



**NATIONAL OPEN UNIVERSITY OF NIGERIA**

**COURSE CODE : CIT 701**

**COURSE TITLE: Foundation of Information and  
Communication Technology**

Course Code	CIT 701
Course Title	Foundation of Information and Communication Technology
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## **Introduction**

Information is the life wire of today's business organizations, institutions and industries. **Information and Communication Technologies (ICT)** covers all advanced technologies in manipulating and communicating information. Understanding the ICT three main components: Information; the use of computers to transform data into information, Communications; transmission of information through networks, Technology; the know-how used for the transmission, will ease your understanding of this course.

This course, **Foundation in Information and Communication Technology (ICT)** focuses on the way ICT is transforming the way people do business and how ICT impacts their personal lives. The emphasis is on the way ICT is used and applied for problem solving; the new and emerging technologies as they are being implemented in real organizations; applications to personal and professional practice; and the challenges and opportunities of IT in local and international business solutions.

## **What you will learn in this Course**

The Course material has two components; this course guide and the main lecture note. This course guide tells you briefly what the course is about, what course material you will be using and how you can use the materials. In addition, it advocates some general guidelines for the amount of time you are likely to spend on each unit of the course in order to complete it successfully.

It gives you guidance in respect of your Tutor-Marked assignment which will be made available in assignment folder. There will be regular tutorial classes that are related to the course. It is advisable for you to attend these tutorial sessions. The course will prepare you for the challenges you will meet in trying to build a foundation in Information and Communication Technology, by describing the combination of traditional computer and communication technologies and how they interrelate within the Enterprise.

## **Course Aims**

The aim of this course is simply to teach you the basics in ICT and help you develop a habit of keeping current technology trend which is a key to your success with Information and Communication Technology.

## **Course Objectives**

In order to achieve this aim, the course has a set of objectives. Each unit has specific objectives which are included at the beginning of the unit. You are expected to read these objectives before you study the unit. You may wish to refer to them during your study to check on your progress. You should always look at the unit objectives after completion of each unit. By doing so, you would have followed the instructions in the unit.

Bellow are the comprehensive objectives of the course as a whole. By meeting this objectives, you should have achieved the aim of the course. Therefore, after going through this course you should be able to:

- Explain the principles and practices in Information and Communication Technology.
- Identify uses, types and advantages of Databases and Computer Networks.
- Discuss the importance and infrastructural use of Distributed Networks, the Internet and W3.
- Explain how Information and Communication Technology Applications are managed by personal, enterprise and businesses, and the strategies they used to survive.
- Know the challenges posed by Information and Communication Technology and the provided solutions.

## **Working through this Course**

To complete this course, you are required to read each study unit, read the textbooks and read other materials which may be provided by the National Open University of Nigeria.

Each unit contains self-assessment exercise and at certain points in the course you would be required to submit assignment for assessment purposes. At the end of the course there is a final examination. The course should take you about a total of 17 weeks to complete. Bellow you will find listed all the components of the course, what you have to do and how you

should allocate your time to each unit in order to complete the course on time and successfully.

This course entails that you spend a lot of time to read and practice. For easy understanding of this course, I will advise that you avail yourself the opportunity of attending the tutorials sessions where you would have the opportunity to compare your knowledge with that of other people, and also have your questions answered.

## **The Course Material**

The main components of this course are:

1. The Course Guide
2. Study Units
3. Further Reading/References
4. Assignments
5. Presentation Schedule

## **Study Units**

The study units in this course are as follows:

### **Module 1**      Introduction to Information Communication Technology

- Unit 1: Information Communication Technology: Principles, Practices, and Opportunities.
- Unit 2: Essentials of Computing
- Unit 3: The System Unit and the Central Processing Unit
- Unit 4: Input Devices
- Unit 5: Output Devices
- Unit 6: Storage Devices and Memory

### **Module 2**      Databases and Computer Networks

- Unit 7      Databases

- Unit 8: Database Management System (DBMS).
- Unit 9: Database Queries
- Unit 10: Enterprise Databases and Data Warehouses
- Unit 11 Computer Networks
- Unit 12 Networking Technologies

### **Module 3**                      Distributed Networks and the Internet

- Unit 13: Communications Networks
- Unit 14: Enterprise and Wireless Communications Networks
- Unit 15: Essentials of the Internet
- Unit 16: World Wide Web
- Unit 17: Electronic Commerce and Electronic Business
- Unit 18: Launching Information Technology Applications Projects

### **Module 4**                      Managing Information and Communication Technology Applications in the Enterprise.

- Unit 19: Creating Enterprise Applications
- Unit 20: Project Management
- Unit 21: Web Based Application
- Unit 22: Information Systems in the Enterprise
- Unit 23: Issues in Information Technology
- Unit 24: Careers in ICT.

For easy presentation of the course to you, we have divided the course into four modules of six units each, with each module covering an important aspect of the course; Module 1

focused on the information dissemination and the Computer System, Module 2: databases and networking technologies, Module 3: distributed networks and the internet and Module 4: how to manage information and communication technology applications in the enterprise and the corresponding challenges.

In module one (1), the first unit focuses on the basic principles, practices and opportunities in ICT. The second unit deals with the essence of computing. The third unit discusses about the system unit (SU) and the central processing unit (CPU) acting as the brain of the computer. The fourth unit deals with the Input devices acting as the ear and eye that feed the brain with data to process. The fifth unit explores the Output devices; used by the computer to transmit information to the outside world. The sixth unit discusses the Storage Devices and Memory; that keeps information permanently and temporary, respectively.

Module two (2) is made up of unit 7 to 12, and it is mainly concerned with how data and information are kept and shared among users. In unit 7, the components, types, uses and development of database applications are dealt with. Unit 8 deals with the software used in manipulating the database known as the database management system (DBMS). Unit 9 deals with the language used for easy manipulation of data in a database known as the Query language. Unit 10 deals with why and how data is shared within the organization. Unit 11 discusses the infrastructures used in sharing the data. Unit 12 being the last in this module introduces you to the concept of computer networks; the inter-connection of computers, using wires or wireless links, confined in a location or scattered around distant places for the purpose of sharing information with ease.

Module three (3) comprises unit 13 to 18, which focuses on how computers and communication devices are inter-connected to form extranets, intranets and internet. In unit 13, the principles of communication networks, types of network service applications, network channels and data transport technologies were discussed. In unit 14, wireless communications, the role of network operating system and network administration in an enterprise were discussed. Unit 15 introduces the concept of internet, its uses, capabilities, communication, information retrieval and differences with other networks such as Extranets and Intranets. Unit 16 explores the World Wide Web used to connect to the internet and to access available resource using browser software. The Web has an e-mail facility used to transmit electronic messages over the internet. In Unit 17, the concept, advantages and disadvantages, types and ways of buying and selling over the internet through Electronic Commerce were discussed. Unit 18, the last unit in module three, discusses about the ICT department, the key players and how an information system is analyzed and designed objectively.

Module four (4) is made up of unit 19 to 24, unit 19 focuses on how to develop and launch an ICT application in an enterprise successfully. Unit 20 deals with how to manage a project by setting a goal, sharing responsibilities, designing a work plan and working as a team. Unit 21 deals with Web based applications; how they work, the types and advantages of technologies

involved. Unit 22 described the types of Information System and their Characteristics, the Competitive Strategies used by business and enterprise resource planning. Unit 23 “Issues in Information Technology,” explores important challenges surrounding the use of ICT, including issues of IT security, digital piracy, ethics, personal privacy and ICT reliability. Finally unit 24 “Careers in ICT,” explores the professions in the world of IT, their required qualifications and responsibilities to enable you build a career by adding value to your resume and know who to handle your job.

Each unit consists of one or two weeks’ work and include an introduction, objectives, main content (reading material), conclusion, summary, tutor-marked assignment (TMAs), references and other resources. The unit directs you to work on exercises related to the required reading. In general these exercises test you on the materials you have just covered or require you to apply it in some way, hence assist you to evaluate your progress and to reinforce your comprehension of the material. The TMAs will help you in achieving the stated learning objectives of the individual units and of the course as a whole.

### **Presentation of Schedule**

Your course materials have important dates for early and timely completion and submission of your TMAs and attending tutorials. You should remember that you are to submit all your assignments by the stipulated time and date. You should guard against falling behind in your work.

### **Assessment**

There are three aspects to the assessment of the course. The first is made up of self-assessment exercise, second consist of the tutor marked assignments and third is written examinations/end of the course examination.

You are advised to do the exercise. In tackling the assignment, you are expected to apply information, knowledge and techniques you gathered during the course. The assignment must be submitted to your facilitator for formal assessment according to the deadline stated in the presentation schedule and the assignment file. The work you submit to your tutor for assessment will count for 30% of your total course work. At the end of the course you will need to sit for a final or end of course examination of about three hours duration. This examination will count for 70% of your total course mark.

### **Tutor Marked Assignment**

The TMA is a continuous assessment component of your course. It accounts for 30% of the total score. You will be given four (4) TMAs to answer. Three of these must be answered before you are allowed to sit for the end of course examination. The TMAs would be given to you by your facilitator and returned after you have done the assignment. Assignment questions for the units in this course are contained in the assignment file. You will be able to complete your assignment from the information and material contained in your reading, references and study units. However, it is desirable in all degree level of education to demonstrate that you have read and researched more into your references, which will give you a wider view point and may provide you with a deeper understanding of the subject.

Make sure that each assignment reaches your facilitator on or before the deadline given in the presentation schedule and assignment file. If for any reason you cannot complete your work on time, contact your facilitator before the assignment is due to discuss the possibility of an extension. Extension will not be granted after the due date unless there are exceptional circumstances.

### **Final Examination and Grading**

The end of course examination for this course will be for about two and a half hours and it has a value of 70% of the total course work. The examination will consist of questions, which will reflect the type of self-testing, practice exercise and tutor-marked assignment problems you have previously encountered. All areas of the course will be assessed.

You are to use the time between finishing the last unit and sitting for the examination to revise the whole course. You might find it useful to review your self-test, TMAs and comments on them before the examination. The end of the course examination covers information from all parts of the course.

### **Course Marking Scheme**

<b>Assignment</b>	<b>Marks</b>
Assignment 1 – 4	Four assignments, best three marks of the four counts at 10% each -30% of course marks.
End of Course Examination	70% of the overall course marks.
<b>Total</b>	100% of course materials.

### **Facilitators/Tutors and Tutorials**

There are 16 hours of tutorials provided in support of this course. You will be notified of the dates, times and location of these tutorials as well as the name and phone number of your facilitator, as soon as you are allocated a tutorial group.

Your facilitator will mark and comment on your assignments, keep a close watch on your progress and any difficulties you might face and provide assistance to you during the course. You are expected to mail your Tutor Marked Assignment (TMA) to your facilitator before the schedule date (at least two working days are required). They will be marked by your tutor and returned to you as soon as possible.

Do not delay to contact your facilitator by telephone or e-mail if you need assistance.

The following might be circumstances in which you would find assistance necessary, hence you would have to contact your facilitator if:

- ✓ You do not understand any part of the study or the assigned readings.
- ✓ You have difficulty with the self-tests.
- ✓ You have a question or problem with an assignment or the grading of an assignment.

You should Endeavour to attend the tutorials. This is the only chance to have face to face contact with your course facilitator and to ask questions which are answered instantly. You can raise any problem encountered in the course of your study.

To gain much benefit from the course tutorials prepare a question list before attempting them. You will learn a lot from participating actively in discussions.

## **Summary**

Information is an organized, meaningful and useful interpretation of data. The foundation of Information and Communication Technology course attempts to provide you with the basic tools, a wide variety of items and abilities used in the creation, storage and dispersal of data and information as well as the creation of knowledge. This course explores the role of ICT in today's world. Today whether you start, sell, buy, invent, build, manage, or finance companies, products, or services, you will find that a working knowledge of ICT is essential with no exceptions. Using ICT capabilities effectively and creatively can be a key to your success, whether you are focusing on a professional, healthcare, entrepreneurial, manufacturing, or service career.

This course will answer basic questions such as:

- What is Information and Communication Technology (ICT)?
- What are the functions and uses of ICT components?
- How are ICT applications and infrastructure managed in the Enterprise?
- What are the importance of ICT in business and other fields?
- Who are the Professionals and Managers of ICT?
- What are the challenges of ICT and how were they addressed?

Apart from the academic benefit of studying this course, you will find the principles taught in this course quite helpful in your everyday life. It is also hoped that this course will improve your quality of decision; enable you acquire ICT skills and know how to apply it to your environment.

Finally, I wish you success in the course and I hope that as you give your best to this course, you will find it both interesting and useful.

# **MODULE 1 INTRODUCTION TO INFORMATION COMMUNICATION TECHNOLOGY**

## **UNIT 1: PRINCIPLES, PRACTICES, AND OPPORTUNITIES OF INFORMATION COMMUNICATION TECHNOLOGY**

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## **1.0 INTRODUCTION**

Information is the life wire of today's business organisations, institutions and industries. Every organisation, regardless of its size and purpose, is concerned with processing data in order to provide current and accurate information. Employees at every level within most organisations use various devices or tools in the performance of their everyday duties.

## **2.0 OBJECTIVES**

- Define Information and what are its characteristics
- Explain the three primary components of information technology.
- Summarise the principles of business reengineering, while emphasising the potential benefits to people and business.
- Discuss the types of opportunities that information technology offers to people.

## **3.0 MAIN CONTENT**

Data refers to facts, events, activities and transactions which have been recorded. Data is the raw material from which information is produced. When you were admitted into school your school gave you the school information about yourself. You probably wrote it on a form that must have been supplied to you. The information that you gave is a set of facts about yourself. The school now has some data on you.

### **3.1 INFORMATION**

“It will be sunny tomorrow;” “There are some men in the field”. “The turkey gave birth to a lion day before yesterday.” These statements convey to you something. It does not matter whether they are true or false, each is telling a story. The story being passed to you is what is known as information. Therefore **Information is news passed to you either orally or in written**. If the information given is true no matter who is giving it or when it is given it is said to be a fact or **data**.

#### **3.1.1 CLASSIFICATION OF INFORMATION**

Information could be classified based on the forms in which information can exist, the time of occurrence, and the frequency of occurrence.

- Information classified based on form of existence include, **written, oral, visual, and sensory**.

- Information classified based on time of occurrence could be **historical, present, and future.**
- While information based on frequency of occurrence are those that are **continuously, hourly, daily, weekly, monthly, and annually.**

### 3.2 TRANSMISSION OF INFORMATION

After receiving information the question of how to disseminate it now arises. Ideally for an item to be a piece of information, it has to be passed from one person to another and from one place to another. Information could be passed through an ancient or a modern method as summarised in the Table 1.1.

**Table 1.1** Methods of Spreading Information.

<i>Old methods of spreading Information</i>	<i>New methods of spreading Information</i>
<ul style="list-style-type: none"> <li>• Oral</li> <li>• Town crier</li> <li>• Beating drums</li> <li>• Lighting fire</li> <li>• Drawing diagrams representations /symbols</li> </ul>	<ul style="list-style-type: none"> <li>• Writing</li> <li>• Typing</li> <li>• Printing</li> <li>• Telephone</li> <li>• Telex</li> <li>• Radio</li> <li>• Television</li> <li>• Fax</li> <li>• Satellite</li> <li>• Computer</li> <li>• E-mail</li> </ul>

**Source:** (Wikipedia, 2006).

### 3.3 STAGES OF INFORMATION REVOLUTION

The oldest evidence of writing by man so far consists of clay tablets discovered at Sumer in Mesopotamia about 3000BC. These tablets contain records of grains received from, or issued to, individuals at a temple store. Since then the society has seen five distinct stages of information revolution. These stages are:

- Invention of language
- Invention of printing
- Invention of mass media particularly radio and television
- Invention of computer
- Link-up of computers with communications devices and the development of the Internet.

### 3.4 THE EVOLUTION OF THE INFORMATION AGE

The evolution of the information age is classified into three basic groups:

- **Agricultural Age:** The period up to the 1800s, when the majority of workers were farmers whose lives revolved around agriculture.
- **Industrial Age:** The period from the 1800s to 1957, when work processes were simplified through mechanisation and automation.
- **Information Age:** The period that began in 1957, in which the majority of workers are involved in the creation, distribution, and application of information.
- **Knowledge Workers:** Workers involved in the creation, distribution, and application of information.

**Table 1.2** The Evolution of Information Age.

Characteristics	Agricultural Age	Industrial Age	Information Age
Time Period	Pre 1800	1800 - 1957	1957 - Present
Majority of Workers	Farmers	Industrial Workers	Knowledge Workers
Partnership	People and Land	People and Machine	People and People
Principal Tool	Hand Tool	Machine	Information Technology

**Source:** (Senn, 2004).

### 3.5 THE CHARACTERISTICS OF THE INFORMATION AGE

- An information-based society in which more people work at handling information than at agriculture and manufacturing combined.
- Businesses depend on information technology to get their work done.
- Work processes are being transformed to increase productivity.
  - **Work Processes:** The combination of activities that workers perform, the way they perform those activities, and the tools they use.
  - **Productivity:** The relationship between the results of an activity (output) and the resources used to create those results (inputs).
  - **Effectiveness:** The extent to which desirable results are achieved.
- Information technology provides the means to rethink / recreate / reengineer conventional business processes.
  - **Reengineering:** The reshaping of business processes to remove barriers that prohibit an organisation from providing better products and services and to help the organisation capitalise on its strengths.

- ***Business Processes:*** Collections of activities, often spanning several departments that take one or more kinds of input and create a result that is of value to a company's customers.
- Success in business is largely determined by the effectiveness with which information technology is used.
- Information technology is embedded in many products and services.
- Reengineering efforts to attain greater productivity:
  - ***Industrial Age*** - Division of Labour: Separation of work process into component task, with different workers specialising in each of the tasks.
  - ***Information Age*** – Teamwork, Interconnection, and Shared Information.

### **3.6 WHAT IS INFORMATION AND COMMUNICATION TECHNOLOGY?**

Information and communication technologies (ICT) is an umbrella term that covers all advanced technologies in manipulating and communicating Information. The term is sometimes used in preference to Information Technology (IT) or "InfoTech". It is sometimes said to have been coined by Jim Domsic of Michigan in November 1981, to modernise the outdated phrase "***data processing***".

Information Technology means the processing and distribution of data using computer hardware and software, telecommunications, and digital electronics. This unit will give us a background view on Information Communications Technology (ICT).

#### **3.6.1 CONCEPT OF INFORMATION AND COMMUNICATION TECHNOLOGIES (ICT)**

Focusing on the three words behind ICT:

- INFORMATION
- COMMUNICATIONS
- TECHNOLOGY

We can deduce that ICT is concerned with the storage, retrieval, manipulation, transmission or receipt of digital data. Importantly, it is also concerned with the way these different uses can work with each other in business.

- The nature of information (the "I" in ICT) covers areas such as the meaning and value of information; how information is controlled;
  - Management of information - this covers how data is captured, verified and stored for effective use; the manipulation, processing and distribution of information; keeping information secure; networks design to share information.

- Information systems strategy - this considers how ICT can be used within a business or organisation as part of achieving goals and objectives.
- The C part of ICT refers to the communication of data by electronic means, usually over some distance. This is often achieved via networks of sending and receiving equipment, wires and satellite links.
- The T part of ICT refers to the more recent, and fast-growing range of digital technologies which allow people and organisations to communicate and share information digitally

ICT three main components are

- Computers; used to process data into information,
- Communications networks; transmission of information,
- Know-how; the technology used for the transmission



**Figure 1.1** The Forces of Information Technology.

Source: (Senn, 2004).

### 3.6.1.1 Computers

A computer is an electronic system that can be instructed to accept, process, store, and present data and information. It is made up of two component parts: hardware and software.

- **Hardware:** The computer and its associated equipment.
- **Software:** The general term for a set of instructions that controls a computer or a communications network.

- **Program:** A set of instructions that directs a computer to perform certain tasks and produce certain results.
- **System:** A set of components that interact to accomplish a purpose.
- **Data:** Raw facts, figures, and details.
- **Information:** An organised, meaningful, and useful interpretation of data.
- **Knowledge:** An awareness and understanding of a set of information and how that information can be put to the best use.
- **Information System:** A business information system designed to produce the information needed for successful management of a structured problem, process, department, or business.

#### **Computers come in four sizes:**

- Microcomputers
- Midrange computers
- Mainframes
- Supercomputers
- **Microcomputers:** A relatively compact type of computer, the most common of all, easily outsells all other types of computers annually for use in schools, business and at homes. There are five types of Microcomputers:
  - Desktop Computers:
  - Tower Systems
  - Laptop Computer
  - Notebook Computer:
  - Palmtop computers:

**Desktop Computers:** These are the type of microcomputers whose monitor is placed on top of the system's unit.



**Figure 1.2** Desktop Microcomputers.  
**Source:** (Google Images, 2009).

**Tower Systems:** These are the type of microcomputers whose system's units sits beside the computer monitor.



**Figure 1.3** A tower system.  
**Source:** (Google Images, 2009).

**Laptop Computer:** This describes the type of microcomputers whose miniature size makes it possible for a user to place on top of his/her lap for usage.



**Figure 1.4** A Laptop computer.

**Source:** (Google Images, 2009).

**Notebook Computer:** This describes the type of microcomputers whose size can be compared to that of a notebook.



**Figure 1.5** A Notebook computer.

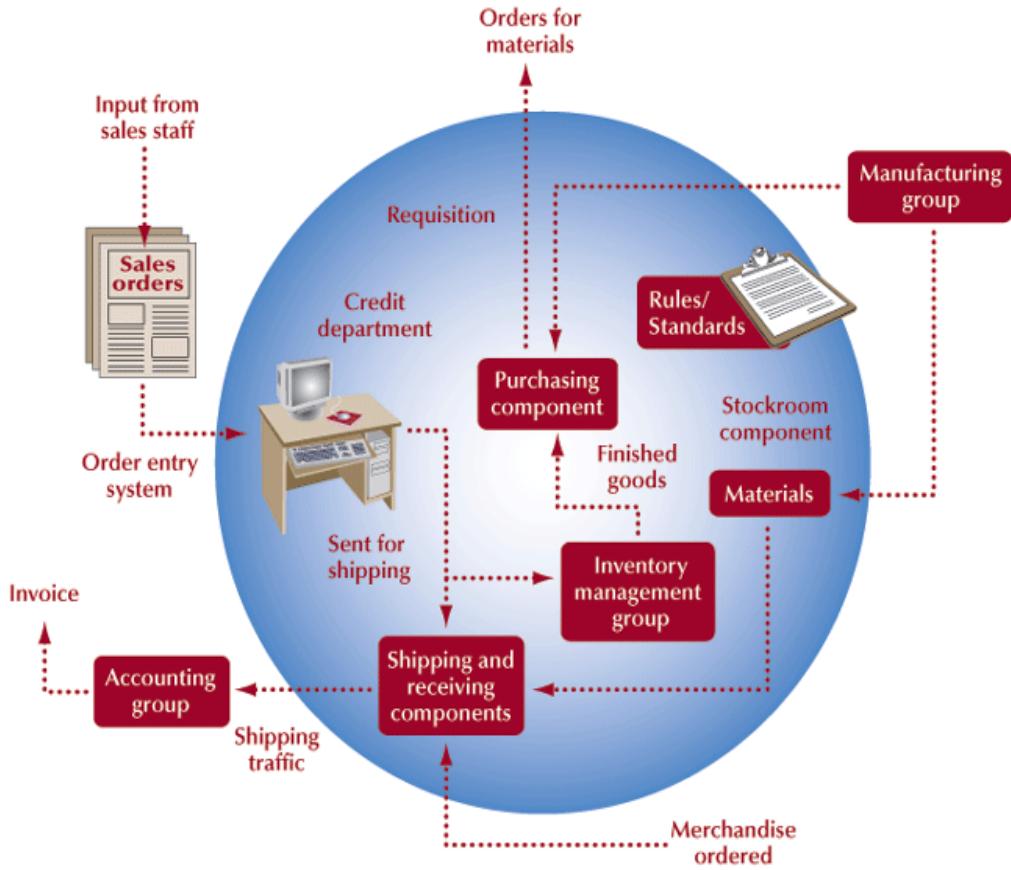
**Source:** (Google Images, 2009).

**Palmtop computers:** This describes the type of microcomputers a user can place on top of his palms for usage, and can as well easily carry it around. It's also called Personal Digital Assistant (PDA).



**Figure 1.6** A Psion Series 3mx Palmtop and mini Palmtop computers.  
**Source:** (Google Images, 2009).

- **Midrange computers and Mainframes:** A computer used to interconnect people and large sets of information. More powerful than a microcomputer, the minicomputer is usually dedicated to performing specific functions. Examples are IBM 360/370 systems, NCR V-8800 system.
- **Supercomputers:** The most powerful of all computers, supercomputers were designed to solve problems consisting of long and difficult calculations. Example A Cray x-mp Super Computer
- **Minicomputers:** These were developed in the 1970s for specialised tasks (i.e. they are special purpose computers). They are smaller and less powerful and even less expensive than mainframes. Examples include PDP 11, VAX 750/6000, NCR 9300, DEC, HEWLETT PACKARD 3000, IBM system 38 and MV400.



**Figure 1.7** A typical Business System.

Source: (Senn, 2004).

### 3.6.1.2 COMMUNICATIONS NETWORKS

Communications Network can be defined as a set of locations, or nodes, consisting of hardware, programs, and information linked together as a system that transmits and receives data and information.

- **Communication:** The sending and receiving of data and information over a communications network.
- **Data Communication:** The transmission of data and information through a communications medium.

### **3.6.1.3 KNOW-HOW**

Know-how is the capability to do something well. Information technology know-how consists of:

- Familiarity with the tools of IT; including the Internet
- Possession of the skills needed to use these tools
- An understanding of when to use IT to solve a problem or create an opportunity

## **3.7 THE PRINCIPLES OF INFORMATION TECHNOLOGY**

A principle is a fundamental rule, guideline, or motivating idea that, when applied to a situation, produces a desired result. ICT's great usefulness is an aid in solving problems, unlocking creativity, and making people more effective than they would be if they did not apply ICT to their activities.

### **3.7.1 THE FUNCTIONS OF INFORMATION TECHNOLOGY**

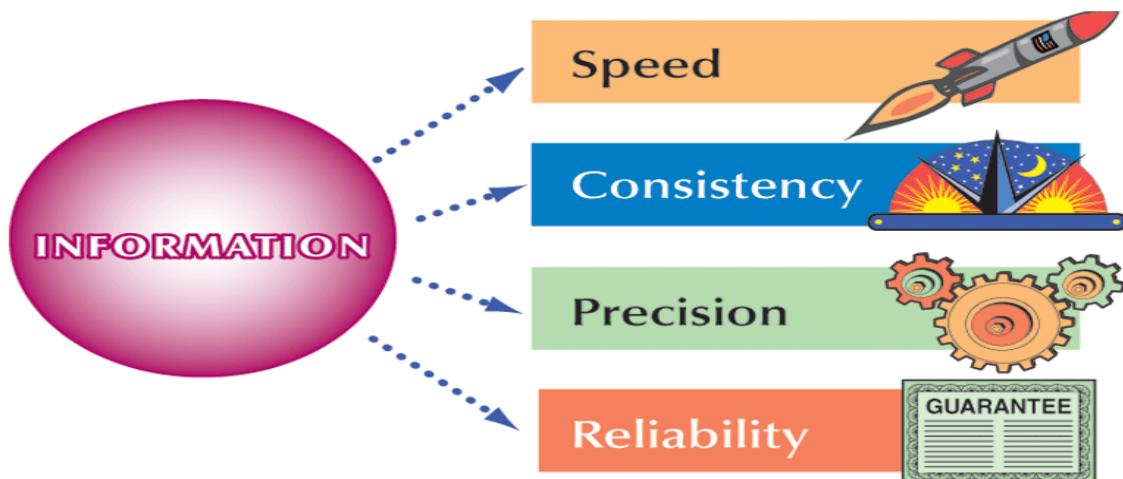
Information Technology is made up of nine (9) major functions, namely; Capture, Verifying, Processing/Manipulation, Storage, Retrieval, Data Update, Reproducing, Transmit/Communication, and Generation.

- **Capture:** The process of compiling detailed records of activities. This could be by recording of data from an event or occurrence, in some form such as sales slips, personnel forms, purchase orders, meters, course registration forms, etc.
- **Verifying:** Is the operation for checking or validating of data to ensure it was captured and recorded correctly.
- **Processing/Manipulation:** The process of converting, analysing, computing, and synthesising all forms of data or information.
  - **Classifying:** Is the operation for placing data elements into specific categories such as size, type, customer, etc.
  - **Arranging (Sorting):** This is placing data elements in a specified or predefined sequence.
  - **Calculating:** This entails the arithmetic and /or logical manipulation of data e.g. computations to derive employee's pay, customer's bills etc.
  - **Summarising:** Reducing data in logical sense. For example the school principal may only be interested in the total amount of the development levies collected out of the total school fees.
- **Storage:** This entails placing data onto some storage media such as magnetic disk, etc where it can be retrieved when needed.
- **Retrieval** this entails searching out and gaining access to specific data elements from the medium where it was stored for further processing or for transmission to another user.

- **Data Update:** This involves making changes to the stored data. Such changes may be to insert new records or modify some data items of the existing record. However, this is usually the exclusive preserve of a class of authorised data users
- **Reproducing:** This entails duplicating data from one medium to another or into another position in the same medium. Example a file of data stored on a magnetic disk may be reproduced onto another disk or onto a magnetic tape for further processing or for security reasons.
- **Transmission/Communication:** The computer process of distributing information over a communications network. This entails transfer of data from one place to another e.g. data can be transferred from a device to a user in form of a report or a display on the screen of a computer controlled terminal.
  - Electronic Mail, or E-Mail
  - Voice Messaging, or Voice Mail
- **Generation:** The process of organising information into a useful form, whether as numbers, text, sound, or visual image.

### 3.7.2 THE BENEFITS OF INFORMATION TECHNOLOGY

The benefits of ICT are Information processing speed, consistency, accuracy and reliability as illustrated in the diagram bellow.



**Figure 1.8** The Benefits of Information Technology.

Source: (Senn, 2004).

### **3.7.3 THE OPPORTUNITIES OF INFORMATION TECHNOLOGY**

- Helping People
- Solving Problems
  - Problem: A perceived difference between an existing condition and a desired condition.
  - Problem Solving: The process of recognising a problem, identifying alternatives for solving it, and successfully implementing the chosen solution.

Information technology is all around us, improving our lives especially in areas such as:

- Media
  - Print (Newspaper, Magazines, Posters and Billboard)
  - Electronic (Television, Radio and Internet)
- Education, Training, Entertainment, Shipping, Paperwork, Money and Investments, Agriculture, Taxation and Accounting, Health and Medicine, Manufacturing, Journalism, Energy, and Sports.

## **4.0 CONCLUSION**

Organisations today now require tools that will enable them to get relevant information easily and on time. The responsibilities of using Information and Communication Technology (ICT) is to get people informed, make proper use of the technology and protect the information against unauthorised access by hackers and unethical users.

## **5.0 SUMMARY**

The concepts, methods and applications involved in ICT are constantly evolving on an almost daily basis. A good way to think about ICT is to;

- Consider all the uses of digital technology that already exist to help individuals, businesses and organizations use information,
- Know the technique used to store, retrieve, manipulate, transmit or receive information electronically in a digital form,
- Believe information and communication technology (ICT) has truly turned the world into a global village.

## **6.0 TUTOR MARKED ASSIGNMENT (TMA)**

- a. What is Information and Communication Technology? List its three main components.
- b. List five ways by which information can be transmitted.
- c. Name the three stages of information evolution.
- d. Why do we need computers to process data into information?

## **7.0 FURTHER READING/REFERENCES**

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# **MODULE 1 INTRODUCTION TO INFORMATION COMMUNICATION TECHNOLOGY**

## **UNIT 2: ESSENTIALS OF COMPUTING**

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## **1.0 INTRODUCTION**

In Unit 1, you were introduced to the concept of ICT. In this unit you will be looking at the basic components of a computer system, their various uses and the people responsible for acquiring, developing, maintaining, or operating the hardware associated with computers and communications networks to process these data.

## **2.0 OBJECTIVES**

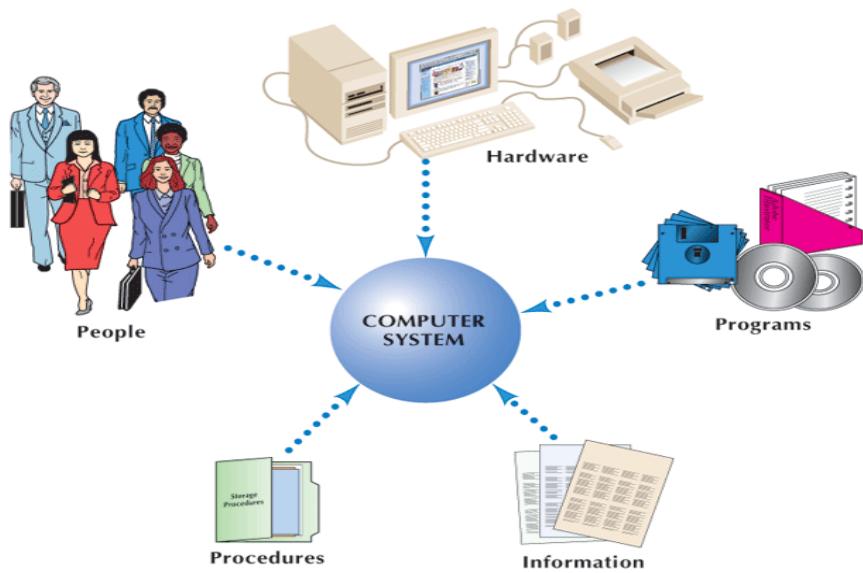
- Know the difference between a Computer and a Computer System.
- Identify the four categories of hardware.
- Discuss the relationship between hardware and software.
- Distinguish between the users of information technology and IT professionals.

## **3.0 MAIN CONTENT**

**Computer:** An electronic system that can be instructed to accept data as an input, process it and gives a result as an output, and in turn stores the data for retrieval in the long run is a computer.

**Computer System:** The computer system is made up of two components parts (Hardware and Software). These components integrate and interrelate. They do this independently by interacting together to perform the basic operations of the computer system. These components are linked together via cords and interface connectors, except for the user who is the people ware, the processes (procedures), and information (processed data).

- Hardware
- Software (Programs)
- Information
- People (People Ware)
- Procedures



**Figure 2.1** The five Components of a Computer System.  
**Source:** (Senn, 2004).

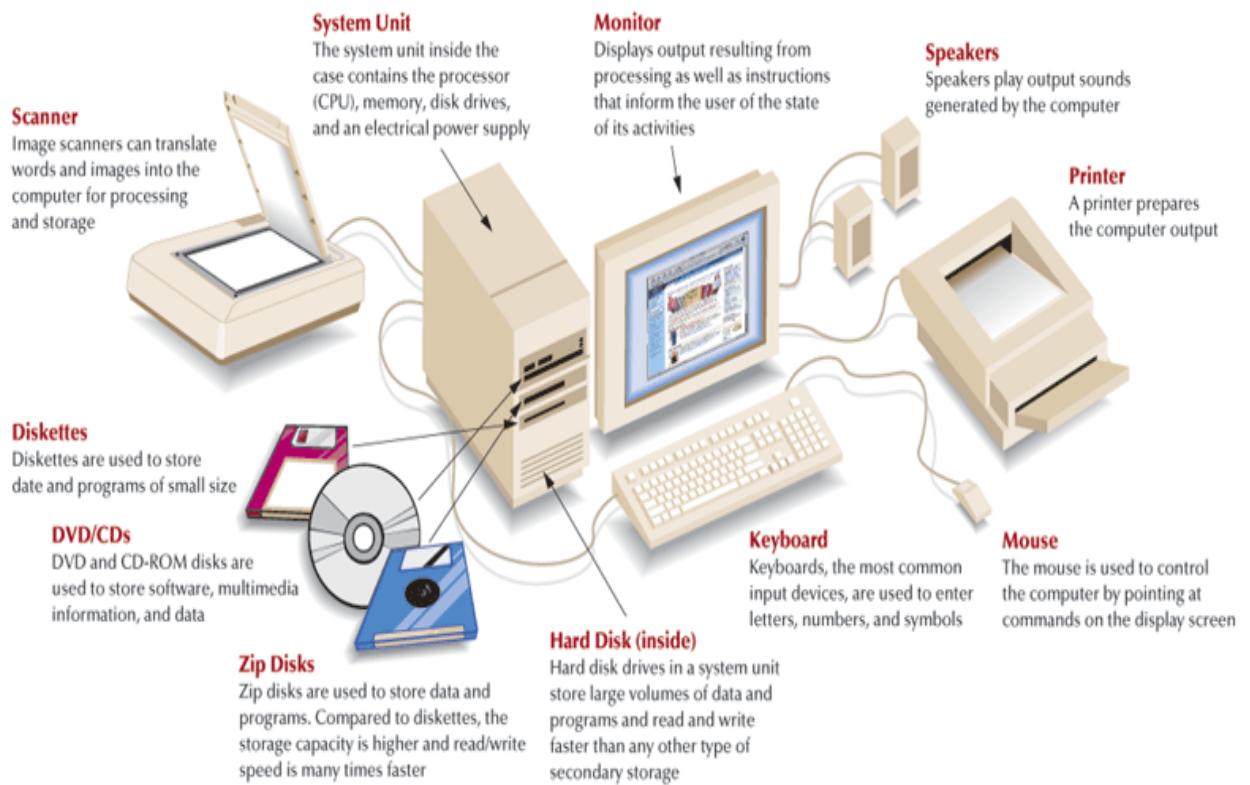
### 3.1 HARDWARE (COMPUTER HARDWARE OR DEVICES)

The hardware component is the physical component of a computer system i.e. those parts of the computer that can be touched, felt and seen physically. More or less, the hardware component consists of a combination of different devices which play specific roles in the operation of the computer system.

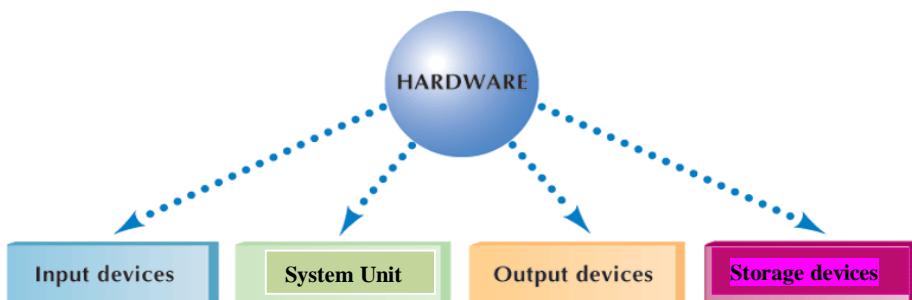
These devices that make up the hardware are classified into one of four units depending on the role they play in the computer system as follows:

- Input devices (Keyboard, Mouse, Scanner, Camera etc)
- Output devices (Printers, plotters etc)
- Storage (Hard disk, floppy disk, CD, flash drives etc)
- System unit (SU).

(Note that the above mentioned hardware components will be discussed in later units.)



**Figure 2.2** The four categories of Hardware and commonly used media.  
**Source:** (Senn, 2004).



**Figure 2.3** Four categories of Hardware.  
**Source:** (Senn, 2004).

## 3.2 SOFTWARE

Software is the general term for the set of programs and data, which direct the hardware on what to do. A program is an independent set of instructions, which work to direct the hardware to perform specified tasks. In other words, software's are set of logical instructions that put the hardware to tasks assigned to it. Softwares are subdivided into **Application** and **System software**.

- System software focuses on handling technical details.
- Application software focuses on completing specific tasks or application.

### a. System Software

These are programs expressly designed to make the computer more efficient and flexible as a human tool. System software works with end users, application programs, and computer hardware to handle many details relating to computer operations.

Not a single program but a collection or system of programs. These programs handle hundreds of technical details with little or no user intervention. Four kinds of system programs are operating systems, utilities, device drivers, and language translators.

- **Operating Systems (OS):** coordinates resources, provide an interfaces between users and the computer, and run programs.
- **Utility (service programs)** performs specific tasks related to managing computer resources.
- **Device Drivers:** This is a program developed by the manufacturer of a device or computer hardware component to make the devices work on different software platforms. The examples of such devices are network interface cards (NIC), sound cards, printers, and other computer peripherals.
- **Language Translator:** converts programming instructions written by programmers into a language that computers can understand and process.

**Operating Systems**, also known as software environments or platforms, consist of a collection of programs to handle technical details.

### Functions

Operating systems perform a variety of functions. These functions can be classified into three groups:

- **Resources manager** – coordinates and monitor all computer resources.
- **Provides user interface** – provides interface between users, application programs, and computer hardware. Character based interface uses written commands. Graphical user interface (GUI) uses graphical elements.

- **Applications control** – load and run programs. It has the ability to switch between applications stored in memory. Current program run in foreground. Others run in background.

## Categories

There are hundreds of operating systems but only three basic categories:

- **Embedded** for handheld computers and small devices
- **Network (NOS)** control and coordinate computers on a network. Network server coordinates all network communication.
- **Stand-alone (desktop)** for desktop and notebook computers; called client operating systems in networked environment.

**Proprietary** operating systems are owned and licensed by a corporation; **non proprietary** are free and called open source programs.

b. **Application software:** There are two categories:

- Basic applications (general-purpose applications, productivity applications) are widely used.
- Specialised applications (special-purpose applications) are more specialised.

## Common Features

Common features of most application programs include:

- **User interface** – most have graphical user interface (GUI) that displays icons. **Graphic User Interface (GUI)** is a link to an operating system that allows users to use icons rather than command words to start processing. An Interface is the means by which a person interacts with a computer.
- **Windows** – rectangular areas that can contain documents, programs, and messages.
- **Menus** – present commands listed on the menu bar; use pull-down (drop down) menus. Help menu provides access to online assistance.
- **Dialog box** – provides additional information or requests user input.
- **Toolbars** – contains buttons and menus; standard toolbar common to most applications

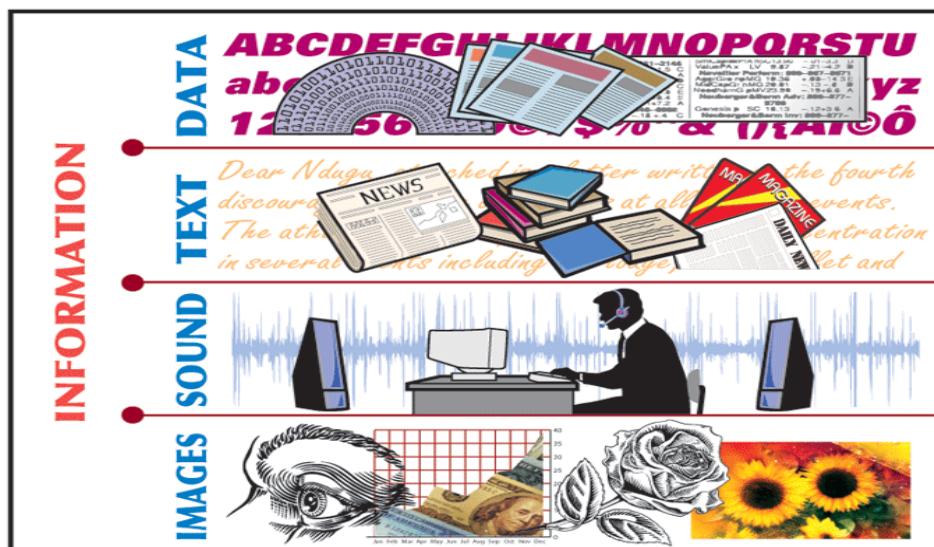
Some of the most popular applications software's are data management packages, spread sheets, graphics packages; word-processing packages, communication packages; presentation software and integrated packages. We now look at some application software's in detail.

