it. These threats can typically be classified into one of these seven categories:

Exploits

An exploit (from the same word in the French language, meaning "achievement", or "accomplishment") is a piece of software, a chunk of data, or sequence of commands that take advantage of a bug, glitch or vulnerability in order to cause unintended or unanticipated behaviour to occur on computer software, hardware, or something electronic (usually computerized). This frequently includes such things as gaining control of a computer system or allowing privilege escalation or a denial of service attack. Many development methodologies rely on testing to ensure the quality of any code released; this process often fails to

discover extremely unusual potential exploits. The term "exploit" generally refers to small programs designed to take advantage of a software flaw that has been discovered, either remote or local. The code from the exploit program is frequently reused in trojan horses and computer viruses. In some cases, a vulnerability can lie in certain programs' processing of a specific file type, such as a non-executable media file. Some security web sites maintain lists of currently known unpatched vulnerabilities found in common programs.

Eavesdropping

Eavesdropping is the act of surreptitiously listening to a private conversation. Even machines that operate as a closed system (ie, with no contact to the outside world) can be eavesdropped upon via monitoring the faint electro-magnetic transmissions generated by the hardware such as TEMPEST. The FBI's proposed Carnivore program was intended to act as a system of eavesdropping protocols built into the systems of internet service providers.

Social Engineering and Human Error

A computer system is no more secure than the human systems responsible for its operation. Malicious individuals have regularly penetrated well-designed, secure computer systems by taking advantage of the carelessness of trusted individuals, or by deliberately deceiving them, for example sending messages that they are the system administrator and asking for passwords. This deception is known as Social engineering.

Denial of Service Attacks

Unlike other exploits, denial of service attacks are not used to gain unauthorized access or control of a system. They are instead designed to render it unusable. Attackers can deny service to individual victims, such as by deliberately guessing a wrong password 3 consecutive times and thus causing the victim account to be locked, or they may overload the capabilities of a machine or network and block all users at once. These types of attack are, in practice, very hard to prevent, because the behaviour of whole networks needs to be analyzed, not only the behaviour of small pieces of code. Distributed denial of service (DDoS) attacks are common, where a large number of compromised hosts (commonly referred to as "zombie computers", used as part of a botnet with, for example; a worm, trojan horse, or backdoor exploit to control them.) are used to flood a target system with network requests, thus attempting to render it unusable through resource exhaustion. Another technique to exhaust victim resources is through the use of an attack

amplifier — where the attacker takes advantage of poorly designed protocols on 3rd party machines, such as FTP or DNS, in order to instruct these hosts to launch the flood. There are also common vulnerabilities in applications that cannot be used to take control over a computer, but merely make the target application malfunction or crash. This is known as a denial-of-service exploit.

Indirect Attacks

An indirect attack is an attack launched by a third party computer. By using someone else's computer to launch an attack, it becomes far more difficult to track down the actual attacker. There have also been cases where attackers took advantage of public anonymizing systems, such as the tor onion router system.

BackDoors

A backdoor in a computer system (or cryptosystem or algorithm) is a method of bypassing normal authentication, securing remote access to a computer, obtaining access to plaintext, and so on, while attempting to remain undetected. The backdoor may take the form of an installed program (e.g., Back Orifice), or could be a modification to an existing program or hardware device. A specific form of backdoors are rootkits, which replace system binaries and/or hooks into the function calls of the operating system to hide the presence of other programs, users, services and open ports. It may also fake information about disk and memory usage.

Direct Access Attacks

Common consumer devices that can be used to transfer data surreptitiously. Someone who has gained access to your computer can install any type of devices to compromise security, including operating system modifications, software worms, key loggers, and covert listening devices. The attacker can also easily download large quantities of data onto backup media, for instance CD-R/DVD-R, tape; or portable devices such as keydrives, digital cameras or digital audio players. Another common technique is to boot an operating system contained on a CD-ROM or other bootable media and read the data from the harddrive(s) this way. The only way to defeat this is to encrypt the storage media and store the key separate from the system.

3.5 Reducing Vulnerabilities

Computer code is regarded by some as just a form of mathematics. It is theoretically possible to prove the correctness of computer programs

though the likelihood of actually achieving this in large-scale practical systems is regarded as unlikely in the extreme by some with practical experience in the industry.

It is also possible to protect messages in transit (i.e., communications) by means of cryptography. One method of encryption — the one-time pad — is unbreakable when correctly used. This method was used by the Soviet Union during the Cold War, though flaws in their implementation allowed some cryptanalysis .The method uses a matching pair of key-codes, securely distributed, which are used once-and-only-once to encode and decode a single message. For transmitted computer encryption this method is difficult to use properly (securely), and highly inconvenient as well. Other methods of encryption, while breakable in theory, are often virtually impossible to directly break by any means publicly known today. Breaking them requires some non-cryptographic input, such as a stolen key, stolen plaintext (at either end of the transmission), or some other extra cryptanalytic information.

Social engineering and direct computer access (physical) attacks can only be prevented by non-computer means, which can be difficult to enforce, relative to the sensitivity of the information. Even in a highly disciplined environment, such as in military organizations, social engineering attacks can still be difficult to foresee and prevent.

In practice, only a small fraction of computer program code is mathematically proven, or even goes through comprehensive information technology audits or inexpensive but extremely valuable computer security audits, so it is usually possible for a determined cracker to read, copy, alter or destroy data in well secured computers, albeit at the cost of great time and resources. Extremely few, if any, attackers would audit applications for vulnerabilities just to attack a single specific system. You can reduce a cracker's chances by keeping your systems up to date, using a security scanner or/and hiring competent people responsible for security. The effects of data loss/damage can be reduced by careful backing up and insurance.

3.5 Security Measures

A state of computer "security" is the conceptual ideal, attained by the use of the three processes:

1. Prevention,
2. Detection, and
3. Response.

User account access controls and cryptography can protect systems files and data, respectively.

Firewalls are by far the most common prevention systems from a network security perspective as they can (if properly configured) shield access to internal network services, and block certain kinds of attacks through packet filtering.

Intrusion Detection Systems (IDS's) are designed to detect network attacks in progress and assist in post-attack forensics, while audit trails and logs serve a similar function for individual systems.

"Response" is necessarily defined by the assessed security requirements of an individual system and may cover the range from simple upgrade of protections to notification of legal authorities, counter-attacks, and the like. In some special cases, a complete destruction of the compromised system is favoured, as it may happen that not all the compromised resources are detected.

Today, computer security comprises mainly "preventive" measures, like firewalls or an Exit Procedure. A firewall can be defined as a way of filtering network data between a host or a network and another network, such as the Internet, and is normally implemented as software running on the machine, hooking into the network stack (or, in the case of most UNIX-based operating systems such as Linux, built into the operating system kernel) to provide realtime filtering and blocking. Another implementation is a so called physical firewall which consists of a separate machine filtering network traffic. Firewalls are common amongst machines that are permanently connected to the Internet (though not universal, as demonstrated by the large numbers of machines "cracked" by worms like the Code Red worm which would have been protected by a properly-configured firewall). However, relatively few organisations maintain computer systems with effective detection systems, and fewer still have organised response mechanisms in place.

3.7 Difficulty with Response

Responding forcefully to attempted security breaches (in the manner that one would for attempted physical security breaches) is often very difficult for a variety of reasons:

Identifying attackers is difficult, as they are often in a different jurisdiction to the systems they attempt to breach, and operate through proxies, temporary anonymous dial-up accounts, wireless connections, and other anonymising procedures which make backtracing difficult and are often located in yet another jurisdiction.