**Software Package:** An application that focuses on a particular subject, such as word processing, and is sold to businesses and the general public. Examples are:

- **Spreadsheet:** A table of columns and rows used by people responsible for tracking revenues, expenses, profits, and losses.
- **Word-processing (WP) Program:** A program that allows the user to enter, change (edit), move, store, and print text information.
- **Desktop Publishing (DTP) Program:** A program that combines text and image-handling features with document-design capabilities.
- **Graphics Presentation Program:** A program that translates data into visual representations using charts, graphs, and map.
- **Photo Editing Program:** A program used to touch up, remove, or add features to a digital version of photographs.
- **Illustration Program:** A program in which the computer screen becomes a drawing board on which artists translate their ideas into visual form.
- **Database Management Program:** A program that makes it possible for users to manage the data in ways that increase accessibility and productivity.
  - **Database:** A collection of data and information describing items of interest to an organisation.
- **Browser:** Client computer program designed to locate and display information on the World Wide Web.
- **Information System or Management Information System (MIS):** A business information system designed to produce the information needed for successful management of a structured problem, process, department, or business.
- **Transaction Processing:** A shared business information system that uses a combination of information technology and manual procedures to process data and information and to manage transactions.
- **Computer Programming Language:** A series of commands or codes that a computer can translate into the electronic pulses that underlie all computing activities.
- **Utility Program (Utilities):** Special programs used to perform tasks that occur repeatedly using processing.
- **Custom Software:** Software written specially for a particular business.
  - **Documentation:** An instruction manual that accompanies software. Also, a technical, detailed written description of the specific facts of a program.

### 3.3 INFORMATION

- **Information:** An organised, meaningful, and useful interpretation of data.
  - Data
  - Text
  - Sound
  - Images
- **Data:** Raw facts, figures, and details.
- **Spoken Information:** Information that is conveyed by sound.



**Figure 2.4** The four components of information.

Source: (Senn, 2004).

### 3.4. IT USERS AND PROFESSIONALS

The following are the users of IT resources:

- Hands-on users: these are the people who use computers or communications systems directly, interacting with them to enter data, do processing, store and retrieve information, transmit details, or produce output.
- Indirect end users: these individuals do not directly operate a computer but benefit from IT as the recipients of reports, electronic messages, communications, or multimedia presentations.

- User managers: people who have supervisory responsibility for activities that involve or are affected by IT are known as user managers.
- Senior managers: these managers evaluate the organisation's dependence on IT and identify the problems that could arise if appropriate operating procedures are not established or followed.

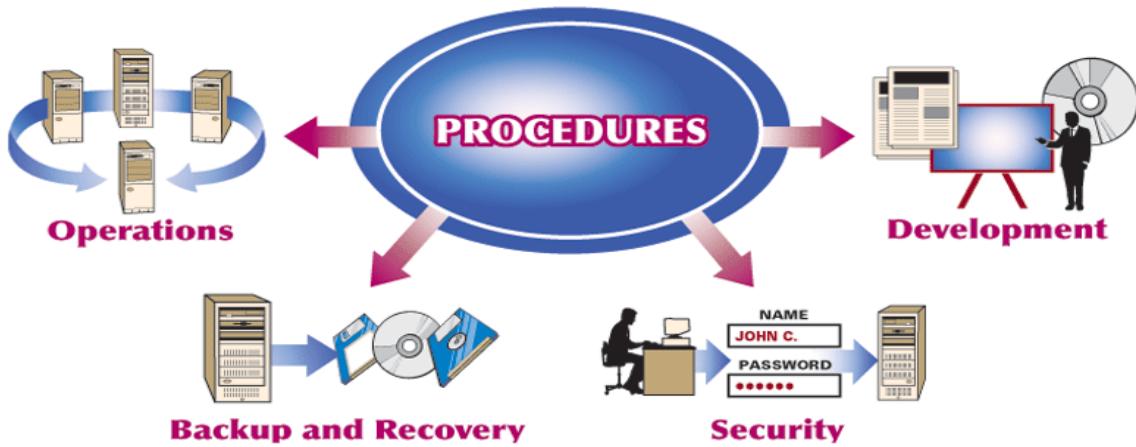
Information Technology Professional is a person who is responsible for acquiring, developing, maintaining, or operating the hardware associated with computers and communications networks. They are:

- Programmers: write codes using programming languages to solve problems.
- Systems Analysts: work with users to determine the requirements an application must meet.
- System Designers: they formulate application specification and design the features of custom software.
- Web Designers: these are specialists who focus primarily on developing applications for the internet and the World Wide Web.
- Project Managers: coordinate the development of a project and manage the team of programmer / analyst.
- Network Specialists: design, operate, and manage computer communications networks, including networks that interconnect with the internet.
- Trainers: work with end users, helping them to become comfortable with and skilled at using hardware and software.
- Computer Operators: oversee the operations of computers in data centres. They also perform support activities, such as starting applications, loading magnetic tapes, and any other job that will ensure the smooth operation of the computer facilities.

The above professions will be discussed in details in module four under careers in IT and certifications.

### **3.5 IT PROCEDURES**

A Procedure is a step-by-step process or a set of instructions for accomplishing specific results. These are: Operations, Backup and Recovery, Security, Development.



**Figure 2.5** The four types of procedures.

Source: (Senn, 2004).

- **Operations Procedure:** A procedure that describes how a computer system or application is used, how often it can be used, who is authorised to use it, and where the results of processing should go.
- **Backup Procedure:** A procedure that describes how and when to make extra copies of information or software to protect against losses.
- **Recovery Procedure:** An action taken when information or software must be restored.
- **Security Procedure:** A procedure designed to safeguard data centres, communications networks, computers, and other IT components from accidental intrusion or intentional damage.
- **Security Software:** Software that is designed to protect systems and data.
- **Development Procedure:** A procedure that explains how IT professionals should describe user needs and develop applications to meet those needs.

### 3.6 AN INTRODUCTION TO SYSTEMS

A System is a set of components that interact to accomplish a purpose.

- **Single-User System (Personal Computer):** An IT system used by only one person. A system that stands alone and is not interconnected with other companies or shared by other people.
- **Multi-user System:** A communication system in which more than one user share hardware, programs, information, people, and procedures.

- To share a computer
- To share hardware
- To share software
- To share information
- To share communications

## **4.0 CONCLUSION**

A computer is a device used in computing data into information. It can be used as a stand alone system or as a communication system comprising of five components, namely: hardware, programs, information, people, and procedures. The components interact with each other to achieve a business set goal.

## **5.0 SUMMARY**

In this unit, you learnt that while hardware and software are the essential components of computing, the real reason for using them is to produce the information that people need. The information processing and information handling functions of IT are the means by which these components deliver useful results to their users.

## **6.0 TUTOR MARKED ASSIGNMENT (TMA)**

- a. List the four categories of hardware with examples.
- b. Define an operating system and an application program.
- c. Define four OS you know
- d. Define the four kinds of Systems program you know.

## **7.0 FURTHER READING/REFERENCES**

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# **MODULE 1 INTRODUCTION TO INFORMATION COMMUNICATION TECHNOLOGY**

## **UNIT 3: THE SYSTEM UNIT AND THE CENTRAL PROCESSING UNIT**

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## **1.0 INTRODUCTION**

In Unit 2, you read about the over-view of a computer system (Hardware and Software types) and its various components. In this unit you will read about the Computer System Unit which serves as the brain and the centre of the computer activities.

## **2.0 OBJECTIVES**

At the end of this unit, you should be able to:

- Describe the components of a System Unit and the major functions of the central processing unit (CPU).
- Identify the components of the CPU.
- List and explain the four determinants of processor speed.
- Describe eight ways of increasing processing and computer speed.

## **3.0 MAIN CONTENT**

In its general interpretation, a system is a collection of inter-related parts, working together to achieve a common goal. For our purpose however, a system shall be considered as a set of inter-relating elements responding to input to produce output.

### **3.1 THE SYSTEM UNIT**

The System Unit is the hardware unit that houses a computer's processor, ports, power supply, casing, motherboard and add-in boards and memory chips (Memory will be discussed in unit 6).

### **3.2 THE PROCESSOR**

#### ***Central Processing Unit (CPU)***

Central Processing Unit (CPU) or Processor is the computer hardware that executes program instructions and performs the computer's processing actions. It is made up of the following components housed in the Computer System Unit:

- ***Integrated Circuits/Chip/Microchip:*** A collection of thousands or millions of transistors placed on a small silicon chip.
- ***Transistor:*** An electrical switch that can be in one of two states: open or closed.
- ***Integrating:*** The process of packing more transistors onto a single chip.

- **Control Unit:** The part of the CPU that oversees and controls all computer activities according to the instructions it receives.
- **Instructions:** Detailed descriptions of the actions to be carried out during input, processing, output, storage, and transmission.
- **Arithmetic/Logic Unit (ALU):** The part of the CPU that performs arithmetic and logical operations.
  - **Arithmetic Operations:** Addition, Subtraction, Multiplication, and Division.
  - **Logical Operations:** Greater Than (>), Less Than (<), Equal To (=)

### 3.2.1 FUNCTIONS OF THE CENTRAL PROCESSING UNIT (CPU)

**The Central Processing Unit (CPU):** is known to be the brain and the computational unit of the System Unit (SU). It performs the following major functions;

- Coordinating the activities of all units or devices associated with the computer system.
- Accepting and executing instructions to cause the computer system unit to perform tasks.

### 3.2.2 PROCESSOR CHIPS

Microprocessor is the smallest type of processor, with all of the processing capabilities of the control unit and ALU located on a single chip.

- *Evolution of Intel Pentium Family of Microprocessors*

**Table 3.1** Evolution of Intel Pentium Family of Microprocessors

NAME	DATE INTRODUCED	TRANSISTORS	CLOCK SPEED UPON INTRODUCTION	DATA WIDTH	MIPS
8080	1974	6,000	2MHz	8bits	0.64
8088	1979	29,000	5MHz	16bits, 8bits	0.33
80286	1982	134,000	6MHz	16bits	1
80386	1985	275,000	16MHz	32bits	5
80486	1989	1,200,000	25MHz	32bits	20
Pentium	1993	3,100,000	60MHz	32bits, 64bits bus	100

Pentium II	1997	7,500,000	233MHz	32bits, bus	64bits	NA
Pentium III	1999	9,500,000	450MHz	32bits, bus	64bits	NA
Pentium 4	2000	42,000,000	1.5GHz	32bits, bus	64bits	NA

**Source:** (Senn, 2004).

- *Intel Microprocessors*
  - Intel Celeron Processors (R, M, Duo Core, 2Duo Core)
  - Intel Pentium-M Processors
  - Intel Celeron-M Processors
  - Intel Xeon Processors
  - Intel Itanium Processors
- Evolution of Microprocessors for Macintosh Computers

**Table 3.2** Evolution of Microprocessors for Macintosh Computers

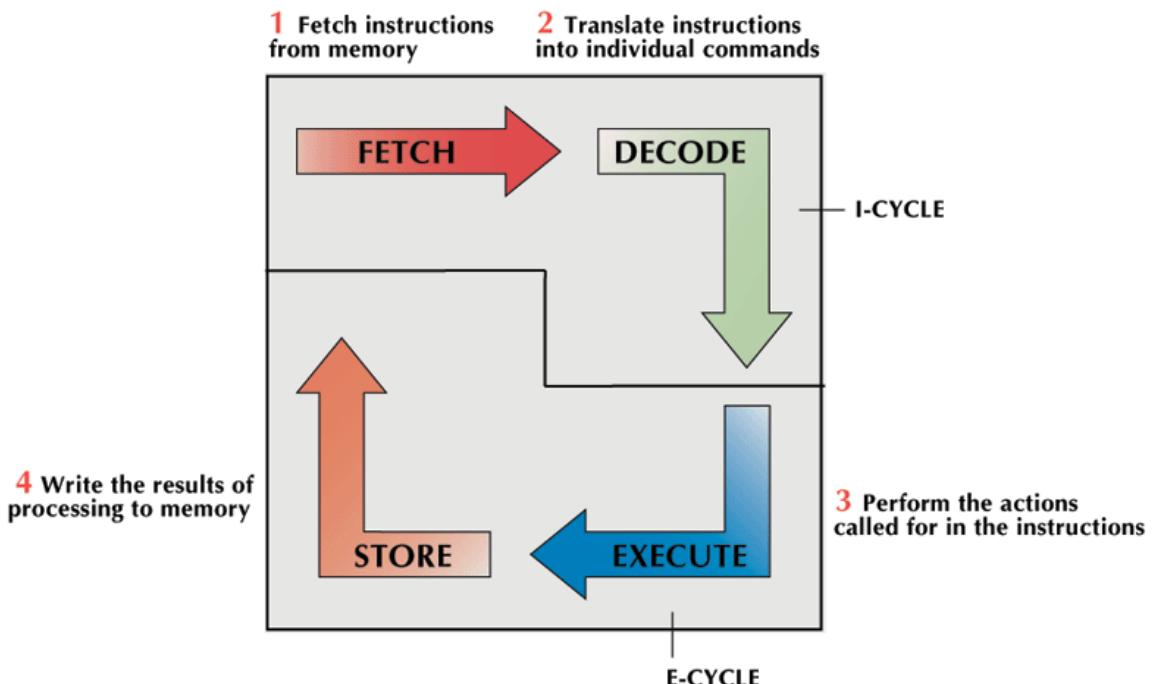
NAME	DATE INTRODUCED	CLOCK SPEED UPON INTRODUCTION	DATA WIDTH
Motorola MC 68000	1982	8MHz	16
Motorola MC 68020	1984	16.7 MHz	32
Motorola MC 68030	1987	20 MHz	32
Motorola MC 68040	1989	25 MHz	32
PowerPc 603	1994	120 MHz	64
PowerPc 620	1994	133 MHz	64
PowerPc 750	1997	233 MHz	64
PowerPc 64	1999	500 MHz	64
PowerPc 64 with Velocity engine	2002	1GHz	128
PowerPc G5	2003	2GHz	128

**Source:** (Senn, 2004).

- *Other Microprocessor Chips*
  - AMD
  - Digital Equipment Corp.
  - Mercury
  - Hewlett-Packard
  - MIPS Technologies
  - Sun Microcomputers

### 3.2.3 THE PROCESSING SEQUENCE

- **Machine Cycle:** The four processing steps performed by the control unit: fetch, decode, execute, and store.



**Figure 3.1** The Machine Circle

Source: (Senn, 2004).

- **Instruction Cycle (I-cycle):** The first two steps of the machine cycle (fetch and decode), in which instructions are obtained and translated.
- **Execution Cycle (E-cycle):** The last two steps of the machine cycle (execute and store), which produce processing results.
- **Register:** A temporary storage area in the processor that can move data and instructions more quickly than main memory can, and momentarily hold the data or instructions used in processing as well as the results that are generated. There are four types:
  - Storage Registers
  - Address Registers
  - Accumulators
  - General-Purpose Registers

### 3.2.4 PROCESSOR SPEED

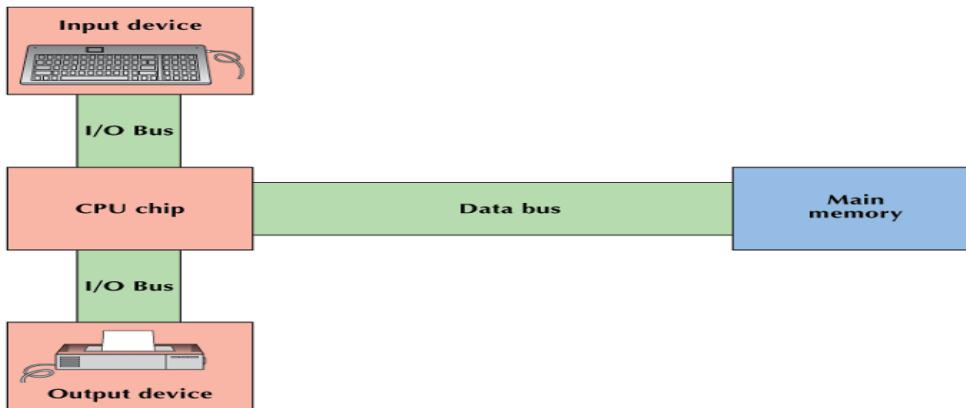
- **Millisecond:** One thousandth of a second
- **Microsecond:** One millionth of a second.
- **Nanosecond:** One billionth of a second.
- **Picoseconds:** One trillionth of a second.
- **Millions of Instructions per Second (MIPS):** The number of instructions the processor can execute per second – a measure of processor speed.
- **Megaflops:** Millions of floating point operations per second – a measure of how many detailed arithmetic calculations the computer can perform per second.

#### 3.2.4.1 DETERMINING PROCESSOR SPEED

In determining Processor Speed, four elements are considered:

- System Clock
- Bus Width
- Word Size
- Available Memory (will be discussed in Unit 4)
- **System Clock:** A circuit that generates electronic impulses at a fixed rate to synchronise processing activities.

- **Megahertz (MHz):** Millions of electric pulses per second – a measure of a computer's speed.
- **Gigahertz (GHz):** Billions of pulses per second
- **Bus Width**
  - **Input/Output (I/O) bus:** A bus (electronic circuit) that moves data into and out of the processor.
  - **Data Bus:** A bus that moves data between the central processor and memory.
- **Word Size**
  - **Word:** The number of bits a computer can process at one time.



**Figure 3.2** The two types of BUS  
**Source:** (Senn, 2004).

- **Cache Memory:** A form of high-speed memory that acts as a temporary holding/processing cell.

Other factors include:

- **Coprocessors:** A special-purpose chip mounted on a processor board; it is designed to handle common functions quickly and efficiently.
- **Accelerator Boards:** An add-in circuit board that increases a computer's processing speed.
- Reduced Instruction Set Computer (RISC)
  - **Complex Instruction Set Computing (CISC):** A computing instruction set that moves data to and from main memory so often that it limits the use of registers.

- **Microcode:** The instructions that coordinate the execution of the instructions to move data and from memory.
- **Reduced Instruction Set Computing (RISC):** A computing instruction set that takes data for the execution of an instruction only from registers.
- **Pipelining:** A computer starts processing a new instruction as soon as the previous instruction reaches its next step in the processing cycle.
- **Parallel Processing:** Processing in which a computer handles different parts of a problem by executing instructions simultaneously.
  - **Sequential Processing:** Processing in which the execution of one instruction is followed by the execution of another.
  - **Single Instruction/Multiple Data (SIMD) method:** A parallel-processing method that executes the same instruction on many data values simultaneously.
  - **Multiple Instruction/Multiple Data (MIMD) method:** A parallel-processing method that connects a number of processors that run different programs or parts of a program on different sets of data.
- **Grid and Cloud Computing:** A process that harnesses idle time on computers and then uses them to provide processing for an application that needs more speed and capability than may be available on a single computer, or even on a supercomputer.

### 3.3 PORTS

- **Port:** A connector through which input/output devices can be plugged into the computer.
- **Expansion Slot:** A slot inside a computer that allows a user to add an additional circuit board.

### 3.4 UNIVERSAL SERIAL BUS (USB)

- **Universal Serial Bus (USB):** A general purpose port that can connect up to 128 devices, and also hot swappable, meaning that devices can be plugged in or unplugged without having to shut down or reboot the system.

### 3.5 ADD-IN BOARDS

- **Add-in Boards:** A board that can be added to a computer to customise its features and capabilities.

**Table 3.3** Types of Add-In Boards for Microcomputers

BOARD FUNCTION	DESCRIPTION
<i>Accelerator Board</i>	Increases speed of Computer
<i>Controller Board</i>	Allows different printers and storage devices to be attached to computer
<i>Coprocessor Board</i>	Include special chips that speed up the system's overall processing capabilities
<i>Display Adaptor Board</i>	Permit the use of computer displays by providing interaction with the computer board
<i>Fax Modem Board</i>	Enables the computer to send and receive facsimile images, data and information
<i>Memory expansion Board</i>	Extends the computer's memory capacity by adding additional sockets for memory chips
<i>Network interface Board</i>	Enable the computer to be connected to a Local Area Network (LAN)
<i>SCSI adaptor</i>	Provides an interconnection for a variety of peripheral devices, including scanners, CD ROM Units, and DVD players and recorders. Also interconnects disk drives and scanners using a SCSI interface rather than using the more common IDE or USB interfaces
<i>Sound Board</i>	Contains chips and circuitry that translates data and information into sound output including music, permits connection of speakers to computers.
<i>TV-tuner Board</i>	Enable computers to receive television signals
<i>Video Capture Board</i>	Enable the computer to capture full motion colour video and accompanying sound for processing and storage.
<i>Voice Board</i>	Provide the capability to translate stored data and information into spoken output.

**Source:** (Senn, 2004).

### 3.6 PLUG AND PLAY

- **Plug and Play:** The ability to install devices into a computer when the computer itself makes any necessary internal adjustments.

## **4.0 CONCLUSION**

The System Unit is more or less synonymous with the computer because it represents the processing capability, which is unique to Computers. Generally speaking, a computer system is recognised by the type and nature of its system unit (SU).

## **5.0 SUMMARY**

In this unit, we learnt that the system unit housed some important components which play a great role in the purchase of a computer system.

- The processor - controls operations and performs arithmetic and logical operations.
- The memory - serves the purpose of storage (holding data and instruction) and also used to boot the computer system.
- Expansion Slots-allows external devices to connect and expand a computer capabilities.

## **6.0 TUTOR MARKED ASSIGNMENT (TMA)**

- a. List the four elements to be considered when determining processor speed?
- b. What are the functions of the Central Processing Unit (CPU)?
- c. What is the difference between the System Unit and the Central Processing Unit?
- d. Define Grid Computing?

## **7.0 FURTHER READING/REFERENCES**

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# **MODULE 1 INTRODUCTION TO INFORMATION COMMUNICATION TECHNOLOGY**

## **UNIT 4: INPUT DEVICES**

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## **1.0 INTRODUCTION**

In Unit 3, you learnt about the system unit is the computer's brain. In this unit you will learn about the input devices which are the eyes and ears of the computer. The computer would be useless if you could not interact with it, because the machine will not receive instructions for onward processing.

## **2.0 OBJECTIVES**

At the end of this unit, you should be able to:

- Identify the six special key groups on a standard computer keyboard
- Name the functional keys on a keyboard
- Describe the purpose of a mouse and the role it plays in computing
- Identify other input devices apart from the mouse and keyboard

## **3.0 MAIN CONTENT**

An Input is the data or information entered into a computer or the process of entering data or information into the computer for processing, storage and retrieval, or transmission.

### **3.1 INTERACTION WITH COMPUTERS USING INPUT DEVICES**

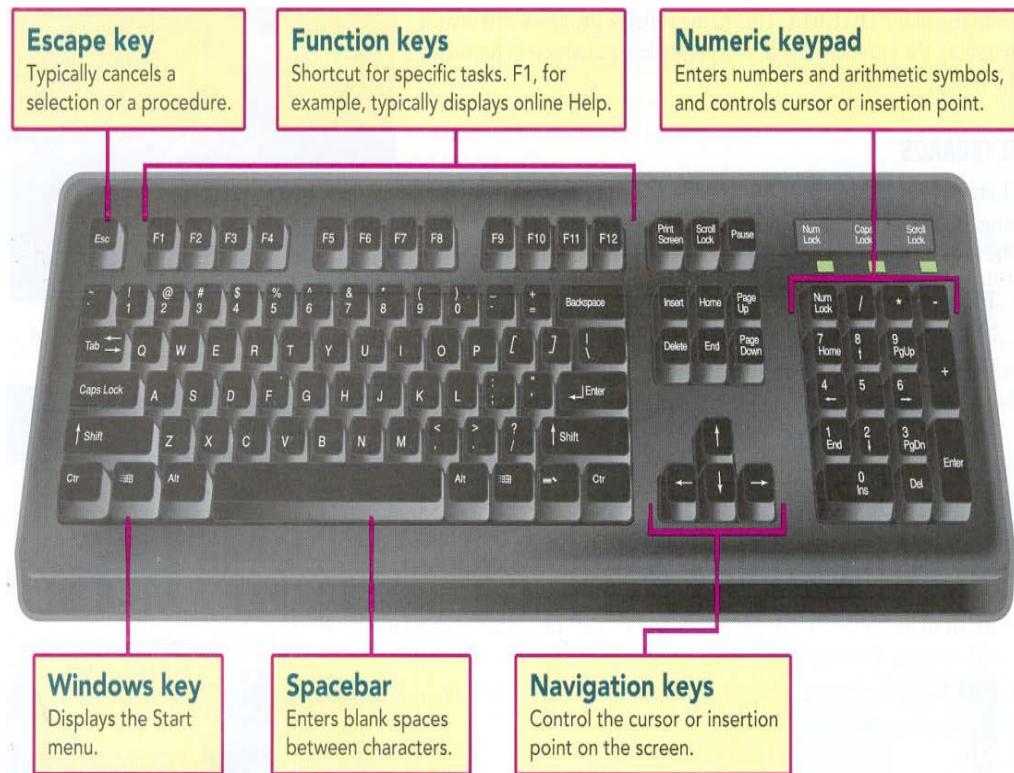
Input Device is a device by which input is fed into a computer's central processor.

#### **3.1.1 KEYBOARD**

This is the most common computer input device. All keyboards are used to enter data and text information into a computer, but computer keyboards differ in four ways:

- **Characters:** both alphabetic and symbolic keyboards are available depending on the country to be put into use.
- **Key Arrangement:** the arrangement of the keyboard's keys varies. The QWERTY keyboard is the most common in English speaking countries. This keyboard uses the conventional typewriter layout, in which the top row of alphabetic keys begins with the letters Q, W, E, R, T, and Y (reading from left to right).
- **Special-Purpose Keys:** certain keys are designed to assist the user to enter data or information.
  - **Numeric Keys:** these are found to the right of the alphabetic keys section on a keyboard, used to key in numeric characters.

- **Function Key:** A key designed to assist the computer's user to control processing, e.g. the F1 key used in most software to invoke the help file that guides user through the use of the application.
- **Detachability:** most desktop computers have keyboards that can be detached from the rest of the computer system. The most popular of this kind are the wireless keyboards that transmit data to the computer electronically.



**Figure 4.1** An example of a computer Keyboard  
**Source:** (O'Leary, 2004).

### 3.1.2 TERMINAL

A terminal is a combination of keyboard and video screen that accepts input and displays it on the screen.

- Dumb Terminals
- Automated Teller Machines (ATMs)
- Point-of-sale (POS) Terminals

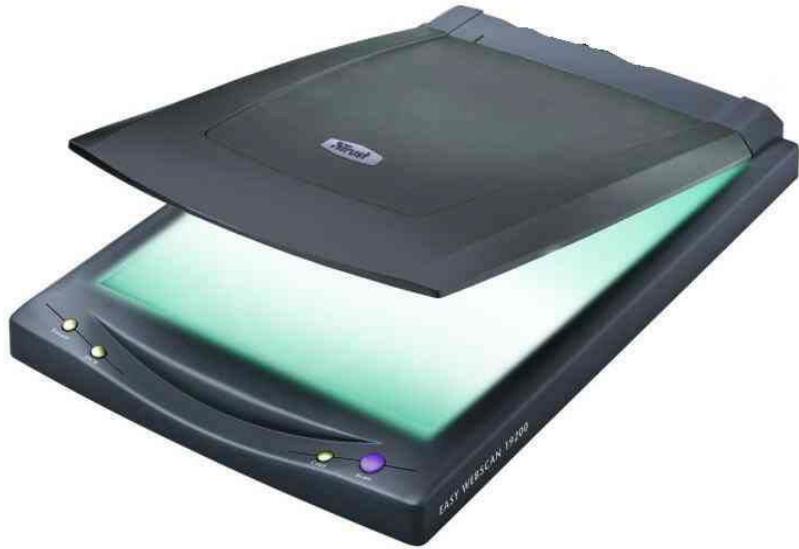


**Figure 4.2** A Dumb Terminal.

**Source:** (Google Images, 2009).

### 3.1.3 SCANNERS

- **Source Data Automation:** A method of data entry in which details enter computers directly from their written or printed forms without the intermediate step of keying.  
**Scanning:** The process of transforming written or printed data or information into a digital form that is entered directly into the computer.



**Figure 4.3** An example of a Flat-Bed Scanner.

**Source:** (Google Images, 2009).

### 3.1.4 OPTICAL CHARACTER RECOGNITION (OCR)

OCR is a technology by which devices read information on paper and convert it into computer-processible form. The following are different forms of OCR:-

- **Optical Mark Reader:** An OCR device that recognises the location of dark marks on a special form as the form is scanned.
- **Optical Character Reader:** An OCR device that recognizes printed information rather than just dark marks.
- **Magnetic Ink Character Recognition:** A form of optical character reading in which pre-printed information written in magnetic ink is read optically or sensed magnetically.
- **Optical Code Reader:** An OCR device used to read bar codes.
- **Universal Produce Code (UPC):** A bar code that identifies a product by a series of vertical lines of varying widths representing a unique product number.
- **Image Scanning:** Examining an image and translating lines, dots, and marks into digital form.
- **Flatbed Scanner:** A large image scanner that works like an office photocopier.
- **Resolution:** The clarity of sharpness of an image.

### 3.1.5 DIGITISERS

Digitiser is an input device that translates measured distances into digital values that the computer can process.

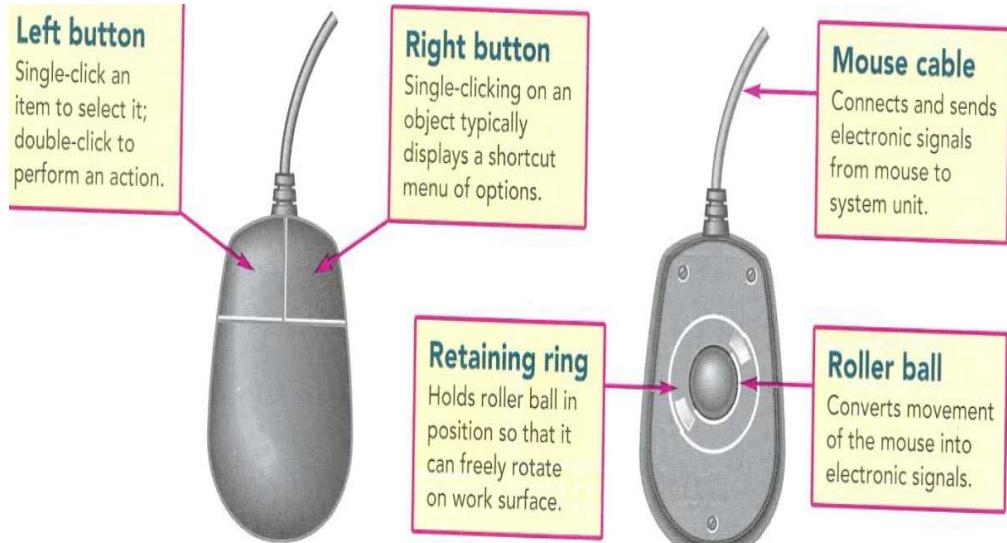


**Figure 4.4**   Lenovo Digitiser.  
**Source:** (Google Images, 2009).

### 3.1.6 POINTING DEVICES

They accept pointing gestures and convert them into machine readable input

- **Mouse:** An input device with a small ball underneath that rotates, causing a corresponding movement of a pointer on a display screen.



**Figure 4.5** A Computer Mice

**Source:** (O’Leary, 2004).

- **Touchpad:** An alternative to the mouse that senses the user’s finger movement and downward pressure, moving the cursor in the corresponding direction on the display screen.



**Figure 4.6** An example of a computer touchpad.

**Source:** (Google Images, 2009).

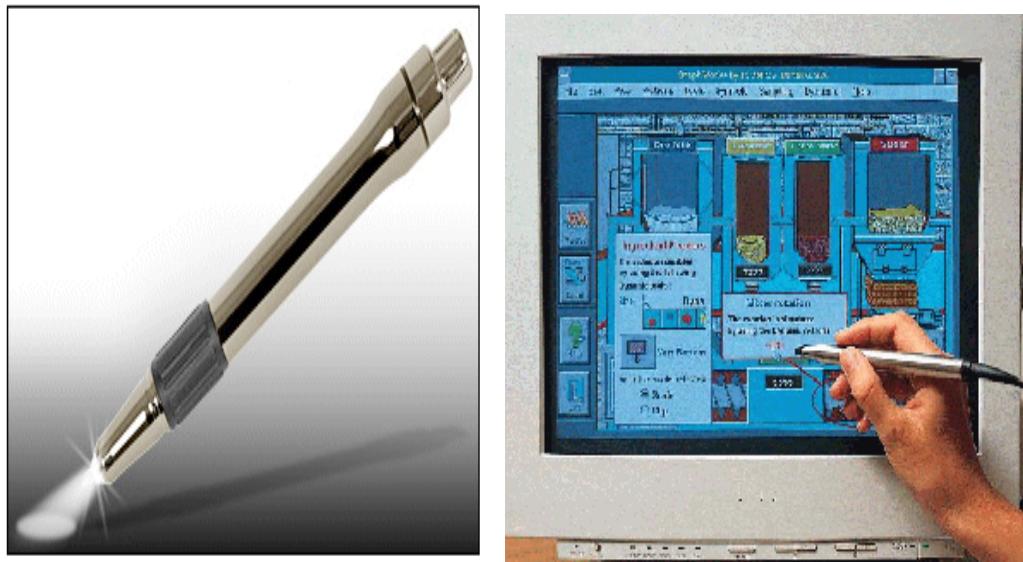
- **Pointing Stick:** A device that positions the cursor on the computer screen.



**Figure 4.7** A Laptop Pointing Stick.

**Source:** (Google Images, 2009).

- **Light Pen:** An input device that uses a light-sensitive cell to draw images and to select options from a menu of choices displayed on a computer screen.



**Figure 4.8** A Computer light pen.

**Source:** (Google Images, 2009).

- **Joystick:** An input device used to control the actions in computer games or simulations. The joystick extends vertically from a control box.



**Figure 4.9** A black hawk Joystick.

**Source:** (Google Images, 2009).

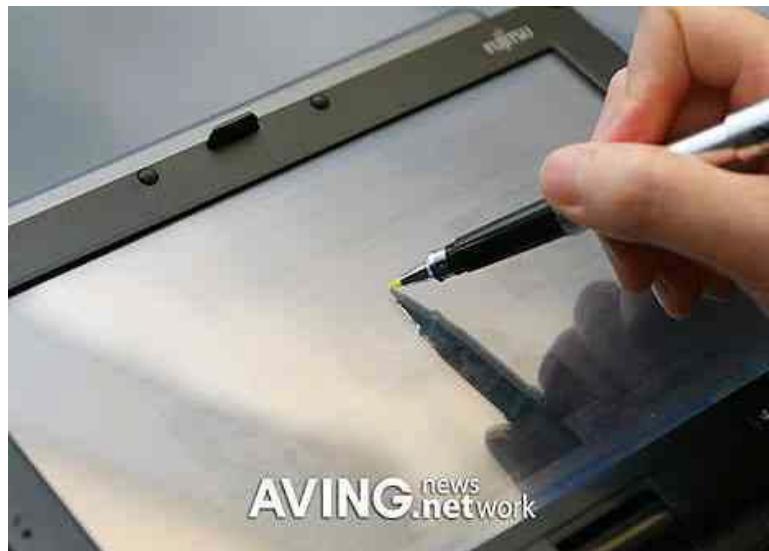
- **Trackball:** An input device that consists of a ball mounted on rollers. As the user rotates the ball in any direction, the computer senses the movement and moves the cursor in the corresponding direction.



**Figure 4.10** A Trackball.

**Source:** (Google Images, 2009).

- **Stylus:** A pen like instrument that is used to trace images on paper for translation into electronic form.



**Figure 4.11** A Stylus.

**Source:** (Google Images, 2009).

### 3.1.7 DIGITISING TABLE

This is a device by which an image on paper can be translated into electronic form.



**Figure 4.12** A Digitising Table.

**Source:** (Google Images, 2009).

### **3.1.8 DIGITAL CAMERA**

A digital camera captures a photographic image as a collection of tightly grouped dots that can be stored on disk or in memory.



**Figure 4.13** Olympus 7.1 Mega Pix Digital Camera.

**Source:** (Google Images, 2009).

### **3.1.9 DIGITAL VIDEO CAMCORDERS**

It is used to capture the sound and sight of events on videotape, information is recorded as individual bytes of information. Digital recording thus increases the quality of both audio and video.

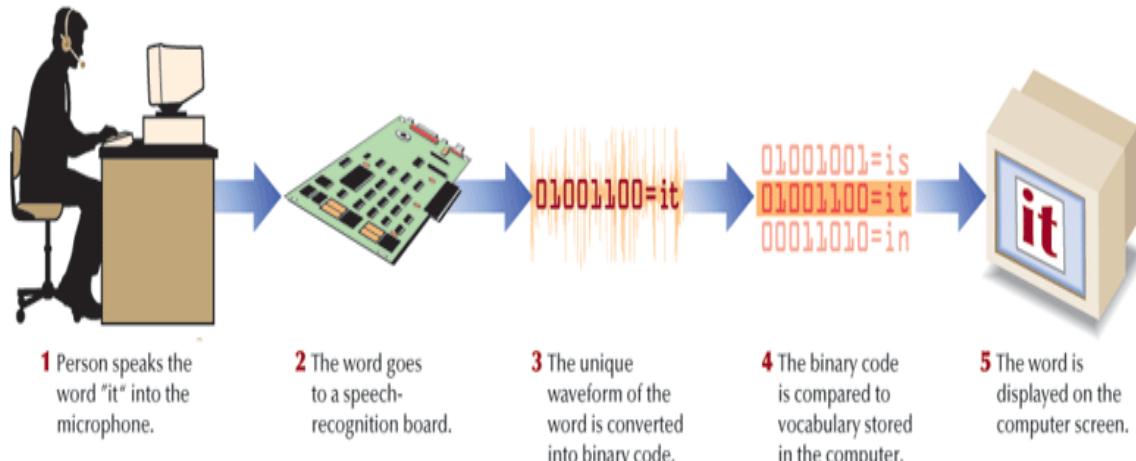


**Figure 4.14** Digital Video Camcorders .

**Source:** (Google Images, 2009).

### 3.1.10 VOICE AND SOUND INPUT DEVICES

This is an input device that can be attached to a computer to capture the spoken word in digital form. Used as an assistive device for the disabled.



**Figure 4.15** Capturing and Digitising Sounds

**Source:** (Senn, 2004).

### 3.1.11 BAR CODE

A bar code is a computer-readable code consisting of bars or lines of varying widths or lengths.

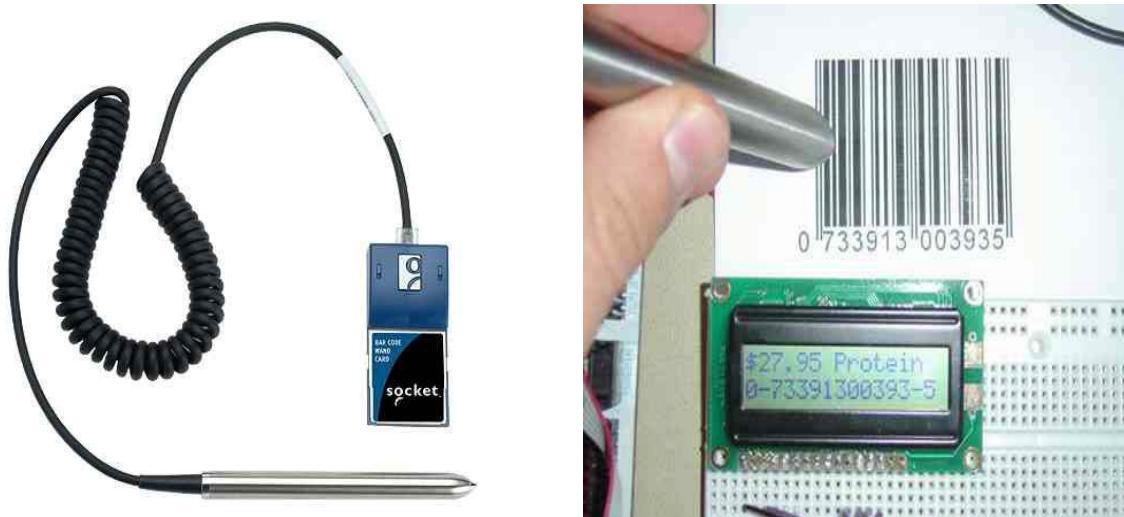


**Figure 4.16** Bar code and Bar code Scanner.

**Source:** (Google Images, 2009).

### 3.1.12 WAND

A wand is an input device used to read a bar code and input this information directly into a PC.



**Figure 4.17** Wand Devices.

**Source:** (Google Images, 2009).

### 3.1.13 MULTIMEDIA

This is a system that contains standard PC features but also has the capability to handle audio, video, animation, and graphics.



**Figure 4.18** A Multimedia Device.

**Source:** (Google Images, 2009).

### **3.2 THE PURPOSE OF THE MOUSE**

The mouse is used to point at the screen (monitor), the process is called pointing. Everything you do with a mouse is accomplished by combining pointing with other techniques, such as:

- clicking,
- double clicking
- dragging
- right clicking
- scrolling

### **4.0 CONCLUSION**

Input Devices are devices which enable data, information and instructions to be transmitted into the Computer system. They act as a gateway for receiving input usually in user understandable form from the outside world and convert it to machine understandable form which the Computer can understand.

### **5.0 SUMMARY**

In summary you have learnt about:

- The special keys on the keyboard
- Purpose of the mouse
- Other input devices, such as: scanning devices, image capturing devices, digitizing devices, audio input devices and assistive input devices.

### **6.0 TUTOR MARKED ASSIGNMENT (TMA)**

- a. List three pointing devices
- b. Which category of device is the Optical Character Recognition (OCR)?
- c. What are the basic functions of a mouse?
- d. What category of device is the joystick and what is it used for?

### **7.0 FURTHER READING/REFERENCES**

- Cohn, Z., Lefolii, S. (1998). *An Illustrated Dictionary of Information Technology*. Lewes, UK: Godfrey Cave Associates Ltd.
- Google Images. (n.d). Retrieved August 2009, from <http://www.google.com/images>.
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# **MODULE 1 INTRODUCTION TO INFORMATION COMMUNICATION TECHNOLOGY**

## **UNIT 5: OUTPUT DEVICES**

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## **1.0 INTRODUCTION**

In Unit 4, you read about the input devices, its uses, types and technologies. This unit will introduce you to the output devices and their uses in business.

## **2.0 OBJECTIVES**

At the end of this unit, you should be able to:

- Define an Output device.
- Identify the types of output devices and their properties.
- State their various functions and uses in business.

## **3.0 MAIN CONTENT**

An output is the results of inputting and processing data and information returned by the computer, either directly to the person using the system or to secondary storage.

### **3.1 OUTPUT AND INFORMATION DISTRIBUTION DEVICES**

Output devices are devices through which computer transmits information to the outside world. Output devices work to transform information processed in the computer, which is in machine form, to human understandable forms e.g. text, pictures etc. With the aid of output devices information can be viewed, heard, and printed.

### **3.2 TYPES OF OUTPUT DEVICES**

Example of output devices are:

- Visual Displays (Monitors)
- Data Projector
- Printers
- Audio Response Unit
- Television
- Plotter
- Film Recorder

### 3.2.1 VISUAL DISPLAYS (MONITORS)

A computer's visual display. It is a computer hardware that resembles a television. It is capable of displaying text and graphics. A monitor is one type of computer display, defined by its CRT screen. Other types of displays include flat, laptop computer screens that often use liquid-crystal displays (LCDs). Other thin, flat-screen monitors that do not employ CRTs are currently being developed. Visual displays can be distinguished using the following features;

- **Size**
  - Monitors come in various sizes, ranging from the small screen built into palmtops and laptops to the extra-large monitors used for special purpose by engineers and illustrators who need to examine fine details closely
- **Colour**
  - **RGB Display:** A video screen display with the ability to create 256 colours and several thousand variations on these colours by blending shades of red, green, and blue.
  - **Monochrome Display:** A video screen display that shows information using a single foreground colour on a contrasting background colour (e.g. black on white).
- **Resolution**
  - **Pixels:** The dots used to create an image; the higher the number of dots, the better the resolution of the image.
  - **Bit Mapping:** A feature of some monitors that allows each dot on the monitor to be addressed or controlled individually. Graphics created through bit mapping are sharp and crisp.
  - **Character Addressing:** The precursor to bit mapping that allowed only full characters to be sent to and displayed on a VDT.
- **Graphics Standard**
  - **Graphic Adapter Card:** An interface board between a computer and monitor that is used to determine the monitor's resolution and use of colour.
  - **Multisync/Multiscan Monitors:** Monitors designed to work with a variety of graphics standards.



**Figure 5.1** A CRT and LCD Flat Screen Monitor.

**Source:** (Google Images, 2009).

### 3.2.2 DATA PROJECTOR

**Data Projector:** Equipment connected to the computer's display output port by a data cable that is used to show the contents of a computer video display on a movie screen.

- **Liquid Crystal Display (LCD) projector:** An LCD projector works on the principle of blocking light rather than emitting it. The brightness of the light (measured in lumens) determines how easily the images can be viewed in a room with ordinary lighting (as opposed to a darkened room).
- **Digital Light Processing (DLP) Projector:** This projector builds images on screen by digitally controlling the reflected angle of incident light, converging it with a prism, and passing the image through a lens on to the screen. It has clear, sharp images and high contrast text as well as rich colour in projected images.

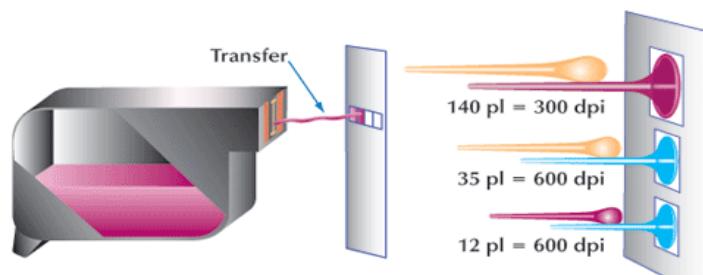


**Figure 5.2** Projectors.

**Source:** (Google Images, 2009).

### 3.2.3 PRINTERS

- **Hard Copy:** The paper output from a printer.
- **Nonimpact Printing:** A printing process in which no physical contact occurs between the paper and the print device; the characters are produced on the paper through a heat, chemical, or spraying process.
  - **Laser Printer:** A nonimpact printer that uses laser beams to print an entire page at once.
  - **Ink-jet Printer:** A printer that sprays tiny steams of ink from holes in the print mechanism onto the paper in a dot pattern that represents the character or image to be printed.
  - **Thermal Printer:** A printer that heats a wax-based coloured ink contained in the printer ribbon and transfers it to a special paper.
- **Impact Printing:** A printing process in which the paper and the character being printed come into contact with each other.
  - **Line Printer:** Prints a full line at one time on continuous-form paper. Because of their high speed, which ranges up to several thousand lines per minute, line printers have been used in computer centres that routinely print large volumes of documents or very long reports.
  - **Dot Matrix Printing:** Characters and images are formed by wire rods pushed against a ribbon and paper to create characters that are actually a collection of small dots.
  - **Characters Printer:** A printer that prints one character at a time. Its speed is rated according to the number of characters printed per second.



**How ink-jet printing works** – The print head in an ink-jet printer contains four ink cartridges – one each for magenta, cyan, yellow and black. When output is to be formed, certain cartridges and nozzles are activated. Nozzles fire drops to transfer ink from print head to paper. This printer measures the transfer rate in picoliters (pl), a microscopic drop.

**Figure 5.3.1** Ink-jet Printing Process  
**Source:** (Senn, 2004).



**Figure 5.3.2** A LaserJet Printer.

**Source:** (Google Images, 2009).

### 3.2.4 AUDIO RESPONSE UNIT

***Audio Response Unit/Speech Synthesizer:*** An output device that transforms data or information into sound.

- **Speakers:** - Speakers are connected to computers through Sound cards, so as to listen to voice outputs.



**Figure 5.4** A set of mini Computer speakers.

**Source:** (Google Images, 2009).

### 3.2.5 TELEVISION

Television, system of sending and receiving pictures and sound by means of electronic signals transmitted through wires and optical fibres or by electromagnetic radiation. Television has a variety of applications in society, business, and science. The most common use of television is as a source of information and entertainment for viewers in their homes. Security personnel also use televisions to monitor buildings, manufacturing plants, and numerous public facilities. Public utility employees use television to monitor the condition of an underground sewer line, using a camera attached to a robot arm or remote-control vehicle. Doctors can probe the interior of a human body with a microscopic television camera without having to conduct major surgery on the patient



**Figure 5.5** CRT and LCD TV Sets.

**Source:** (Google Images, 2009).

### 3.2.6 PLOTTER

**Plotter:** An output device that draws image information (such as charts, graphs, and blueprints) stroke by stroke. Computer device for drawing graphs: a computer output device that draws graphs and other pictorial images on paper, sometimes using attached pens. Large plotters are used in computer-aided design applications to produce more rapidly the engineering drawings and architectural plans once prepared by skilled drafts people



**Figure 5.6** A Plotter.

**Source:** (Google Images, 2009).

### 3.2.7 FILM RECORDER

**Film Recorder:** A Film Recorder is a graphical output device for transforming digital images on a computer screen into a photographic film.



**Figure 5.7** A Film Recorder.

**Source:** (Google Images, 2009).

## **4.0 CONCLUSION**

Output Device is a device that makes the results of processing available outside of the computer to be used in business decision making. It brings out the information after the data has been processed.

## **5.0 SUMMARY**

In summary you have learnt that the input and output devices:

- Play a great role in enhancing business decision taking, through outputting of information.
- Are of different types and technology.
- Transform data in machine form, to human understandable forms e.g. text and pictures.

## **6.0 TUTOR MARKED ASSIGNMENT (TMA)**

- a. Briefly define an output device.
- b. Discuss the use of a data project and list its types.
- c. What does RGB stands for in a monitor?
- d. Define the following: film recorder, speaker and laser printer.

## **7.0 FURTHER READING/REFERENCES**

- Cohn, Z., Lefolii, S. (1998). *An Illustrated Dictionary of Information Technology*. Lewes, UK: Godfrey Cave Associates Ltd.
- Google Images. (n.d.). Retrieved August 2009, from <http://www.google.com/images>.
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# **MODULE 1 INTRODUCTION TO INFORMATION COMMUNICATION TECHNOLOGY**

## **UNIT 6: STORAGE DEVICES AND MEMORY**

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## **1.0 INTRODUCTION**

In Unit 5, you read about the output unit or devices that help the computer to deliver its work. In this unit you will learn about a new concept that enables the inputted data and outputted information to be archived.

## **2.0 OBJECTIVES**

At the end of this unit, you are expected to:

- Understand what storage is, types and technology
- Know the types of memory and their sizes.
- Identify the differences between storage and memory.
- Distinguish between primary storage (also called memory) and secondary storage (also called storage), and between RAM and ROM.

## **3.0 MAIN CONTENT**

Storage in computer is the process of retaining information for future use. A computer can function with only processing, input and output devices. To be really useful however, a computer also needs a place to keep program files and related data when they are not in use.

### **3.1 STORAGE**

The purpose of storage is to hold data.

- ***Secondary Storage/Auxiliary Storage:*** A storage medium that is external to the computer, but that can be read by the computer; a way of storing data and information outside of the computer itself.

#### **3.1.1 CHARACTERISTICS OF STORAGE**

- Reliable: storage retains its data when the power is turned off.
- Economical: storage is cheaper than memory.
- Compact: large volumes of data can be stored at high density.
- Convenient: storage is easy to use and can transfer data rapidly, though not as fast as memory.

### 3.2 TYPES OF STORAGE

- By Read/Write Capability
  - **Read/Write:** A computer application can use storage for both writing and reading data.
- By Access Capability
  - **Sequential Storage:** Elements of data are read one right after the other.
  - **Sequential Access:** The contents are accessed in sequence.
  - **Random Access Storage:** The process of retrieving a particular record of information from any track directly.
  - **Random Access Device:** The self-contained unit that holds and processes the disk.

### 3.3 STORAGE TECHNOLOGIES

- **Magnetic Storage**
  - **Magnetic Tape:** A magnetic storage medium in which data are stored on large reels of tape.
  - **Read/Write Head:** A device that records data by magnetically aligning metallic particles on the medium. The write head records data and the read head retrieves them.
  - **Disk Cartridge:** The cartridge, a hard disk sealed in a protective package, is inserted into the disk drive for reading and writing data.
- Extended Disk Storage Alternatives
  - **Redundant Arrays of Independent Disks (RAID):** A set of small disk drives that work together as a single unit.
    - **Striping:** A method of combining multiple physical drives into one logical storage unit.
    - **Fault Tolerance:** The capability for a computer application to continue processing even if a disk drive fails.
    - **Disk Mirroring:** The most frequently used form of RAID; it uses pairs of drives within the array and duplicates the entire contents of a disk on a second disk.

- **Optical Storage**

- **Optical Storage Device:** A device that uses a beam of light produced by a laser to read and write data and information.

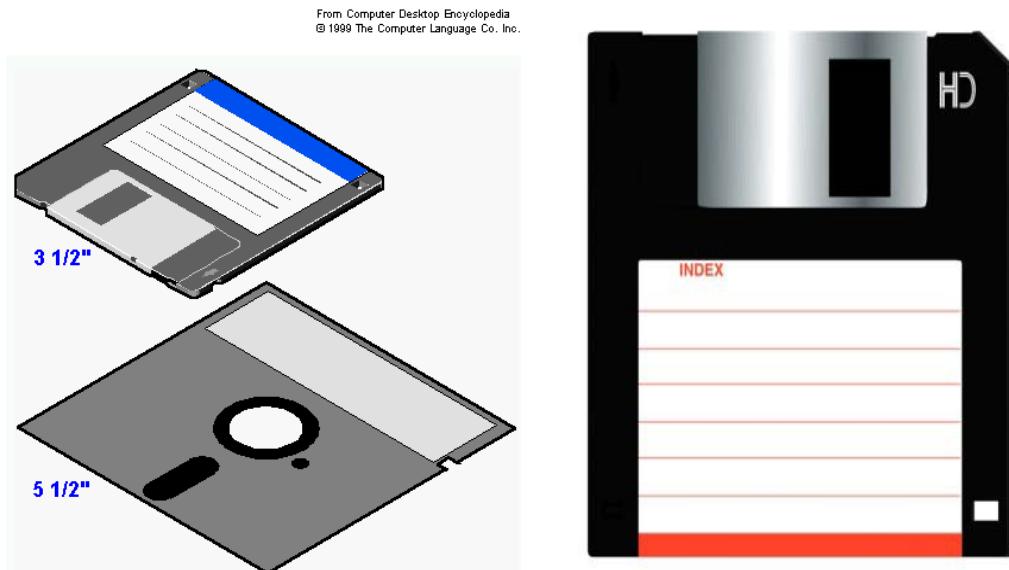


**Figure 6.1** A WORM Optical disc.

Source: (Google Images, 2009).

- **Flexible Disks**

- **Flexible Disk/Diskette/Floppy Disk:** A type of magnetic disk made of flexible plastic.



**Figure 6.2** A 3 1/2 and 5 1/2 diameter floppy discs.

Source: (Google Images, 2009).

- **Hard Disk**

A type of secondary storage that uses nonflexible, non removable magnetic disks mounted inside the computer to store data or information.

- **Hard Drive/Disk Drive:** The device that holds and processes the disk.
- **Record:** A grouping of data items that consists of a set of data or information that describes an entity's specific occurrence.

### Disk Storage Areas

- **Track:** The area in which data and information are stored on magnetic tape or disk.
- **Sector:** A subdivision of a track on a magnetic disk; used to improve access to data or information.
- **Cylinder:** A storage concept that refers to the same track location on each of the platters.
- **Head Crash:** The situation that occurs when the read/write heads that normally float close to a magnetic disk's surface actually touch the surface.
- **Disk Pack:** A stack of disks, enclosed in a protective plastic cover that can be lifted onto or off a disk drive.
- **Random Access Storage/Direct Access Storage:** The process of retrieving a particular record of information from any track directly.



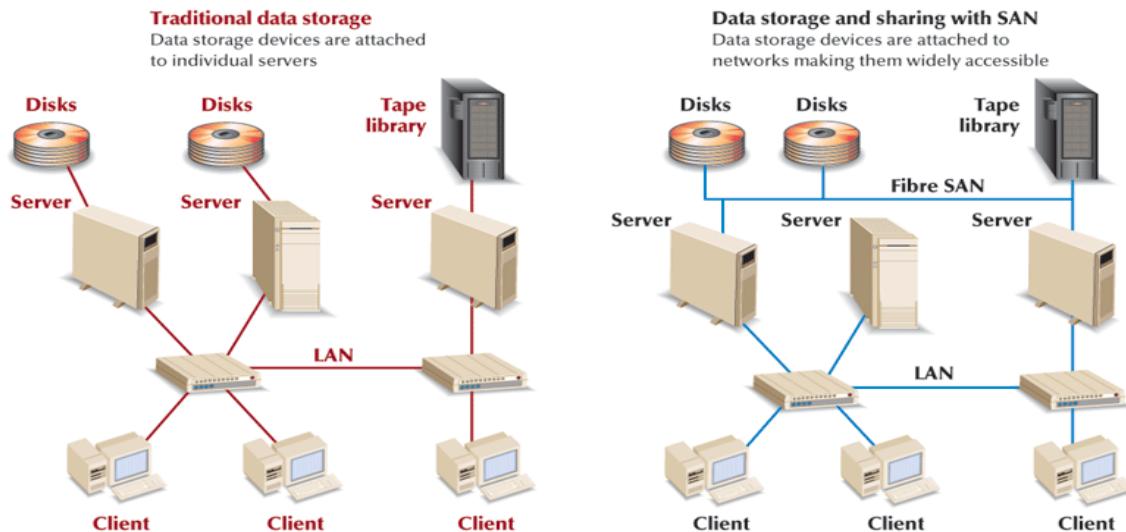
**Figure 6.3** A Seagate Hard disc  
Source: (Google Images, 2009).

- **Disk Controller Interfaces**

- **Hard Disk Controller:** A hardware interface that may be built into the hard drive itself, in the form of an expansion board, or a connection on the system board.
- **Integrated Drive Electronics (IDE):** A standard electronic interface used between the bus or data path on a computer system board and the computer's disk storage devices.
- **Small Computer System Interface (SCSI):** A device created to speed the transfer of data between hard disks and other peripherals.
- **Universal Service Bus (USB):** A recent addition to PCs that can connect up to 128 devices, ranging from computer disk storage to a variety of multimedia devices.
- **Fire Wire:** One of the fastest peripheral interface standards ever developed.
- **Disk Cache:** Disk caching allows the system to store information that is frequently read from a disk in RAM.

## STORAGE AREA NETWORK

SAN is a high-speed network or system that allows different kinds of storage devices, such as tape drives and disk arrays, to be shared by all users through network servers.



**Figure 6.4** Storage Area Network  
**Source:** (Senn, 2004).

### 3.4 OTHER MAGNETIC DISK STORAGE SYSTEMS

- **USB Drives:** Consisting of flash memory and a USB connection, it can read and write data when connected to the computer's USB port.
- **Zip Drive:** A removable storage device that uses hard-shelled removable Zip disks, which can store up to 750 MB of information.
- **SuperDisk:** A storage alternative developed by Imation (originally part of 3M Corp.) that has a capability of 120 MB.

### MAGNETIC TAPE

- Tape for Large Systems and SANs.
- Tape for PCs.
  - **Digital Audiotape (DAT):** A 4-mm tape that uses a different recording system (called helical scanning), similar to that found on videotape recorders.
  - **Advanced Intelligent Tape (AIT):** Latest tape alternative that was introduced in the late 1990s for use with PCs functioning as servers and with midrange systems.



**Figure 6.5** A cassette magnetic tape.

**Source:** (Google Images, 2009).

### OPTICAL STORAGE

- **CD-ROM Disk:** Short for “compact disk-read only memory,” an optical storage medium that permits storage of large amounts of information. CD-ROM disks can only be written to and cannot be erased.

- Standard CD
- Mini-CD
- **Business Card CD/Personal Compact CD (PCD):** A variant on the mini-CD, it holds 20 to 60 MB, depending on the physical size of the CD.
- **CD-ROMs have two formats**
  - **CD-R disks:** A disk that allows users to write information to a disk only once but to read it many times (sometimes known as worm optical storage).
  - **CD-RW disks:** A disk that combines the eraseability and editing options of magnetic storage devices with the permanence, capacity, and reliability of optical storage.
  - **CD Recorder:** Also known as a CD writer or CD burner, this equipment is attached to a PC to create CDs.
- **Digital Video Disk (DVD):** The newest generation of optical storage. It appears to operate the same way and has the same dimensions as a CD-ROM but has a much larger capacity.
  - **DVD-RAM:** A rewritable DVD form that can be used in PCs.

### 3.5 MEMORY

- **Primary Storage/Primary Memory/Main Memory/Internal Memory:** Storage within the computer itself. Primary memory holds data only temporarily, as the computer executes instructions.



**Figure 6.6** Primary Memory Allocation  
**Source:** (Senn, 2004).

## **PRIMARY (MAIN) MEMORY**

Primary or main memory is always connected to the processor. In a computer it is usually in the same box as the processor. When you type instructions on the keyboard of your computer, they are put into the main memory. There are two parts of the main memory:

- Read Only Memory (ROM) and
- Random Access Memory (RAM).

## **MEMORY (RAM AND ROM)**

- ***Random-access Memory (RAM):*** Memory that permits data or information to be written into or read from memory only as long as the computer is turned on. Other forms of RAM include SRAM (Static RAM), DRAM (Dynamic RAM), SDRAM (Synchronous Dynamic RAM) & DDR2. It is the memory used to store instructions and data needed by the Central Processing unit (CPU).
- ***Read-only Memory (ROM):*** A type of storage that offers random access to memory and can hold data and information after the electric current to the computer has been turned off.

## **MEMORY SIZE**

- ***Byte:*** A storage location in memory; the amount of memory required to store one digit, letter, or character.
- ***Kilobyte/K-byte/KB/K:*** One thousand bytes.
- ***Megabyte/M-byte/MB/Meg:*** One million bytes.
- ***Gigabyte/G-byte/GB/Gig:*** One billion bytes.
- ***Terabyte/T-byte/TB:*** One trillion bytes.
- ***Address:*** An identifiable location in memory where data are kept.

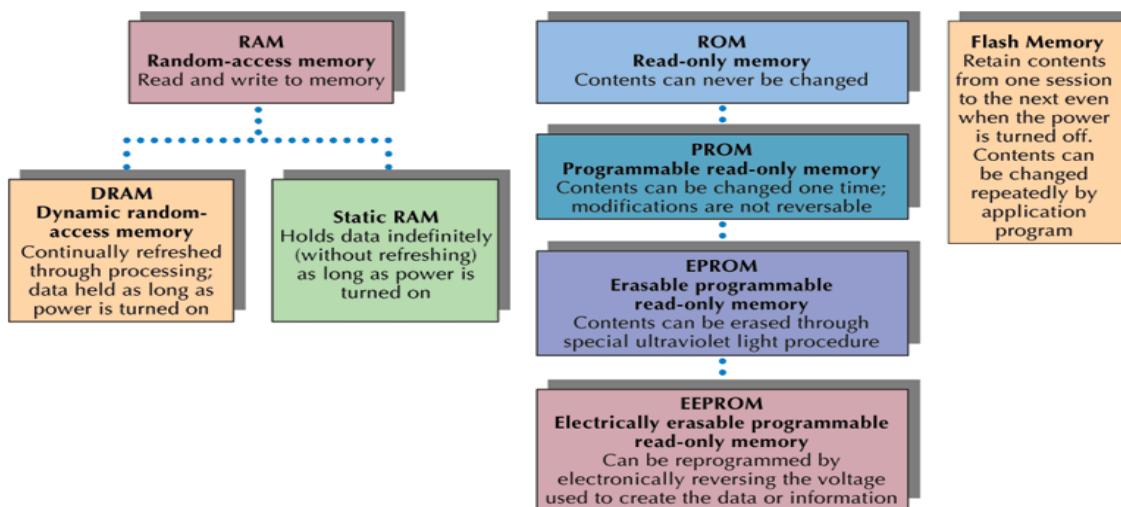
## FLASH MEMORY

- **Flash Memory:** Memory that retains its contents even when electricity is turned off.



**Figure 6.7** A USB Flash disc.

Source: (Google Images, 2009).



**Figure 6.8** Types of Memory Chips

Source: (Senn, 2004).

## MEMORY (PCMCIA CARD MEMORY)

**PCMCIA Card/PC card:** A card designed to expand a computer's memory.



**Figure 6.7** A USB Flash disc.

**Source:** (Google Images, 2009).

## MEMORY (BOOTING)

- **Boot:** To turn on the computer system and let the built-in self-test run.
- **Cold Boot:** The system is turned on and started from an off state. The CPU invokes the ROM BIOS boot program, which in turn, runs the power-up, self-tests and loads the operating system from disk storage.
- **Warm Boot:** In a restart, the BIOS know the system is already running, data is written in a specific memory location checked by the BIOS and skips the power-on test.

## MEMORY CHIPS

**Single In-line Memory Module (SIMM):** A multiple-chip memory card inserted as a unit into a predesignated slot on a computer's system board.

- **Installed Memory:** The amount of memory included by a computer's manufacturer on its memory board.
- **Maximum Memory:** The most memory that a processor can hold.

## 3.6 THE DIFFERENCES BETWEEN STORAGE AND MEMORY

Although the functions of storage and memory are similar, they work in different ways.

- There is more room in storage than in memory, just as there is more space in a file cabinet than on a table top.
- Contents are retained in storage when the computer is turned off, whereas the program or data you put into memory disappear when you shut down the computer
- Storage is very slow compared to memory, but it is much cheaper than memory.

## **4.0 CONCLUSION**

Storage and memory look similar but perform different tasks. Memory is used to load program files and is volatile, while storage are used to hold data permanently and to be retrieved for future use.

## **5.0 SUMMARY**

In this unit, we learnt that the:

- The functions of storage and memory are similar, they work in different ways.
- The memory - serves the purpose of temporary storage (holding data and instruction) and also used to boot the computer system.
- Storage come in different types, sizes, and are made of various technologies.
- Storage can be used on a local area network- allowing different kinds of storage devices, such as tape drives and disk arrays, to be shared by all users through network servers.

## **6.0 TUTOR MARKED ASSIGNMENT (TMA)**

- a. What does SAN stands for in storage?
- b. What are the other magnetic disk storage systems?
- c. Is memory and storage the same? Explain.
- d. What does the following means in memory?
  - Byte
  - Kilobyte/K-byte/KB/K.
  - Megabyte/M-byte/MB/Meg
  - Gigabyte/G-byte/GB/Gig
  - Terabyte/T-byte/TB
  - Address

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## **MODULE 2 DATABASES AND COMPUTER NETWORKS**

### **UNIT 7 DATABASES**

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## **1.0 INTRODUCTION**

In module 1, you were introduced to how data is being processed into information using the basic ICT tools (computer's hardware and software). In this unit you will be introduced to a new concept of how you can collect related information and store the Information in a structured format.

## **2.0 OBJECTIVES**

By the end of this unit you should be able to:

- Describe the main components of a database.
- Describe the types of databases.
- Identify when a business should use a spreadsheet and when it should use a database.
- Identify the seven-step sequence for developing database applications.

## **3.0 MAIN CONTENT**

A database is a single organized collection of structured data, stored with minimum duplication of data items so as to provide a consistent controlled pool of data. It is a good program to use to manage lists that are entirely numbers, such as addresses and phone numbers, inventories and membership rosters.

### **3.1 WHAT IS A DATABASE?**

A database is a collection of data and information describing items of interest to an organization.

With a database you could sort the data by name or city or postal code or by any individual item of information recorded. You can create forms to enter or update or just display the data. You can create reports that show just the data you are interested in, like members who owe dues.

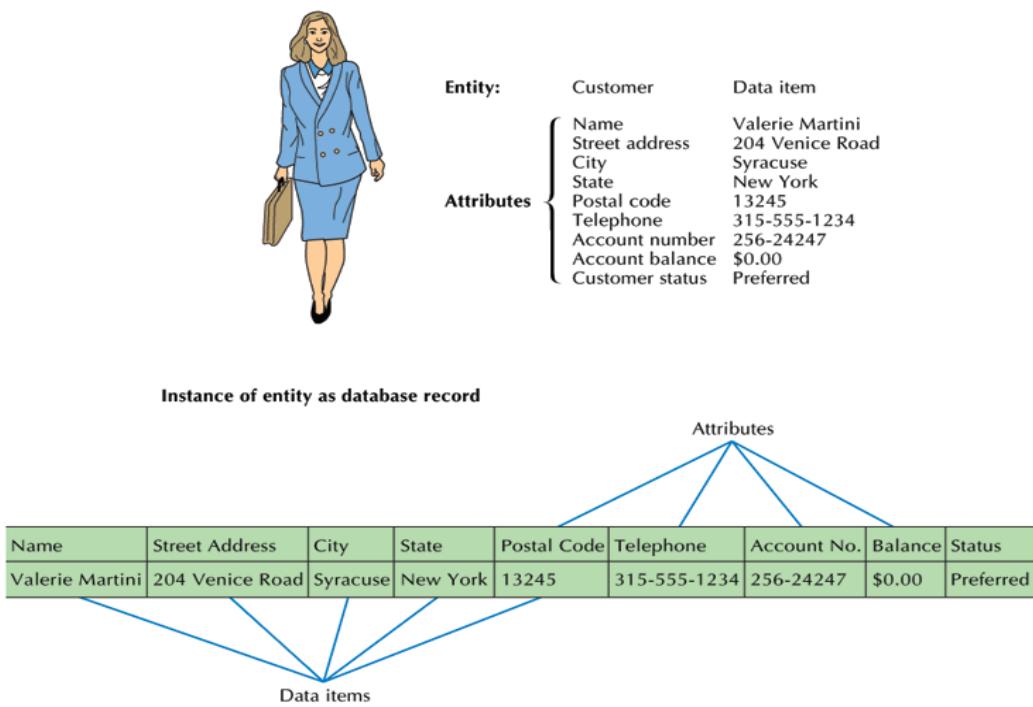
Some basic components of a database are:

- **Entities and Attributes**
  - **Entity:** A person, place, thing, event, or condition about which data and information are collected.
  - **Attribute:** A category of data or information that describes an entity. Each attribute is a fact about the entity.

- **Data Items and Records**
  - **Data Item:** A specific detail of an individual entity that is stored in a database.
- **Data Items and Records**
  - **Record:** In a database, a designated field used to distinguish one record from another.
  - **Relational Database:** A database in which the data are structured in a table format consisting of rows and columns.
  - **Relation/File:** The table in a database that describes an entity.
  - **Tuples:** The rows of a relation. Also called records.
  - **Fields:** The column of a relation. Also called attributes.

STUDENT RELATION						Attributes or Fields	
	Name	Student ID Number	Street Address	City	State	Postal Code	
Records or Tuples	Gorzynski, John	253054720	71 West Washington	Chicago	Illinois	60602-1634	
	Markus, Lewis	762027721	22 Ocean Blvd	Atlantic City	New Jersey	08103	
	Martin, Carol	934841834	33 Hightower Lane	Montgomery	Alabama	36116	
	O'Rafferty, Thomas	102347654	1201 Sixth Avenue	New York	New York	10020-3021	
	Patterson, Jane	376358722	440 Holcomb Lane	Atlanta	Georgia	30338-1538	

**Figure 7.1a** The Elements of a Relation  
**Source:** (Senn, 2004).



**Figure 7.1b** Entity Description in a Database

Source: (Senn, 2004).

### 3.2 REASONS FOR USING DATABASE

The following are reasons for using a database:

- Enterprise Database: Large multiuser database systems developed and maintained by IT professionals.
- Personal Database (PC Database): Typically reside on personal computers and are designed to support a particular function.
- Storing Data
- Retrieving Data
  - *Query/Querying*: A question to be answered by accessing the data in a database.
- Editing: Adding, deleting, or changing the data about companies.
- Organizing Data
- Distributing Data and Information

### 3.3 TYPES OF DATABASES

Both spreadsheets and databases can be used to handle the same information, but each is optimized to handle a different type of data most efficiently. The larger the number of records, the more important the differences are. Some popular databases include MS Access, dBase, FoxPro, Paradox, Approach, MySQL, and Oracle.

#### 3.3.1 FLAT DATABASES

A database that consists of a single table. Lightweight database programs such as the database component in Microsoft Works are sometimes called 'flat-file managers' (or list managers) because they can only handle single-table databases. More powerful programs, such as FileMaker Pro, Access, Approach and Paradox, can handle multi-table databases, and are called relational databases managers, or RDBMSs.

A flat database contains files which contain records which contain fields. The earliest and simplest databases are flat databases, they are easy to setup and understand. It may require entering the same information in many records. Examples are text databases and spreadsheets

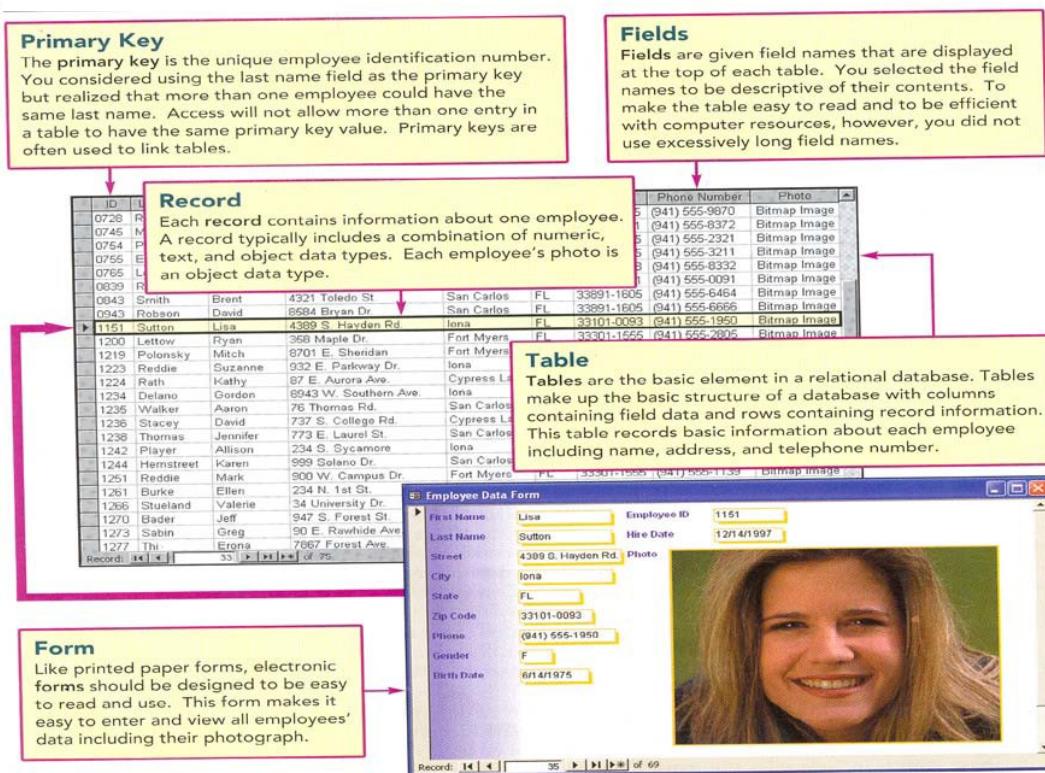


Figure 7.2 A flat database, files, records, and fields.

Sources: (O'Leary, 2004).

- **A text databases**

This is a plain text file where the fields are separated by a particular character like a vertical bar “|” or a comma “,” or a semi-colon “;”. The example bellow put the vertical bar between each field. The first record shows the names of the fields.

A text database is hard to read in this raw form. A database program can show each record separately in a more readable display. It is hard to create a report that contains just the parts you want to see.

ID	First name	Middle	Last name	Title	
Organization	Street address		City		Postal Code
Country	Home phone	Work phone	Mobile	Fax	
	Email		Notes		
1	Luis	P	Perez	President	World Travel
Inc.	Montevideo 6553		Buenos Aires	1123	
Argentina	555-1234		555-9876	557-3344	555-9875
	<a href="mailto:luisperez@viajesmundiales.com">luisperez@viajesmundiales.com</a>				
2	Hector		Chavez		World Travel
Inc.	Primero 3344		Buenos Aires	1123	
Argentina	999-0011		555-9876	555-6666	555-6655
	<a href="mailto:hchavez@viajesmundiales.com">hchavez@viajesmundiales.com</a>				
3	Rosa	F	Garcia		
1111		1234 Norte		Gualajara	
		Mexico			
		<a href="mailto:rozog@mi1sp.com">rozog@mi1sp.com</a>			

**Figure 7.3** A Text database

Sources: (Smith, 2009).

- **A Spreadsheet**

A spreadsheet can work as a flat database. Each field is in a separate column and each row is a single record. The example bellow shows how quickly a record gets wider than the screen. You cannot use two rows for one record.

LineList	FirstName	MiddleName	LastName	Nickname	Title	OrganizationName	Address
1	Luis	P	Perez		President	World Travel Inc.	6553 But
2	Hector		Chavez			World Travel Inc.	Primero 3344 But
3	Rosa	F	Garcia				1234 Norte Gui
4	Maria	H	Hernandez				4444 Este Car
5							
6							
7							

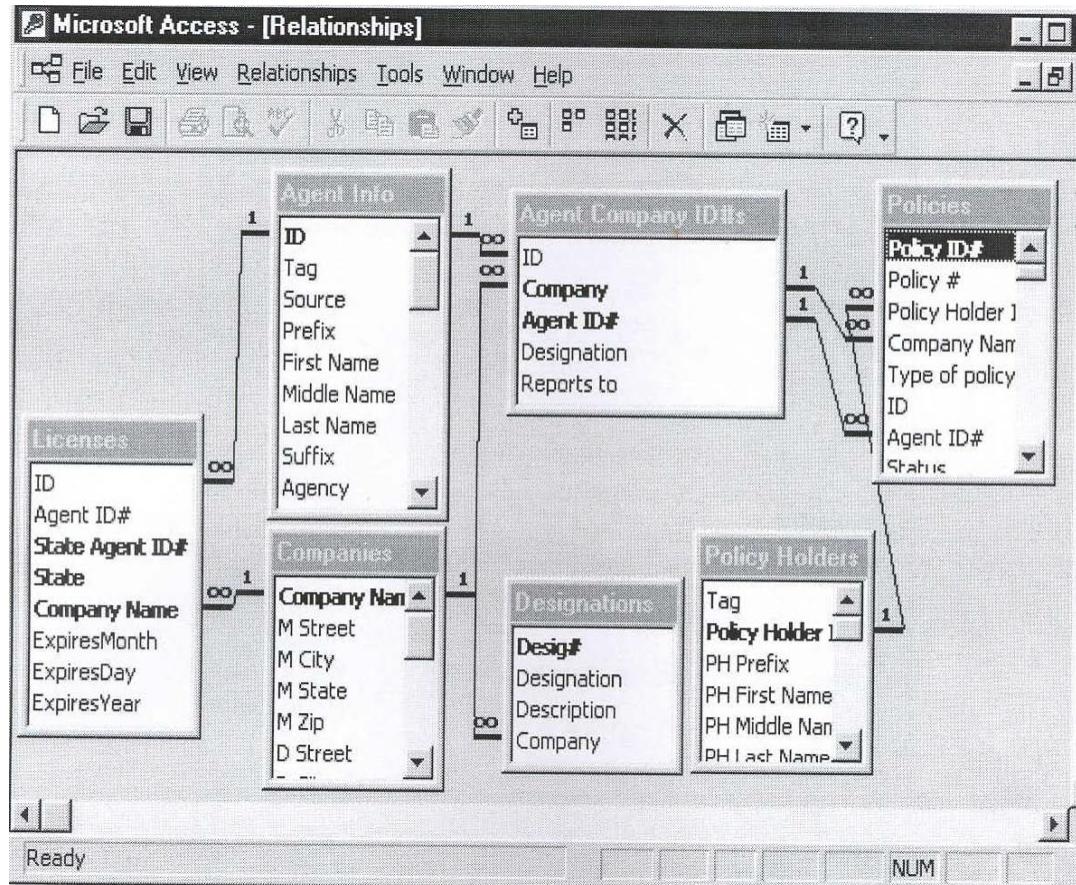
**Figure 7.4** A Spreadsheet  
**Sources:** (Smith, 2009).

### 3.3.2 RELATIONAL DATABASES

A relational database contains tables which are linked together. Each table contains records which contain fields. Microsoft Access, Oracle and other relational databases are more advanced and more efficient. This kind of database uses a set of tables which are linked together. Using a well-designed relational database can greatly reduce the amount of data you must enter each time you add a record. For large number of records, a relational database can search through the records faster.

Relational database can be complex to set up, using many tables, but it reduces the duplication in data entry, records are searched faster, forms are created and reports that display only the data you want to see. Queries can be created to answer questions that are hard or impossible to answer in flat databases.

Bellow is an illustration of the tables in a small database that records information about insurance agents and policy holders. The particular insurance office works with several different insurance companies. There are seven tables in the database. The lines show which fields in each table are the same. These link the tables together.



**Figure 7.5** Relational Database

Sources: (Smith, 2009).

Each agent can be licensed with several different companies and in several different states. In a flat database you would have to have a record for each agent for every company and state he is licensed with, repeating the agent info for each record. This is too much typing.

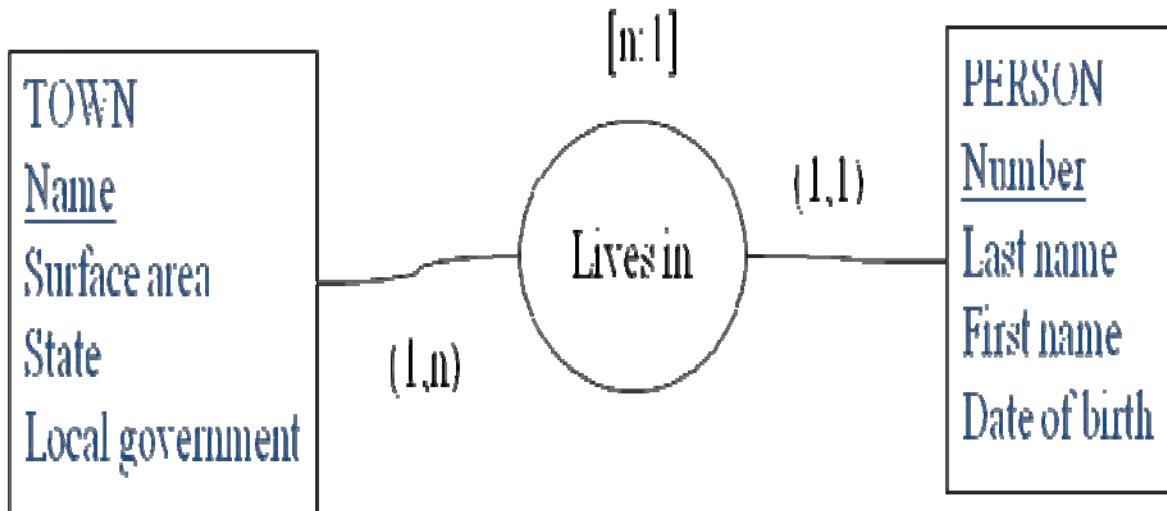
You can design a form so that you can do this all in one spot. This is easier than repeating so much information for each record as you would do in a flat database. The images below show the two screens for the agents info form. This form can be used for entering new agents as well as for displaying the current ones.

### 3.4 TYPES OF RELATION IN A RELATIONAL DATABASE

A relation specifies the association between two or more entities for example **Town** and **Person**. The relation should specify the semantic of the association like: A *person lives* in a *town*.

A relation is symbolized by an oval with its semantic inside the oval. A relation is further specified by cardinalities that indicate the number of associated instances. For example;

- A person lives in a minimum of **one** town and in a maximum of **1** town
- A town is inhabited by a minimum of **one** person and a maximum of **n** (indicating several)



**Figure 7.6** Entity Relationship Diagram.

Source: (DAVID, 2008).

### Relationships

Relationship is the association between entities, it could be represented graphically using an entity relationship data model. Relationships between real-world entities can be quite complex, involving numerous entities each having multiple relationships with each other. For example, a family has multiple relationships between multiple people—all at the same time. In a relational database such as Microsoft Access, however, you consider only relationships between pairs of tables. These tables can be related in one of three different ways: one-to-one, one-to-many or many-to-many.

### 3.5 DEVELOPING DATABASE APPLICATION

**Database Application** is a computerized database routine for collecting, retrieving, or manipulating data to meet recurring needs. There are seven step sequence:

- **Study the Problem:** Describe the system's data entry (input) requirements, inquiry requirements, and output requirements.
- **Determine the Requirements:** Determine the problem's characteristics and how database creating and processing can assist in solving the problems.
- **Design the Database:** Identify entities of interest, determine the data or information that describes them, and determine which data items will be used to distinguish one entity from another.
  - **Index Key/Search Key:** A data item used by database management software to locate a specific record.
- **Create the Database:** Name the database; establish the database structure (field names, types, widths, and decimal positions; field indexation).
  - **Indexing:** A database system's capability to find fields and records in the database.
- **Design the Application:** Develop data entry, report generation, and query-processing methods.
  - **Data Entry:** The process of populating a database with data and information.
    - **Data Entry Form:** Custom-developed video display used to enter and change data in a database.
  - **Report Generation**
  - **Query Processing**
    - **Relational Operator:** A symbol that tells a database system to make a comparison to call up the requested data.
- **Create the Application:** Write the programs to perform data-processing tasks.
  - **Custom Programming:** In a database system, the writing of detailed procedures, using the commands and functions built into the database management software.
  - **Application Generation:** In a database system, the use of menus and simple commands to describe the application to a system program that creates the set of detailed commands.
- **Test the Application:** Evaluate the application's processes and procedures to ensure they are performing as expected.

**Table 7.1** Field Types

FIELD TYPE	DESCRIPTION	EXAMPLE
Character or Alphanumeric	Alphabetic or special characters and numbers (can not be used in arithmetic processes)	Kk9, 2ND Avenue, Na'omi
Numeric	Any integer or any number with a decimal point or minus sign (can be used in arithmetic processes)	540, -12, 4.7
Floating Point	Decimal numbers (typically used in applications involving frequent multiplication and division)	128.6
Logical	One space used to indicate True or False, or Yes or No	Tt, Ff, Yy, Nn
Memo	Text data used to explain or annotate other details contained in the record, frequently at length.	“Details captured by Binta Abraham During interview with Students at NOUN on 10 August”
Date	Calender date in the format mm/dd/yyyy (Month, Date, Year)	22/15/2009

**Source:** (Senn, 2004).

### 3.6 DATABASE NORMALISATION

The process of structuring data to minimize duplication and inconsistencies. The process usually involves breaking down a single table into two or more tables and defining relationships between those tables. Normalisation is usually done in stages. The first three levels in normalising a database are:

- **First Normal Form (1NF):** There should be no repeating groups in a table. For example, say you have a students table with the following structure:

**Student Table (Student\_ID, name, date of birth, advisor, advisor's telephone, student, course ID 1, course description 1, course instructor 1, course ID 2, course description 2, course instructor 2)**

The repeating course fields are in conflict with first normal form. To fix the problems created by such repeating fields, you should place the course information in a separate course table, and then provide a linking field (most likely Student\_ID) between the students table and the course table.