If they successfully breach security, they are often able to delete logs to cover their tracks.

The sheer number of attempted attacks is so large that organisations cannot spend time pursuing each attacker (a typical home user with a permanent (e.g., cable modem) connection will be attacked at least several times per day, so more attractive targets could be presumed to see many more). Note however, that most of these attacks are made by automated vulnerability scanners and computer worms.

Law enforcement officers are often unfamiliar with information technology, and so lack the skills and interest in pursuing attackers. There are also budgetary constraints. It has been argued that the high cost of technology, such as DNA testing, and improved forensics mean less money for other kinds of law enforcement, so the overall rate of criminals not getting dealt with goes up as the cost of the technology increases. In addition, the identification of attackers across a network may require logs from various points in the network and in many countries, the release of these records to law enforcement (with the exception of being voluntarily surrendered by a network administrator or a system administrator) requires a search warrant and, depending on the circumstances, the legal proceedings required can be drawn out to the point where the records are either regularly destroyed, or the information is no longer relevant.

3.8 Computer Viruses

A virus is a **program** designed by a computer programmer (**malicious hacker**) to do a certain unwanted function. The virus program can be simply annoying like displaying a happy face on the user's screen at a certain time and date. It can also be very destructive and can damage your computer's programs and files causing the computer to stop working.

The reasons why hackers create viruses are open to speculation. The most stated reason is simply to see if it can be done. Other reasons are Ludite based "smash the machine" motivations, anti-establishment/anti-corporate actions, criminal intent, and various others that range into the "conspiracy theory" realm.

Viruses Take Two Basic Forms

One is the **boot sector** viruses which infect the section of a disk that is first read by the computer. This type of virus **infects** the boot or master section of any disks that it comes in contact with. The second is the **program virus** that infects other programs when the infected program is run or executed. Some viruses infect both and others change themselves (polymorphic) depending on the programs they encounter.

Though viruses do not damage computer **hardware**, there have been attempts to create programs that will do things like run the hard drive until it fails or lodges itself in the computer's clock (which has a rechargeable battery) allowing it to remain active even months after the computer has been unplugged. Other viruses affect certain microchips (BIOS chip for instance). These microchips need to be modified under normal computer use but the virus program can produce changes which cause them to fail. Other viruses will affect the characters or images displayed on the screen which may give the impression of monitor failure.

Viruses can cause a great deal of damage to the computers they infect and can cost a lot of time and money to correct.

Computer viruses have been around for a long time, even before computers became widely used and they will likely remain with us forever. For that reason computer users will always need ways to protect themselves from virus programs. The main, common feature of a virus is that it is **contagious**! Their sole purpose is to spread and infect other computers.

A computer gets a virus from an infected **file**.

The virus might attach themselves to a **game**, a **program** (both shareware and commercial) or a **file** downloaded from a bulletin board or the Internet.

You cannot get a virus from a plain **email** message or from a simple **text** file! That is because the virus needs to be '**run**' or **executed** before it can take effect. This usually happens when the user tries to open an infected program, accesses an infected disk or opens a file with an infected macro or script attached to it. A plain email message is made up of text which does not execute or run when opened.

Modern email programs provide the ability to allow users to format email messages with HTML and attach scripts to them for various purposes and it is possible for a malicious hacker to attempt to spread a virus by building a virus script into an HTML type of email message.

When you are accepting software or scripts on Internet sites or reading mail from unknown senders it is best to run **anti-virus program** first before running them.

Protect Yourself

You can take safeguards against virus infection. The first thing is to get an anti-virus program. Most reputable companies that create virus protection programs release an **evaluation copy** that an Internet user can download for free and use for a certain amount of time. This anti-virus program will be able to **check your computer** for viruses and **repair damage** or **delete files** that are infected with viruses. You may have to replace infected files that cannot be repaired.

The second thing you can do is **purchase a copy** of the program. The reason for this is that viruses are constantly being created. When you purchase an anti-virus program you are also purchasing **periodical updates** which keep your anti-virus program up-to-date and able to deal with new viruses as they are encountered. Commercial virus programs also allow the user to customize when and how the program will check the computer for viruses. You will need to renew this updating service periodically.

If you find that your computer has been infected with a virus use an anti-virus program to clean your computer and make sure to **check all the disks** that you use. This includes all the hard drives on your computer(s) and all your floppy disks and CDs as well as any media that you save information on. Remember that the virus can easily re-infect your computer from one infected file!

If you have to reload your computer programs, use the original program disks. You may want to check your original disks before reinstalling the software. If your original disks are infected contact the distributor to get replacements.

Always take the time to ensure that your computer is properly protected. Spending money on a good virus checking program could save you hundreds of dollars and lots of time later.

A discussion of viruses would not be complete without mentioning **hoaxes**. Malicious people without programming skills will send out fake virus warnings causing people to take unnecessary measures which often cause your computer harm. One example tries to get the unsuspecting computer user to delete an important system file by warning them that it is a virus. A legitimate virus warning will provide a link to a website operated by an anti-virus company with more

information about that virus. Don't forward a virus warning until you have checked out whether it is legitimate.

4.0 CONCLUSION

Coming advances in computation such as the Internet will, no doubt, continue to produce new security challenges. Free agents, for example, are software programs that travel the Internet and run independently on host computers. While providing new and powerful communication tools, they also create security threats and viruses. The challenge of computer security has made this sub-sector also dynamic in trying to deal with new issues, thereby making it a big industry. The anti virus market is already a multi billion business which has the tendency to grow the more. But it must be seen that security threat is just common to the computer industry and can never be eradicated.

5.0 SUMMARY

Many current computer systems have only limited security precautions in place. This unit on **computer insecurity** article describes the current battlefield of computer security exploits and defenses.

Most current real-world computer security efforts focus on external threats, and generally treat the computer system itself as a trusted system.

Serious financial damage has been caused by computer security breaches, but reliably estimating costs is quite difficult.

There are many similarities (yet many fundamental differences) between computer and physical security. Just like real-world security, the motivations for breaches of computer security vary between attackers, sometimes called hackers or crackers.

To understand the techniques for securing a computer system, it is important to first understand the various types of "attacks" that can be made against it.

Computer code is regarded by some as just a form of mathematics. It is theoretically possible to prove the correctness of computer programs though the likelihood of actually achieving this in large-scale practical systems is regarded as unlikely in the extreme by some with practical experience in the industry.

A state of computer "security" is the conceptual ideal, attained by the use of the three processes: Prevention, Detection and Response.

Responding forcefully to attempted security breaches (in the manner that one would for attempted physical security breaches) is often very difficult for a variety of reasons.

A virus is a **program** designed by a computer programmer (**malicious hacker**) to do a certain unwanted function. The virus program can be simply annoying like displaying a happy face on the user's screen at a certain time and date. It can also be very destructive and can damage your computer's programs and files causing the computer to stop working.

6.0 TUTOR-MARKED ASSIGNMENT

1. List five categories of attacks a computer system is exposed to.
2. Briefly discuss 'Hoaxes' as a form of virus attack.

7.0 REFERENCES/FURTHER READINGS

Ross J. Anderson: *Security Engineering: A Guide to Building Dependable Distributed Systems*, ISBN 0-471-38922-6.

Bruce Schneier: *Secrets & Lies: Digital Security in a Networked World*, ISBN 0-471-25311-1.

Cyrus Peikari, Anton Chuvakin: *Security Warrior*, ISBN 0-596-00545-8

Jack Koziol, David Litchfield: *The Shellcoder's Handbook: Discovering and Exploiting Security Holes*, ISBN 0-7645-4468-3.

Clifford Stoll: *The Cuckoo's Egg: Tracking a Spy through the Maze of Computer Espionage*, an informal — and easily approachable by the non-specialist — account of a real incident (and pattern) of computer insecurity, ISBN 0-7434-1146-3.

Roger R. Schell (1996). *The Internet Rules but the Emperor Has No Clothes* ACSAC.

William Caelli (2002*) Relearning "Trusted Systems" in an Age of NIIP: Lessons from the Past for the Future.*

Noel Davis (2000) Cracked! Story of a community network that was cracked and what was done to recover from it.

Shon Harris, "CISSP All-In-One Study Guide" ISBN 0071497870.

UNIT 2 HEALTH AND SAFETY

CONTENTS

1.0 Introduction
2.0 Objectives
3.0 Main Content
    3.1 Characteristics of Healthy Job
    3.2 Health and Safety
    3.3 Laptop Related Health Challenges
    3.4 Autonomy and Power
    3.5 Use of Valued Skills
    3.6 Meaningfulness of Work
        3.6.1 Variety and Scope of Work
        3.6.2 Nature of Computer-Mediated Work
    3.7 Social Relationships
4.0 Conclusion
5.0 Summary
6.0 Tutor-Marked Assignment
7.0 References/Further Readings

1.0 INTRODUCTION

The impact of computer system on individuals varies widely. For some, new technology has brought professional and personal gains. For others it has meant obsolescence and frustration. For some, work has become easier or more enjoyable. For others it has become more difficult and sometimes intolerable. In this unit we will explore impacts by identifying characteristics of a healthy job and then look at related impacts on information systems.

Health and Safety are crucial to the effective operation of a computer. Stress is widely accepted as a common and possibly the most dangerous aspect of using a computer.

2.0 OBJECTIVES

At the end of this unit, the student should be able to:

identify the characteristics of a healthy job
identify the ways computer system impacts on the health and safety of workers
enunciate the roles of information systems in defining power and independence at work
understand why a person can loose his skill to information systems technology
understand the roles of information systems in defining social relationships at work.

3.0 MAIN CONTENT

3.1 Characteristics of Healthy Job

People in healthy jobs use their skills in meaningful work, enjoy autonomy and social relations with others, have personal rights including some control over demands of the job, and can have enough time and energy to participate in family and community life. Based on these characteristics, the least healthy type of work are those with continual pressure to perform but little personal control. Example includes assembly-line workers, clerks who process business transactions and telephone operators. These are jobs with rigid hours and procedures, threats to layoff, little learning of new skills, and difficulty in taking a break or time off for personal needs. Stereotyped high-stress jobs such as managers, electrical engineers, and architects are healthier because professionals have more control over their work.

Table 1: Characteristics of a healthy Job

Job Characteristic	***Meaning to you as an Employee***
Skills	You can use and increase your skills.
Meaningfulness	You understand and respect the importance of your work and understand how it fits into the organization's work.
Autonomy	You can control your work. You are not made to feel childish by the method of supervision.
Social relations	Your job includes collaboration and communication with others.
Psychological demands	Your job includes a mix of routine demands and new but reasonable demands. You have some control over what demands to accept
Personal rights	You feel that you have appropriate personal rights at work and have reasonable ways to settle grievances.
Integration with life outside work	The job does not interfere excessively with your ability to participate in family and community life.

3.2 Health and Safety

Researchers have found relationships between psychological well-being at work and physical health. People with active jobs involving initiatives, discretion, and advancement have the lowest heart attack rates, even though these jobs often involve stress. People in high strain jobs at the bottom of the job ladder have the highest rates of heart attacks. Even when such risk factors as age, race, education, and smoking are considered, those in the bottom 10% of the job ladder are in the top 10% for illness. These workers have four to five times greater risks of heart attack than those at the top 10% of the ladder, whose jobs

give them a high sense of control. The same pattern applies in the middle of the socio economic distribution. A study conducted on 7,400 men and women with civil service jobs in London found that those in low-grade position with little control over their responsibilities were at a 50% higher risk in developing heart disease than those in high-leveljobs.

Computer systems have an impact on health because they are part of the job environment. The impact is positive if the system contributes to personal feelings of initiative, discretion, advancement, and control. It is negative if the system reduces these feelings by diminishing skills, meaningfulness of work, autonomy, and social relations. We will see examples in both directions.

Even though they may have generally healthier jobs, some professionals and managers believe that their stress level has increased due to information overload. They believe information technology applied in information system has contributed to this overload, and that routine use of v-mail, e-mail, fax, and personal computers has not been liberating at all. To the contrary they feel unremitting work pressure because the technology brings work faster, and people expect immediate responses. The Nobel Prize winner Herbert Simon describes this phenomenon eloquently: “what information consumes is rather obvious; it consumes the attention of its recipients. Hence a wealth of information creates a poverty of attention and a need to allocate efficiently among the overabundance of information sources that might consume it”.

Using Video Display Unit at Work

An additional aspect of computer system that has come into question is the effect of personal computers on intensive users. These individuals often suffer higher stress levels and related physical problems than other workers in the same business. This stress has been attributed to a combination of lack of control, feelings of being monitored, lack of social contact, and physical discomforts such as eyestrain and physical tension. A study comparing clericals who worked on video display terminals (VDTs) and clericals who did not work on VDTs, and professionals who worked on VDTs revealed that clericals working on VDTs have the highest stress. They had to follow rigid work procedures and had little control over what they did. They felt a machine was controlling them. In contrast, the professional who used VDTs experienced the list stress. They were newspaper reporters who found satisfaction in their work and had flexibility in meeting deadlines.
Impacts specifically related to the physical relationship between people and their work environments are studied in the field of ergonomics. Many VDT operators suffer eyestrain, backache, and muscle tension.

Some also suffer repetitive strain injury (RSI) such as carpal tunnel syndrome, which causes severe pain due to nerve irritation in the wrist.

Musculoskeletal

Musculoskeletal problems can occur when improper office equipment is used. Chairs should be adjustable so that legs are at a right angle. The back should have good support for the spine and lower back. The seat should swivel and be made from fabric that is porous.

Eye Strain

Eye strain can be caused by staring at a fix object for extended periods of time (like a computer). People who use glasses may have to get their prescriptions changed and people who use bifocals can find that the line interferes with the screen and trifocals triple the problem. Regular users of computers may develop focusing problems. Temporary colour distortion has also been reported.

Working Environment

A safe working environment is crucial. Ventilation is an integral part of the new technological workplace. Though standards are set by the manufacturer of computer equipment the modern office has many different pieces of equipment. All electronic equipment emit some level of **electromagnetic field** which, on it's own, most likely is not a concern but when combined with other equipment can create hazardous working environments. **Pregnant women** should take extra care when working around electromagnetic fields. Like any piece of equipment, computers should have **scheduled maintenance**.

Stress

Stress is caused by many factors including poor or inadequate training, monitoring, fear of new technology, lack of control over work, physical problems, hardware problems causing delays, poor layout of work space and the myriad of other problems that people experience that combine to create stressful situations.