- **Second Normal Form (2NF):** No non-key fields may depend on a *portion* of the primary key.

For example, say you create a course table with the structure:

**Student\_ID**, course ID, course description, course instructor

You can create a unique primary key by combining Student\_ID + course ID (Student\_ID is not unique in itself, as one student may take multiple courses; similarly, course ID is not unique in itself as many students may take the same course; however, each student will only be taking a particular course once at any one time, so the combination of Student\_ID + course ID gives us a unique primary key).

Now, in 2NF, no non-key fields (course description, course instructor) may depend on a *portion* of the primary key. That, however, is exactly what we have here: the course instructor and course description are the same for any course, regardless of the student taking the course.

To fix this and put the database in second normal form, you create a third table, so our database structure now looks like this (with key fields in italics):

Student table (*Student\_ID*, name, date of birth, advisor, advisor's telephone)

Student courses table (*Student\_ID*, *course ID*)

Courses table (*course ID*, course description, course instructor)

- **Third Normal Form (3FN):** No fields may depend on other non-key fields. In other words, each field in a record should contain information about the entity that is defined by the primary key.

In our students table, for example, each field should provide information about the particular student referred to by the key field, *Student\_ID*. That certainly applies to the student's name and date of birth. But the advisor's name and telephone doesn't change depending on the student. So, to put this database in third normal form, we need to place the advisor's information in a separate table:

Student table (*Student\_ID*, name, date of birth, advisor ID)

Student courses table (*Student\_ID*, *course ID*)

Courses table (*course ID*, course description, course instructor)

Advisor table (*advisor ID*, advisor name, advisor telephone)

## **4.0 CONCLUSION**

When you are storing data, caution need to be taken, especially in the database design stage to avoid duplicates of data. PC database are for limited access and small size database, while enterprise database are for distributed environment.

## **5.0 SUMMARY**

In this unit, you learnt that:

- the process of structuring data to minimise duplication and inconsistencies by breaking down a single table into two or more tables and defining relationships between those tables is known as normalization.
- data can be either stored on a single PC or over a distributed network
- there are procedures followed to develop a database application.

## **6.0 TUTOR MARKED ASSIGNMENT (TMA)**

- a. What is a database?
- b. List two reasons for using database.
- c. What is Database Normalisation?
- d. What are the steps taken to design a Database Application?

## **7.0 FURTHER READING/REFERENCES**

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## **MODULE 2 DATABASES AND COMPUTER NETWORKS**

### **UNIT 8: DATABASE MANAGEMENT SYSTEM (DBMS).**

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## **1.0 INTRODUCTION**

In Unit 7, you were introduced to the concept of *Information Repository* (database). In this unit you will be introduced to manage in a database using specific software known as the database management system (DBMS).

## **2.0 OBJECTIVES**

By the end of this unit you should be able to:

- Know what a database management system (DBMS) is
- List and describe five objectives of database management systems.
- Identify criteria used in classifying a DBMS
- The different data models of a DBMS.

## **3.0 MAIN CONTENT**

Database management system is a program which lets you manage information in databases. Lotus Approach, Microsoft Access and FileMaker Pro, for example, are all DBMSs, although the term is often shortened to 'database'. So, the same term is used to apply to the program you use to organise your data and the actual data structure you create with that program. The database management system is complex software systems that constructs, expand and maintains the database. It also controls the interface between the user and the data in the database.

### **3.1 DATABASE MANAGEMENT SYSTEM (DBMS)**

The DBMS maintains the data in the database by: adding new records, deleting “Unwanted” record, and amending records.

The DBMS also has the function of providing security for data in a database through: protecting data against unauthorized access, safeguarding data against corruption and providing recovery and restart facilities after a hardware or software failure.

The DBMS provides facilities for different types of file processing: process a complete file (serially and sequentially), process required records (selective, sequential and random), and retrieve individual records.

### 3.2 OBJECTIVES OF DATABASE MANAGEMENT SYSTEMS

The Objectives of Database Management Systems are:

- **Data Definition Language (DDL):** A tool provided in a database management system that allows users to define the database.
- **Data Manipulation Language (DML):** A tool provided in a database management system that allows users to store, retrieve, and edit data in the database.
- **Integrating Databases:** database management systems allow the merger of separate files, created at varying times or by different people. The data needed to solve a particular problem reside in several databases, problem solvers must be able to integrate databases. Integration is often done to process an inquiry or to create a report.
- **Reducing Redundancy:** redundancy is the duplication between databases. When files are developed independently, some data may be repeated in the databases, and unfortunately, these multiple copies sometimes become inconsistent.
- **Sharing Information:** information can be stored in a database once and then retrieved any number of times by any authorized user of the database.
- **Maintaining Integrity:** a database that is both secure and reliable is said to have integrity. Information can be accessed on by authorized users.
- **Enabling Database Evolution:** databases are dynamic, they are constantly changing. Databases change in two way:

Content – the data items in current record, new records are added, and existing records are deleted.

Structure – the data items that make up a record can change the logical structure of a database, either because fields are added or deleted, because data items' characteristics change, or because the way the database is stored physically changes.

**Table 8.1** Popular PC Database Management Systems

SOFTWARE	MANUFACTURER	VERSIONS AVAILABLE
Access	Microsoft	Windows and Macintosh
FileMaker Pro	Apple	Windows and Macintosh
Visual FoxPro	Microsoft	Windows and Macintosh
Interbase	Borland	Windows and Linux

**Source:** (Senn, 2004).

### 3.3 CLASSIFICATION OF DBMS

Several criteria are normally used to classify DBMSs.

- The first is the **data model** on which the DBMS is based. The main data model used in many current commercial DBMSs is the **relational data model**. The basic relational data model represents a database as a collection of tables, where each table can be stored as a separate file
- The second criterion used to classify the DBMSs is the **number of users** supported by the system.
  - **Single-user systems** support only one user at a time and are mostly used with personal computer (PC).
  - **Multi-user systems**, which include the majority of DBMSs, support multiple users concurrently.
- A third criterion is the **number of sites** over which the database is distributed.
  - A DBMS is **centralized** if the data is stored at a single computer site and can support multiple users, but the DBMS and database themselves reside totally at a single computer site.
  - A **distributed** DBMS (DDBMS) can have the actual database and DBMS software distributed over many sites, connected by a computer network.
- A forth criterion is the **cost** of the DBMS. Most DBMS are expensive but there are a few free ones like MySQL.

### 3.4 SPECIAL PURPOSE DATABASES

We can also classify a DBMS on the basis of the **types of access path** and **other purpose** options for storing files.

- **General-purpose Database System:** A database maintained with powerful database management software that can be applied to just about any PC database.
- **Special-purpose Database: Predesigned for a specific use.**
- **Directory:** A listing of information by category.
- Commercial and Government Topical Databases
  - **Economic Database:** Capture details related to the state of the Nigerian economy (other nations have comparable databases).
  - **Statistical Database:** Include the measurement data to measure the level of statistical activity and a means of comparing areas of activity.

- ***Financial Database:*** Focus on areas of monetary and investment activity, including stock market trading, issuance of mortgages, real-estate transactions, corporate finance, and venture-capital investment activities.
  - ***Literary Database:*** Pertain to books, monographs, or reports, or to articles appearing in newspapers and magazines. Alternatively, a literary database may contain the actual publications themselves or links to the publications.
- ***Personal Information Manager (PIM)/Contact Manager:*** Contains preprogrammed features enabling users to manage data helpful in their personal activities.
  - Contacts
  - Calendar
  - To-Do list
  - Memos and Notes

### 3.5 DBMS STRUCTURE

DBMS programs are designed to work with specific data structures or **data models**. These models define rules and standards for all the data in the database. Five principal data models are:

- ***Hierarchical Database:*** uses nodes to link and structure fields and records; entries may be one parent node with several child nodes in a one-to-many relationship.
- ***Network Database:*** this is like the hierarchical except the child node may have more than one parent in many-to-many- relationships.
- ***Relational Database:*** data is stored in tables (relations); related tables have common data items (key field).
- ***Multidimensional Database:*** extend two dimensional relational tables to three or more dimensions sometime called **hyper cube**.

Advantages include:

- Conceptualisation – database provides an intuitive model for complex data and relationships.
  - Processing Speed – analyzing and querying is faster.
- ***Object Oriented:*** store data, instructions and unstructured data. Data organized using objects, classes, entities, attributes, and methods.

Objects – contains both data and instructions to manipulate data.

Classes – are similar to objects grouped together

Entities – are a person, place, thing or event.

Attributes – similar to fields, are descriptions of entities.

Methods – describe how data is to be manipulated.

### **3.6 DATABASE ADMINISTRATOR (DBA)**

This is a person who acts as a special manager managing the database usually a staff in the organisation. She/he must have a sound knowledge of the structure of the database and the DBMS. The DBA is responsible for ensuring that the data in the Database meets the information needs of the organization and provides facilities for retrieving data and structuring reports. To perform most of the functions the DBA will have to liaise with the managers, System Analyst (SA) and programmers who develop the system. The security and integrity of data in the database is his/her responsibilities, and the preparation of a periodic appraisal of the data to ensure its completeness, accuracy, and to reduce duplicates.

The DBA is also responsible for preparing manuals for the users of the system describing the facilities the database offers and their uses and designing the data dictionary.

### **4.0 CONCLUSION**

When you are storing data, caution need to be taken, especially in the database design stage to avoid duplicates of data. PC database are for limited access and small size database, while enterprise database are for distributed environment.

### **5.0 SUMMARY**

In this unit, you learnt that:

- the data and information can be stored using specified Software package like Database Management System (DBMS)
- data can be either stored on a single PC or over a distributed network
- DBMS programs are designed to work with specific data structures or **data models**.  
Five principal data models are:
  - Hierarchical Database
  - Network Database
  - Relational Database
  - Multidimensional Database
  - Object Oriented

## **6.0 TUTOR MARKED ASSIGNMENT (TMA)**

- a. What is a DBMS?
- b. What are the advantages of using a Multidimensional Database?
- c. Who is a DBA?
- d. What is the difference between a Database and DMS?

## **7.0 FURTHER READING/REFERENCES**

- Elmasri, R., Navathe, S. B. (2004). *Fundamentals of Database Systems* (4<sup>th</sup> Edition). Essex, UK: Pearson Higher Education.
- Senn, J. A. (2004). *Information Technology: Principles, Practices, Opportunities* (3<sup>rd</sup> Edition). New Jersey, US: Pearson Prentice Hall.
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## **MODULE 2 DATABASES AND COMPUTER NETWORKS**

### **UNIT 9: DATABASE QUERIES**

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## **1.0 INTRODUCTION**

In Unit 7, you learnt of a software called the database management system (DBMS) used in managing data in a relational database. In this unit, you will discover that in recent years there has been a major increase in the use of relational databases. An easy way of manipulating the record at a high level was devised using the query. A query is used to filter records from a database to show just the ones that meet certain criteria or to arrange them in a particular order.

## **2.0 OBJECTIVES**

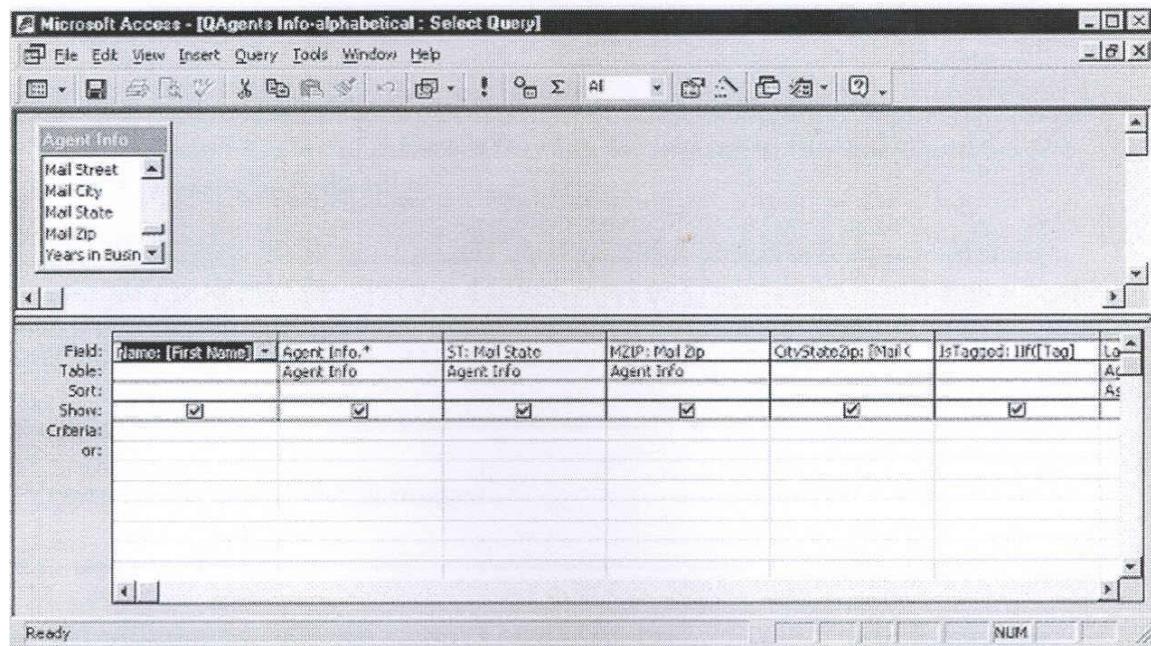
By the end of this unit students are expected to;

- define a query
- How to construct a query to filter records
- The most common query language (SQL)
- The Join Operation

## **3.0 MAIN CONTENT**

A query is a view of your data showing information from one or more tables. For instance, using the sample database we used in the previous Unit 7 when describing normalisation, you could query the Students database asking "Show me the first and last names of the students who take both history and geography and have Alice Hernandez as their advisor" Such a query displays information from the Students table (firstname, lastname), Courses table (course description) and Advisor table (advisor name), using the keys (Student\_ID, course ID, advisor ID) to find matching information.

The query below brings together the fields from the agent info tables that are needed for mailing labels.



**Figure 9.1** Query Design View Window

Sources: (Smith, 2009).

The SQL code for this query looks a lot different from the design view above. No wonder a drag-and-drop method was created.

```

SELECT DISTINCTROW [First Name] & " " & [Middle Name] & " " & [Last Name] AS Name, [Agent Info].*, [Agent Info].[Mail State] AS ST, [Agent Info].[Mail Zip] AS MZIP, [Mail City] & " " & [ST] & " " & [MZip] AS CityStateZip, IIf([Tag]=Yes,1) AS IsTagged
FROM [Agent Info]
ORDER BY [Agent Info].[Last Name], [Agent Info].[First Name], [Agent Info].[Middle Name]
WITH OWNERACCESS OPTION;

```

**Figure 9.2** Query Code View Window.

Sources: (Smith, 2009).

### **3.1 QUERY LANGUAGE FEATURES**

A query language normally comprises a Data Descriptive Language (DDL) and a Data Manipulative Language (DML). There are two types of queries:

- Query By Example (QBE) and
- Structural Query Language (SQL).

For our purpose we shall look at only the SQL. Queries languages have two basic modes of operation:

- **Terminal Monitor Mode**

The user is able to use query language at a terminal, in the same way a command language interpreter is used. Ad-hoc queries are formulated to obtain data from databases.

- **Embedded Query Language**

The query language statements are included within the code of programs written in some other programming language, e.g. C or Oracle, and effectively because part of the program, hence the term “embedded query language”.

### **3.2 STRUCTURED QUERY LANGUAGE (SQL)**

Structured Query Language (pronounced *sequel* in the US; *ess-queue-ell* elsewhere). A computer language designed to organise and simplify the process of getting information out of a database in a usable form, and also used to reorganise data within databases. SQL is most often used on larger databases on minicomputers, mainframes and corporate servers.

This is an international standard for database query languages and has been adopted by many computer manufacturers and database product suppliers, e.g. IBM, INGRES, ORACLE, SYBASE, and INFORMIX.

#### **3.2.1 TABLES**

Data in a relational database are stored in tables sometimes called “relations”. A row in a table corresponds to a single record in a file. Another name for row in a table is “tuple”.

**Table 9.1** A table called “STUDENT”

Student_ID	Name	Address	date of birth	Boarding Fees
NOUN/SC/98/01	BINTA ABAKA	KK9 ABIDJAN STR.	22 DEC 1962	800
NOUN/SC/98/02	DULEN KPENETESE	63 ABA RD P/H	15 MAY 1975	1000
NOUN/SC/98/03	UGOMA IFEANYI	3 POLICE STATION RD	22 JAN 1970	300
NOUN/SC/98/04	ADEMOLA RUFA'I	61B BISHOP OLUWOLE STR	22 JUN 1965	450

**Source:** (French, 2004).

Each row should be uniquely identifiable by a suitable key. The key may either be a simple key consisting of the value in one column or a composite key consisting of multiple columns. The example of the table above of the “Student\_ID” field is a simple key.

To create a table similar like the one above using SQL statement we use the following syntax;

```
Create          table student
(
    Student_ID      char (13)      not null unique,
    Name            char (20)       not null,
    Address         char (40)       not null,
    date of birth   date,
    Boarding Fees   smallint (13)
)
```

The layout above has been chosen for readability, with the definition of each column in the table set out on a separate line in the order in which it is to appear in the table.

The explanations of the above statements are as follows;

“Student\_ID char (13) not null unique”, states that the first column is to be called “Student\_ID”, it can be up to 13 characters long, it must not be empty “null” and its value must be unique.

“date of birth”, states that the fourth column is to be called “date of birth”, and its value must be a date.

### 3.2.2 SELECT STATEMENTS

Every **select** statement yields a table of values as output and Sometimes there's only one row in the table, depending on how you use the command.

<b>select</b>	columns and/or expressions
<b>from</b>	tables
<b>where</b>	conditions on the rows
<b>group</b>	by group rows together
<b>having</b>	conditions on the groups
<b>order</b>	by order the rows
<b>into</b>	temp save results of query in a temporary table

This is used to retrieve values form a table. The following statement retrieves rows from the table “Student” displaying just the three columns “Student\_ID”, “Name” and “Boarding Fees”. The expression after the word “where” defines what values in a row must have for the row to be selected.

#### Select

*Student\_ID, Name, Boarding Fees*

From

*Student*

Where

Boarding Fees > 400

And

Boarding Fees <1000

Another short syntax is:

Select \* from Table where Boarding Fees > 400 and Boarding Fees <1000

This “\*” implies ‘**everything**’ or ‘**all records**’.

In the above statements the values are Boarding Fees between 400 and 1000 will produces the table bellow;

**Table 9.2** Result of the SELECT Statement

<b>Student_ID</b>	<b>Name</b>	<b>Boarding Fees</b>
NOUN/SC/98/01	BINTA ABAKA	800
NOUN/SC/98/04	ADEMOLA RUFA'I	450

**Source:** (French, 2004).

### **3.2.3 INSERT STATEMENT**

Insert statement is used to add a record into a table, in performing the operation care is taking not to insert a null value. It has the following syntax;

Insert into Table (Field 1, Field 2, ...) Values ('Value 1', 'Value 2', ...)

For example:

Insert into Student (*Student\_ID*, Name, Boarding Fees) Value ('NOUN/SC/98/01', 'BINTA ABAKA', '800')

### **3.2.4 UPDATE STATEMENT**

The update statement is used to modify or change values in one or more rows within a table. It has the following syntax;

Update      Table    Set      computation    where condition

Update      Student

Set              Boarding Fess = Boarding Fess + 250

where              *Student\_ID* = 'NOUN/SC/98/01'

### **3.2.5 DELETE STATEMENT**

The delete statement is used to remove one or more rows from a table. It has the following syntax;

Delete From    Table    Where condition

Delete from Student where *Student\_ID* = 'NOUN/SC/98/01'

The table means the name of the table in the database such as "Student", while the condition states the parameters to consider during execution of the command such as "*Student\_ID* = 'NOUN/SC/98/01'".

## **3.3 OTHER COMMANDS USED WITH THE SQL STATEMENTS**

### **3.3.1 JOIN OPERATIONS**

It is possible to retrieve cross referenced data from a number of tables by using the relationships between the tables. For example;

**Select Table1.Field 1, Table2.Field 3, ... from Table T, Table R where T.Field 1= R.Field 2**

select  
     S.Student\_ID, S.Name, R.Course\_Description, C.CrdUnit  
 from  
     Student S, Registration R, Course C  
 where  
     R.Student\_ID = S.Student\_ID  
 and  
     R.Course\_ID = C.Course\_ID  
 and  
     CrdUnit = '3'

Looking closely to the select statement syntax above, you will notice some abbreviations for table names like “Student S”, which implies that “S” may be used as a shorthand to represent the table “Student”. The use of the **dot notation** after the table name :Student” is used to specify **fields** that represents the **records** in the **table**. For example “**S.Name**” means the **Name column** in the **Student table**.

The first join in the query matches the Student\_ID in the Registration table with the Student\_ID in the Student table, as shown bellow;

**R.Student\_ID = S.Student\_ID**

The second join in the query matches the Course\_ID in the Registration table with the Course\_ID in the Course table, as shown bellow;

**R.Course\_ID = C.Course\_ID**

**Table 9.3** Result of the JOIN Operation

Student_ID	Name	Course_Description	CrdUnit
NOUN/SC/98/01	BINTA ABAKA	Database Organisation	3
NOUN/SC/98/01	BINTA ABAKA	Information System	3
NOUN/SC/98/04	ADEMOLA RUFA'I	Research Methods	3
NOUN/SC/98/04	ADEMOLA RUFA'I	Operation Research	3

**Source:** (French, 2004).

## **4.0 CONCLUSION**

Structured Query Language (SQL), in computer science is a database sublanguage used in querying, updating, and managing relational databases. It has the ability to manipulate data from several tables in a single statement as in the **JOIN** example.

## **5.0 SUMMARY**

In this unit you learnt about:

- an effective tool called Queries, used to look at just part of the data in a database.
- Data can be reorder or filter using the **Structural Query Language (SQL)**.
- SQL is an international standard for database query languages

## **6.0 TUTOR MARKED ASSIGNMENT**

- a. What is the mode of operation of a Query language?
- b. What does the acronym SQL means? List its statement type
- c. What are the two types of queries you know?
- d. List the two types of query windows.

## **7.0 FURTHER READINGS/REFERENCES**

- Elmasri, R., Navathe, S. B. (2004). *Fundamentals of Database Systems* (4<sup>th</sup> Edition). Essex, UK: Pearson Higher Education.
- French, C. S. (2004). *Data Processing and Information Technology*, (10<sup>th</sup> Edition). London, UK: Thompson Learning.
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## **MODULE 2 DATABASES AND COMPUTER NETWORKS**

### **UNIT 10: ENTERPRISE DATABASES AND DATA WAREHOUSES**

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## 1.0 INTRODUCTION

In the previous units (7, 8 & 9), you read how data and information are stored using specialized application software (DBMS) and manipulated using the SQL tool. You will now learn to identify the reasons organizations choose to share databases.

## 2.0 OBJECTIVES

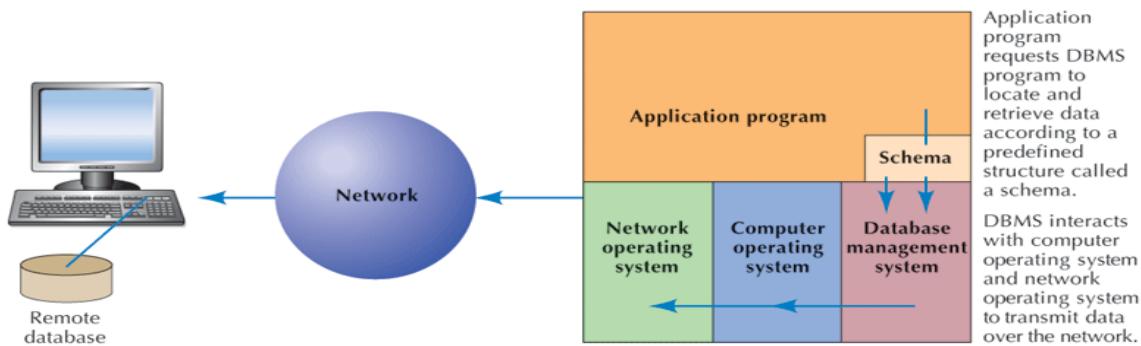
By the end of this unit you should be able to:

- Explain the difference between relational and object-oriented databases and their uses in business.
- Describe the differences between schemas, views, and indexes.
- Differentiate between shared and distributed databases.
- Discuss database administration procedures and concurrency procedures and explain why these are an essential part of a shared database system.

## 3.0 MAIN CONTENT

### THE PRINCIPLES OF DATA SHARING

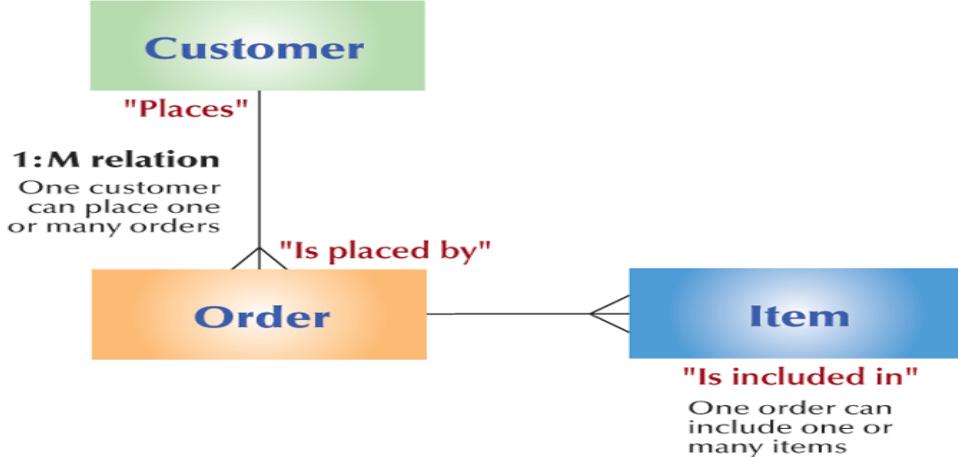
- **Database:** A collection of data and information describing items of interest to an organization.
- **Entity:** A person, place, thing, event or condition about which data and information are collected.
- **Enterprise Database:** A collection of data designed to be shared by many users within an organization.



**Figure 10.1** Relationship of DBMS to other Programs in Computer memory.  
Source: (Senn, 2004).

### 3.1 ENTERPRISE DATABASE STRUCTURES

**Enterprise Data Model/Entity Relationship:** A graphical representation of the items (the entities) of interest about which data is captured and stored in the database.



**Figure 10.2** Entity Relationship Model Showing Relations Between Customers and Orders.

**Source:** (Senn, 2004).

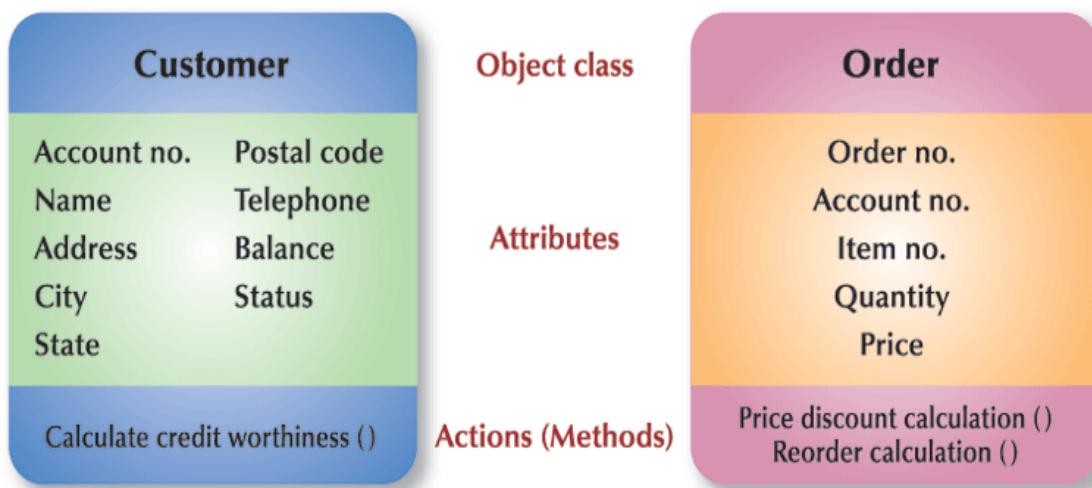
- **Schema:** The structure of a database.
- **Schema for Relational Database**
  - **Relational Database:** A database in which the data are structured in a table format consisting of rows and columns.

Customer relation									
Account No	Name	Address	City	State	Postal Code	Telephone	Balance	Status	
Order relation									
Order No	Account No	Item No	Quantity	Price					
Item relation									
Item No	Item Description	Price	Quantity on Hand						

**Figure 10.3** Schema for Customer-Order Relationship  
**Source:** (Senn, 2004).

- **Schema for Object-Oriented Database**

- ***Object-oriented Database:*** A database that stores data and information about objects.
- ***Object:*** A component that contains data about itself and how it is to be processed.
- ***Action/Method:*** An instruction that tells a database how to process an object to produce specific information.



**Figure 10.4** Classes in an Object Oriented Database Featuring Customer and Order Objects.

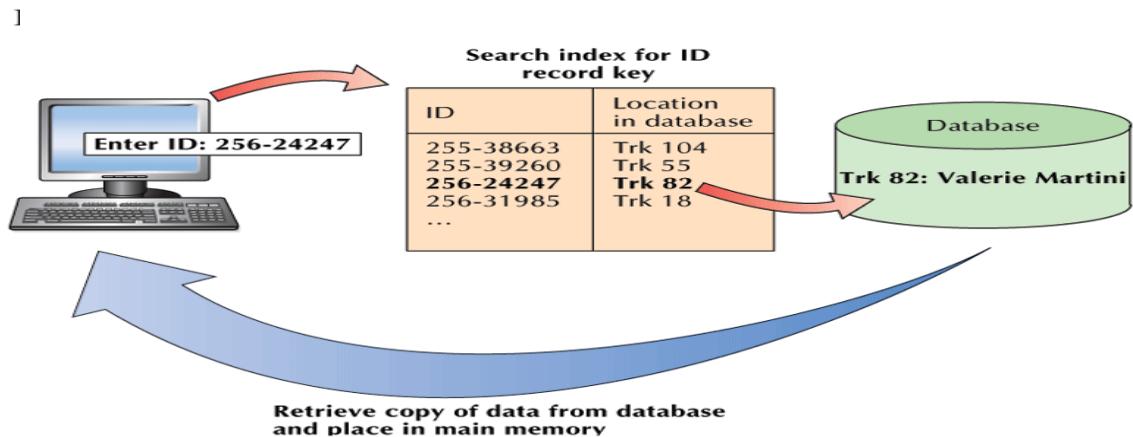
**Source:** (Senn, 2004).

## Views

- ***View:*** A subset of one or more databases, created either by extracting copies of records from a database or by merging copies of records from multiple databases.

## Indexes

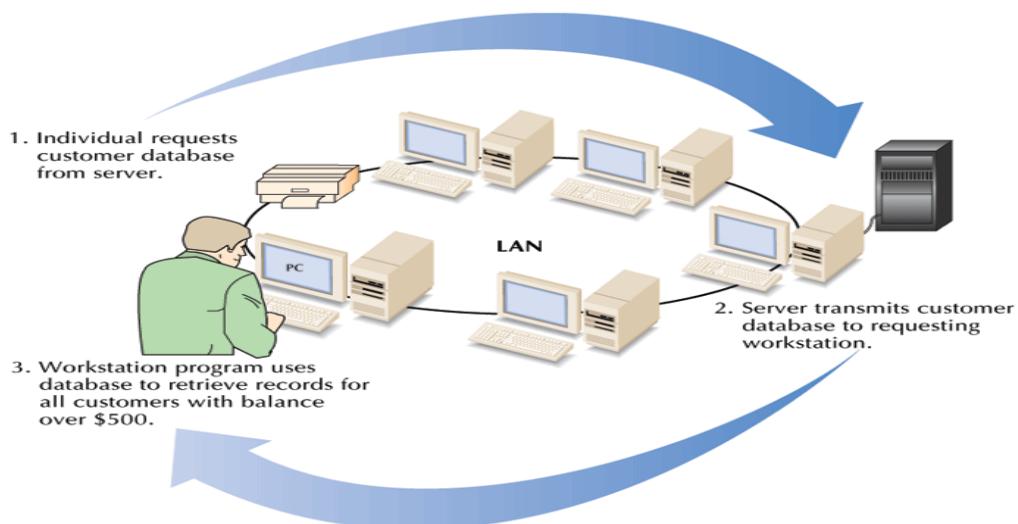
- ***Index:*** A data file that contains identifying information about each record and its location in storage.
- ***Record Key:*** In a database, a designated field used to distinguish one record from another.



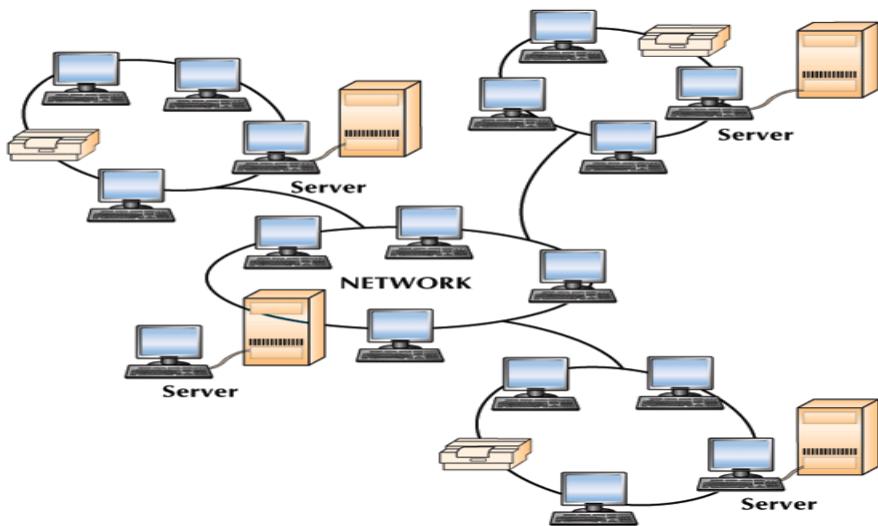
**Figure 10.5** Using an Index to Retrieve Data  
 Source: (Senn, 2004).

### 3.2 CLIENT/SERVER COMPUTING

- **File Server:** A computer containing files that are available to all users interconnected on a local area network.
- **Client/Server Computing:** A type of computing in which all data and information retrieval requests and responses pass over a network. Much of the processing is performed on the server and the results of the processing are transmitted to the client.

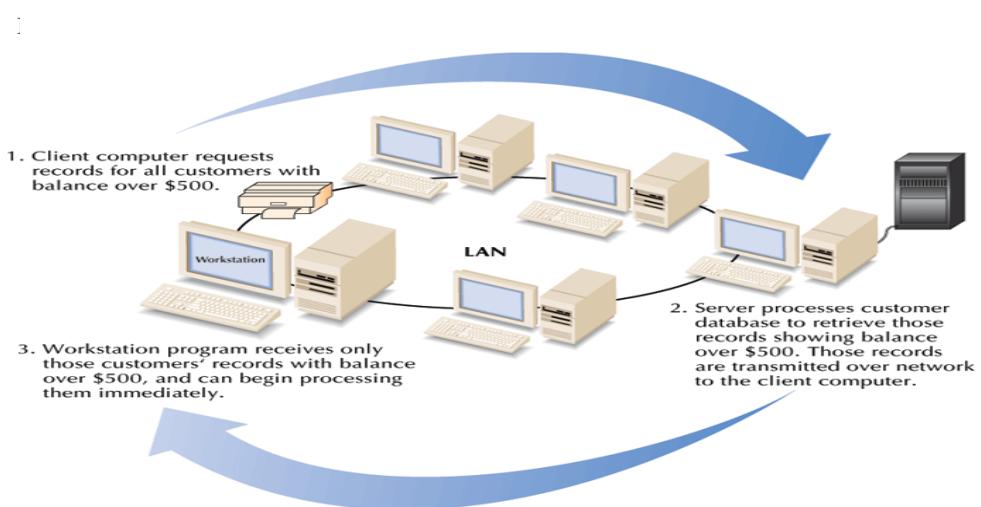


**Figure 10.6** Data and Information retrieval Using file Server Computing  
 Source: (Senn, 2004).



**Figure 10.7** Multilevel Client/Server Architecture.  
**Source:** (Senn, 2004).

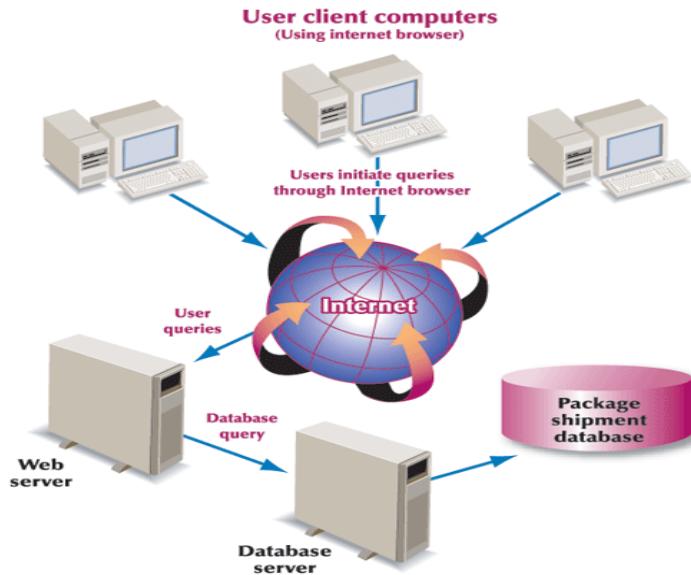
- **Client:** In client-server computing, a desktop workstation.
- **Server:** A computer that hosts a network and provides the resources that are shared on the network.



**Figure 10.8** Data and Information Retrieval Using Client Server Computing  
**Source:** (Senn, 2004).

### 3.3 DATABASES ON THE INTERNET

- **Web-based Integration:** Makes data from enterprise databases available to users connecting through the Internet (including enterprise intranets and extranets).



**Figure 10.9** Web-Enabled Database Processing

Source: (Senn, 2004).

### 3.4 DISTRIBUTED DATABASES

- **Shared Database:** A database shared among many users and applications.
- **Distributed Database:** A database that resides in more than one system in a distributed network. Each component of the database can be retrieved from any node in the network.

#### *Partitioning and Replication*

- **Partitioning:** A method of database distribution in which different portions of the database reside at different nodes in the network.
- **Replication:** A method of database distribution in which one database contains data that are included in another database.

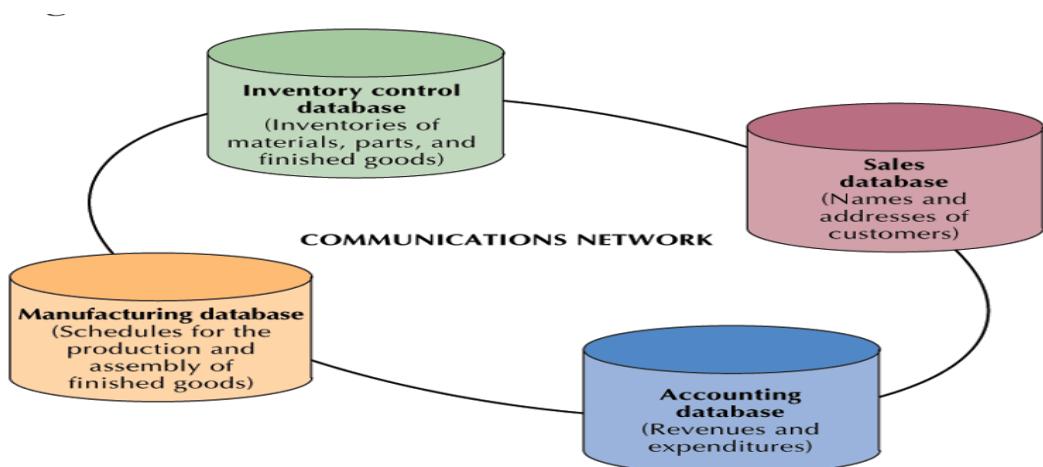
#### *Distribution Strategies*

- **Geographic Distribution Strategy:** A database distribution strategy in which the database is located in a region where the data and information are used most frequently.

- **Functional Distribution Strategy:** A database distribution strategy in which the database is distributed according to business functions.

*Designed a Distributed Database*

- **Database Directory:** The component of a shared database that keeps track of data and information.
- **Other Design Factors:** distributed database designers are faced with six factors besides the ease of use.
  - *Storage Costs:* designers must carefully monitor the volume of data in a distributed database to avoid cost accrued from data duplication..
  - *Processing Costs:* designers must ensure that database is distributed to only those who will use it to reduce the cost of processing data.
  - *Communication Costs:* the cost of distributing data must be justifiable to user access.
  - *Retrieval and Processing:* the designer must put into consideration the response time of access certain information in a database. Since most data will be accessed from remote locations.
  - *Reliability :* designers must safeguard both the existence of and access to important database.
  - *Frequency of Updates and Queries:* updates to frequently accessed database and the queries used to access them must be put into consideration during design process.



**Figure 10.10** Functional Distribution of a Database  
**Source:** (Senn, 2004).

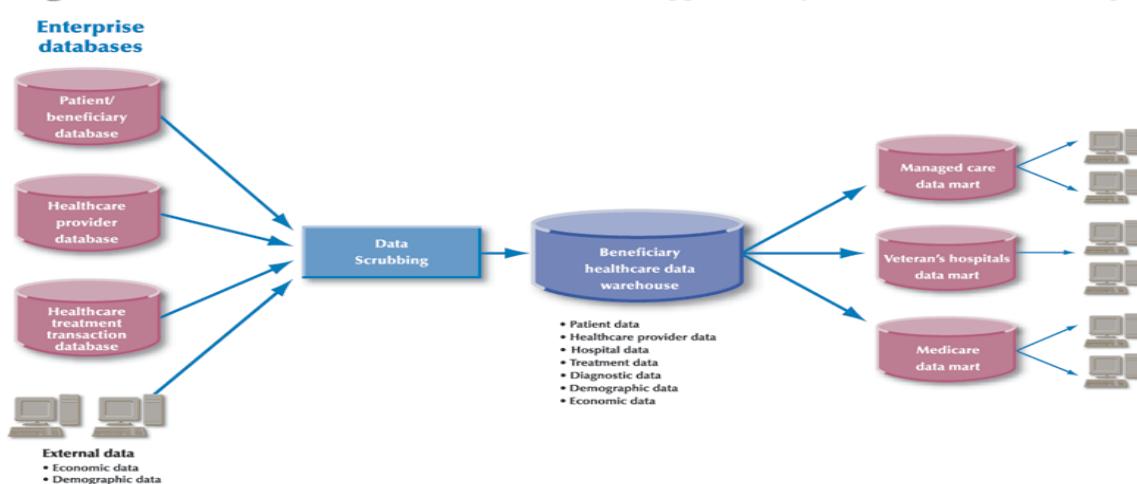
### 3.5 DATA WAREHOUSES AND OLAP

- **Online Analytical Processing (OLAP):** Database processing that selectively extracts data from different points of view.
- **Data Warehouse:** A large data store, designed from inquiries, that combines details of both current and historical operations, usually drawn from a number of sources.
- **Data Mining:** Uses software designed to detect information hidden in the data.
- **Data Marts:** Processed to focus on a specific area of activities or isolated scientific or commercial processes.

**Table : 10.1** Comparison of Enterprise Database and Data Warehouses

	ENTERPRISE DATABASE	DATA WAREHOUSE
Subject Focus	Data are stored with a function or process orientation	Data are subject oriented, reflecting multiple views of functions and processes
Temporal Focus	Data are recorded as current transactions or to reflect current events.	Data reflects an historical orientation spanning several periods of time
Volatile	Updates to data are routine and may be frequent	Data does not change (i.e., details are read-only). However, additional data may be added to the warehouse, reflecting additional time periods or areas of interest.

**Source:** (Senn, 2004).



**Figure 10.11** Data warehouses and Data Marts Support Analysis and Decision Making  
**Source:** (Senn, 2004).

### **3.6 PEOPLE**

The IT professional responsible for managing all the activities and procedures related to an organization's database are **Database Administrator (DBA)** and the **Systems Programmer**.

### **3.7 PROCEDURES**

A procedure is a step-by-step process or set of instructions for accomplishing a specific results. Database Administration Procedures are the procedures associated with managing a database. Some of these procedures are:

- *Database Planning*: this includes being aware of and understanding business needs and user requirements of a database.
- *Database Design*: designers must define the records and objects-including the schema, data names and length that makes up the database.
- *Database Creation*: database design is only a framework, but keying in data and saving on a storage device makes it functional
- *Database Maintenance*: database maintenance pertains to the changes made to the structure and organization of the database. This is caused as a result of an increase in users' needs and demand.
- *Analysis of Usage*: managing a database means monitoring how and when it is used, to suggest restructuring to meet new user request.
- *Creation and Monitoring of Security Procedures*: developing, implementing, and monitoring security procedures are important parts of database administration.

#### ***Concurrency Procedures***

This is the concept of checkmating the type of sharing access to a database resource.

- ***Concurrent Data Sharing***: A database procedure that allows several users to access the database simultaneously.
- ***Nonconcurrent Data Sharing***: A database procedure that allows individuals to access a database only when no other person or application is processing the data.
- ***Record Locking***: A concurrency procedure that prohibits another user from accessing or altering a record that is in use.
- ***File Locking***: Used in systems that store unstructured information and have file-level sharing.
- ***Deadlock***: A situation in which each user of a database is waiting for the others to unlock a record.

## **4.0 CONCLUSION**

In a distributed database data can be accessed either centrally from one location or over a distributed network. The benefit of client/server computing is Data and information can be retrieved easily.

## **5.0 SUMMARY**

In this unit you learnt that:

- **Data Warehouse** - combines details of both current and historical database operations
- **OLAP** - view data from different point
- The IT professional responsible for an organization's database are **Database Administrator (DBA) and the Systems Programmer**

## **6.0 TUTOR MARKED ASSIGNMENT (TMA)**

- a. What are the Concurrency Procedures?
- b. List the functions of a DBMS
- c. Identify the two most common distribution strategies used for database systems. Explain
- d. What items must be taken into account when designing a distributed database system?

## **7.0 FURTHER READING/REFERENCES**

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## **MODULE 2 DATABASES AND COMPUTER NETWORKS**

### **UNIT 11 COMPUTER NETWORKS**

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## **1.0 INTRODUCTION**

In Module 1, you read about a computer system, its basic components and how it is used to process data. In this unit we will discuss how computers can be connected together to share resources and process data.

## **2.0 OBJECTIVES**

By the end of this unit, you should be able to:

- Identify the basic components of a network and their uses
- Types of Networking Connection
- Basic networking checklist

## **3.0 MAIN CONTENT**

Computer Networking refers to the techniques, physical connections, and programs used to interlink two or more computers together. This is fundamentally to enable the networked computers share resources such as hard discs, modems, printers.

### **3.1 TYPES OF NETWORK CONNECTION**

There are two basic types of network connections:

- Physical connections and
- Logical or virtual connections

**Physical connections** that let computers directly transmit and receive signals. Physical connections are defined by the medium used to carry the signal, the geometric arrangement of the computers (topology), and the method used to share information.

**Logical, or virtual,** connections that allow computer applications, such as e-mail programs and the browsers used to explore the World Wide Web, to exchange information. Logical connections are created by network protocols and allow data sharing between applications on different types of computers, such as a personal computer (PC) running the Microsoft Corporation Windows operating system, in a network. Some logical connections use client-server application software and are primarily for file and printer sharing. The Transmission Control Protocol/Internet Protocol (TCP/IP) suite is the set of logical connections used by the Internet, the worldwide consortium of computer networks.

## **3.2 BASIC COMPONENTS OF A NETWORK**

A classical computer network has three essential components or segments. They are as follows:

- Network Software.
- Application Software, &
- Network Hardware

### **3.2.1 NETWORK SOFTWARE**

This also, consists of computer programs that establish protocols, or rules for computers to talk to one another. These protocols are carried out by sending, and receiving formatted instructions of data called *packets*. Protocols make reasonable connections between network applications, direct the movement of packets through the physical network, and reduce the chances of clashes between packets sent at the same time.

### **3.2.2 APPLICATION SOFTWARE**

This consist of computer programs that interface with network users and permit the sharing of information such as files, graphics, videos, and other resources like printers and disks. The types of application software are called client-server and peer-to-peer.

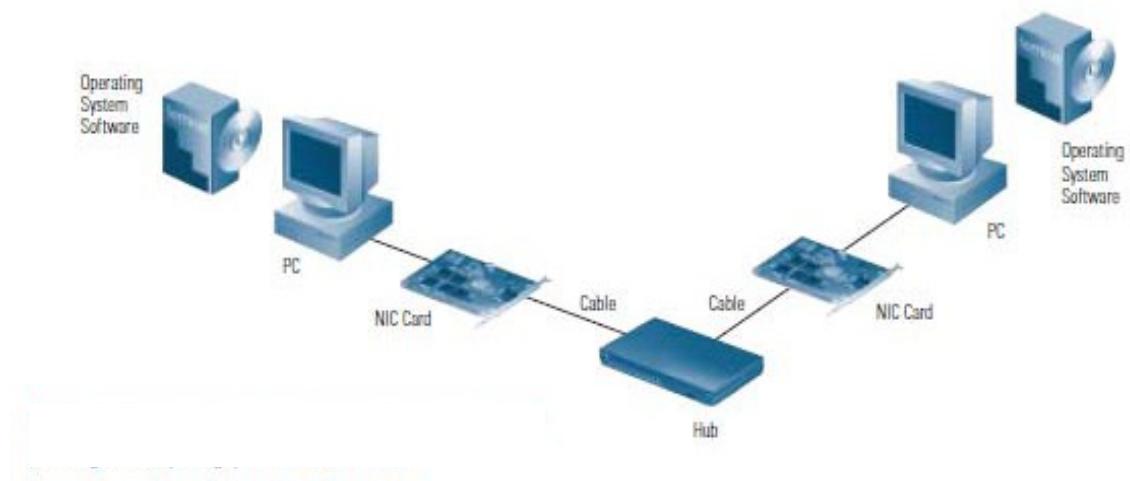
***Client/Server Application:*** - *Client* computers send requests for information or requests to use resources to other computers in a network, called *Servers*. Network and web servers control data and applications commonly. Often, as a network grows and more computers are added, one computer will act as a *server*. A *server* is a central storage point for files or application programs shared on the network.

An example involves a database that can be accessed via a network. The database is stored on a network server, along with a portion of the database management system (DBMS). The DBMS allows users to work with the database. The user's computer (which can be called the node, workstation, or client) stores and runs the client portion of the DBMS.

***Peer-to-peer:*** - In a peer-to-peer network, (sometimes called workgroup) you don't need to have a dedicated *server* in your network, because all nodes on the network have equal relationship to all others. Therefore, computers send messages and requests directly to other computers of their social class on the network without a *Server* linkage.

### **3.2.3 NETWORK HARDWARE**

This consists of the computers, nodes and the physical components such as: cables, connectors and network adapter (Network Interface Card, modem, wireless cards, e.t.c.) that interconnect them together. Whereas the cables and connectors serve as a pathway for the smooth flow of electrical signals in-between devices, the network adapter makes it possible for different computers, with different speeds, voltages and codes to work together, following a set of rules, or a standard known as a *Protocol*.

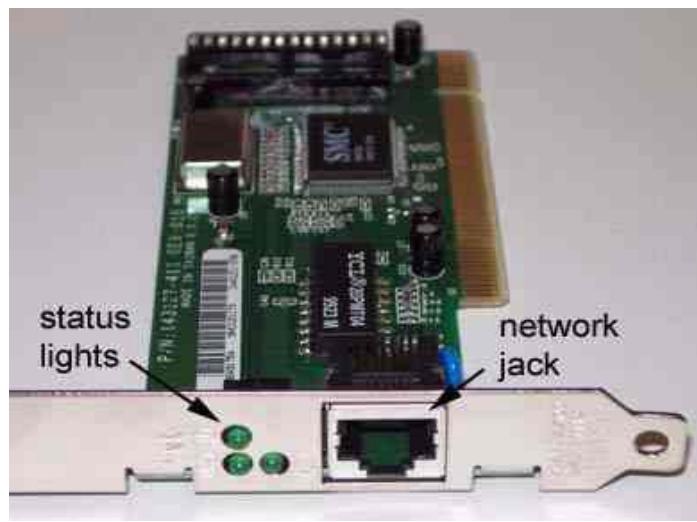


**Figure 11.1** Basic Components of a Network  
**Source:** (Cisco Networking Essentials, 2009).

#### A. NETWORKING DEVICES

##### i. Network Interface Cards

Network interface cards (NICs), or adapters, are usually installed inside a computer's case. With portable and notebook computers, the NIC is usually in the credit card sized PC card (PCMCIA) format, which is installed in a slot. Ethernet NICs support only Ethernet connections, while 10/100NICs can work with either Ethernet or higher-performance *Fast Ethernet* connections. In addition, you will need to ensure that your NICs will support the type of cabling you will use and these are twisted-pair (also called 10BaseT), coaxial (also called 10Base2), or a mixture of both.



**Figure 11.2** Network Interface Cards.  
**Source:** (Google Images, 2009).

## ii. Hubs

Hubs, or repeaters, are simple devices that interconnect groups of users. Hubs forward any data packets they receive over one port from one workstation including e-mail, word processing documents, spreadsheets, graphics, or print requests to all of their remaining ports. All users connected to a single *hub* or stack of connected hubs are in the same “segment,” sharing the hub’s **bandwidth** or data-carrying capacity. As more users are added to a segment, they compete for a finite amount of bandwidth devoted to that segment.



**Figure 11.3** Hub.

Source: (Google Images, 2009).

## iii. Switches

*Switches* are smarter than hubs and offer more *bandwidth*. A switch forwards data packets only to the appropriate port for the intended recipient, based on information in each packet’s header. To insulate the transmission from the other ports, the switch establishes a temporary connection between the source and destination then terminates the connection when the conversation is done. As such, a *switch* can support multiple “conversations” and move much more traffic through the network than a hub. A single eight-port Ethernet hub provides a total of 10 megabits per second (Mbps) of data-carrying capacity shared among all users on the hub. A “full-duplex,” eight-port Ethernet *switch* can support eight 10-Mbps conversations at once, for a total data-carrying capacity of 160 Mbps. “Full-duplex” refers to simultaneous two-way communications, such as telephone communication. With half-duplex communications, data can move across the cable or transmission medium in just one direction at a time.



**Figure 11.4** Switch.

Source: (Google Images, 2009).

#### iv. Routers

Routers use a more complete packet “address” to determine which router or workstation should receive each packet. Based on a network roadmap called a “routing table,” routers can help ensure that packets are traveling the most efficient paths to their destinations. If a link between two routers goes down, the sending router can determine an alternate route to keep traffic moving. Routers also provide links between networks that speak different languages or, in computer speak networks that use different “protocols.” Examples include IP (Internet Protocol), the IPX® (Internet Packet Exchange Protocol), and AppleTalk. Routers not only connect networks in a single location or set of buildings, but they provide interfaces or “sockets” for connecting to wide-area network (WAN) services. These WAN services, which are offered by telecommunications companies to connect geographically dispersed networks, are explained in more detail in the next topic



**Cisco Router 2500 series**

**Figure 11.5** Linksys and Cisco Routers.

Source: (Google Images, 2009).

##### v. Modems

Modems are used for “dialup” communications; in other words, they dial up a network connection when needed, and when the transmission is completed, the connection is disabled. They work with ordinary telephone lines. When you want to send data across telephone lines, the modem takes the information from digital format and converts it (or modulates it) into an analog signal. The receiving modem converts the analog signal back into digital form (or demodulates it) to be read by your computer. This modulating and demodulating gives the modem its name.

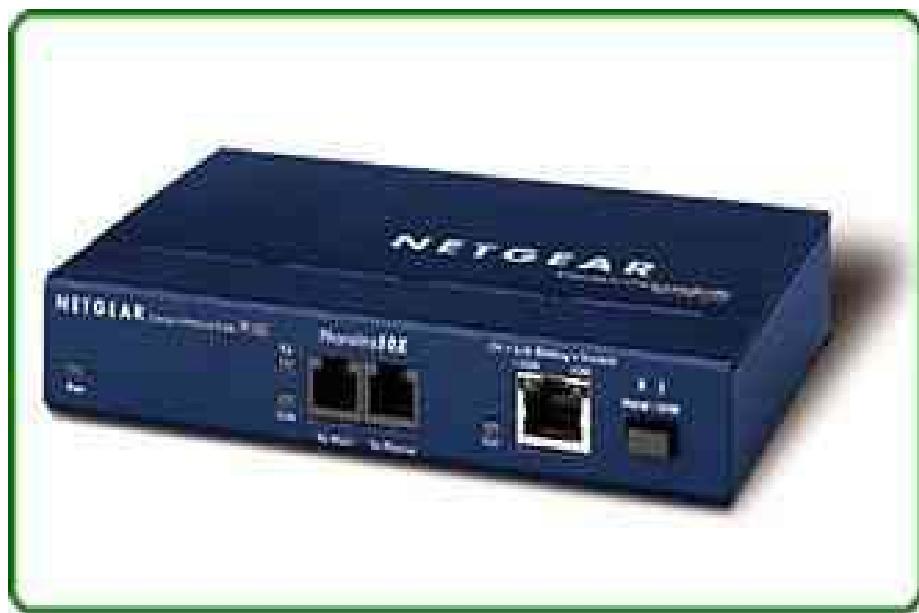


**Figure 11.6** A Modem

Source: (Google Images, 2009).

##### vi. Bridges

As the network becomes crowded with users or traffic, bridges can be used to break them into multiple segments. Switches are basically multiple bridges in a single device. Bridges help to reduce congestion by keeping traffic from traveling onto the network “backbone” (the spine that connects various segments or “sub networks”). If a user sends a message to someone in his own segment, it stays within the local segment. Only those packets intended for users on other segments are passed onto the backbone.



**Figure 11.7** A Bridge.

**Source:** (Google Images, 2009).

#### vii. Uninterruptible Power Supplies

Uninterruptible power supplies (UPS) are not essential to networks but are highly recommended. They use constantly recharging batteries to prevent momentary power outages from shutting down your network servers or clients. Most of them also provide protection against potentially damaging voltage spikes and surges.



**Figure 11.8** A UPS

**Source:** (Google Images, 2009).

### viii. Wiring and Cable

Networks use three primary types of wiring (also referred to as “media”):

- **Twisted-pair:**- the industry standard in new installations. This wire comes in several “standards.” Unshielded twisted pair (UTP) Category 3 wire (also called 10BaseT) is often used for your phone lines, and UTP Category 5 (also called 10Base2) wire are the current networking standards.
- **Coaxial:**- resembles round cable TV wiring.
- **Fiber-optic:**- usually reserved for connections between “*backbone*” devices in larger networks, though in some very demanding environments, highly fault resistant fiber optic cable is used to connect desktop workstations to the network and to link adjacent buildings. Fiber-optic cable is the most reliable wiring but also the most expensive.



**Figure 11.9** The three primary types of Networking cables

Source: (Cisco Networking Essentials, 2009).

## B. Network Management

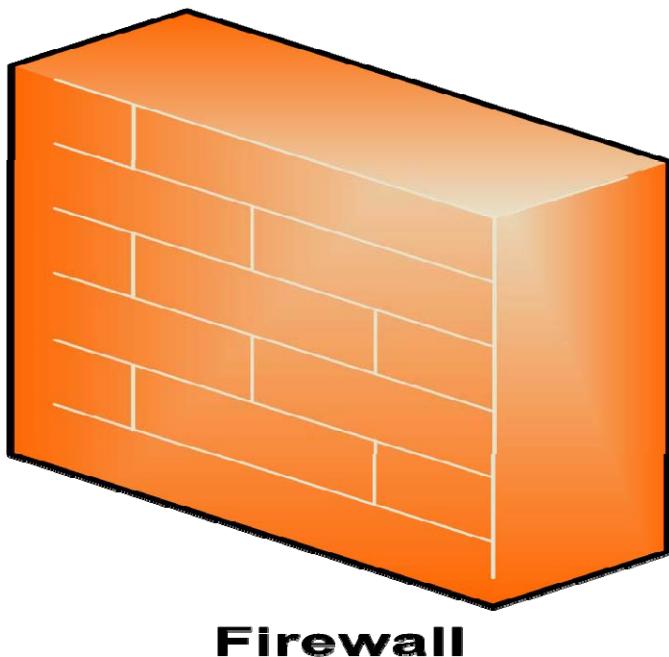
Network management software allows you to monitor traffic flows, configure new equipment, and troubleshoot network problems. ‘Managed’ hubs and switches have the ability to tell network management software ‘console’ how much data they are handling, sound alarms when problems occur, and record traffic volumes over time to help you understand when users are placing the heaviest demands on the network throughout the day. While not essential for very small networks, network management becomes increasingly important as the network grows. Without it, keeping traffic flowing smoothly throughout the network, adding or moving users, and troubleshooting problems can be difficult.

## C. Security

Your network is bound to carry at least some information you want to protect from certain users—students’ grades and attendance records, for example. For this reason, you’ll want to consider some form of network security. Security solutions come in three basic forms: user

authentication and authorization, audits, and firewalls. Authentication designates who can access the network, and authorization governs what they can see when they're connected. Audits enable you to track user activity to help spot unauthorized activity before it becomes a full-fledged security breach.

D. **Firewalls** protect your internal network from invasion through the Internet or other external sources. Firewalls can restrict access to certain users and control which users can use which applications when dialing in from outside.



**Figure 11.10** A Symbol of a Firewall  
Source: (Cisco Networking Essentials, 2009).

### 3.3 STANDARDS FOR NETWORKS

Communication between interconnected computer systems is a complex activity which takes place at a number of different levels. At the lowest level there is the physical transmission of signals and at the highest level there may be communication of messages in everyday languages.

In an attempt to form a basis for standardizing such interconnections the **International Standard Organisation (ISO)** has devised a standard based upon seven distinct levels or layers of communication. The **Open Systems Interconnectivity (OSI)** model has seven layers from the lowest to the highest as follows;

- **The physical control layer** is the level of electrical connections, signal transmission and data in raw form.

- **The data link layer** is the level at which data is transmitted in small units using suitable protocols to control and correct transmission. The units of data are “**frames**”, that is, asynchronously transmitted characters (i.e. individually at will) or synchronously transmitted blocks of characters (i.e. fixed intervals at a fixed rate).
- **The network layer** is the level which provides control among adjacent sending and receiving points in a network. The sending and receiving points which are able to switch transmission are nodes in the network called **IMPs**.
- **The transport layer** is the level which provides an end-to-end service between host computers. It deals with addressing, error controls and regulated data transfer.
- **The session layer** is the level which handles the establishment of connections between host and the management of the dialogue. Messages created at this level are addressed by the transport layer and split into packets at the network layer.
- **The presentation layer** is the level which handles the standard forms for presenting data, e.g. the layouts used for VDU displays.
- **The presentation layer** is the level which the user has control over in determining what data is to be transmitted and how it is to be sent or received.

### **3.4 NETWORKING CHECKLIST**

Every network includes:

- at least two computers
- a network interface on each computer , that is the device that lets the computer talk to the network. It is usually called a network interface card [NIC] or adapter
- a connection medium: this is usually a wire or cable, but wireless communication between networked computers and peripherals is also possible.
- Network operating system software: such as Microsoft Windows 95 or Windows NT, Novell NetWare, AppleShare, Linux or Unix.
- a **hub** or a switch to act as a connection point between the computers and a router to connect different networks together.

## **4.0 CONCLUSION**

For an ease of communication among computer users, computers need to be conjoined on a network. A network combines the capabilities of a Computer and other network devices to share or distribute resources to end users.

## **5.0 SUMMARY**

We learnt in this unit that classical computer network has three essential components or segments. They're as follows:

- Network Software.
- Application Software, &
- Network Hardware

## **6.0 TUTOR MARKED ASSIGNMENT**

- a. What are the Advantages of Using Networks?
- b. What does ISO means? How many layers are there in the OSI?
- c. List the two types of network connection you know.
- d. Why do you join computers and other devices to form a network?

## **7.0 FURTHER READINGS/REFERENCES**

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## **MODULE 2 DATABASES AND COMPUTER NETWORKS**

### **UNIT 12 NETWORKING TECHNOLOGIES**

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## **1.0 INTRODUCTION**

In Unit 11, you read about the basic devices used in setting up a network. In this unit we will discuss how these devices can be combined with computers and geometrical be arranged into two basic technologies local area network (LAN) and wide area network (WAN).

## **2.0 OBJECTIVES**

By the end of this unit, you should be able to:

- Identify the two network technologies (LAN and WAN)
- Know what are Network Topologies
- The concept of wireless networks in LAN and WAN

## **3.0 MAIN CONTENT**

There are basically two types of computer networks namely:

- Local Area Networks (LAN), and
- Wide Area Networks (WAN).

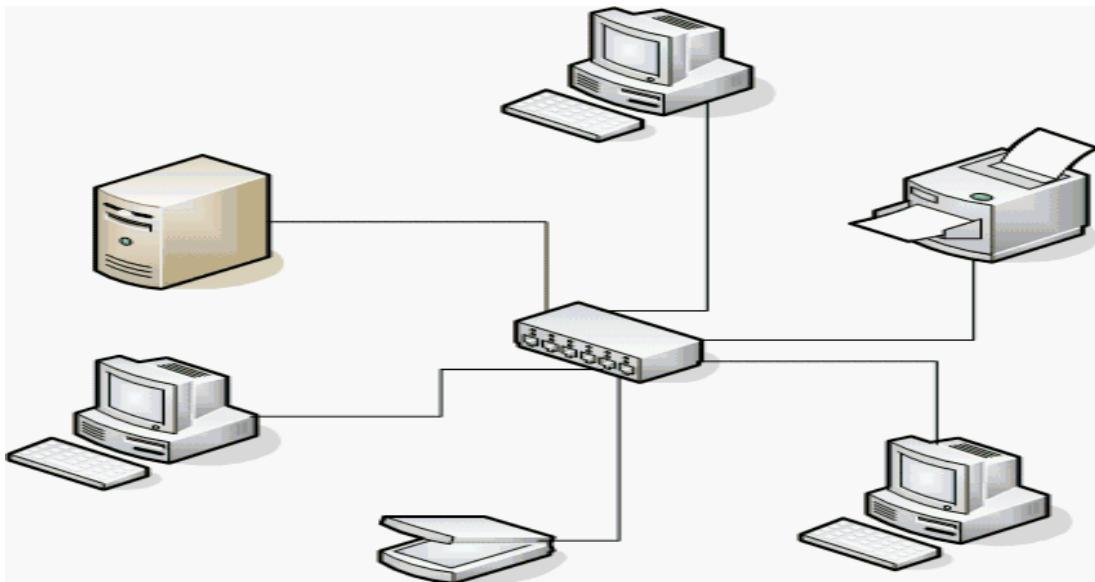
Other types of networks co-exist due to the combination of the LAN or WAN networks. Depending upon the size, computer networks are further classified Metropolitan Area Networks (MAN), Campus Area Networks (CAN) and Personal Area Networks (PAN). The topology (topology is the way the computer networks and network resources are connected) of the networking can be classified as Bus Network, Ring Network and Star Network.

The networking hardware basically consists of wiring, network cards and a hub. Computer network cards are required so that one computer can understand what the other computer is “talking”. Network cards have a unique MAC address to identify computers on a computer network. Hubs connect all the computers in the network. Hubs can also be used to connect to other hubs to increase the size of the computer network. Two computers can be connected using Ethernet cards or phone lines or power lines for communication.

(Networks will be treated in details in the next Unit)

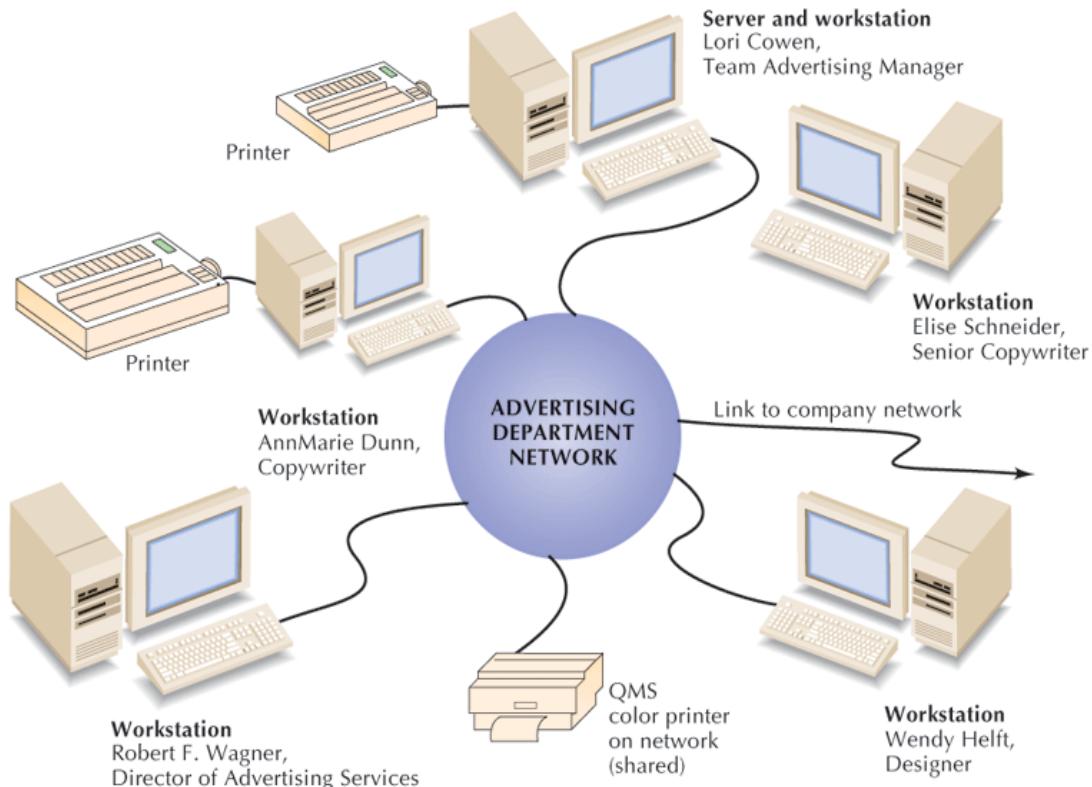
### **3.1 A LOCAL-AREA NETWORKS (LAN)**

A Local-Area Networks (*LAN*) is a network contained in a building or on a single campus. The first LANs installed are usually basic networking services to support this printer-sharing requirement. Now a printer anywhere in the local area can be authorized for shared use. The physical medium to accomplish this connection is the LAN cabling. Each workstation is connected to a cable that routes the transmission either directly to the next workstation on the LAN or to a hub point that routes the transmission to the appropriate destination. There are three primary LAN technologies in use: the Ethernet, Token Ring and High-Speed LAN Technologies



**Figure 12.1** A Local Area Network

**Source:** (Computer Networks, 2009).



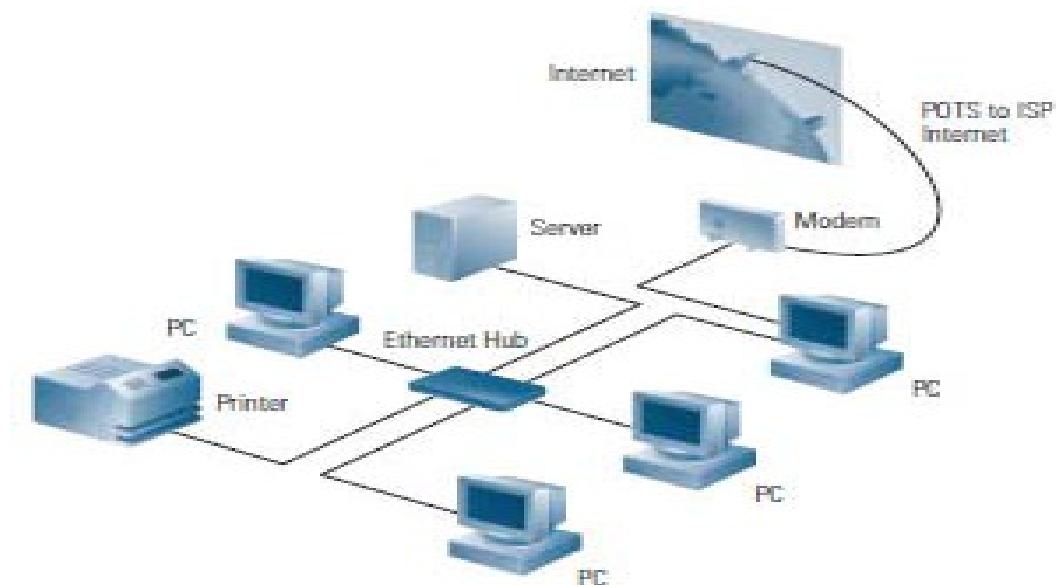
**Figure 12.2** A Local Area Network in an Advertising Department

**Source:** (Senn, 2004).

## Ethernet and Fast Ethernet

**Ethernet** has been around since the late 1970s and remains the leading network technology for local-area networks. Ethernet is based on carrier sense multiple access with collision detection (CSMA/CD). An Ethernet workstation can send data packets only when no other packets are traveling on the network, that is, when the network is “quiet.” Otherwise, it waits to transmit, just as a person might wait for another to speak during conversation.

If multiple stations sense an opening and start sending at the same time, a “collision” occurs. Then, each station waits a random amount of time and tries to send its packet again. After 16 consecutive failed attempts, the original application that sent the packet has to start again. As more people try to use the network, the number of collisions, errors, and subsequent retransmits grows quickly, causing a snowball effect. Collisions are normal occurrences, but too many can start to cause the network to slow down.



**Figure 12.3** An Ethernet Network Technology

**Source:** (Cisco Networking Essentials, 2009).

## Token Ring

Token Ring is a “token-passing” technology and an alternative to Ethernet’s collision-detection method. A token travels through the network, which must be set up in a closed ring, and stops at each workstation to ask whether it has anything to send. If not, the token continues to the next point on the network. If there is data to send, the sending station converts the token frame into a data frame and places it into the ring. The frame continues around the ring, sets repeated by all stations, but the destination station also copies the frame into memory. When the frame comes around to the sending station, it strips the data frame from the ring and releases a new token. Token Ring networks operate at either 4 or 16 Mbps,

but with the low cost, ease of use, and easy migration to higher performance in Ethernet networks. Token Ring is rarely used for new network installations.

### **High-Speed LAN Technologies**

Today's growing fast-changing networks are like growing communities; the traffic they create tends to cause congestion and delays. To alleviate these problems, you can install higher-speed

LAN technologies in your network that move traffic more quickly and offer greater data-carrying capacity than Ethernet.

## **3.2 WIDE-AREA NETWORKS**

Local Area Networks accommodate local users; people within a building or on a campus. Wide Area Networks connect users and Local Area Networks spread between various sites, whether in the same city, across the country, or around the world. "Remote access" refers to a simple connection, usually dialed up over telephone lines as needed, between an individual user or very small branch office and a central network.

In general, Local Area Networks speeds are much greater than Wide Area Networks and remote access speeds. For example, a single shared-Ethernet connection runs at 10 Mbps (mega means "million"). Today's fastest analog *modem* runs at 56 kilobits per second (Kbps) (kilo means "thousand")—less than one percent of the speed of an Ethernet link.

## **3.3 WIRELESS NETWORKS**

As the number of computers in an office or a home increases, so do the number of cables, so wireless networking is a viable solution. In wireless networking radio transceivers or infrared signals are used to communicate between computers and devices. Examples of wireless networking include Wi-Fi and Bluetooth technology, though there may be security issues involved in wireless networking. However there definitely is a stronger preference towards wireless networking nowadays among consumers.

Computer networks have added a new dimension to the 21st century. Today the cyber world is much faster and wider than the real world. This has all been made possible due to computer networks. Computer networks have revolutionized business, communication, travel, research, defense, society and almost all human endeavors. The evolution of computer networks has helped the technological revolution take a big leap forward.



**Figure 12.4** A PCMCIA Adaptor used for Wireless networking.

**Source:** (Computer Networks, 2009).

Wireless networks have become incredibly popular - so much so that virtually all new laptop computers have wireless network cards included as part of a set of standard features. As a matter of fact, customers will offer salespeople a strange, blank look if wireless networking is not included as one of the standard features. People love the convenience of being able to boot up the laptop and surf the net wherever they may be.

Wireless networks have become so popular and affordable that many people are now opting to include this convenience in their homes also, then there are a few things that you will need to understand about how wireless networks work.

Most wireless networking technology available for home use operates on what is called 802.11g technology. What this means is that the data sent over the network is transmitted at 2.4 GHz at a speed of 54 megabits. For non-technical people, that means the data is moving pretty fast. Newer technology is currently in the works for wireless networks (802.11n), but it is still in the beta, or testing, phase.

Wireless networks operate by using either modulating radio waves or pulsing infrared light. They include a router that is hardwired to your Internet connection and transmits data via these radio or light waves. Your computer receives the information via either an internal or external wireless adapter, which acts as a receiver.

### 3.4 NETWORK TOPOLOGY

A network topology is the geometric arrangement or layout of computers in a network. The following types of layouts are common:

- Point-To-Point Network Topology

- Bus Network Topology
- Star Network Topology
- Ring Network Topology, and
- Tree Network Topology.

**a. Point-To-Point Network Topology**

Point-to-point topology is the simplest, consisting of two connected computers.

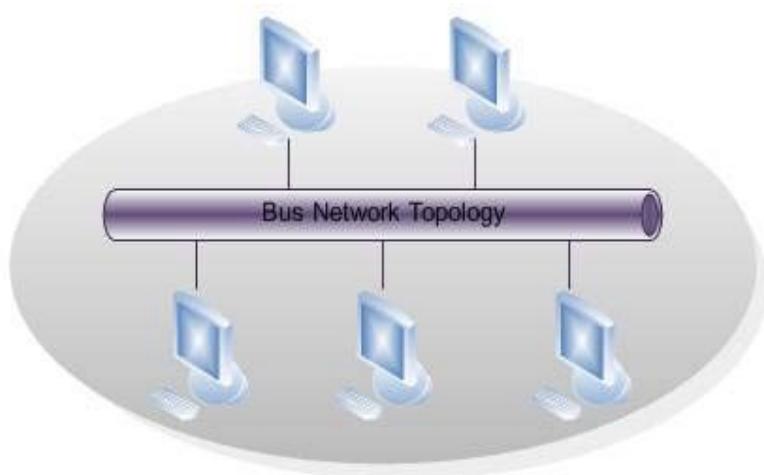


**Figure 12.5** A Point-To-Point Network Topology

**Source:** (Computer Networks, 2009).

**b. Bus Network Topology**

The bus topology is composed of a single link connected to many computers. All computers on this common connection receive all signals transmitted by any attached computer.

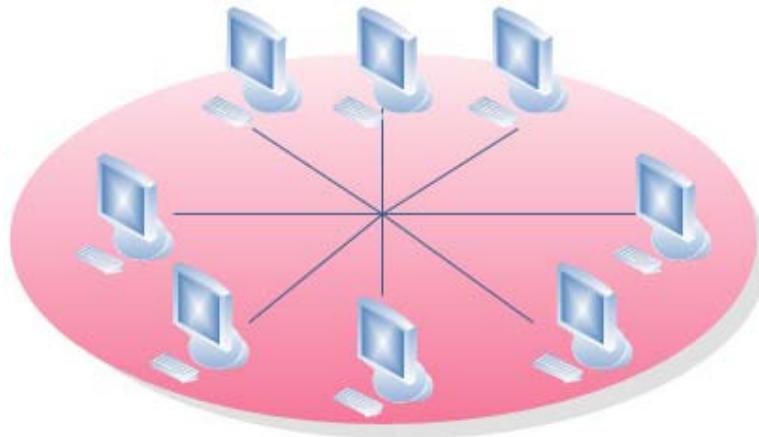


**Figure 12.6** A Bus Network Topology

**Source:** (Computer Networks, 2009).

### c. Star Network Topology

A star topology connects many computers to a common hub computer. This hub can be inactive, repeating any input to all computers similar to the bus topology, or it can be active, selectively switching inputs to specific destination computers.

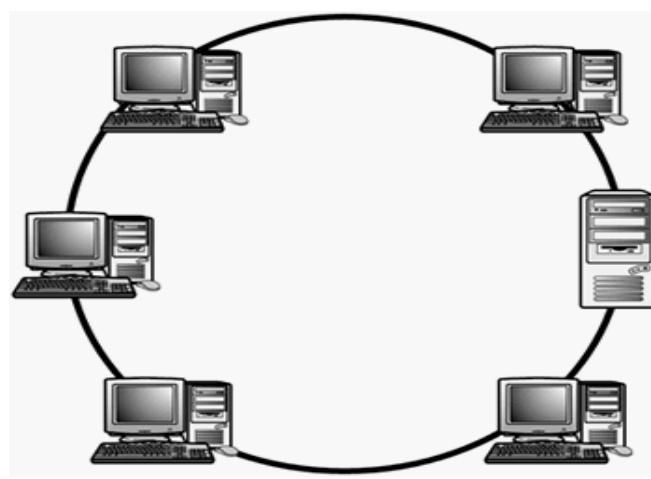


**Figure 12.7** A Star Network Topology

**Source:** (Computer Networks, 2009).

### d. Ring Network Topology

The ring topology uses multiple links to form a circle of computers. Each link carries information in one direction. Information moves around the ring in sequence from its source to its destination.

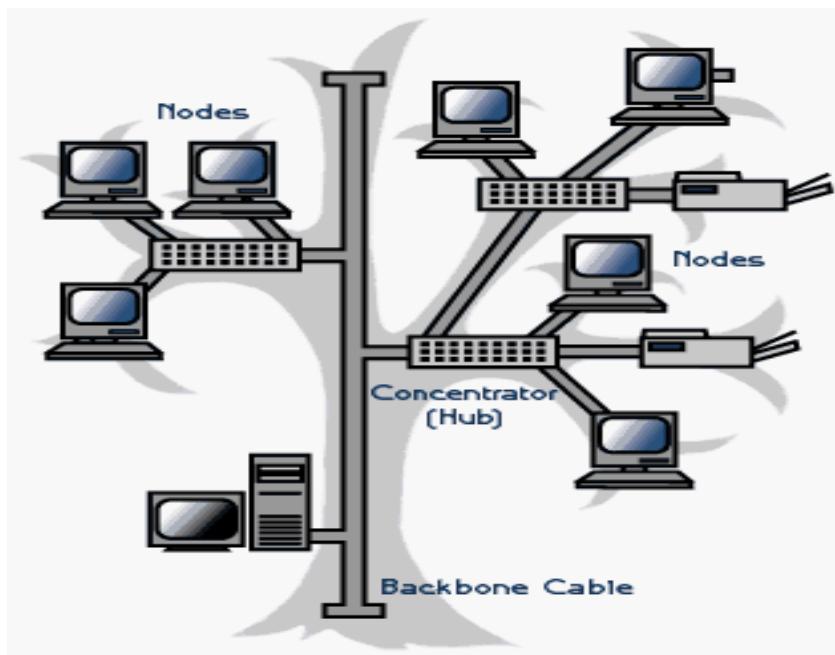


**Figure 12.8** A Ring Network Topology

**Source:** (Computer Networks, 2009).

#### e. Tree Network Topology

A Tree topology combines characteristics of bus and star topologies. It consists of groups of star-configured workstations connected to a bus backbone cable. Tree topologies allow for the expansion of an existing network, and enables institutions to configure networks to meet their needs.



**Figure 12.9 A Tree Network Topology**  
Source: (Computer Networks, 2009).

### 3.5 BASIC ADVANTAGES OF USING NETWORKS

- There are many possible advantages of using networks. The basic ones are:
- The sharing of resources (e.g computers and staff) and information
- The provision of local facilities without the loss of central control
- The even distribution of work, processing loads, e.t.c.
- Shared risk and mutual support.
- Improved and more economic communication facilities in general, e.g. including voice communications.

### 4.0 CONCLUSION

A network topology is the geometric arrangement or layout of computers in a network that form the two basic networking technologies (LAN and WAN). The wireless network is not a separate technology but it used to extend the capabilities of the local area network and wide area network to reduce or eliminate cabling.

## **5.0 SUMMARY**

We learnt in this unit that:

- Local Area Networks speeds are much greater than Wide Area Networks
- There are other types of WAN – (MAN, PAN and CAN)
- A wireless network can be added to either a LAN or a WAN to reduce cabling
- Examples of wireless networking include Wi-Fi and Bluetooth technology

## **6.0 TUTOR MARKED ASSIGNMENT**

- a. Identify the types of Network Technology?
- b. What is Network Topology?
- c. Which type of wide area network is faster than the local area network?
- d. Define high speed LAN.

## **7.0 FURTHER READINGS/REFERENCES**

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## **MODULE 3 DISTRIBUTED NETWORKS AND THE INTERNET**

### **UNIT 13 COMMUNICATIONS NETWORKS**

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## **1.0 INTRODUCTION**

Unit 12 introduced you to computer networks. This unit will expand the computer networks to communication networks by adding communication channels.

## **2.0 OBJECTIVES**

By the end of this unit you should be able to:

- State the principles of communication networks.
- Identify the various types of network service applications
- State the various network channels with examples.
- Identify the five transport technologies that are in widespread use in physical channel networks.

## **3.0 MAIN CONTENT**

A communication network is a set of locations, or nodes, consisting of hardware, programs, and information that are linked together as a system that transmit and receives data and information.

### **3.1 PRINCIPLES OF COMMUNICATIONS NETWORKS**

- ***Communication:*** The sending and receiving of data and information over a communications network.
- ***Multiuser System:*** A communications system in which more than one user share hardware, programs, information, people, and procedures.