3.3 Laptop Related Health Challenges

A study by State University of New York researchers says heat generated from laptops can significantly elevate the temperature of the scrotum, potentially putting sperm count at risk. The small study, which included little more than two dozen men ages 13 to 35, found that the sitting position required to balance a laptop can raise scrotum temperature by as much as 2.1 °C (3.8 °F). Heat from the laptop itself can raise the temperature by another 0.7 °C (1.4 °F), bringing the potential total increase to 2.8 °C (5.2 °F). However, further research is needed to determine whether this directly affects sterility in men. A common practical solution to this problem is to place the laptop on a table or desk.

Heat from using laptop on lap can also cause skin discoloration on the thighs.

Because of their small keyboard and trackpad pointing devices, the use of laptops can cause RSI, and for this reason laptops have docks that are used with ergonomic keyboards to prevent injury. The integrated screen often causes users to hunch over for a better view, which can cause neck or spinal injuries. Some health standards require that ergonomic keyboards be used in workplaces.

3.4 Autonomy and Power

Autonomy in a job is the degree of discretion individuals or groups have in planning, regulating, and controlling their own work. Power is the ability to get others to do things. Computer system can cause increases or decreases in either area.

Computer system may increase autonomy whenever the individual can control the use of the tools. For example, a data analysis system might permit total independent analysis work by a manager who previously had to ask for assistance for analysis of data. Likewise, professional such as lawyers and engineers can use information system to do work for themselves that previously would have required more collaboration and negotiation with others.

In contrast many computer systems are designed to reduce autonomy. The need for limited autonomy is widely accepted in transaction processing and record keeping. Systems in these areas are designed to ensure that everyone involved in repetitive process such as taking order or producing paychecks, use the same rules for processing the same data in the same format. If individuals could process transactions however

they wanted to, tracking system and accounting system would quickly degenerate into chaos.

In other situations, a competition-driven push towards consistency and cost-cutting is leading toward increased electronic surveillance, especially where computerizations are used continually as part of work. Even a decade ago a survey found that over six million American workers were being monitored electronically. For jobs using telephone intensively, this means someone may be listening in, for jobs involving sales transactions or anything else that can be tracked, every completion of a unit of work may be recorded and available for analysis by someone at a remote location. For data entry jobs, every keystroke may be monitored and statistics taken for speed and accuracy of work, and even time spent on break.

As a case in point a company known as WinVista developed software that monitors a personal computer and records every file that is opened, every web site that is visited, and every e-mail message that is sent.

Computer systems that monitor workers closely and that decrease autonomy are often experienced as threats. Consequently, systems that increase employee monitoring may lead to resistance and may result in turnover of personnel, especially if autonomy is traditional in the work setting. In the trucking industry, for example, many formally independent drivers are now among the most closely monitored U.S. workers. A decade ago, truckers were able to set their own schedules as long as they occasionally called a dispatcher from a pay telephone. Today, 75% of trucking firms have computers on board each rig, and many trucks have antennae used to monitor the truck's exact location. The truck's engines are programmed for efficient gear shifting, optimum idle times, and top speed. Truck drivers are happy to use cellular phones instead of lining up at a pay phone, but some object to the monitoring and the limits on how they drive. Some have taken evasive action such as blocking their truck's satellite dishes or parking under a wide overpass to escape surveillance from the sky.

Capabilities to monitor minute details of work may create the temptation to misuse the available information, but the way the information is used determines whether participants feel as though 'big brother' is watching. For example recording conversations by telemarketers can help resolve disputes with customers even if it is never used for day-to-day monitoring of individuals. Similarly, random samples of calls can be used for training rather than for punishment. Given the natural tendency to imagine whether such systems are being misused, it is especially important for managers to explain whether they will be used for monitoring work, and if so, how they will be used.

Information System and Power

Just as computer system can affect autonomy, they can also affect power by redistributing information, changing responsibilities, and shifting the balance of power in an organization. Across the entire organizational spectrum, information systems have increased the power of people who operate largely on facts and technical competence, and have reduced the ability of people to give orders based on power of their position. The availability of information across business functions has also made it easier to resolve conflicts based on facts rather than on opinions and power.

Computer systems have had an important impact in reducing the power of many middle managers. High-level executives can often use their MIS or EIS directly to get some of the information they once received from middle managers. In addition, they can use communication systems such as e-mail and v-mail to bypass middle managers and go directly to the individuals who know the most about a particular situation or issue. Middle managers therefore may see information systems squeezing them from below and above.

3.5 Use of Valued Skills

Computer systems may have either positive or negative effects on people's skills. As a simple example, consider what happens when you rely on pocket calculator to do arithmetic. Although you usually get the right answer more quickly, your ability to do arithmetic without the calculator deteriorates through disuse. The calculator has the positive effect of helping you calculate more quickly and the negative effect of allowing your skills to decline.

New computer systems have enhanced the skills in wide range of jobs. MIS and EIS have provided information to managers that help them learn how to manage based on analyzing facts rather than just on intuition. DSS and executive systems such as CAD have helped professionals analyze data, define alternatives, and solve problems in new ways.

Introducing computer system has also had the opposite effect in some cases, especially when the system automated the judgment and discretion in the work. Such systems redefined jobs by replacing the individual's autonomy and authority with computer-enforced consistency and control. Now, less skilled people could do the same task, and previous skills have less value. Reducing the value of skills previously needed to do specific types of work is called de-skilling.

Tasks most susceptible to de-skilling call for repetition, endurance and speed, rather that flexibility, creativity and judgement. Such tasks are highly structured and can be described in terms of procedures. In general they could involve processing data or could involve physical actions such as spray painting a new car. In some specific cases, de-skilling has occurred with the partial automation of decision processes once thought of as requiring years of experience. For example, managers of insurance once believed it took five years to become a reasonable group health insurance underwriter (An underwriter determines rates for insurance premiums). The mystery in training new underwriters disappeared when a new system automated standard underwriting calculations. Although the system's purpose was to provide better customer service and reduce the stress of year end peak loads, it also de-skilled the job. New underwriters could be productive on same cases within months, and the knowledge of the more experienced underwriters was less valued.

Automating significant job components also tend to reduce people's skills by encouraging mental disengagement and peripheralization, a feeling that one is at the periphery of action. Consider the way automatic flight control systems built into new airlines allow pilots to almost become spectators. Many aviation experts wonder whether pilots of highly automated planes will be able to react quickly enough in emergencies. The quandary of how much control to put into automatic systems came up when an airliner with highly automatic system crashed into an unsafe maneuver at an air show, killing three people and injuring 50. Although the automatic system was suspect, it is also possible that the pilot error caused the crash and that the automatic system prevented a worst crash by keeping the wing level after the engine hit a group of trees. Regardless of how much training pilots receive in realistic flight simulators on the ground, there is also the question of whether this practice is enough.

Computer systems may require that workers learn new skills. For professionals the skill may involve new analytic methods or new ways to obtain information. For non-professional workers, the necessary skill may be simple literacy. Many companies are installing flexible manufacturing systems to permit the same manufacturing line to produce different products. When these systems were being installed, many companies found that their workers were not literate enough to read the instructions for product changes or new machine set-ups. In some cases, the employees were foreigners who could not read English. In others, the employees were good workers who had not learnt to read in school. In response to this problem, many companies now provide literacy training for employees.