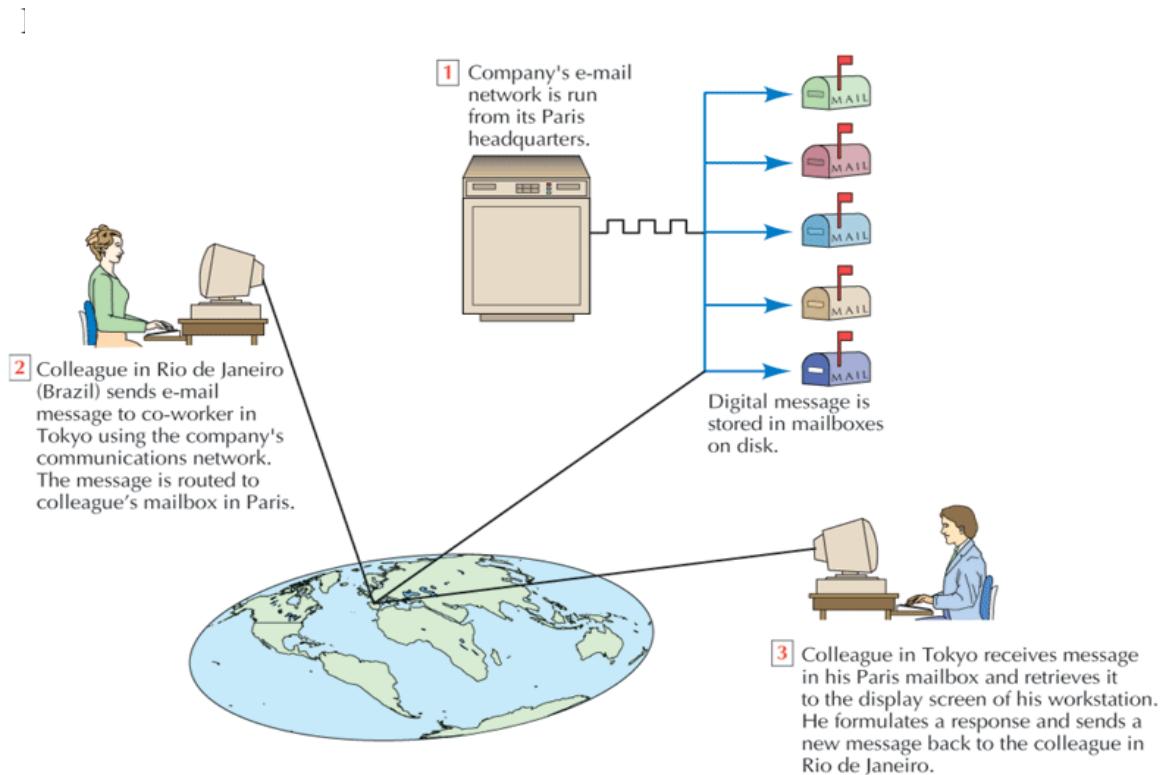
### **3.2 ROLE OF COMMUNICATIONS NETWORKS**

- ***Communications Network:*** A set of locations, or nodes, consisting of hardware, programs, and information linked together as a system that transmits and receives data and information.
- ***Node:*** A communication station within a network.

### 3.3 NETWORK SERVICE APPLICATIONS

Network Services are the applications available on a communications network.

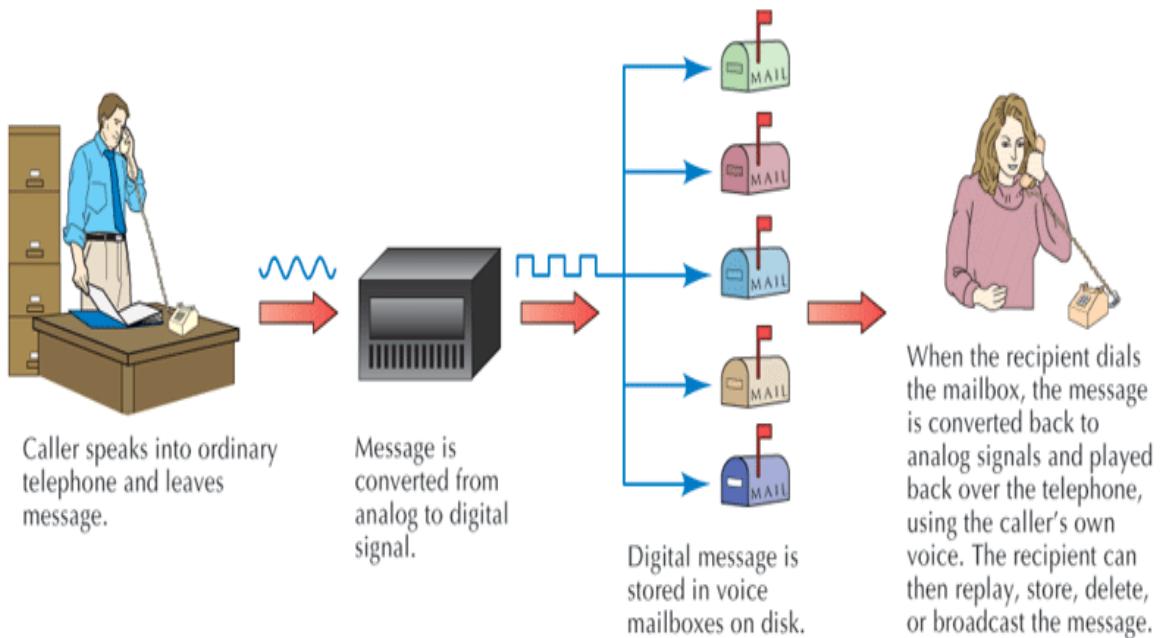
- **Electronic Mail:** sometime called e-mail are designed to overcome the communication barrier created by time and distance over a phone. E-mail is a service that transports text messages from a sender to one or more receivers.
  - **Electronic Mailbox:** An area of space on magnetic disk in a server or host computer that is allocated for storing an individual's e-mail.



**Figure 13.1** E-mail Network and Mailboxes

Source: (Senn, 2004).

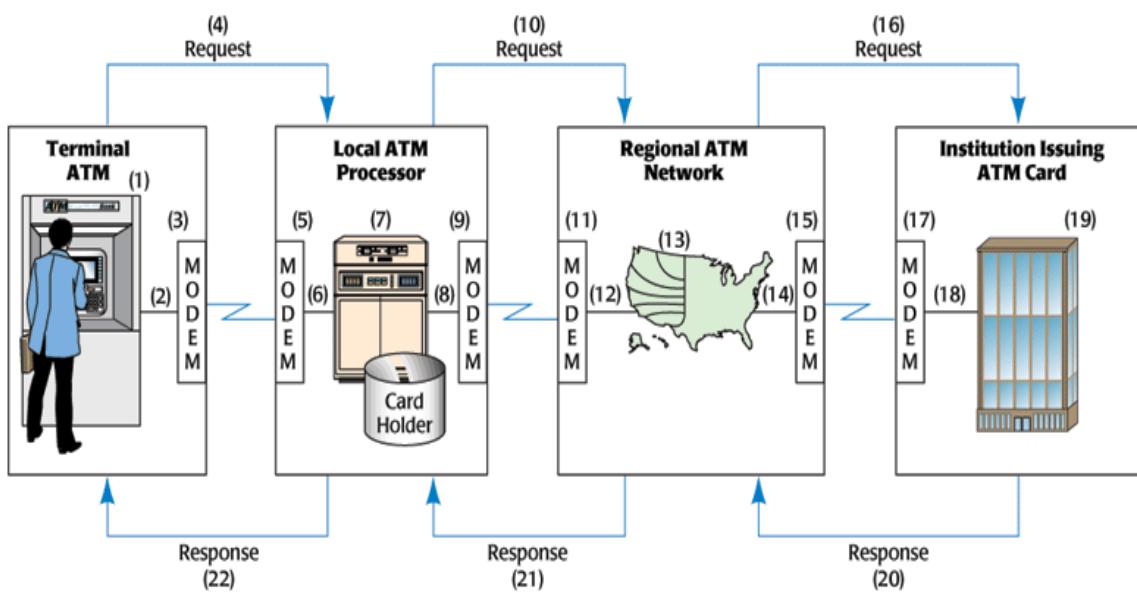
- **Voice Mail:** A system that captures, stores, and transmits spoken messages using an ordinary telephone connected to a computer network.
  - **PPTs (post, telephone, and telegraph companies):** A general term for telephone companies outside the United States.
  - **Unified Messaging Systems:** Offers users the ability to manage several communications media, including telephone, fax, e-mail (including those from the Web), and voice mail through a central message manager.



**Figure 13.1** How Voice Mail Works

Source: (Senn, 2004).

- **Videoconferencing:** A type of conferencing in which video cameras and microphones capture the sight and sound of participants for transmission over a network.
  - **Webcasting:** Uses the reach of the Internet to link people from anywhere in the world into a conference.
- **Work Group Conferencing:** A type of conferencing that uses a software package called groupware to interconnect participants' computers at their various locations. Participants interact through a microcomputer directly linked to a server and their comments are broadcast to all others taking part in the conference.
- **Electronic Bulletin Board:** A network service application that allows messages and announcements to be posted and read. It is accessed by dialing a telephone number and interconnecting with the bulletin board through a modem.
- **Electronic Funds Transfer (EFT):** The movement of money over a network.



**Figure13.3** ATM Networks Link Regional, National, and International Banks.  
Source: (Senn, 2004).

- **Electronic Data Interchange (EDI):** A form of electronic communication that allows trading partners to exchange business transaction data in structured formats that can be processed by application software.
- **Videotex:** A two-way, interactive, text-only service operating on mainframe computers that combines a video screen with easy-to-follow instructions.

### 3.4 NETWORK CHANNELS

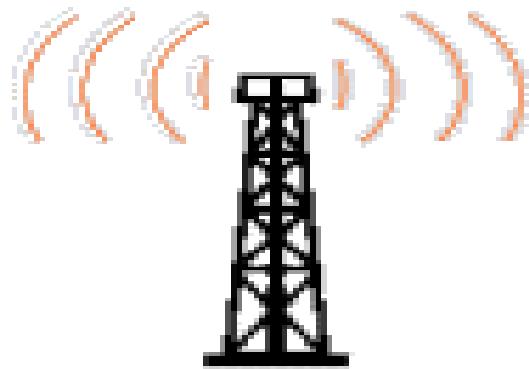
Communications Channel/Communications Medium is the physical or cableless media that link the different components of a network.

- **Physical Channels:**
  - **Twisted Pair:** A physical communications channel that uses strands of copper wire twisted together in pairs to form a telephone wire.
  - **Coaxial Cable/Co-ax:** A physical communications channel that uses one or more central wire conductors surrounded by an insulator and encased in either a wire mesh or metal sheathing.
  - **Coaxial Cable/Co-ax:**

- **Baseband Cable:** Carries a single communication or message at very high megabit speeds, is often used in local area networks.
- **Broadband Cable:** Carries multiple signals – data, voice, and video – simultaneously; each signal can be a different speed.
- **Fiber-optic Cable:** A physical communications channel that uses light and glass fibers.
- **Wireless Channels**

Wireless channels transmit data using radio signals sent through air or space rather than over wire or optical cables.

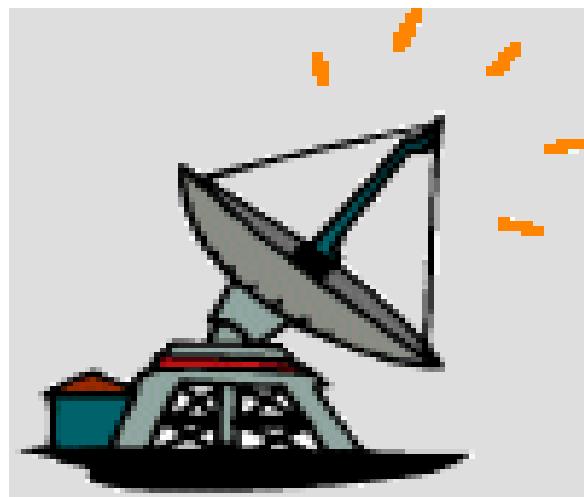
- **Microwave:** A cableless medium that uses high-frequency radio signals to send data or information through the air.



**Figure 13.4** A Microwave Station

**Source:** (Smith, 2009).

- **Satellite:** A cableless medium in which communications are beamed from a microwave station to a communications satellite to orbit above the earth and relayed to other earth stations.
  - **Low-earth-orbit satellite (LEO):** Because they circle Earth at a distance far closer than other satellites, LEO satellite systems offer significant advantages: they do not have the comparatively long propagation delays, do not require use of bulky, expensive, directional antennas, less expensive to produce and to launch into orbit. However, greater numbers are needed to provide coverage for a geographic because they do orbit closer to Earth.
  - **Very Small Aperture Terminal (VSAT):** A satellite earth station with an antenna diameter of under one meter.



**Figure 13.5** A Very Small Aperture Terminal (VSAT).

**Source:** (Smith, 2009).

- **Infrared:** A cableless medium that transmits data and information in coded form by means of an infrared light beamed from one transceiver to another.
  - **Transceiver:** A combination transmitter and receiver that transmits and receives data and information.
- **Radio Waves**
  - **Radio Wave Transmission/Radio Frequency (RF) Transmission:** A cableless medium that uses frequencies rented from public radio networks to transmit data and information.

### 3.5 COMMUNICATION CHANNELS FOR WANS, MAN AND LANS

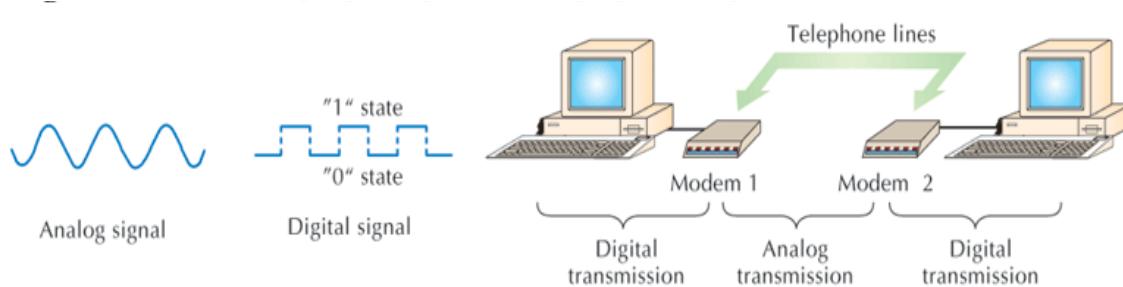
- **Public Access Networks:** A network maintained by common carriers for use by the general public.
  - **Switched Network/Circuit Switched:** The complete set of public access networks, so named because the telephone company operates and maintains the switching centers that make it possible to transmit data and information.
  - **Packet Switching:** A network communication method in which messages are divided into packets. Each packet is then transmitted individually and can even follow different routes to its destination.
  - **Packet:** A piece or section of a transmitted message that contains both data and address information enabling the network to deliver the packet to its intended destination.

- **Private Network:** A network made up for leased (dedicated) communications lines.
  - **Leased Line/Dedicated Line:** A communications line reserved from a carrier by a company for its exclusive use.
  - **Value-added Network (VAN):** A public data communications network that provides basic transmission facilities plus enhancements (e.g. temporary data storage and error detection).

## Connecting to the Channel

The devices used as channels to connect to networks are:

- **Modem:** A device that connects a computer to a communications medium and translates the data or information from the computer into a form that can be transmitted over the channel. Used in WANs.
- **Multiplexer:** A device that converts data from digital to analog form and vice versa in order to allow a single communications channel to carry simultaneous data transmissions from the many terminals that are sharing the channel.
- **Network Interface Card (NIC):** A circuit board used in LANs to transmit digital data or information.



The signals sent along a communications medium can be digital or analog. The phone system carries **analog signals**—continuous waves—over a frequency range.

Most types of computing equipment use **digital signals**, which code data into blocks of zeroes and ones.

When a computer sends data to a modem for transmission at a specified speed, it represents the digital blocks of zeroes and ones electrically as -5 and +5 volts, respectively. The modem changes, or **modulates**, the electrical signals into two analog frequency tones. It converts zeroes into a frequency of 2025 cycles per second (2025 hertz) and ones into a frequency of 2225 cycles (2225 hertz) per second.

This process is reversed at the receiving end of the transmission, where a second modem converts the analog signals back into digital signals.

**Figure 13.6** Converting Digital Signal to Analog Signal using a Modem.  
Source: (Senn, 2004).

## Interconnecting Networks

- **Bridge/Router:** A device that interconnects compatible LANs.
- **Gateway:** A device that connects two otherwise incompatible networks, network nodes, or devices.

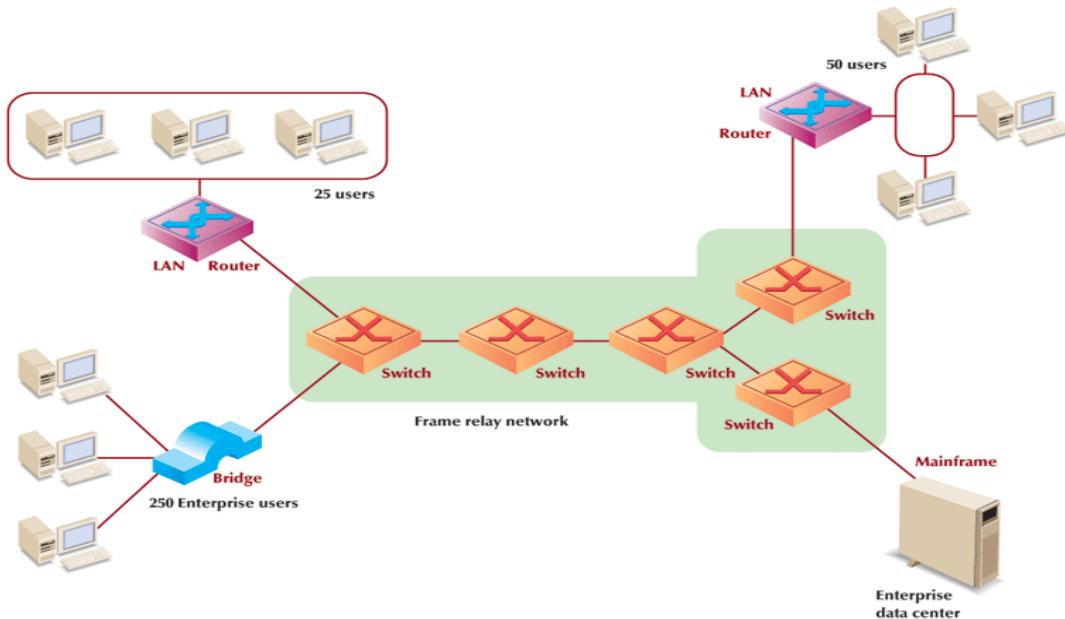
## Extending Networks

- *Microwave/RF Radios*
- *Switch*
- *Hub*

## 3.6 PHYSICAL NETWORK TRANSPORT TECHNOLOGY

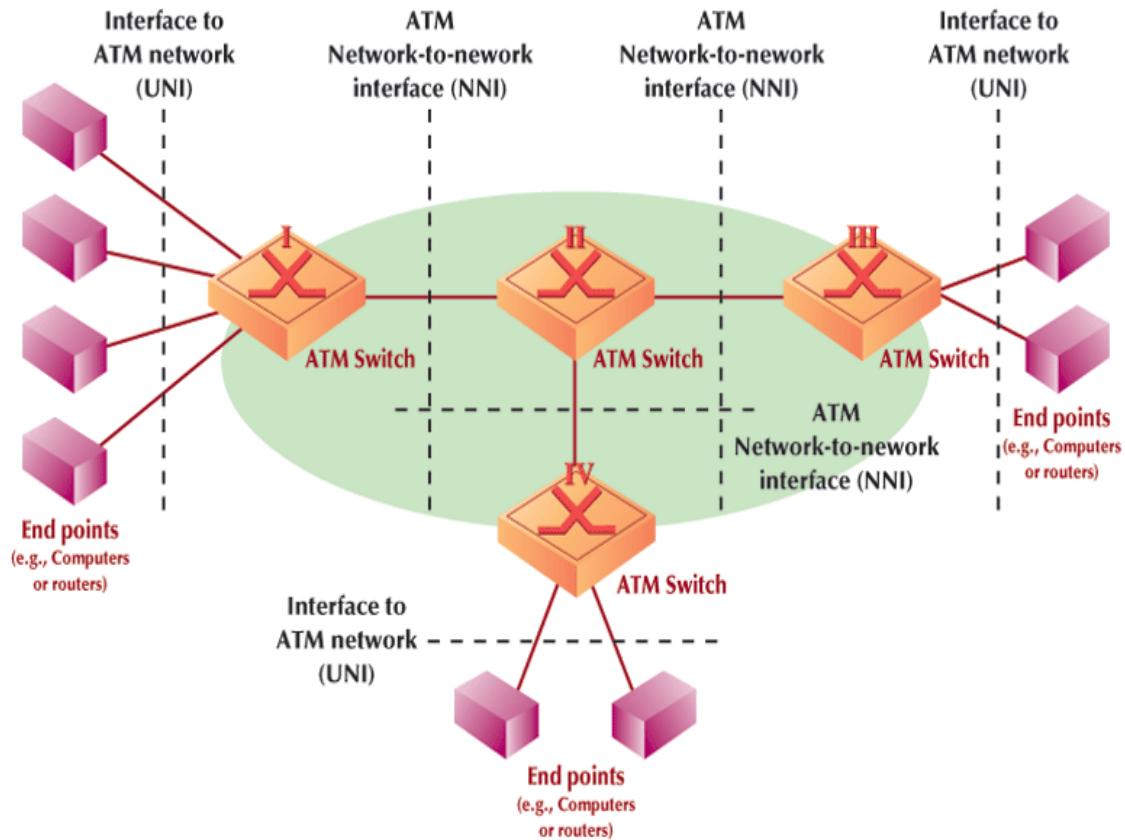
### Five Types of Transport Technology

- **Frame Relay:** A way of sending data over a wide area network in which data are divided into frames (i.e., packets) with each containing an address that the switched network uses to determine its destination.
- **Asynchronous Transfer Mode (ATM):** A data transmission method using switched networks in which a message containing data, voice, or video is divided into fixed length cells.



**Figure 13.7** Frame Relay Network.

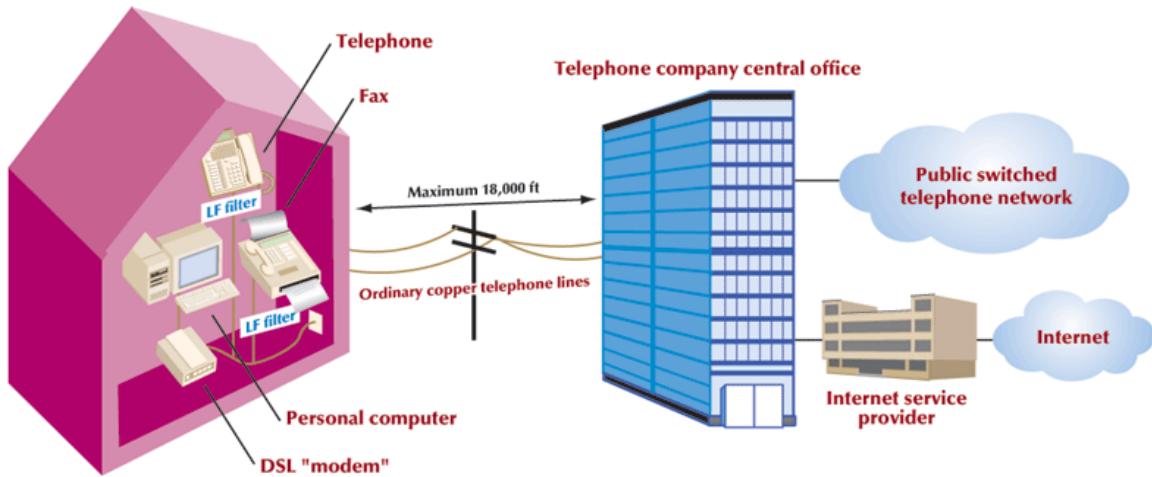
Source: (Senn, 2004).



**Figure 13.8** Asynchronous Transfer Mode (ATM):

**Source:** (Senn, 2004).

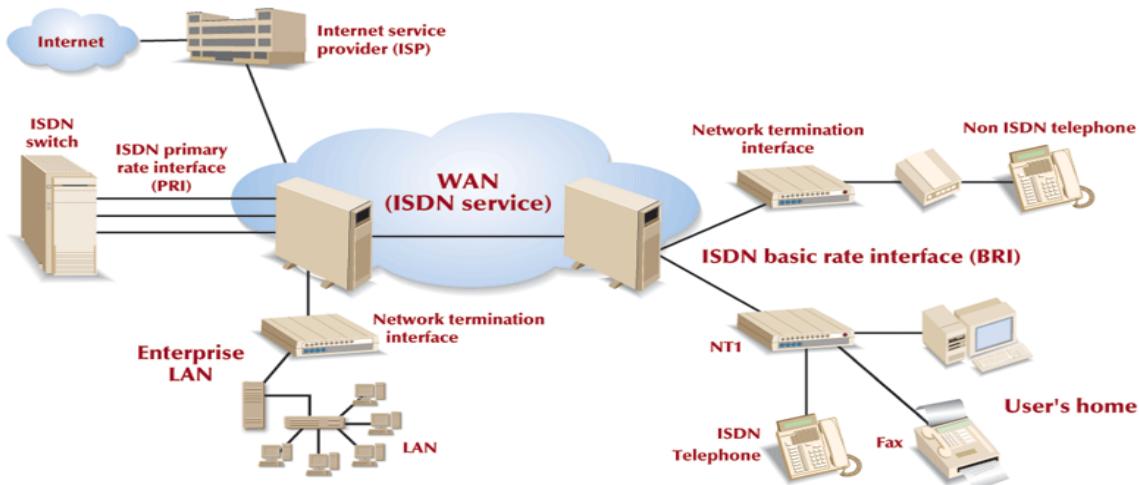
- **Digital Subscriber Line (DSL):** Offers high-speed data access over the single pair of the ordinary copper lines used with basic voice-grade telephone service.
  - **Asymmetric Digital Subscriber Line (ADSL):** The most commonly used form of high speed digital subscriber line (DSL) Internet access characterized by higher receiving (upstream) transmission rates compared to sending (downstream) transmissions.
  - **Very High Speed DSL (VDSL):** Provides transport of data over copper twisted pair lines at even higher speeds, ranging from 13 mbps to 55 mbps.



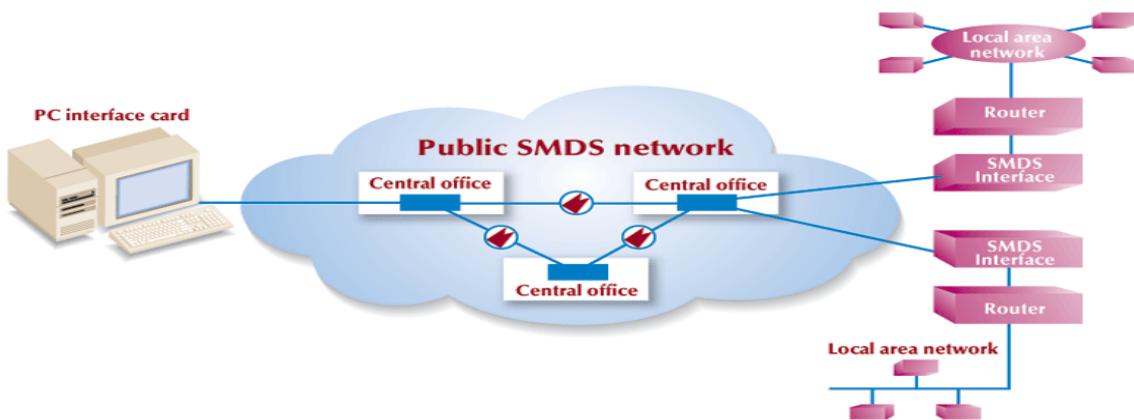
**Figure 13.9** A digital subscriber line provides high-speed data transmission over ordinary copper telephone lines.

**Source:** (Senn, 2004).

- **Integrated Services Digital Network (ISDN):** A next generation telephone system integrating voice and data onto one line and capable of transporting digital data over analog lines.
- **Switched Multimegabit Data Services (SMDS):** A high-speed, packet-switched transport technology that can operate over copper or fiber channels.



**Figure 13.9** Integrated Services Digital Network.  
**Source:** (Senn, 2004).



**Figure 13.10** Switched Multimegabit Data Service.

Source: (Senn, 2004).

#### 4.0 CONCLUSION

A Communications Channel/Medium is used to physically or wireless link the different component of a communication networks for the benefit of sharing various network service applications (e-mail, e-conference, e-transfer).

#### 5.0 SUMMARY

In this unit you learnt that a communication network is made up of:

- Interconnecting networks - using a router, bridge and gateway.
- Extended networks - using Microwave/RF radio, switch and hub.
- Physical Channels: Twisted Pair, Co-ax and Fiber-optic Cable.
- Wireless Channels: Microwave, Satellite, Radio Frequency (RF) Transmission.

#### 6.0 TUTOR MARKED ASSIGNMENT (TMA)

- a. What is a communication network?
- b. List three network service applications you know.
- c. What do you understand by the term network channels?
- d. List the five Types of Transport Technology you know

## **7.0 FURTHER READING/REFERENCES**

- Norton, P. (2003). *Computing Fundamentals* (5<sup>th</sup> Edition). United States of America: Glencoe/McGraw-Hill.
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## **MODULE 3 DISTRIBUTED NETWORKS AND THE INTERNET**

### **UNIT 14 ENTERPRISE AND WIRELESS COMMUNICATIONS NETWORKS**

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## **1.0 INTRODUCTION**

Unit 13 introduced you to communication networks. In this unit you will learn more about the wireless communication networks and the enterprise (Organizations).

## **2.0 OBJECTIVES**

By the end of this unit you should be able to:

- Describe the four forms of wireless communications.
- Explain the role of a network operating system.
- Discuss the activities involved in network administration.
- Explain the three types of enterprise architectures and the advantages offered by each.

## **3.0 MAIN CONTENT**

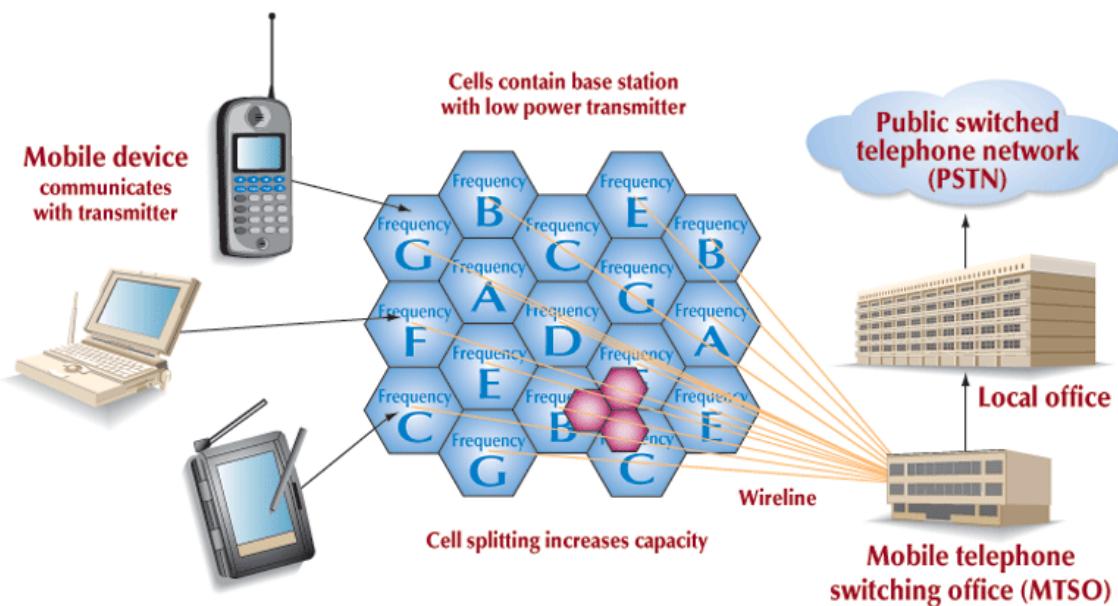
### **3.1 WIRELESS COMMUNICATIONS NETWORKS**

Wireless communication has gained a lot of interest for a wide range of ICT applications. The four wireless forms of interest are:

- Cellular Communication Service
- Wireless LAN (WLAN)
- Bluetooth Personal Area Network/Personal Area Network
- Wireless Data Networks

#### **A CELLULAR COMMUNICATION SERVICE**

- ***Cellular Communications Service:*** A wireless technology that transmits radio messages between a mobile device (such as mobile telephone, PDA, or wireless laptop) and a cell site.
- **Cellular Radio System**
  - ***Mobile Telecommunications Switching Office (MTSO):*** The switch used in a cellular (mobile) telephone system that links the cell tower to a traditional telephone switch in the public switched telephone network (PSTN).



**Figure 14.1** A Cellular Radio System

Source: (Senn, 2004).

- **Analog and Digital Cellular Service**

- **Time Division Multiple Access (TDMA):** A digital cellular transmission technology that divides a radio frequency into time slots and then allocates slots to an individual device's conversation or message, thereby distinguishing it from other transmissions.
- **Code Division Multiple Access (CDMA):** A digital cellular transmission technology that encodes each device's conversation or message with a unique identification code to distinguish it from other transmissions.

- **Next Generation Cellular Service**

- **Generalized Packet Radio Service (GPRS):** GPRS (or 2.5G) features higher speed transmission rates than preceding telecom generations and uses packet switching rather than circuit switching, to transmit messages.
- **Third-generation Service (3G):** Uses packet switching and transmits at higher bandwidths that provide faster downloads of information – rates ranging from 384 Kbs to 2 Mbs, depending on the location of the user
- **Global Positioning System (GPS):** A satellite navigation system and a worldwide navigation system that uses information received from orbiting satellites

## B WIRELESS LAN (WLAN)

Local area networks that transmit data using radio frequencies instead of cables.

- **Components**

- **Access Point:** A device that converts wired LAN signals into radio frequency.
- **802.11 Wireless Ethernet**

- **Wireless LAN Security**

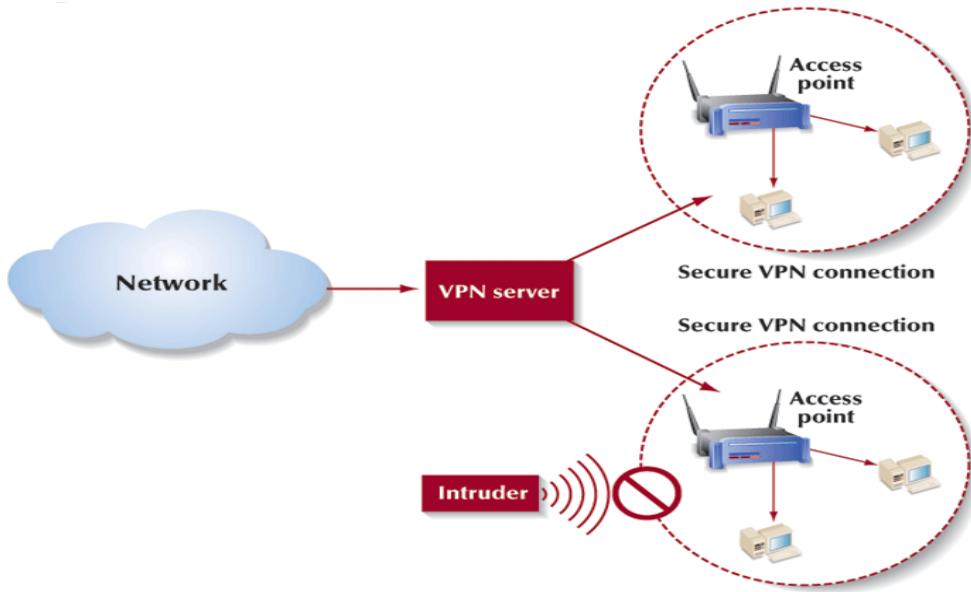
- **Wired Equivalent Privacy (WEP):** A system of security protection that is a standard for encrypting data (converting the data into a protective code) over an 802.11 b wireless network.
- **Service Set Identity (SSID):** An encrypted code keyed into the LAN devices, so that only devices with similar code can access the network resources.

## C BLUETOOTH PERSONAL AREA NETWORK/PERSONAL AREA NETWORK

A wireless technology for communicating between devices that enable short-range radio links (30 feet or 10 meters) between devices, such as between a PC and a laptop, or a PDA and a printer.

## D WIRELESS DATA NETWORKS

- **Wireless Data Networks (WDNs):** Networks that use cellular communications services to support mobile users seeking to interconnect with networks using wireless laptops and PDAs.
- **Virtual Private Network (VPN):** A network constructed of public channels to connect client computers to server, incorporating encryption and other security mechanisms to ensure that only authorized users can gain access and that the data cannot be intercepted



**Figure 14.2** A Virtual Private Network Architecture

Source: (Senn, 2004).

### 3.2 NETWORK OPERATING SYSTEMS

**Network Operating System (NOS):** A software program that runs in conjunction with the computer's operating system and applications programs and manages the network.

- **Protocol and Communications Control**
  - **Protocol:** The rules and conventions guiding data communications, embedded as coded instructions in the network software.
- **Network Administration/Network Management:** The management of a network, consisting of those procedures and services that keep the network running properly. The ICT professional responsible for this job is called a Network Administrator.

### 3.3 ENTERPRISE ARCHITECTURES

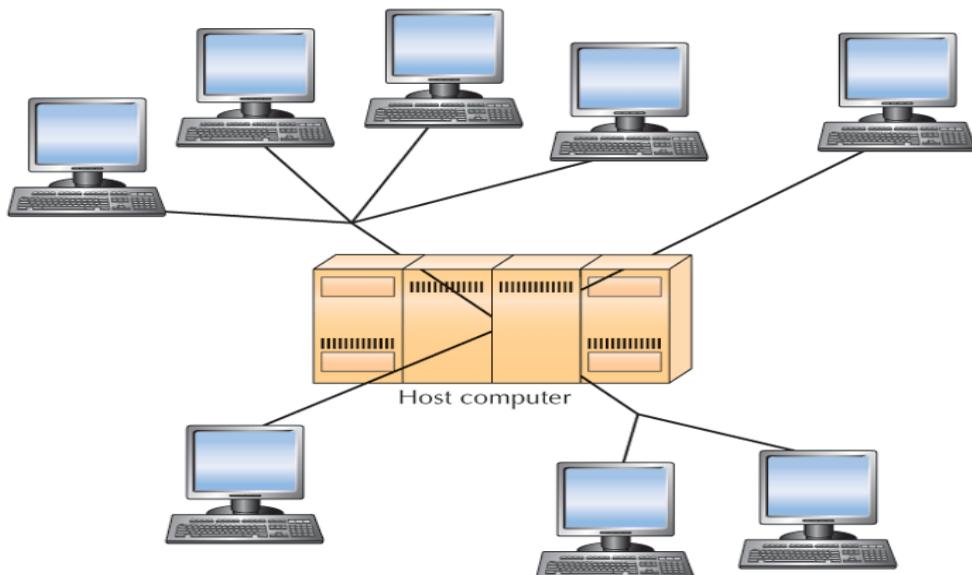
**Architecture:** The structure of a communications network, which determines how the various components of the network are structured, how they interact, and when cooperation between the system's components is needed.

#### *Centralized Architecture*

- **Centralized Architecture:** A communications architecture in which a computer at a central site hosts all of the network's hardware and software, performs all of the processing, and manages the network.

- **Host-based Computing:** Centralized computing.
- **Teleprocessing:** The processing capability made possible by connecting desktop computers to a remote computer through telephone lines.
- **Front-end Computer:** In a centralized system, a minicomputer loaded with specific programs to handle all incoming and outgoing communications traffic.

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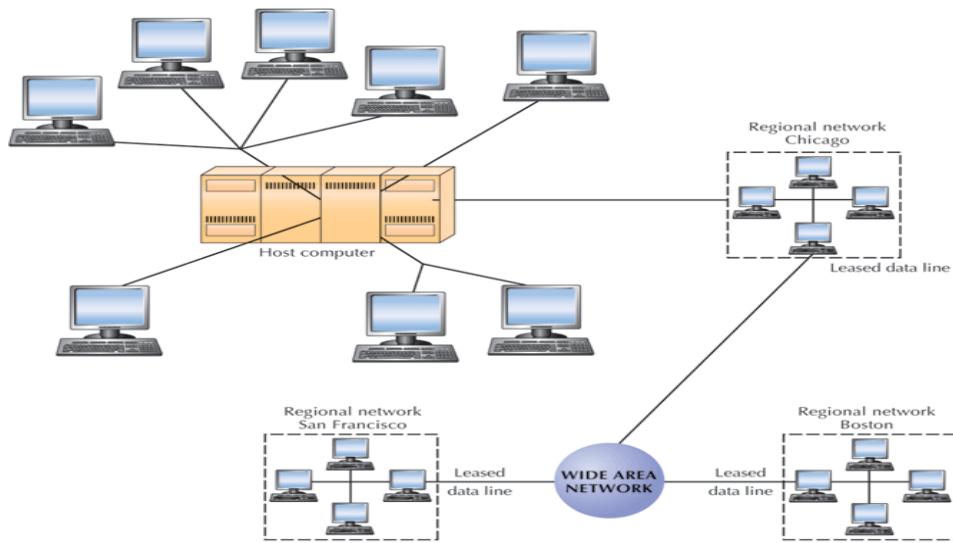


**Figure 14.3** A Centralized Architecture

Source: (Senn, 2004).

### Distributed Architecture

- **Distributed Architecture:** A communications architecture in which the computers reside at different locations and are interconnected by a communications network.
- **Distributed Processing:** Processing in which an application runs on one or more locations of the network simultaneously.
- **Distributed Database:** A database that resides in more than one system in a distributed network. Each component of the database can be retrieved from any node in the network.

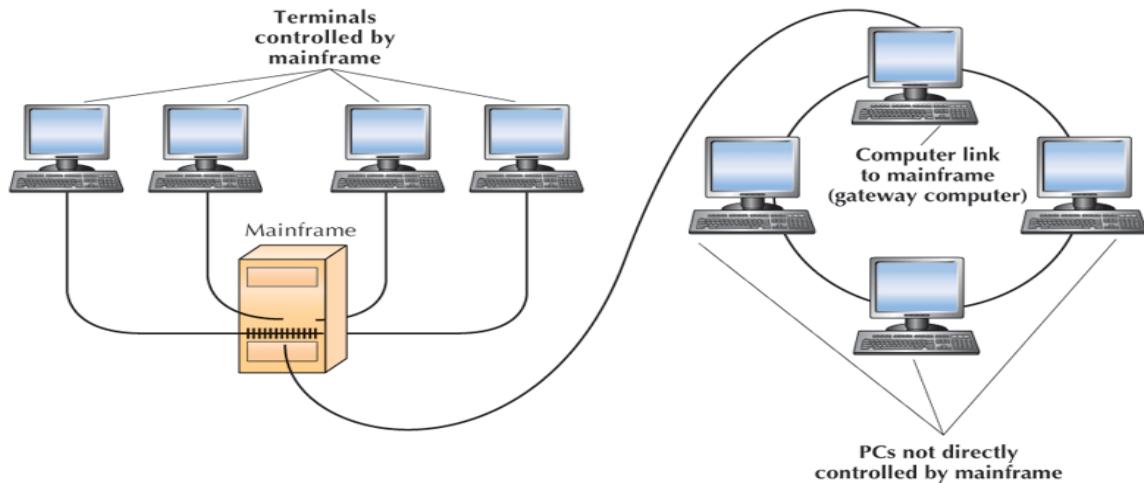


**Figure 14.4** A Distributed Architecture with Distributed Processing  
**Source:** (Senn, 2004).

### Combining Architectures

- **Hybrid Network:** A communications architecture that combines centralized and distributed architectures to take advantage of the strengths of both.
- **Virtual Company:** A company that joins with another company operationally, but not physically, to design and manufacture a product.

**Figure 11.14** Hybrid Architecture



**Figure 14.5** Hybrid Architecture  
**Source:** (Senn, 2004).

## **4.0 CONCLUSION**

Wireless communication networks are mostly used to implement enterprise networks, because it is easier and faster to connect branch offices at different cities over a wide distance to share resources.

## **5.0 SUMMARY**

In this unit you learnt about:

- the four types of wireless communication networks
  - Cellular Communication Service
  - Wireless LAN (WLAN)
  - Bluetooth Personal Area Network/Personal Area Network
  - Wireless Data Networks
- the three types of Enterprise Architectures
  - Centralized Architecture
  - Distributed Architecture
  - Combining Architectures (Hybrid Network: combines centralized and distributed architectures )

## **6.0 TUTOR MARKED ASSIGNMENT (TMA)**

- a. What is security in WLAN
- b. List the four types of wireless communication networks
- c. Who is a Network Administrator?
- d. How many types of Enterprise Architectures do you know?

## **7.0 FURTHER READING/REFERENCES**

- Norton, P. (2003). *Computing Fundamentals* (5<sup>th</sup> Edition). United States of America: Glencoe/McGraw-Hill.
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## **MODULE 3 DISTRIBUTED NETWORKS AND THE INTERNET**

### **UNIT 15 ESSENTIALS OF THE INTERNET**

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## **1.0 INTRODUCTION**

In Unit 13 and 14, you learnt about enterprise and personal communication networks. In this unit you would use these networks to implement the Internet. The internet is a giant highway that connects you to millions other people and organizations located throughout the world. It is considered to be the most important technology of the 21<sup>st</sup> century.

## **2.0 OBJECTIVES**

- Discuss the origin and uses of the Internet
- Describe the three types of capabilities of the Internet.
- Identify the principal communication and retrieval capabilities of the Internet.
- Know the difference between Intranets, Extranets and Internet.

## **3.0 MAIN CONTENT**

A network is a communication system connecting two or more computers. Networks connect people as close as the next office and as far away as halfway around the world. The largest network in the world is the Internet. The internet is a huge computer network available to nearly everyone with a microcomputer and a means to connect to it.

### **3.1 INTERNET**

The internet is often referred to as the information Superhighway; it is like a highway that connects you to millions of other people and organizations. Unlike typical highways that move people and things from one place to another, the internet moves your ideas and information. Rather than moving through geographic space, you move through cyberspace—the space of electronic movement of ideas and information.

#### **3.01 BASIC CONCEPTS**

##### **a. Connectivity**

Connectivity is the capability of your microcomputer to share information with other computers. Data and information can be sent over telephone lines or cable and through air. This means that, your microcomputer can be connected to other computers, to the internet, and to many computerized data banks and other sources of information worldwide.

The most dramatic change in connectivity in the past decade has been the widespread use of mobile and wireless communication devices. It was used in the past for telephone communications, these devices are widely used to connect people and computers located almost anywhere in the world.

##### **b. Wireless Revolution.**

The telephone, mobile and wireless communication systems are the beginning of wireless revolution, a revolution that is expected to dramatically affect the way we communicate and use computer technology. Connectivity and the wireless revolution are significant

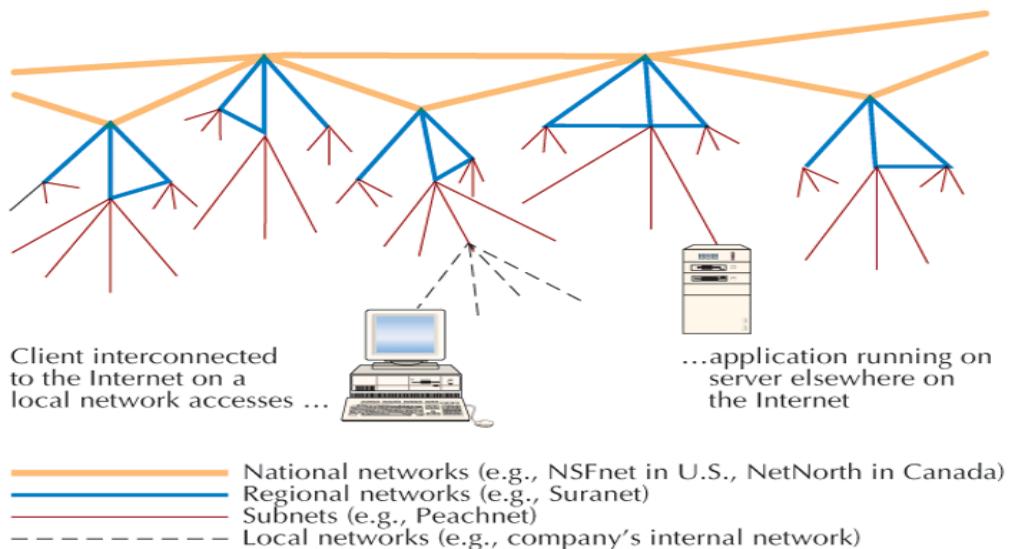
developments, for they expand the uses of the microcomputer several fold. Central to the concept of connectivity is the network or computer network.

### 3.2 THE ORIGINS OF THE INTERNET

The Internet, or the Net, was launched in 1969 when the United States funded a project that developed a national computer network called Advanced Research Agency Network (ARPANET). The Internet is a large network that connects smaller networks all over the globe together.

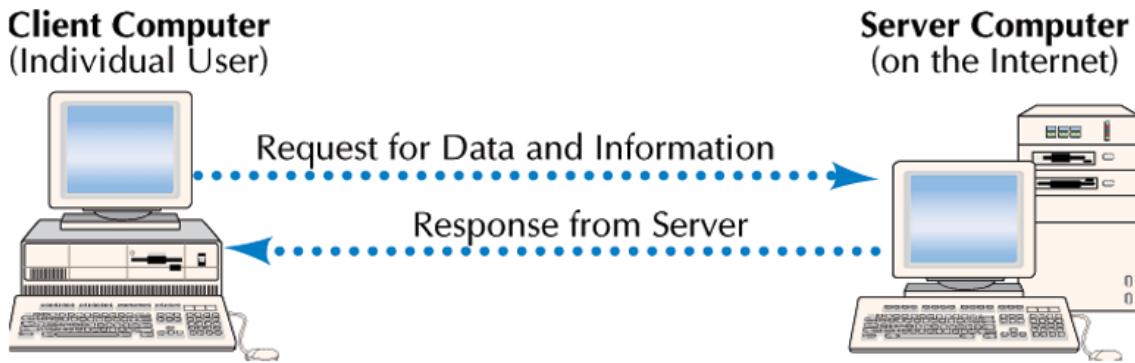
### 3.3 COMPUTERS ON THE INTERNET

- **Client Computer:** The computer that accesses the information stored on a server computer.
- **Server Computer:** The computer that contains data and information that can be accessed by a client computer.
- **Client-server Computing:** A type of computing in which all data and information retrieval requests and responses pass over a network. Much of the processing is performed on the server and the results of the processing are transmitted to the client.
- **Surf or Surfing:** Moving among a number of networks that are linked together, or inter-networked.



**Figure 15.1** Structure of the Internet

**Source:** (Senn, 2004).



**Figure 15.2** Client / Server Computing  
 Source: (Senn, 2004).

### 3.4 CAPABILITIES OF THE INTERNET

The Internet is used by billion of users in different countries in the world to perform the following activities;

- Communicate
- Retrieve
- Research on the Web
- Shopping or Cybermalls

#### a. Communications Capabilities

- **E-mail or Electronic Mail:** A service that transports text messages from a sender to one or more receivers via computer.
- **Mailing Lists:** Each mailing list has subscribers who receive messages as part of an ongoing discussion of the list's topic.
  - **Moderated:** A mailing list in which the messages are first screened by an individual to determine their suitability given the purpose of the list.
- **Newsgroups:** Worldwide discussion areas where notices can be posted for anyone to view.
  - **Usenet or User's Network:** A system of worldwide discussion groups, not an actual physical network.
  - **Netiquette:** A list of simple newsgroup guidelines that keep people from making mistakes.

- ***Chat Session or Internet Relay Chat (IRC):*** A live interactive discussion in which parties on the network exchange ideas and observation electronically.
  - ***Portal:*** A gateway or hub site, such as Yahoo!, that provides chat rooms.
- ***Instant Messages:*** A combination of real-time chat and e-mail by which short text messages are rapidly exchanged over the Internet, with messages appearing on recipient's display screen immediately upon arrival.
- ***Internet Telephony or Voice Over the Internet or Voice over IP:*** Real-time voice conversations transmitted between computers on the Internet.
- ***Telnet:*** A network capability that permits remote sign-on to any computer on the Internet from the computer an individual is using at that time.

**b. Retrieval Capabilities**

- ***FTP (File Transfer Protocol):*** Used for transferring files containing documents or software between computers on the Internet.
- ***Web Directory:*** A listing of Web sites and their URLs, categorized by topic.
  - ***Keyword:*** A string of letters or words that indicates the subject to be searched.
- ***Search Engines:*** Software programs that look through the Web to locate sites matching a keyword entered by the user. They provide two different search approaches: Keyword and Directory search. Examples include Yahoo, Google, Alta Vista, Ask, My Search, and others.
  - ***Metasearch Engines:*** The metasearch engine receives the results, eliminates duplicates, orders the hits, and then provides edited list to you. Metacrawler is an example of metasearch engine.
  - ***Specialised Search Engines:*** This focused on subject specific Web sites ([www.invisibleweb.net](http://www.invisibleweb.net)), they save time by narrowing the search. When researching for information on production or engineering. You could begin with a general search engine like Google or go directly to [howstuffworks.com](http://howstuffworks.com).
- ***Portal:*** A gateway or hub on the Internet from which other sites can be visited.
  - ***Vertical Portal or Vortal:*** A Web site that specializes in providing information related to a particular industry such as automobiles, healthcare, or investments.
  - ***Horizontal Portal:*** Provides services and links to Web sites of interest to a wide variety of users.
- ***Webcasting:*** The prearranged delivery, or push, of information of interest to a user's desktop automatically.

- **Pull:** To get something from a Web site by clicking on a link or entering a URL.
  - **Push:** The capability of a Web site for automatic Internet delivery of information, including software updates, to a user's desktop.
  - **Channel:** A Web site designed to push information to a user's desktop.
- **Streaming:** An on-demand retrieval and playing of audio, video, or other media that can occur while the downloading is occurring.

**c. Research on the Web**

The Web being an invaluable research tool for materials to write thesis, has three basic procedures: locating information, evaluating the information and citing references.

- **Locating information:** with all the numerous information available on the Web, it is very difficult for you to locate the right material you are looking for. Discussion groups ([www.liszt.com](http://www.liszt.com)) that can link you to experts are being overlooked.
- **Evaluating the information:** locating information is not all because not everything you find on the Web is useful, nearly anyone can publish anything. Care is to be taken when considering the quality of information by considering a few common sense questions, like, who put the information there and what are the sources. For example if the site is maintained by a university, college, or government agency, the information is likely to be more reliable than information from an unknown individual.
- **Citing references:** Plagiarism is the illegal copying of someone else's words or ideas. You can use someone's words or ideas without committing plagiarism by simply acknowledging or citing the source.

*Author Name, day month year, <sources>*

*Binta Musa, 22 December 2008, <http://www.billytuks.com>*

This citation acknowledges information created by Binta Musa (author) that was obtained on December 22, 2008, from <http://www.billytuks.com> Web site <source>. If the authors name is unknown the title of the Web page would replace the author's name.

**d. Shopping or Cybermalls**

- **Electronic Commerce/e-commerce:** Conducting commercial activities on the Internet. (Will be discussed in details in unit 17)

### 3.5 THE INTERNET COMMUNITY

The way you connect a phone to a telephone system that is how you connect a computer to the Internet. The computer becomes an extension of a giant network of computers with branches all over the world that allow the use of a browser program to the Web.

- a. **Internet Users** – you, organizations, schools, hospitals, e.t.c
- b. **Providers** - The providers or host computers provide a path or connection for individuals to access the Internet. The National Open University of Nigeria (NOUN) most likely provides free internet access to staff and students either through their local area network or a dial-up or telephone connection. They provide connection to the users through the following technologies including dial-up, DSL, cable, and wireless modems.

The follow are Companies that act as providers in different capacities:

- **Service Providers or Internet Service Providers (ISPs):** A company that sells communications services that enable users to access the Internet.
  - **National services providers:** through standard telephone connections users can access the internet from almost anywhere within the country for a standard fee without incurring long distance telephone charges. They are Nigerian Telecommunication (NITEL), American Online (AOL) and GSM companies.
  - **Regional services providers:** they also use telephone lines known and also fixed wireless system, but the coverage is not as wide as the national service providers. They cover several states. If the user accesses the internet from outside the regional area they incur long distance connection charges in addition to the service's standard fees. Intercellular, Multilinks, Starcoms, Visafone, e.t.c
  - **Wireless services providers:** they do not use telephone lines but rather use microwave radio, Vsat and other satellite technologies. They provide connections for computers with wireless modems and a wide array of wireless devices. They include MicroAccess ltd, Linkserve, Propercom, IntelSat, Direct on Pc, GSM Companies, e.t.c.
- **Application Service Providers (ASPs):** Companies that develop, install, and operate (or host) an information technology application on the Internet for the user, charging a recurring fee for doing so.
- **Content Providers:** Individuals or companies that furnish the information available on the Internet.
  - **Content:** Information distributed over the Internet.
- **Infrastructure Providers**
  - **Network Infrastructure Providers:** Companies, such as telephone, cellular telephone, cable TV, and satellite transmission companies, that operate the network of communication channels that carry data and information to and from user and content locations.

- **Component Infrastructure Providers:** Companies that supply the computer hardware and software that makes it possible to use, operate, or store and retrieve content from the Internet.
- *Internet Support Agencies*
  - **Internet Corp. for Assigned Names and Numbers (ICANN):** The nonprofit corporation that was formed to assume responsibility for the IP address space allocation, protocol parameter assignment, domain name system management, and root server system management.
  - **Internet Engineering Task Force (IETF):** A large international community of network designers, operators, vendors, and researchers concerned with the evolution of Internet architecture and the smooth operation of the Internet.

### **3.6 ORGANISATIONAL INTERNET: INTRANETS AND EXTRANETS**

Computer networks in organisations have evolved over time. Most large organisations have a complex and wide range of different network configurations, operating systems, and strategies. Integrating or connecting all of these has been very challenging task. One way is to apply Internet technologies to support communication within and between organisations using intranets and extranets.

#### **Intranets**

An intranet is a private network within an organisation that resembles the Internet. Like the public Internet, intranets use browsers, Web sites, and Web pages. Intranets typically provide e-mail, mailing list, newsgroup, and FTP services accessible only to those within the organisation.

Organisations use intranets to provide information to their employees. Typical applications include electronic telephone directories, e-mail addresses, employee benefit information, internal job openings, and much more. Employees find surfing their organizational intranets to be easy and as intuitive as surfing the Internet.

#### **Extranets**

An extranet is a private network that connects more than one organisation. Many organisations use Internet technologies to allow suppliers and others limited access to their networks. The purpose is to increase efficiency and reduce costs. For example, General motors have thousands of suppliers for the parts that go into an automobile. By having access to the production schedules, suppliers can schedule and deliver parts as they are needed at the General motors assembly plant. General motors can be assured of having adequate parts without maintaining large inventories.

## **4.0 CONCLUSION**

The internet is the actual physical network. It is made up of wires, cables, and satellites. Being connected to this network is often described as being Online. The Internet connects to over 100 million computers and resources worldwide. The internet has changed the world into a global village.

## **5.0 SUMMARY**

You learnt in this unit that:

- The Internet is the world's largest network.
- the internet is made up of a community of end-users and providers.
- the Internet is used to Communicate, Retrieve, Research and E-Commerce

## **6.0 TUTOR MARKED ASSIGNMENT (TMA)**

- a. Identify the main functions of the Internet.
- b. When was the Internet launched and by who?
- c. What is the difference between e-mail, instant message, and chat session?
- d. What is the difference between Intranets, Extranets and Internet?

## **7.0 FURTHER READING/REFERENCES**

- Norton, P. (2003). *Computing Fundamentals* (5<sup>th</sup> Edition). United States of America: Glencoe/McGraw-Hill.
- O'Leary, T.J., O'Leary, L. I. (2004). *Computing Today*. New York, US: McGraw-Hill
- Senn, J. A. (2004). *Information Technology: Principles, Practices, Opportunities* (3<sup>rd</sup> Edition). New Jersey, US: Pearson Prentice Hall.

## **MODULE 3 DISTRIBUTED NETWORKS AND THE INTERNET**

### **UNIT 16 WORLD WIDE WEB**

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## **1.0 INTRODUCTION**

In the Unit 15, you learnt about the Internet changing the world into a global village. In this unit you will learn how to use the Web; a multimedia interface to resources available on the internet

## **2.0 OBJECTIVES**

- Discuss the origin Web.
- Summarize how the Internet knows the location of a particular user.
- Explain the purpose of hyperlinks and their role on the Web.
- Describe the characteristics of browser software and relate them to the types of information that can be included in a home page.

## **3.0 MAIN CONTENT**

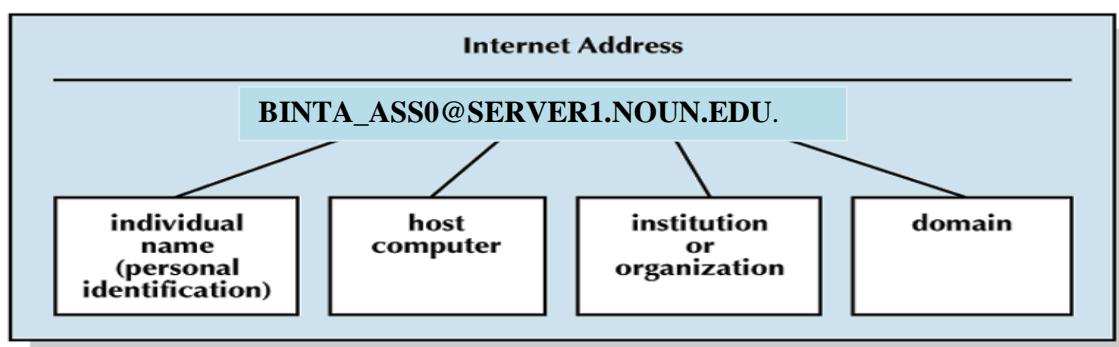
The web, also known as the World Wide Web or WWW or W<sup>3</sup>, provides a multimedia interface to the numerous resources available on the internet. The web provides an easy to use, exciting, multimedia interface to connect to the internet and to access the resources available in cyberspace. It has become an everyday tool for all of us to use.

### **3.1 THE ORIGINS OF THE WEB**

The Web also known as the WWW and the World Wide Web was introduced in 1992 at the Center for European Nuclear Research (CERN) in Switzerland. Prior to the Web, the internet was all text (no graphics, animations, sound, or video). The Web made it easy to include these elements.

### **3.2 INTERNET ADDRESSES**

**Figure 16.1** Internet Addresses



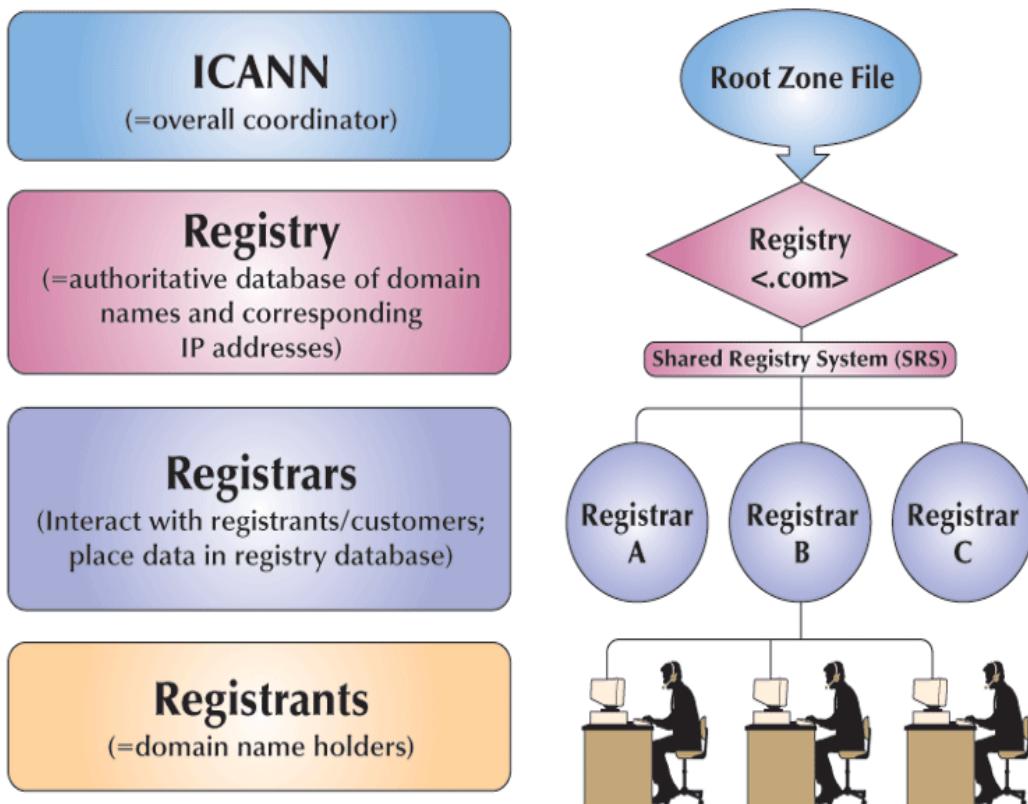
**Figure 16.1** Internet Address

Source: (Senn, 2004).

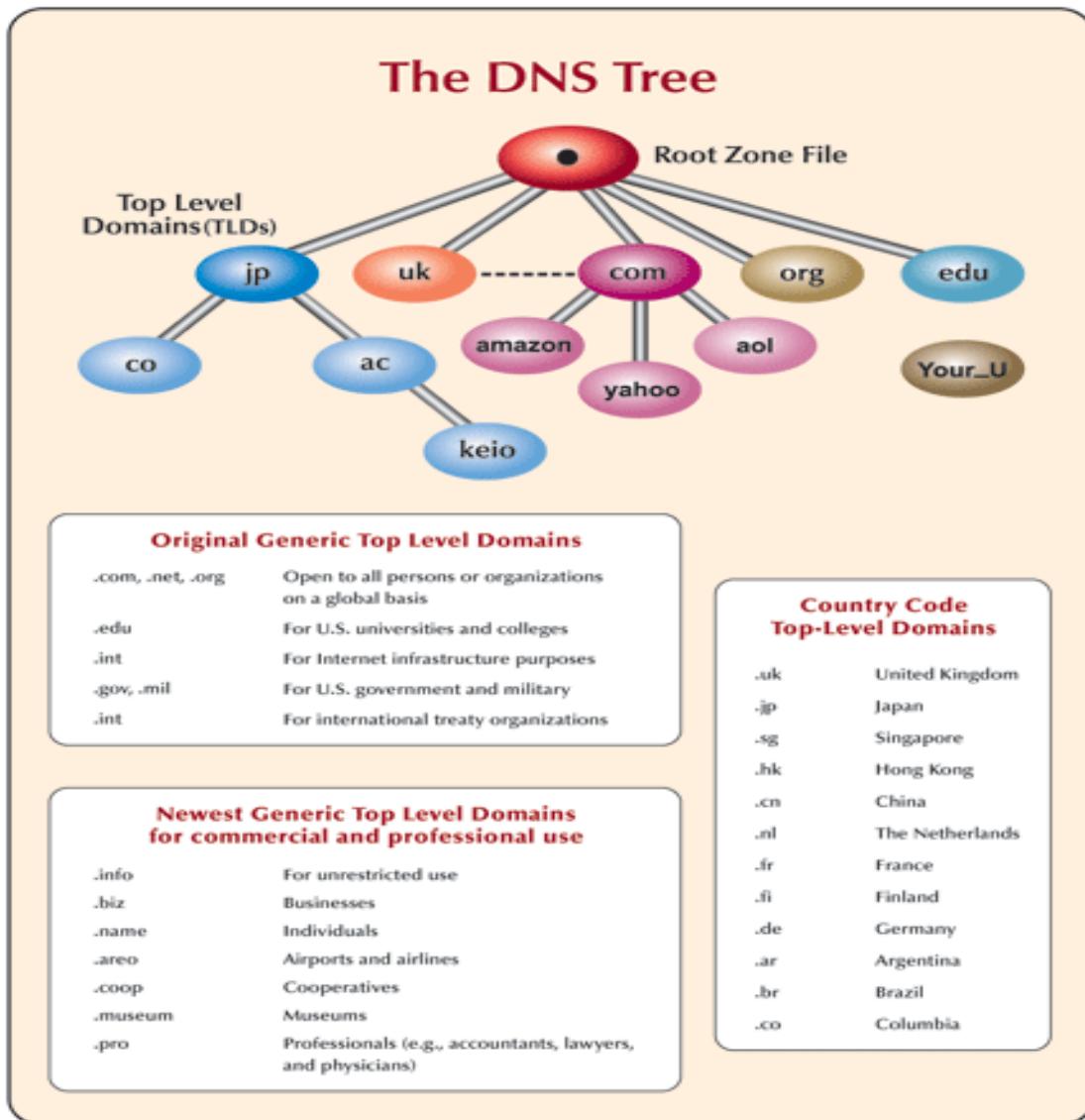
### 3.2.1 DOMAIN NAME SYSTEM

**Domain Name System (DNS):** Computers have numeric addresses consisting of strings of numbers known as their Internet protocol (or IP) address.

- **Domain Name:** The familiar, easy-to-remember names for computers on the Internet that correlate to assigned IP addresses.
- **Registry:** A regional organization that allocates Internet addresses to requestors in that region.
- **Registrars:** Organizations delegated to accept and process Internet address applications and submit approval applications to the regional registrar.
- **Root Servers:** One of 13 special computers distributed around the world that maintain the Internet addresses for all global and country registries.



**Figure 16.2** Basic DNS Registry Structure  
Source: (Senn, 2004).



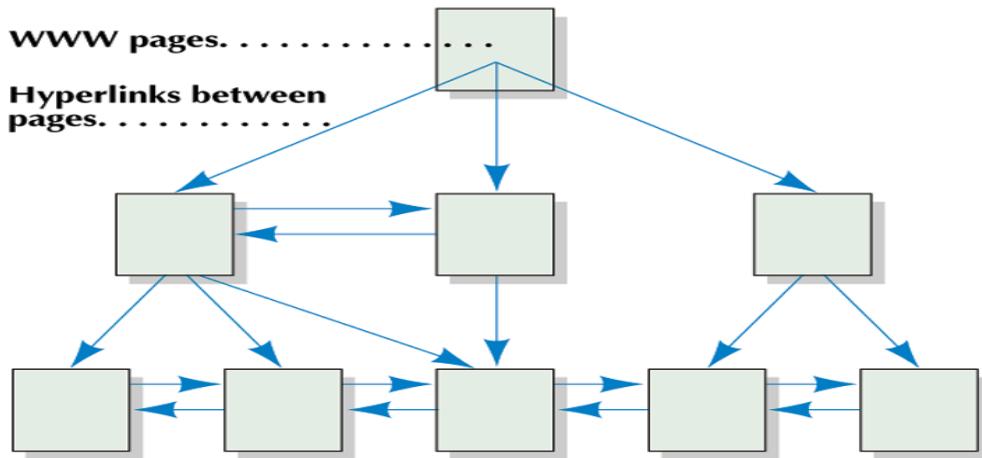
**Figure 16.3** Internet Domain Names

Source: (Senn, 2004).

### 3.2.2 ADDRESSES ON HOST COMPUTERS

- **E-mail Addresses**
- **World Wide Web Addresses**
  - **Uniform Resource Locator (URL):** A document's address on the WWW.
- **FTP Addresses**

- **World Wide Web (WWW) or the Web:** The set of interconnected electronic documents, or Web pages, that are linked together over the Internet.
  - **Web Pages:** Interconnected electronic documents.
  - **Hyperlinks:** Words and/or symbols highlighted by blinking, color, or underline that connect one document to another related document on the Web.



**Figure 16.4** Hyperlink Structure

Source: (Senn, 2004).

### 3.3 E-MAIL OR ELECTRONIC MAIL

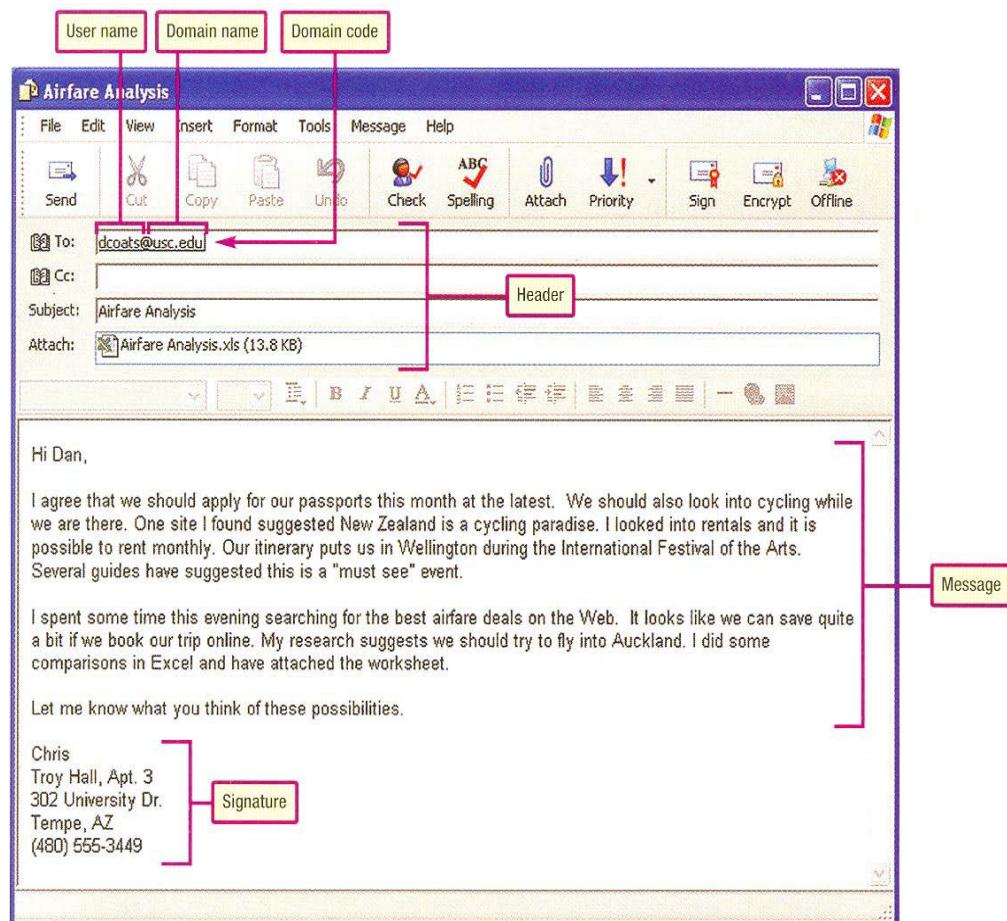
This is the transmission of electronic messages over the Internet. People all over the world can now send e-mail containing text, graphics, pictures and different types of file attachments. You need the following to send and receive e-mail; e-mail account, access to the Internet, and an e-mail program. The most widely used e-mail programs are Outlook Express and Microsoft office outlook, others are located on the company's Web site like yahoo, google, hotmail, etc. A typical e-mail message has three basic elements: header, message and signature.

**The Header** appears first and include the following information:

- **Addresses:** addresses of the person sending, receiving, and, optionally anyone who is to receive copies. E-mail addresses have basically three main parts: the user's name, the domain name and the domain code. For example [dr\\_ahmed@noun.edu.ng](mailto:dr_ahmed@noun.edu.ng), the user's name is dr\_ahmed . The server providing services for Dr Ahmed is **noun**. The domain code indicates that the provider is an educational institution in Nigeria.
- **Subject:** A one line statement used to present the topic of the message. It also appears when a person checks his/her mail box.
- **Attachment:** these are documents, photos or worksheets attached and sent together with the typed text in a mail. The file name usually appears on the attachment line if a message contains an attachment.

**The Message:** this is the short note written in text format and usually straight to the point.  
**The Signature:** the signature line provides additional information about the sender: name, address, and telephone number.

The draw back to this technology is the presence of **Spam** (unwanted and unsolicited mails) and **Computer Viruses** (destructive programs attached to Spam).



**Figure 16.5** Showing sample E-mail.

**Source:** (O'Leary, 2004).

### 3.4 BROWSING THE WORLD WIDE WEB

Browsers are programs that provide access to Web resources. This software connects you to remote computers, open and transfers files, display text and images, and provides in one tool an uncomplicated interface to the Internet and Web documents. Some basic browsing terms include;

- **Surf:** this is the process of exploring the Web, by easily moving from one Web site to another using browser like Netscape Navigator, Microsoft Internet Explorer, Mozilla and Opera.
- **Uniform Resource Locators (URLs):** for browsers to connect to resources, the location or addresses of the resources must be specified. These addresses are called URLs. The first part presents the protocols (`http://`) used to connect to the resources while the second part presents the domain name (noun). The last part of the domain name following the dot (.) is the domain code (edu, ng).  
The URL `http:// www.noun.edu.ng` connects your computer to a computer that provides information about the National Open University of Nigeria, which is an educational institution located in Nigeria.
- **Protocol (`http://`):** these are rules for exchanging data between computers. The Protocol (`http://`) are the most widely used Web protocol.
- **Domain Name and Domain Code:** the domain name is the name of the server where the resource is located on the URL. Many URLs have additional parts specifying directory paths, file names, and pointers. The domain code identifies the type of organization. For example;
 

.com	commercial organization
.edu	educational institution
.ng	Nigeria(.jp-Japan, .uk-United kingdom, .zo-South Africa, .gh- Ghana)
.org	Organisation
.gov	government of a nation
- **Hyperlinks or Links:** when the browser connects to the Internet it opens up the Web page specified in the browser settings containing information about the site.  
Hyperlinks are the references that connect to other documents containing related information like text files, graphic images, audio, and video clips on a Web page.
- **Web Server:** this is the computer that stores and shares document to nearby computer systems around the world. When a link is established with the Web Server the document is automatically displayed on your screen.
- **Applets:** are links to special programs on a Web page, they are written in Java programming Language. Java applets are widely used to add interest and activities to a Web site by presenting animations, displaying graphics, providing interactive games, and much more.

### *One Home Page, Many Links*

- **Home Page:** The first page of a Web site, which identifies the site and provides information about the contents of electronic documents that are part of the site.

### *Creating Web Pages Using HTML*

- **Hypertext Markup Language (HTML):** A set of commands that specifies the position, size, and color of text, the location of graphic information, and the incorporation of sound and video. HTML commands also identify the words or images that will serve as hyperlinks to other documents.

### *Browser Software*

- **Web Browser:** Client computer program designed to locate and display information on the World Wide Web.
- **Graphical Browser:** A type of browser used with the Web that displays both text and images within a page.
  - Title Bar
  - Menu Bar
  - Net Site
  - Toolbar
  - In-line Image
  - Hyperlinks
  - Status Bar
  - Activity Indicator
  - Scroll Bars
- **Navigating the Web**
  - Using Search Engines
  - Directories

### **3.5 WEB UTILITIES**

These are specialized utility programs that make using the internet and the Web easier and safer, some of these utilities are internet services for connecting and sharing resources over the Internet. Others are browser programs that either become part of your browser or are executed from your browser.

- **Telnet**

Telnet is an Internet standard that helps you connect to another computer remotely on the Internet and use that computer as if you were a terminal in the next room. You do that using the computer's IP address, for example **Telnet 192.168.1.30**, then you enter the computer's security code (Username and Password).

- **FTP**

FTP is an acronym for File Transfer Protocol which is an Internet standard for transferring files. **Downloading** is the process of receiving a file from another computer while **Uploading** is the process of sending a file to another computer.

- **Plug-ins**

Plug-ins are automatically located and operated as part of a browser. Many Web sites require specific plug-ins to fully express their content. Some plug-ins are included in many of today's browsers while others must be installed.

- Quick time player from Apple-for playing audio and video files
- Windows Media player from Microsoft-for playing audio and video files and much more as discussed earlier.
- Cosmos form Silicon Graphics-for displaying three dimensional graphics.
- Adobe Reader from Adobe-for viewing and printing a variety of standard forms and other documents saved in a special format called PDF.

- **Filters**

Filters are used by parents or organizations to block certain sites and to monitor use of the Internet and the Web. Filters are special programs used to generate reports detailing the total time spent on the Internet and the time spent on individual Web sites, chat groups, and news group. There are basically three well known filters: Cyberpatrol, Cybersitter, and NetNanny.

### **4.0 CONCLUSION**

Understanding how to efficiently and effectively use the internet to browse the web, communicate with others, and locate information are indispensable ICT competencies.

## **5.0 SUMMARY**

You learnt in this unit that:

- The web also known as the World Wide Web (WWW) provides a multimedia interface to resources available on the internet.
- Web sites are group of related pages and Web portals are designed to encourage you to visit them each time you are on the Web, to act as your home base, and to use as a gateway to their resources.
- Web utilities are specialized utility programs that make using the internet and the Web easier and safer
- Browsers are programs designed to locate and display information on the World Wide Web by displaying both text and images within the page.

## **6.0 TUTOR MARKED ASSIGNMENT (TMA)**

- a. When was the WWW launched and where?
- b. Explain the elements of a URL and the purpose of each.
- c. What do you understand by the terms downloading and uploading?
- d. What are the three basic elements of an e-mail message?

## **7.0 FURTHER READING/REFERENCES**

- Norton, P. (2003). *Computing Fundamentals* (5<sup>th</sup> Edition). United States of America: Glencoe/McGraw-Hill.
- O'Leary, T.J., O'Leary, L. I. (2004). *Computing Today*. New York, US: McGraw-Hill
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## **MODULE 3 DISTRIBUTED NETWORKS AND THE INTERNET**

### **UNIT 17 ELECTRONIC COMMERCE AND ELECTRONIC BUSINESS**

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## **1.0 INTRODUCTION**

In Unit 16, you learnt that the Internet came with a lot of opportunities, especially its ease of access and use. Understanding how the Internet and the Web work to provide a foundation for e-commerce is an enormous potential. In this unit you will learn how to trade over the Internet through Electronic Commerce.

## **2.0 OBJECTIVES**

After you have read this unit, you should be able to know:

- Concept of E-Commerce
- The advantages and disadvantages of E-commerce
- Types of E-commerce

## **3.0 MAIN CONTENT**

Electronic commerce, also known as e-commerce is the buying and selling of goods over the Internet. Shopping on the Internet is growing rapidly because E-commerce provides incentives for both buyers and sellers.

### **3.1 PLAYERS IN THE GAME**

There are two major parties in the e-commerce business world. They are:

- Buyers
- Sellers.

#### **Buyer**

From the buyer's perspective, goods and services can be purchased at any time of the day or night. Traditional commerce, also known as bricks and mortar business, is typically limited to standard business hours when the seller is open. Buyers don't have to travel physically to the seller's location. Busy parents don't have to arrange for a nanny or baby sitter in order to visit the market or go for shopping.

#### **Seller**

From the sellers perspective the cost associated with renting a shop is eliminated. For example a supermarket can operate on the Web without a physical store or employing a lot of sales staff. Traditional stores maintain an inventory of goods in their stores and periodically replenish this inventory from warehouses. With e-commerce, there is no in-store inventory and products are shipped directly from warehouse.

### **3.2 TYPES OF E-COMMERCE**

There are three basic types of electronic commerce: business-to-consumer (B2C), consumer-to-consumer (C2C), business-to-business (B2B).

#### **A. Business-to-consumer (B2C)**

B2C e-commerce is the fastest growing type of e-commerce. It is used by large corporation, small corporations and start-up corporations. This involves the sale of a product or service to the general public or end-users. Most times this arrangement eliminates the middleman by

allowing the manufacturers to sell directly to customers. Existing retailers use B2C e-commerce to create a presence on the Web as a means of reaching out to customers. Because extensive investments are not required to create traditional retail outlets and to maintain large marketing and sales staff, e-commerce allows start-up companies to compete with larger established firms.

The three most widely used B2C applications are online banking, financial trading, and shopping.

- **Online banking:** this is known as e-banking, a standard feature for banking institution. Customers are able to go online with a standard browser to perform many banking operations. These online operations include accessing account information, balancing check books, transferring funds, paying bills, re-charging mobile phones, and applying for loans. Using these electronic services is safer than using Automated Teller Machine (ATM).
- **Financial trading:** this is referred to as online stock trading or e-trading. it allows investors to research, buy, and sell stocks and bonds over the Internet. The greatest advantage of using e-trading compared to a traditional broker is cost. Traditional brokers provide advice based on their research. E-trading sites typically provide research on individual stocks that many e-traders use to make their trading decisions.
- **Shopping:** this is referred to as e-retailing or e-tailing, it includes the buying and selling of wide range of consumer goods over the Internet. The greatest e-retailing success have been in books, travel, music, and health industries. **Web storefronts** are virtual stores that allow shoppers to visit, inspect merchandise, and make purchases on the Web. A new program called Web storefront creation packages or commerce servers has recently evolved to help business create virtual stores, that allow visitors to register, browse, place products into virtual shopping charts, and trade through a safe communication.

#### B. Consumer-to-consumer (C2C)

This trading involves individuals selling to individuals, and takes the form of an electronic classified advert or an auction (Web Auction). Goods are describe and interested buyers contact sellers to negotiate prices, and buyers and sellers never meet face-to-face. Sellers post description of products at a Web site and buyers submit bids electronically. There are two basic types of Web auction sites.

- **Auction house sites:** they sell a wide range of merchandise directly to bidders. The auction house owners present merchandise that is typically from a company's surplus stock. They are usually considered safe to shop.
- **Person-to-person auction sites:** they operate more like flea markets. The owner of the site provides a forum for numerous buyers and sellers to gather. While the owners facilitate the building process, they are not involved in completing transactions or in verifying the authenticity of the goods sold. As with purchases at a flea market, buyers and sellers need to be cautious.

### C. Business-to-business (B2B)

B2B involves the sale of a service or product from one business to another. This is typically a manufacturer's supplier relationship. For example, a furniture manufacturer requiring raw materials such as wood, paint, and varnish. In B2B e-commerce manufacturers place an order electronically with suppliers and many times payment is made electronically. The most popular B2B e-commerce is for automobile parts, electronics including computers and health care.

### 3.3 BENEFITS OF E-COMMERCE

- **Geographic Reach:** geographical distance does not create a barrier to reaching and serving customers electronically or for interacting with suppliers.
- **Speed:** near instant exchange of information means the interaction between buyer and seller takes place at rapid speed.
- **Productivity:** individuals are more productive when they can do more work in a segment of time. Spending less time getting information means more time available for its use, therein producing greater efficiency.
- **Information Sharing:** virtually any form of information- text, graphics, audio, video or animation- can be transmitted to recipients location on the network.
- **New Features:** new features can be added to product and services offered over communications network, including personalized, automatic notification of activities and instant delivery.
- **Lower Costs:** the cost of business is reduced when companies and individuals can be reached quickly and without respect to geographical distance, while improved efficiencies results from electronic information exchange.
- **Competitive Advantage:** those companies that develop and implement an effective electronic commerce strategy have business advantages over others in their industry that can not offer similar products, services, or operating capability.

### 3.4 MODE OF PAYMENT IN E-COMMERCE

The single greatest challenge for e-commerce is the development of fast, secure, and reliable payment method for purchased goods. The three basic payment options are check, credit card, and electronic cash.

- **Check:** these are the most traditional and perhaps the safest. Unfortunately, check purchases require the longest time to complete. After selecting an item, the buyer sends a check through the mail. Upon receipt of the check, the seller verifies that the check is good. If it is good, then the purchased item is sent out.
- **Credit card:** with credit cards purchases are faster and more convenient than check purchases. Credit card fraud however is a major concern for both buyers and sellers. Criminals known as **carders** specialize in stealing, trading, and using stolen credit cards over the Internet.

- ***Electronic cash:*** this also refers to e-cash or cybergash or digital cash, is the internet equivalent to traditional cash. Buyers purchase e-cash from a third party (a bank that specializes in electronic currency) by transferring funds from their banks. Buyers purchase goods using e-cash while sellers convert the e-cash to traditional currency through the third party. Although not as convenient as credit card purchases, e-cash is more secure. A list of e-cash providers are: Ecash [www.ecash.com](http://www.ecash.com), EmoneyMail [www.emoneymail.com](http://www.emoneymail.com), Internet Cash [www.internetcash.com](http://www.internetcash.com), and PayPal [www.paypal.com](http://www.paypal.com).