3.6 Meaningfulness of Work

Computer systems can affect the meaningfulness of work in several ways. First, an information system can be set up to either expand or limit the scope, variety, and significance in the user's job. In addition, the mere fact that work takes place through the medium of a computer may affect the way people experience their work.

3.6.1 Variety and Scope of Work

The range of different types of things people do at work is called **task variety.** Most people desire variety in their work environments and get bored if the work becomes too routine and repetitive. **Task scope** is the size of the task relative to the overall purpose of the organization. Installing a single door lock on an automobile assembly line is a task with minimal scope. Assembling the entire door is a task of large scope., information systems can either increase or decrease the variety and scope of work.

Computer systems reduce variety if they force the worker to focus on a small aspect of work. Consider what happened with the implementation of a computer-based dental claims system at an insurance company. With the previous paper-based system, the benefit analyst pulled information about each account from a set of paper files, checked contract limitations, completed the necessary paperwork, and returned the account information to the files. Analysts were often hired based on their prior knowledge of dental procedures, and they frequently discussed cases with their supervisors and other analysts. With the new computerized system, much of the information was on the computer, which also ran programs that assured claims were processed in a standard way. The analysts spent more time entering claim data into computers and less time using their knowledge and judgment. Within a year the system had increased productivity 30% to 40%, but at the cost of job satisfaction for the analysts.

3.6.2 Nature of Computer-Mediated Work

The fact that work is done through computer may affect its meaningfulness to participants. Work done using computers, rather than through direct physical contact with the object of task, is often called **computer-mediated work.**

There are many situations in which working through computer affects the way workers experience their work. The **abstractness of work** is a related issue because computer-mediated work doesn't involve direct physical contact with the object of the task. This work is designed to

focus on symbols on a computer screen rather than a more tangible reality. Consider the example of a bank auditor. With a new system, he had less need to travel to the branches, talk with people, and examine financial paperwork. Although some tasks were quicker, he felt it more difficult to define what information he needed. With nothing in front of him except numbers, he has a limited basis for figuring out what the numbers meant. The job had become abstract and for better or worse did not feel like the kind of auditing he had done before.

3.7 Social Relationships

Social interaction at work is an important part of many people's lives that work systems can affect. In some cases computerized systems may create new possibilities for interaction by automating repetitive paperwork and calculations, thereby giving people more time to work on the issues that require interaction with others. Furthermore, communication systems such as e-mail and v-mail support additional contact between people separated geographically or organizationally.

Impacts of computerized systems on social relationships may also be negative, however. Jobs that require sitting at VDTs all day long tend to reduce social interaction. Trends toward downsizing and telecommuting amplify isolation and alienation because they reduce the number of people working in organizations and permit these people to work from their homes.

4.0 CONCLUSION

Computer system and technology revolution are changing every area of our lives. At an ever-increasing rate, they are reshaping our home and our leisure activities. They are transforming the economic and social structures of our land. Lying at the root of this transformation are computer and telecommunications systems that are important components of information systems.

5.0 SUMMARY

This is a summary of this unit:

The impact of computer systems on individuals vary widely. For some, new technology has brought professional and personal gains. For others, it has meant obsolescence and frustration.

Researchers have found relationships between psychological well-being at work and physical health. People with active jobs involving

initiatives, discretion, and advancement have the lowest heart attack rates, even though these jobs often involve stress.

Autonomy in a job is the degree of discretion individuals or groups have in planning, regulating, and controlling their own work. Power is the ability to get others to do things. Information systems can cause increases or decreases in either area.

Computer systems may have either positive or negative effects on people's skills.

Computer systems can affect the meaningfulness of work in several ways. First, information system can be set up to either expand or limit the scope, variety, and significance in the user's job.

Social interaction at work is an important part of many people's lives that work systems can affect.

8.0 TUTOR-MARKED ASSIGNMENT

1. Describe 5 typical characteristics of a healthy job.
2. Discuss Laptop related health challenges

9.0 REFERENCES/FURTHER READINGS

Anonymous, Human and Ethical Issues in Information Technology.

UNIT 3 INFORMATION COMMUNICATION TECHNOLOGY

CONTENTS

1.0 Introduction
2.0 Objectives
3.0 Main Content
3.1 PC-based ICT
3.2 Achievements
3.3 Limitations
3.4 Development
3.5 ICT in Poverty Reduction in Developing Countries
3.6 Future
3.7 Social Relationships
4.0 Conclusion
5.0 Summary
6.0 Tutor-Marked Assignment
7.0 References/Further Readings

1.0 INTRODUCTION

Information and Communications Technology - or technologies (**ICT**) is an umbrella term that includes all technologies for the manipulation and communication of information. The term is sometimes used in preference to **Information Technology** (**IT**), particularly in two sectors: education and government.

Although, in the common usage it is often assumed that ICT is synonymous with IT; ICT in fact encompasses any medium to record information (magnetic disk/tape, optical disks (CD/DVD), flash memory etc. and arguably also paper records); technology for broadcasting information - radio, television; and technology for communicating through voice and sound or images - microphone, camera, loudspeaker, telephone to cellular phones. It includes the wide variety of computing hardware (PCs, servers, mainframes, networked storage); the rapidly developing personal hardware market comprising mobile phones, personal devices such as the BlackBerry; MP3 players such as Apple's iPod, and much more; the full gamut of application software from the smallest home-developed spreadsheet to the largest enterprise packages such as SAP and online software services such as salesforce.com; and the hardware and software needed to operate networks for transmission of information, again ranging from a home network to the largest global private networks operated by major commercial enterprises and, of course, the Internet. Thus, "ICT" makes more explicit that technologies

such as broadcasting and wireless mobile telecommunications are included.

ICT capabilities vary widely from the sophistication of major western economies to lesser provision in the developing world. But the latter are catching up fast, often leapfrogging older generations of technology and developing new solutions that match their specific needs.

2.0 OBJECTIVES

At the end of this unit you are expected to:

define information communications technology (ICT) and differentiate it from information technology (IT).
know some of the achievements associated with ICT.
identify the limitations of ICT.
trace the development of ICT so far.
know the roles ICT has played thus far in the reduction of poverty in developing countries.
answer the question on the future of ICT.

3.0 MAIN CONTENT

3.1 PC-based ICT

A PC (personal computer) connected to the Internet has become a vital tool for communicating, within the past few decades of its introduction. However, while this mode of ICT has achieved much, it has its operational limitations.

3.2 Achievements

The Internet

The Internet has opened up many opportunities, from finding out information, to conducting communications globally, e.g. through e-mail, voice mail, skype, e-commerce or generally just having fun through on line chats or instant messaging. One often wonders: How did people manage before the introduction of the Internet? How much harder was it for people to communicate and find out information they needed, quickly and easily? A PC connected to the Internet whether through a dialup connection, broadband or Wi-Fi has indeed made it a facile act for many people.

Teaching

PC-Internet based ICT is currently used within the English school curriculum. This kind of ICT (amongst others) is now seen as a core subject that is taught in some primary and secondary schools. The major advantage of this development is that ICT has become a transferable subject. Computers or interactive whiteboards are now used across most school subjects as well as innovative schools using more technology like PDA's, Mobile (cell) phones and some games consoles. The interaction created by the use of this ICT makes lessons much more effective and allow children to learn in a way that they enjoy.. Recent initiatives such as the One Laptop per Child program are contributing to this development.

Communications

Apart from Internet, a PC allows communication of information through Compact Discs, pen drives, printers - whether laser or inkjet, flash memory cards and exchange of information within a Local Area Network (LAN).

As communications scholars Gasher and Lorimer articulated:

> We depend on technology for our communications with others-whether they are just a house or two away or halfway around the world. In the second half of the twentieth century it became almost impossible to live without a television in our homes, much less without a telephone, and now we can hardly live without personal computers through which we gain Internet access and send and receive e-mail. The realty of new communications technology is that anyone is able to get in touch with anyone else, anywhere, at any time, for very little money-at least in the developed world. (Gasher and Lorimer, *Communications Technology and Society: Theory and Practice*)

Work Related Aspects

As well as benefiting school students to gather information for assignments, PC based ICT is often used in other jobs such as in the police, within libraries, in offices or even shops. It has also emerged as a source of employment in many emerging economies through Business process outsourcing or Knowledge process outsourcing from companies in the developed world. People now have the chance to conduct remote logon, in which they can access their work computers (For example in an office) from home. This has opened up many more opportunities for

those that struggle to find time to leave their house to go to work, so they can now just work from home.

3.3 Limitations

Previous information communication technologies not been cost effective especially in developing nations hence; teachers in developing countries often use no more than a blackboard and chalk to pass on information about any subject to the students. Printed papers in the form of books, magazines or newspapers have become part of daily routine of many educated citizens, as are broadcast media such as radio and television. The photocopy machine is widely used by students to access information from books they cannot afford to buy. The cost of a PC connected to the Internet is often prohibitive in developing countries. Power needs, physical space and connectivity issues are also factors that add to the challenge of getting these technologies to take root in developing countries.

Limitations of PC-Internet based ICT are:

Bandwidth: The time taken to access a particular piece of information on the Internet depends on the bandwidth available to the user at that time. Often, it takes several minutes, using an economical connection, to download a piece of information. Thus a user may have to spend substantial time before s/he finds the information s/he seeks.

Language: At present most of the information available on the Internet is in English, a limiting factor at the very least.

Text/Voice: Most information on the Internet requires action by the user as opposed to the passive nature of television and radio. As most of the Internet's information is textual, the user must be able to read it. Even more passive forms of Internet information such as video-sharing Websites require action (and reading) by the viewer for navigation.

Disruptive Software: Internet users are often susceptible to computer viruses. Commercial anti-virus software is often prohibitively priced. Thin client technology is a small, but growing alternative.

Participation
Social networks and increased user-managed information stores have emerged in the early part of this century. Increased interaction between the content (whether it be delivered via Internet, television or radio) is leading to an information revolution.

Security

Internet safety is an issue that impacts on every online user from small children to international corporations. When ABC went into public service broadcasting online in the early 1990's, the safety of their users was its top priority. As ABC representatives stated, "[the]relationship between liberty and security was crucial to the implementation of ABC Online interactive sites. The internet is an equalizer in that every user is vulnerable and in a sense, arel at the same level.

The emergence of weblogs, Internet forums and wikis is often grouped under the new technology umbrella term Web 2.0, and has helped to usher in a greater level of global participation.

3.4 Development

ICT can become a revolutionary vehicle in developing countries, provided technological innovations emerge on the following lines.

Local content in local languages: The need of the hour is to enable the intelligentsia to develop information sources that are exclusively for fulfilling the needs of local communities. The content on the Internet that can fulfil these conditions is minuscule at present. Conditions have to emerge in which people are enthused to contribute towards the development of information databases that are exclusively disseminated through local networks, in languages/dialects that are popular in the region. The various modes of ICT need to be integrated with one another, so that a meaningful volume of information can be generated in the minimum possible time.

3.5 ICT in Poverty Reduction in Developing Countries

Few would argue that lack of access to information and communications technologies (ICTs) is an element of poverty in the way that insufficient nutrition or inadequate shelters are. If being poor is defined as lacking access to the Internet, for example, no one in the world escaped poverty before 1969, when the first network was built. But, ICTs are increasingly central in the effort to *escape* poverty. This unit will discuss the use of ICTs in poverty alleviation, the poor's limited access to ICTs, and government policies that might help to overcome this 'digital divide.'

ICTs and Poverty Alleviation

We have forty years of evidence on the utility of broadcast media as a tool for improving incomes. A survey of some of the 21,000 farmers

enrolled in radio-backed farm forums in Zambia showed that 90 percent found programs relevant and more than 50 percent credited the programs and forums with increasing their crop yields.

Building telephone centers is another significant means for creating income. In the Indian state of Punjab, for example, one study found over 10,000 staffed telecenters had sprung up by 1996—generating close to 9,000 USD in gross revenue per center, much of which went to salaries. In Bangladesh, Grameen Phone gives loans to low-income women entrepreneurs in rural areas to provide payphone services based on cellular technology. Villagers reported that the introduction of the service has allowed rural farmers to check livestock prices and coordinate medical needs, and has challenged the traditional power that wealthy landowners and intermediaries have held over rural economies and politics. Also, the phones themselves have become important new business sector in the villages, generating jobs and income where none previously existed. The average income per village telephone operator has been estimated at $700 per annum. Small manufacturers of traditional handicrafts are also discovering how ICTs can assist in the marketing and distribution of their wares to a worldwide client base. In Kenya, the Naushad Trading Company which sells local woodcarvings, pottery, and baskets, has seen revenue growth from US$ 10,000 to over US$ 2 million in the two years since it went online. Consumers and shopkeepers can access constantly updated color pictures of NTCLimited's product line, place orders, and make inquiries of other types of handicrafts.

The impact of ICTs on the lives of poor people goes far beyond income generation, however. In education, at the primary and secondary levels, radio and television are an increasingly important means of reaching the rural poor. Educational radio has been utilized in:

Mexico and Mali, for literacy training;
Thailand, to teach mathematics to school children, and for teacher training and other curricula; and
The Dominican Republic and Paraguay, in support of primary education.

There are also a number of Internet-based education programs, including ENLACES in Chile and the World Bank'sWorldLinks program. Information technology also has a role in improving the quality of health services. A significant percentage of healthworkers in Uganda (54 percent) and Kenya (20 percent/year) have taken part in radio-backed training courses and there are consistent reports and surveys suggesting that these result in improved knowledge, attitudes and practices. ICTs can also significantly cut the cost of education and health care through

the improvement of management systems using net-worked computers. ICTs also have a role in supporting environmental awareness programs and publicizing the actions of polluters, in preserving and disseminating cultural information and practices, and a range of other development tasks.

Finally, ICTs also have a major role in reducing the vulnerability of the poor especially to natural disasters and powerlessness. One of the reasons for this is the part that ICTs can play in amplifying the voices of the poor. ICTs bridge the distance between remote communities and service providers—markets, government departments, and aid agencies. They can allow the opinions of the poor and the needs of the poor to be heard. For example, in India, the women's rights NGO 'Sakashi' had faced difficulties in lobbying for sexual harassment legislation. With help from international women's networks provided over the Internet, Sakashi was able to receive advice and technical assistance on legal issues surrounding sexual harassment. As a result, the group succeeded in convincing the Supreme Court to establish sexual harassment guidelines in the workplace and brought the issue within the purview of human rights violations.

The Digital Divide

Despite these potential links between ICTs and poverty reduction, direct access by the poor to more advanced ICTs in particular, is extremely limited. Radio is listened to every week by as much as 80 percent of the populations of many developing countries. The poorest developing countries also have more televisions per capita than would be suggested by their income level. But citizens of poor countries have significantly less access to telephones and the Internet than those living in rich countries, while poorer people within countries are even furtherexcluded. For example, Rwanda has a population of over 6.5million. In 1998, it had 11,000 telephones—about half the number of telephones asGibraltar, with a population of 27,000. Within Rwanda, these telephoneswere almost exclusively concentrated in Kigali. There were 4 telephonesper hundred people in the capital city, compared to 4 per 10,000 in therest of the country. Looking at the Internet, in 1998, Bangladesh had a population of 125 million, with just over 1,000 Internet users. The unavailability of local content on the Internet is a further pointer to the dominance of industrial countries. A recent host survey shows that Africa generates only 0.4 percent of global content. Excluding South Africa, the rest of Africa generates a mere 0.02 percent.

And, especially for the Internet, use is dominated by a tiny educational elite. Ninety-eight percent of Ethiopian Internet users had a university degree—in a country where 65 percent of the adult population is

illiterate. Finally, women have less access to ICTs than men. Only 38 percent of the population polled in urban Latin America who use a computer and Internet are women. The numbers are even more skewed in Africa: a survey of African users found that 86, 83, and 64 percent of Internet users in Ethiopia, Senegal, and Zambia, respectively, were male.

Should There Be Concern?

Having said that, the mere existence of a gap in levels of ICT services between the rich and poor across and within countries does not imply that ICTs should be a priority for government action; after all, poor countries also have fewer factories, fewer cars, fewer doctors and nurses, and lower calorie intakes per capita than wealthy countries. That said, there are a number of reasons why a *growing* gap in the provision of advanced ICTs *should* be of concern:

The gap in provision is already large, and for advanced ICTs it is much larger than income disparities. This represents a majority of people around the world—and especially the poor—having no access to modern networking technologies. And the gap is growing at a time when the trends in other determinants of development, such as levels of education, health, and access to transport, are converging.

Threshold effects are at work. Two linked economic features suggest that low provision could force people and countries into poverty traps—network externalities, where there are increasing benefits to a connection the more those others are connected, and bottlenecks. In the same way that a weak port infrastructure reduces the attractiveness of all merchandise trade with a country, it might be that a weak information infrastructure will reduce the competitiveness of an even wider range of goods and services. Weak information infrastructure might then act as a bottleneck to trade-led development.

Evidence is growing that a range of ICTs is vital for taking part in trading, and the lack of such technology really does act as a bottleneck. For example, surveys in Botswana and Zimbabwe suggest that areas lacking telephone access see significantly less entrepreneurial activity than those with access.

Within-country gaps in service provision worsen existing inequities. If the opportunities for improved income generation and access to services provided by the new ICTs are limited to the wealthy, this will perpetuate and strengthen a number of disparities, including gender inequality and the inequalities faced by the disabled.

Policies to Ensure Access for the Poorest

The first step to begin fulfilling the communications needs of the poor is to leverage the full potential of market mechanisms in reaching out to poor communities, by allowing the establishment of a competitive, private sector–led market. A range of studies suggest that there can be dramatic increases in access to telephone and Internet services, through a telecommunications-sector reform program based on three pillars: privatization, competition, and independent regulation.

Privatization

Privatized open telecommunications markets in the Asian region saw basic line rollout approximately three times as fast as countries with a state monopoly and twice as fast as those with private monopolies. A liberalized telecommunications sector is also vital to making access to advanced information technology more affordable, because a large part of the costs of Internet access are accounted for by telecommunications. A recent study of African Internet service providers suggests that countries with a highly liberalized telecommunications network had costs of Internet access eight times lower than those with a completely closed market. Countries with more open telecommunications sectors also had more host sites, lower monthly Internet charges, a greater number of providers, and higher rates of Internet penetration.

Opening the broadcast sector to independent operators can also have a dramatic impact on the range and quality of programming. In Columbia, for example, over 1,000 new licenses were issued to community stations in 1995. This should be part of a broader move to issue spectrum licenses to local and national stations, which can dramatically increase listener choice and information flow.

Competition

Gaining full benefit from private-sector participation and liberalization also requires the regulatory environment of the communications industry to be conducive to a well- functioning competitive market. In the telecommunications sector, this can be achieved through legal and regulatory mechanisms that promote, among other things: fair interconnection and revenue-sharing arrangements between telecommunications operators; moving toward cost-oriented tariffs and the elimination of internal cross-subsidies, with the limited exception of carefully designed subsidies to ensure access and use for the poor; as well as recourse to a strong and truly independent regulatory agency, capable of enforcing rules.

Regulation

Moving to private competitive markets is unlikely to be enough to ensure that the poor have access to ICTs, however. A combination of regulatory requirements, carefully designed privatization and license contracts, and bidding procedures and financial support for private provision of public access will be required to meet this goal. Service requirements are a simple method used by regulatory agencies to ensure a certain minimum level or distribution of telecommunications development within a country. They are primarily written as conditions into the license of an operator. They can involve teledensity or rollout targets for public and private lines, along with conditions on the quality and speed of service. Regulations can also support access by the disabled, supporting enhanced accessibility features to allow use by those with visual and auditory impairment. Service requirements should be set bearing in mind their commercial feasibility: requirements that are unrealistically ambitious may jeopardize financial performance and thus operators' ability to meet the targets and improve access.

In license-tendering processes, build-out targets are increasingly used as an important, sometimes primary, bid evaluation criterion, alongside the bid price. This approach, if preceded by careful analysis of the target users' capacity to pay, ensures that the rollout targets are indeed feasible. For example, in both Uganda and India, bid evaluations included rollout or coverage criteria. If license conditions are to be met, enforcement procedures to follow up on the accomplishment of committed targets and a plan of sanctions for failure are essential. To make licenses with rollout conditions more attractive, a range of options are available, including bundling, packaging areas, and free choice of technology.

Potential Benefits

Using regulatory and policy support for public access, be it to a telephone line, to a radio, TV screen, or to an Internet terminal, countries can aggregate demand so that a large number of people benefit from one or a few connections. This allows sustainable provision of ICT services even where incomes are low. In Senegal, for example, more than 6,000 privately operated and highly profitable telecenters have come into existence since the early 1990s.

Public access to a telephone has more than doubled. India, Peru, South Africa, and Thailand have also seen dramatic growth in privately owned and operated telecenters providing rural inhabitants with new information sources and opportunities.

In a competitive environment, the costs of providing public access in environments where private returns to provision are likely to be low can be financed through special funds. These funds are set up as a transitory mechanism to help partially defray the initial investment costs of network expansion in rural and poor areas. A prime regulatory objective in setting up universal access funds is to maximize the impact of the subsidies awarded, which is why the funds should be allocated to operators in a competitive way. The introduction of competition through a bidding process for the use of funds encourages operators to look for the best technology and other cost-savings practices.

This tends to minimize the need for subsidies, if they are required at all. The choice of a funding strategy can also support a level playing field among operators so that none of the operators is overly compensated or unfairly burdened by the funding mechanism.

In such a competitive bidding process, the fund administrator determines the target areas to be served, normally based on socioeconomic studies and on consultation with the local authorities and population. New entrants and sometimes existing operators compete for subsidies for network build-out in these areas. The subsidy is then awarded to the operator with the lowest required subsidy or the highest service roll- out commitment, or a combination of both.

In Chile, for example, just over US$ 2 million in public funds leveraged US$ 40 million in private investment to install telephones in 1,000 localities, at about ten percent of the costs of direct public provision. Very few areas received no bids and thus remained unserved.

Although the initial focus of these types of universal access funds was to support the provision of public telephones by telecommunications operators, some countries are using this approach to support the establishment of public Internet access points, notably through telecenters. This has been the approach followed in South Africa, where the Universal Service Agency has used the funds to franchise telecenters around the country. Peru has recently started using a similar mechanism to support the public provision of telecenters and Internet terminals in poor city neighbourhoods.

3.6 The Future

It should be noted that the ICT movement is still in its early stages in developing countries, and it has faced some set- backs. One study of a pilot program of the Ministry of Environment, Natural Resources, and Fisheries in Mexico, for example, found that of 23 telecenters set up in rural areas around the country, only five remained functional after two

years. Problems encountered included insufficient maintenance funding, inadequate political interest and will, and cultural constraints that hampered community interest in the projects.

This suggests the importance of participatory design and continued government support. Local communities need to be involved in the design of universal access programs by participating in decisions about particular information access outlets. Indeed, most studies find that the most effective way of ensuring the economic success of ICTs in rural areas is to encourage local participation and create social institutions in support of the new technologies. This can be achieved through a participatory approach, to complement technical and economic calculations of telephone placement. Further, given the cost and skills demands of Internet access, it is likely that direct access by the poorest in developing countries will remain limited. Through the more affordable intermediary of the radio, however, some of the benefits of Internet access can be provided to those without direct access. In Kothmale, Sri Lanka, a joint project between UNESCO, the Ministry of Posts, Telecommunications and the Media, the Sri Lanka Broadcasting Corporation, and the Sri Lanka Telecommunication Regulatory Commission, uses radio as an interface between rural people and the Internet. A daily one hour live radio program in which an announcer and a panel of resource persons browse the Internet at the requests of listeners, has proven to be capable of overcoming linguistic barriers in using the Internet by non-English speakers. The radio station adds value to the information by interpreting it into a local context, by broadcasting it in vernacular languages, and by providing a platform for feedback through local discussion and networks of local correspondents. In addition to the radio program, the Kothmale Community radio station is developing a rural database.

It should be noted that provision of infrastructure is only the first step in exploiting ICTs for development. Without appropriate content, for example, the Internet will not be relevant to the poor in developing countries. There is also a large role for government to support the creation of appropriate content in broadcasting media. Same-language subtitling for television broadcasts supports language and literacy goals, and radio-based educational programming across a range of subjects and topics (math, language, health, and agriculture) have been found to be highly cost-effective. Utilizing private investment and entrepreneurship to its full extent, then providing government support to ‘fill in the gaps,’ developing countries can go a long way in overcoming the digital divide and use ICT as a powerful tool of poverty relief.

The ICT may not survive in its present form for long. Sooner than later developing countries would get over the PC mania prevalent now in the

developed world, unless there is a remarkable change in the economy of owning a PC. Any technology that requires the masses to own a PC, in its present form, to access information is unlikely to be successful in the foreseeable future. Possibilities appear to exist, however, in the mobile phone technology, which is fast becoming very affordable by the masses, is voice based and can be integrated with the Information Technology at the server end of a computer network. For example, in the field of education people can ask question through a mobile phone, a database of answers to such questions can be generated using the technologies used currently in Wikipedia and call centers and the text in these databases could be converted into voice, by developing text to voice technologies in the various languages. The person seeking information can be informed when the answer is available and better answers sought based on his/her feedback. The emerging 3G and 4G mobile phone technologies can indeed facilitate such developments. An alternative technology could be to integrate the mobile phone with the television screen, so that visual information can be viewed easily. Similarly, there is a possibility for developing interactive radio, on the lines of interactive TV.

4.0 CONCLUSION

Information and communications technology remains the bedrock that drives developments globally. It is really bridging the divide between developed and developing economies. Indeed, it has helped small and medium scale industries, especially in developing countries. More of information and communications technology is required because it is a highly dynamic industry for global development. Conclusively, one can say that information and communications technology is the fulcrum of modern day developments.

5.0 SUMMARY

Information and Communications Technology - or technologies (**ICT**) is an umbrella term that includes all technologies for the manipulation and communication of information. The term is sometimes used in preference to **Information Technology** (**IT**), particularly in two sectors: education and government.

The Internet has opened up many opportunities, from finding out information, conducting communications globally, e.g. through e-mail, voice mail, skype, e-commerce or generally just having fun through on line chats or instant messaging.

Previous information communication technologies have not been cost effective in developing countries.

ICT can become a major vehicle of change in developing countries, provided technological innovations emerge with serious consideration for local contents.

We have forty years of evidence on the utility of broadcast media as a tool for improving incomes. A survey of some of the 21,000 farmers enrolled in radio-backed farm forums in Zambia showed that 90 percent found programs relevant and more than 50 percent credited the programs and forums with increasing their crop yields.

Despite the potential links between ICTs and poverty reduction, direct access by the poor to more advanced ICTs in particular is extremely limited. Radio is listened to every week by as much as 80 percent of the populations of many developing countries.

The ICT may not survive in its present form for long. Sooner than later developing countries would get over the PC mania prevalent now in the developed world, unless there is a remarkable change in the economy of owning a PC.

6.0 TUTOR-MARKED ASSIGNMENT

2. Discuss the limitations associated with PC-Internet based ICT
3. Mention 4 benefits/achievements of ICT

7.0 REFERENCES/FURTHER READINGS

Kenny, Charles, Juan Navas-Sabater, Christine Z. Qiang (2001). *"Information* and Communication Technologies and Poverty in the World Bank" (Ed) *Poverty Reduction Strategy Sourcebook*, Washington DC: World Bank.

Dodds, T. (1999). *Non-Formal and Adult Basic Education through Open and Distance Learning in Africa*. Mimeo, Centre for External Studies, University of Namibia.

Nwaerondu, Ndubuisi Goodluck, and Gordon Thompson. (1987). "The Use of Educational Radio in Developing Countries: Lessons from the Past." *Journal of Distance Education* 2(2): 43-54.

Wilson, E. and Rodriguez, F. (1999). *Are Poor Countries Losing the Internet Revolution? info*Dev Working Paper. Washington, D.C.

Easterly, W. (1996). *Life during Growth*. Washington D.C.: World Bank.

Africa Internet Forum. (1999). "Internet Economic Toolkit for African Policy Makers."

Wellenius, Bjorn. (1997). A-Telecommunications Reform: How to Succeed, *World Bank Viewpoint Note No. 130*.

Wellenius, Bjorn. (1997). B-Extending Telecommunications Service to Rural Areas—the Chilean Experience. *World Bank Viewpoint Note No. 105*.]

Robinson, Scott S. (2000). *Telecenters in Mexico: Learning the Hard Way*, presented at the "Partnerships and Participation in Telecommunications for Rural Development: Exploring What Works and Why" conference at the University of Guelph, Ontario, Canada, October 26-27.

Charles Kenny, *TechKnowLogia*, July/August, 2001 © Knowledge Enterprise, Inc.

Mobile Technologies and Learning,

Mobile Phone Technologies in Education and Schools.