#### 4.0 CONCLUSION

We should note that while there are numerous advantages to e-commerce, there are disadvantages as well, and just like any other type of commerce, e-commerce involves two parties: businesses and consumers.

Some of these disadvantages include the inability to provide immediate delivery to goods, the inability to sample goods before purchasing, and the issues relating to security of online payment.

#### 5.0 SUMMARY

In this unit we learnt that:

- There are three types of e-commerce namely: business-to-consumer (B2C), consumer-to-consumer (C2C), business-to-business (B2B).
- With e-commerce, there is no in-store inventory and products are shipped directly from warehouse.
- Electronic Commerce (e-commerce) is the use of communication networks, including the public Internet, to conduct commercial transactions between businesses or with consumers.

#### 6.0 TUTOR MARKED ASSIGNMENT

- a. What are the three types of e-commerce?
- b. What are the three basic payments for electronic payments?
- c. What is the greatest challenge for e-commerce development?
- d. Among the three types of e-commerce, which is the fastest growing business?

#### 7.0 FURTHER READINGS/REFERENCES

- Norton, P. (2003). *Computing Fundamentals* (5<sup>th</sup> Edition). United States of America: Glencoe/McGraw-Hill.
- O'Leary, T.J., O'Leary, L. I. (2004). *Computing Today*. New York, US: McGraw-Hill
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## **MODULE 3 DISTRIBUTED NETWORKS AND THE INTERNET**

### **UNIT 18 LAUNCHING INFORMATION TECHNOLOGY APPLICATIONS PROJECTS**

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## **1.0 INTRODUCTION**

In Unit 13 and 14 you learnt about the personal and enterprise communication networks. In this unit you will learn about the origin of IT applications in business and understand why they have become so prominent.

## **2.0 OBJECTIVES**

After you have read this unit, you should be able to know:

- The Characteristics of ICT Applications Project
- The Key player in ICT Projects
- The ICT Department
- Information System Analysis and Design

## **3.0 MAIN CONTENT**

### **3.01 INFORMATION TECHNOLOGY APPLICATIONS**

There are basically two categories of IT applications, they are:

- *Single-user System/Personal System*: An IT system used by only one person. A system that stands alone and is not interconnected with other companies or shared by other people.
- *Enterprise System*: Usually involves the same types of components as a personal system, plus server or mainframe, database, and network. It is generally a shared system.

### **3.02 CHARACTERISTICS OF PERSONAL AND ENTERPRISE SYSTEM**

**Table 18.1** Characteristics of Personal and Enterprise System

S/No.	Characteristics	Personal System	Enterprise System
1	Designed for Hands-On Usage  Hands-on System: A system in which a user enters data and information, directs processing, and determines the types of output to be generated.	X	X
2	Used to Improve Personal Performance	X	X
3	Tailored to Personal Preferences and Performance	X	X
4	Designed for Shared Use		X
5	Designed for Sharing Data Resources		X
6	Designed to Connect a Variety of Users		X
7	Designed for Larger Size and Scope		X

Source: (Senn, 2004).

### 3.03 IMPACT OF IT APPLICATIONS

- **Improved Productivity**

- **Productivity:** The relationship between the results of an activity (output) and the resources used to create those results (inputs).

**Table 18.2** Showing relationship between an activity and resources in Productivity

Inputs	Outputs
Hours of work required to complete a task	Length of time to complete report and number of projects produced
Equipment Investment	Number of contracts negotiated
Total Project budget	Amount of profit per complete contract

Source: (Senn, 2004).

- **Personal Productivity Software:** Software packages that permit activities to be completed more quickly, allow more activities to be completed in a particular period of time, or allow a task to be completed with fewer resources.
- **Greater Effectiveness**
  - **Effectiveness:** The extent to which desirable results are achieved.
- **Increased Creativity and Innovation**

### 3.1 ENTERPRISE SYSTEMS PROJECT

These are projects designed for organizations to promote efficient and safe use of data across the networks within their organizations.

- **Systems Development:** The process of examining a business situation, designing a system solution to improve that situation, and acquiring the human, financial, and information technology resources needed to develop and implement the solution.
- **Project Management:** The process of planning, organizing, integrating, and overseeing the development of an IT application to ensure that the project's objectives are achieved and the system is implemented according to expectations(as will be discussed in details in the next module, Unit 20.)

#### 3.1.1 PROJECT PROPOSAL

- **Project Proposal:** A proposal for a systems project prepared by users or systems analysts and submitted to a steering committee for approval.
- **Steering Committee Review**
  - **Steering Committee:** A group of people from various functional areas of a business that determines whether a systems development project proposal is desirable and should be pursued.

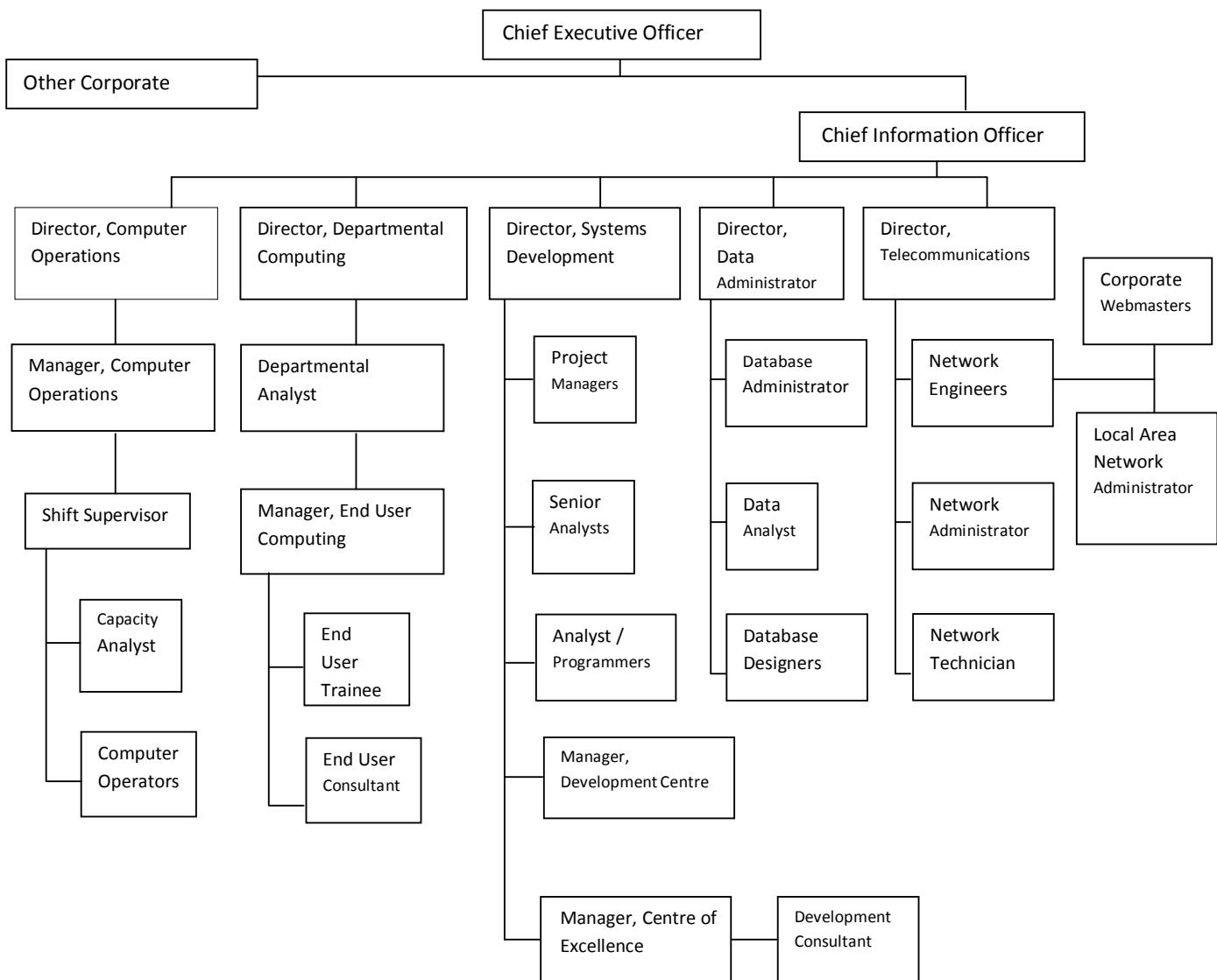
### **3.2 INFORMATION AND COMMUNICATION TECHNOLOGY DEPARTMENT**

In the design of our organizational chart, the Chief Executive Officer (CEO) is the overall highest ranking staff of the organization. The Chief Information Officer (CIO) is also the highest ranking information officer and he reports to the CEO. Information services are placed at the same level of importance as the traditional business functions (e.g., Finance, human Resources, Sales and Marketing, Production and so on). The rest of information services are organized according to the following functions or centers:

- a. ***System development:*** Most system analyst and programmers work for the systems development group in the information services group or department of a business. Alternatively systems analyst (under different titles) works for IT consulting firms, outsourcers, and application software vendors.

The ***Center for Excellence*** is a group of experts who establish and enforces methods, tools, techniques, and quality for all system development projects. Experienced analyst, system designer, system builders staff the center. They provide consulting and mentoring services for all projects.

- b. ***Data administrator:*** this center manages the data and information resources in the organization. This includes the database that are (will be) used by system developers to support application. Data administrators usually employ several system analysts known as data analyst who analyses database requirements and design and construct the corresponding databases.
- c. ***Telecommunications:*** this center design, constructs, and manages the computer networks that have become essential to most businesses. The network analyst does the network design.
- d. ***End-user computing:*** this center supports the growing base of personal computers and local area networks in the end-user community. It provides system support; installation services, training, and help-desk services.
- e. ***Computer Operations:*** this center runs all of the shared computers including mainframes, minicomputers, and non-departmental services. This unit rarely employs system analyst.



**Figure 18.1 THE ORGANISATIONAL CHART OF AN INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) DEPARTMENT.**

**Source:** (Whitten, 2001).

### 3.3 SYSTEM ANALYST

The System Analyst is the key player in most IT application projects, because the System Analyst follows the steps described in the system life cycle (as will be explained in the next topic). Analyst plan and design new systems or reorganize a company's computer resources to best utilize them. Analyst follow the systems development life cycle through all steps: preliminary investigation, analysis, design, development, implementation, and maintenance.

- Professional Skills
  - Problem Solving
  - Outcome Thinking
  - Creativity
  - Meeting Skills
  - Communication Skills

The System Analyst is the IT professional responsible for working with users to determine a system's requirements and for describing the features needed in the system. Systems Analyst position usually requires a bachelors degree in computer science and technical experience in the following fields listed below because he or she will have to interact with experts during the project processes.

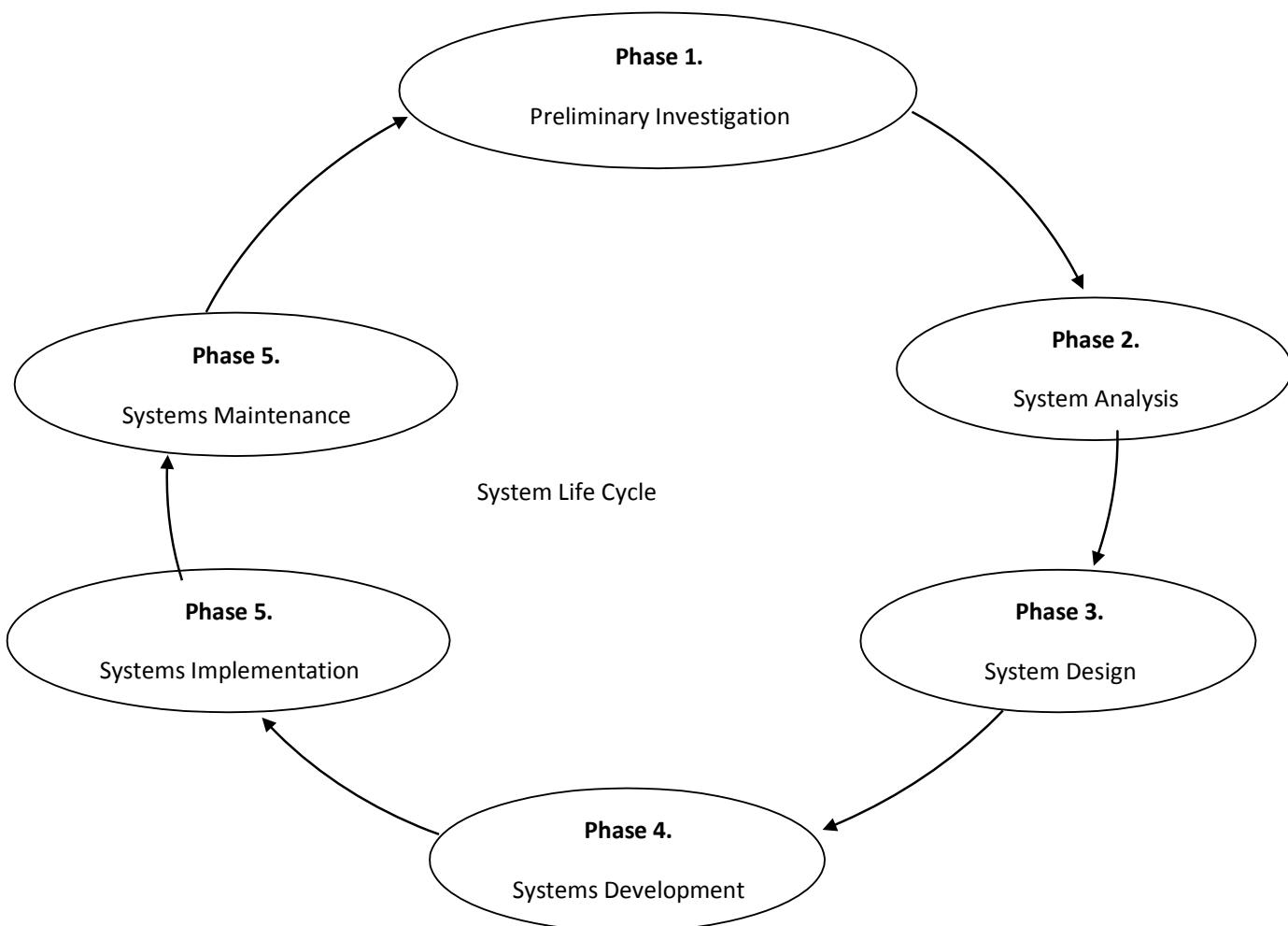
- ***System Design:*** the technical work of designing the system and its software.
- ***Programming/Analysis:*** determining system requirements and developing and implementing the systems.
- ***Web Development:*** additional capabilities that enable him or her to use expertise in creating IT applications that will involve the Internet or company intranets and extranets, Web browsers, and the display of information using browsers.
- ***Computer Security:*** techniques developed to safeguard information and information systems stored on computers.
- ***Software Engineering:*** the writing of instructions for a computer to use to manipulate data, such as a word-processing program or a video game.
- ***Database Administration:*** any collection of data organized for storage in a computer memory and designed for easy access by authorized users.
- ***Computer Hardware Engineering:*** the study of the equipments involved in the function of a computer.
- ***Networking:*** is a system used to link two or more computers. Network users are able to share files, printers, and other resources; send electronic messages; and run programs on other computers.

### 3.4 SYSTEMS ANALYSIS AND DESIGN

A system is a collection of activities and elements organized to accomplish a goal. System analysts are computer professionals that typically conduct system analysis and design. System analysis and design is a phased problem solving procedure that make up the system life cycle. The Systems Development Life Cycle (SDLC) is a six-phased set of activities that brings about a new IT application.

The phases are:

- *Problem Recognition/Preliminary Investigation*: identifies problems or needs.
- *System Analysis/Requirements Determination*: studies present system and specify new requirements.
- *Systems Design*: design new or alternate system to meet new requirements.
- *System Development and Construction*: acquiring, developing and testing needed hardware and software.
- *Systems Implementation*: installing new system and training people.
- *System Maintenance/Evaluation and Continuing Evolution*: periodically evaluating and updating system as needed.



**Figure 18.2** System Life Cycle.

**Source:** (O'Leary, 2004)

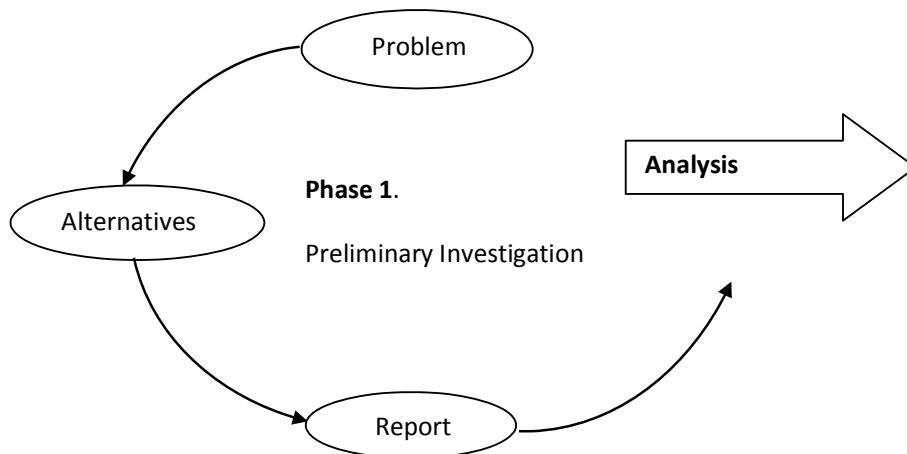
### **Phase 1: Problem Recognition/Preliminary Investigation**

The preliminary investigation determines the need for a new IT application project. It is typically requested by an end-user or a manager. Three tasks of this phase are defining the problem, suggesting alternative systems, and preparing a report.

- **Defining the Problem:** the current information system is examined to determine who needs what information, when the information is needed and why. If the existing information system is large, then a system analyst conducts the survey. Otherwise the end-user conducts the survey.
- **Suggesting Alternative Systems:** some possible alternative systems are suggested. Based on interviews and observations made in defining the problem, alternative information systems are identified.
- **Preparing a short report:** to document and communicate the findings of Phase 1, preliminary investigation, a short report, alternative information systems are identified.

**Note** that the merits and feasibility of a project proposal are determined in this phase.

- Three types of feasibility
  - Operational
  - Financial/Economic
  - Technical



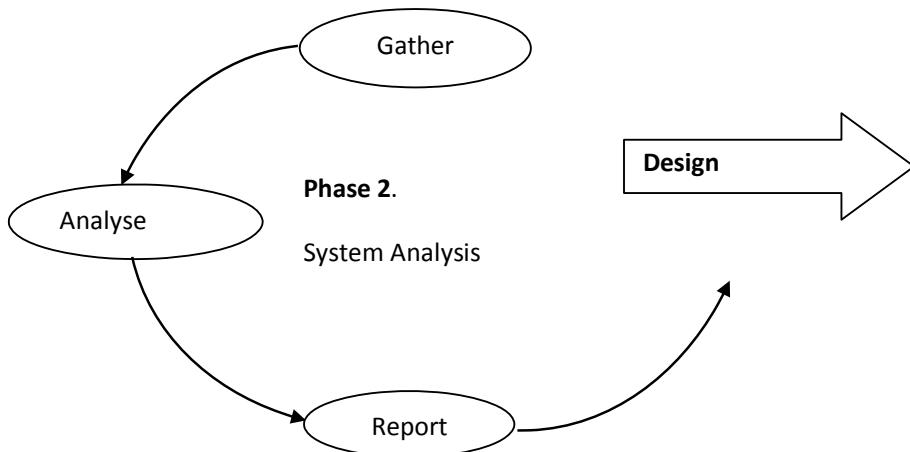
**Figure 18.3** Preliminary Investigation

**Source:** (O'Leary, 2004)

### **Phase 2: System Analysis/Requirements Determination**

In system analysis data is collected about the current system. The focus is on determining the requirements for a new system, three tasks of this phase are gathering data, analyzing data, and documenting the analysis.

- **Gathering data:** data is gathered by observations, interviews, questionnaires, and looking at documents. One helpful document is the organizational chart, which shows a company's function and level of management.
- **Analyzing the Data:** there are several tools for the analysis of data, including *checklist, top-down analysis, grid chats, decision tables, and system flow chats*.
- **Documenting system Analysis:** to document and communicate the findings and phase 2, a systems analysis report is prepared for higher management.



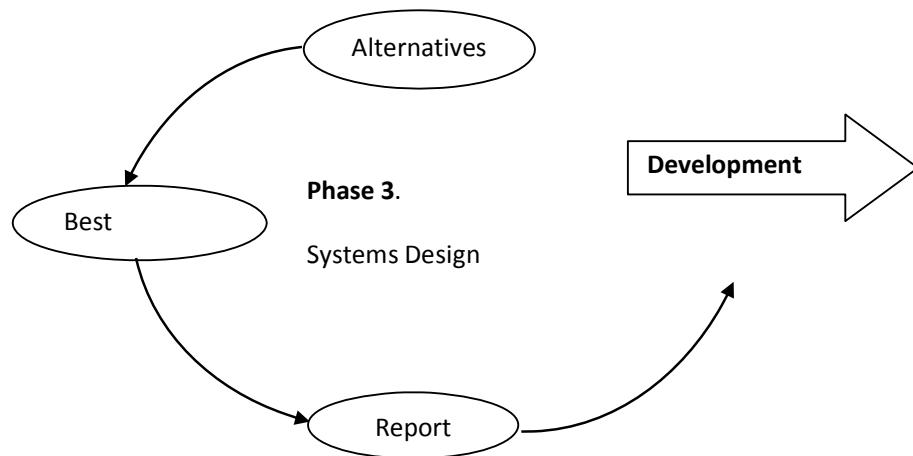
**Figure 18.4** System Analysis

**Source:** (O’Leary, 2004)

### Phase 3: Systems Design

In the system design phase, a new or alternative information system is designed. This phase consists of three tasks:

- **Designing Alternative Systems:** alternative information systems are designed. Each alternative are evaluated for:
  - **Economic feasibility:** cost versus benefit: time for system to pay for itself.
  - **Technical feasibility:** hardware and software reliability.
  - **Operational feasibility:** System work within organisation
- **Selecting the best system:** There are four questions considered when selecting the best system
  - Will the system fit into an overall system?
  - Will the system be flexible enough to be modified as needed in the future?
  - Will it be secured against unauthorized used?
  - Will the system benefits exceed its costs?
- **Writing the system Report:** To document and communicate the findings of Phase, a system design report is prepared for higher management.



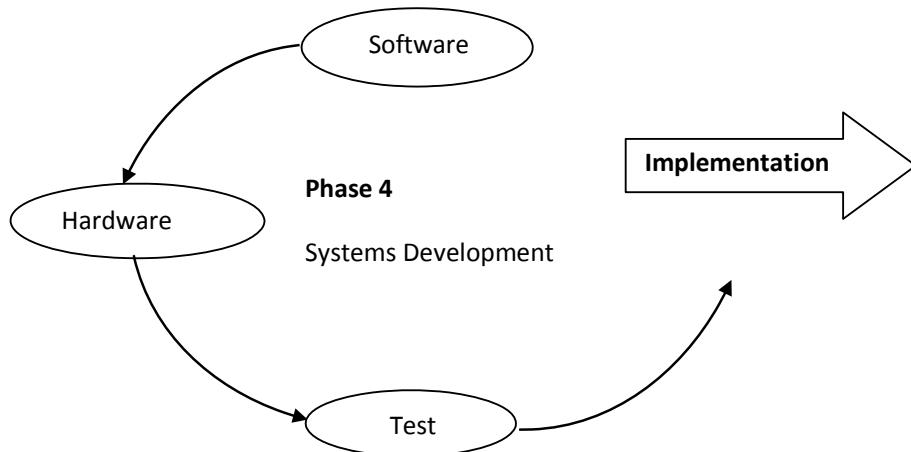
**Figure 18.5** System Design

Source: (O’Leary, 2004)

#### Phase 4: System Development and Construction

In the systems development phase, software and hardware are acquired and tested.

- **Acquiring Software:** two ways to acquire software are:
  - Purchase: buy off the shelf packaged software to be modified if necessary.
  - Custom designed: create programs following programming steps.
- **Acquiring Hardware:** is very critical and involves consideration for future company growth, existing networks, communication capabilities, and training.
- **Testing the New System:** using sample data, the new system is tested. This step can take several months for a complex system.



**Figure 18.6** System Development

Source: (O’Leary, 2004)

## Phase 5: Systems Implementation

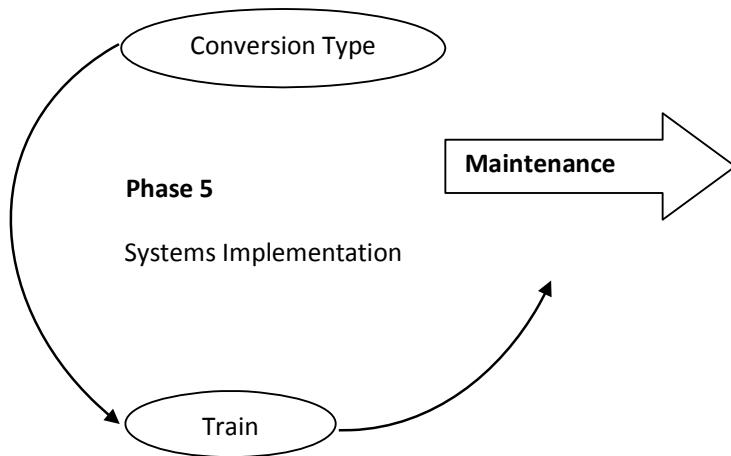
This is the process of changing to the new system and training people.

- **Types of Conversion**

Four ways to convert a system are:

- **Direct approach:** abandoning the old and starting up the new system; can be very risky and not recommended.
- **Parallel Approach:** operating the old and the new side by side until the new one proves it worth; low risk but expensive.
- **Pilot Approach:** trying out the new system in only one part of an organization. Compare to parallel, pilot is riskier and less expensive.
- **Phased Approach:** implementing the new system gradually; low risk but expensive.

- **Training:** a software trainer may be used to train end-users in the new system.



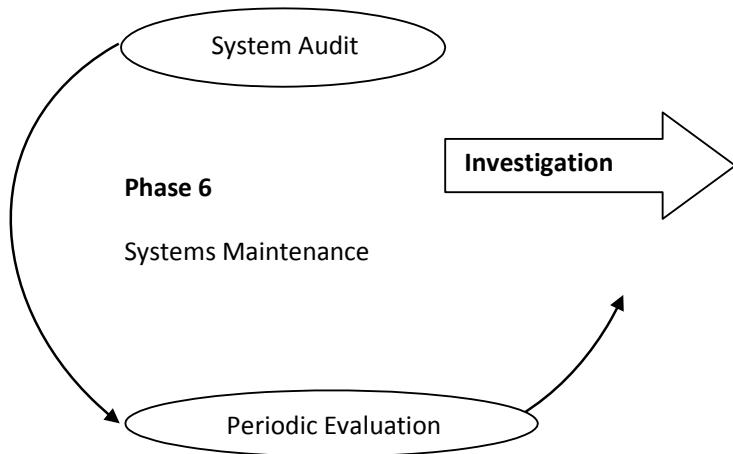
**Figure 18.7** System Implementation

**Source:** (O'Leary, 2004)

## Phase 6: System Maintenance/Evaluation and Continuing Evolution

This is the final phase. It consists of several audits followed by periodic evaluations.

- **System Audit:** once the system is operational, the systems analyst performs a system audit by comparing the new system to its original design specifications. If the system does not meet these specifications, some further redesign of the system may be required.
- **Periodic Evaluation:** the new system is periodically evaluated to ensure that it is operating efficiently. If it is not, some redesign may be required.



**Figure 18.8** System Maintenance

**Source:** (O'Leary, 2004)

**Note:**

Due to time pressures, it is not always feasible to follow every phase of the traditional system life cycle. Other alternatives that can be used will be found in the referenced books, which require less time and cost less.

#### 4.0 CONCLUSION

In conclusion, the ICT projects need careful planning before being launched. This is essential because if it is not properly analysed and designed, the application project will not meet the end-user's requirements.

#### 5.0 SUMMARY

In this unit you learnt about:

- the distinguishing characteristics of an IT application
- the benefits of IT applications to users and enterprise
- the six phases of the systems development life cycle

#### 6.0 TUTOR MARKED ASSIGNMENT

- a. What are ICT applications?
- b. What are enterprise systems projects?
- c. Who is the most valuable player in ICT application projects and what are his competent skills?
- d. What is feasibility and whose responsibility is it in the IT department?

## **7.0 FURTHER READINGS/REFERENCES**

- Norton, P. (2003). *Computing Fundamentals* (5<sup>th</sup> Edition). United States of America: Glencoe/McGraw-Hill.
- Paul F., James M. and Peter H. (2004), *System Development Life Cycle Models and Methodology: System Analysis and Database development*. New Jersey, US: Pearson Prentice Hall.
- Senn, J. A. (2004). *Information Technology: Principles, Practices, Opportunities* (3<sup>rd</sup> Edition). New Jersey, US: Pearson Prentice Hall.
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## **MODULE 4 MANAGING INFORMATION AND COMMUNICATION TECHNOLOGY APPLICATIONS IN THE ENTERPRISE.**

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## **1.0 INTRODUCTION**

The Unit 18, you learnt about the origin of IT projects in business and how they are launched. This unit will introduce you to how the projects are managed and accessed within the enterprise level and the tools the system analyst use in developing an open shared system.

## **2.0 OBJECTIVES**

After you have read this unit, you should be able to:

- Identify the characteristics of shared systems.
- Describe the tools and techniques available to system analysts for collecting data and developing IT applications.
- Summarize the purpose and characteristics of unified modeling language (UML).
- Identify the use of a CASE tool

## **3.0 MAIN CONTENT**

### **3.1 DEVELOPING OPEN SHARED SYSTEMS**

In an enterprise system, two or more users share computers, communication technology, and applications. The introduction of an enterprise system into an organisation affects everyone who interacts with the application or receives information generated by the system. For this reason enterprise systems are not developed by individual staff members, but rather by the organization's information group known as the Management Information System (MIS) department.

#### **3.1.1 DEVELOPMENT ALTERNATIVES**

The information technology group can take any of the three approaches to developing an application:

- Build the application itself.
- Purchase a prewritten application.
- Contract out the application development.

#### **3.1.2 OPEN SYSTEMS FOR SHARING**

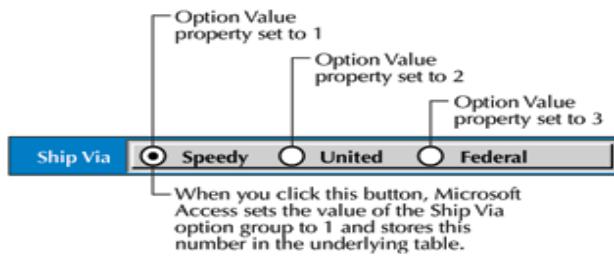
- ***Open System:*** A software system that runs on different computer and communications hardware.
- ***Interoperability:*** The perfect exchange of data and information in all forms (data, text, sound, and image, including animation) between the individual components of an application (hardware, software, and network).

#### **3.1.3 SHIFTING DEVELOPMENT**

- Craft Approach
- Assembly Approach
- ***Object:*** A component that contains data about itself and how it is to be processed.

### 3.1.4 BUILDING IT WITH COMPONENTS

Icon	Tool Name	Control Purpose on a Form or Report
	<b>Select Objects</b>	Select, move, size, and edit controls
	<b>Label</b>	Display text, such as a title or instructions; an unbound control
	<b>Text Box</b>	Display a label attached to a text box that contains a bound control or a calculated control
	<b>Option Group</b>	Display a group frame containing toggle buttons, option buttons, or check boxes; can use Control Wizards to create
	<b>Toggle Button</b>	Signal if a situation is true (button is selected or pushed down) or false
	<b>Option Button</b>	Signal if a situation is true (black dot appears in the option button's center) or false; also called a radio button
	<b>Check Box</b>	Signal if a situation is true (X appears in the check box) or false
	<b>Combo Box</b>	Display a drop-down list box, so that you can either type a value or select a value from the list; can use Control Wizards to create
	<b>List Box</b>	Display a list of values from which you can choose one value; can use Control Wizards to create



**Figure 19.1** Object Design Tools and Option tool.

Source: (Senn, 2004).

## 3.2 SYSTEM ANALYST'S TOOLS AND TECHNIQUES

### 3.2.1 DATA COLLECTION TECHNIQUES

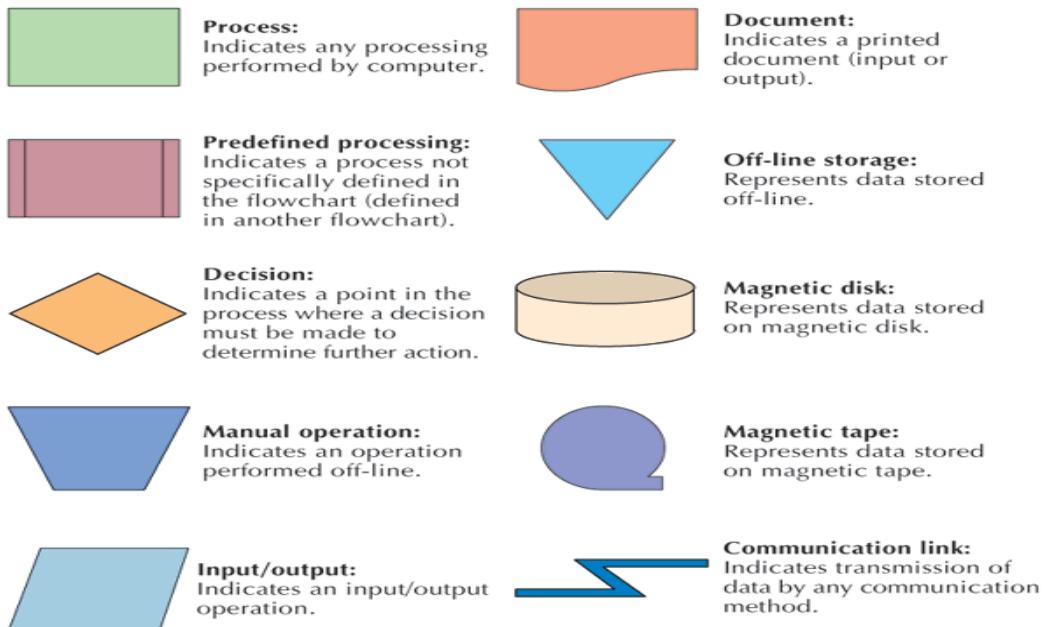
This is the process of collecting data relating to business transactions for processing by any appropriate means. This could be performed through the following methods:

- **Interviews**
  - **Structured Interview:** An interview in which the questions are prepared in advance and each interviewee is asked the same set of questions.
  - **Unstructured Interview:** An interview in which the questions may be prepared in advance, but follow-up questions vary, depending on the interviewees' background and answer.

- **Questionnaire:** A sheet of questions used to collect facts and opinions from a group of people.
- **Document Examination/Record Inspection:** The review of company documents about a system or opportunity under investigation.
- **Observation:** The process of watching an activity takes place to collect information about that activity.
- **Sampling:** The process of collecting data and information at prescribed intervals.

### 3.2.2 DATA PROCESSING TOOLS

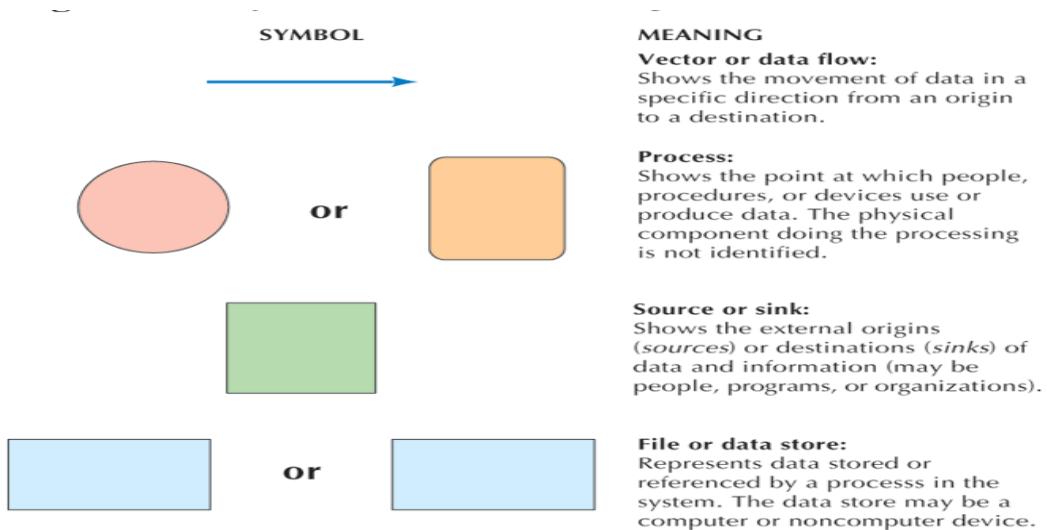
- **System Flowcharts:** A graphical description of a business process or procedure using standard symbols to show decision logic.



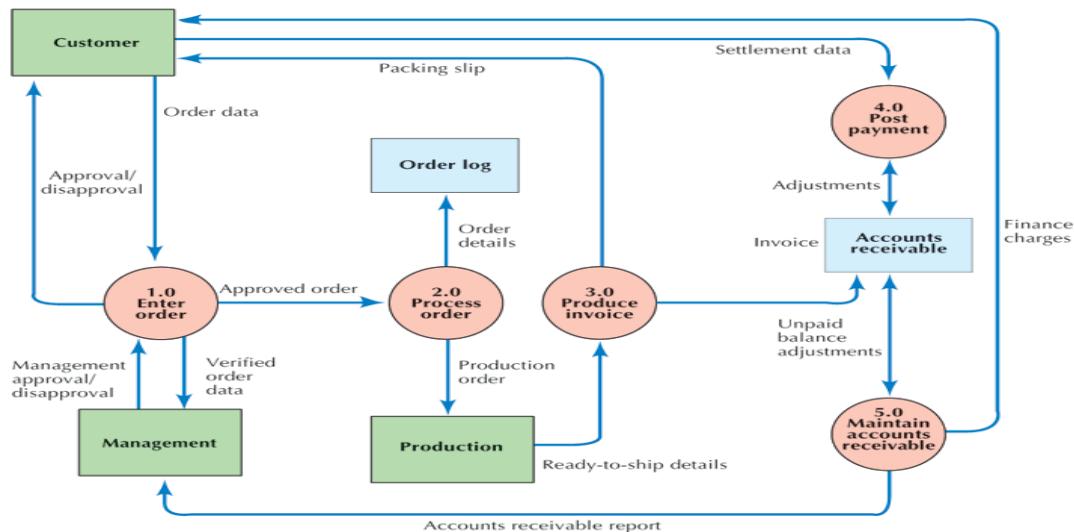
**Figure 19.2** Symbols used in system Flowcharts.

Source: (Senn, 2004).

- **Dataflow Diagram (DFD):** A chart showing the movement of data through a system.
  - **DFD Levels**
    - **Leveling:** The process of exploding processes in a dataflow diagram to show more detail.



**Figure 19.3** Symbols used in Dataflow Diagrams.  
**Source:** (Senn, 2004).



**Figure 19.4** Dataflow Diagram for Order and Invoice Handling at a Mail-Order Company.  
**Source:** (Senn, 2004).

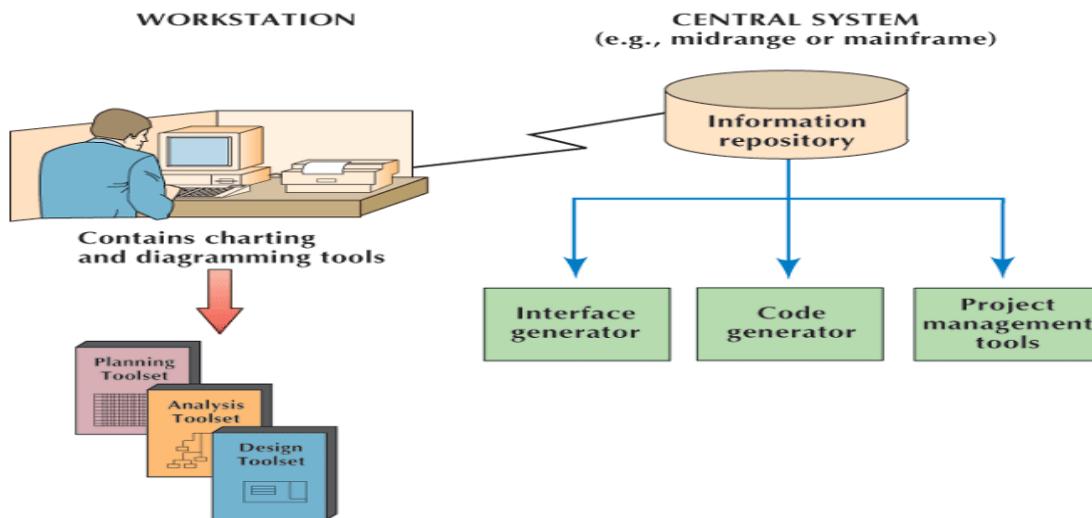
- **Data Dictionary/Repository:** A catalog that lists and describes all the types of data flowing through a system. Composed of data elements and a data structure.
- **Data Element:** The component of a data dictionary that includes data names, alternate names, and length allowances.

- **Data Structure:** The set of data elements used together and the name that collectively identifies the set.

### 3.3 COMPUTED-AIDED SYSTEMS ENGINEERING (CASE)

*Computed-Aided Systems Engineering/Computer-Aided Software Engineering (CASE) is a set of tools used in systems development to improve the consistency and quality of the system while automating many of the most tedious and time-consuming systems tasks.*

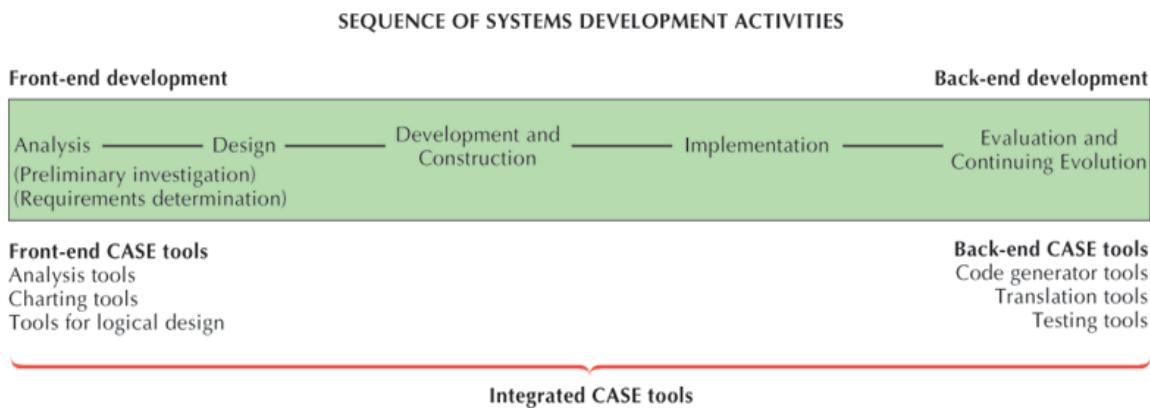
- Charting and Diagramming Tools
- Centralized Information Repository
- Interface Generators
- Code Generators
- Project Management Tools



**Figure 19.5** CASE Tools Diagrams.

Source: (Senn, 2004).

- **Front-End CASE Tool:** A CASE tool that automates the early (front-end) activities in systems development.
- **Back-End CASE Tool:** A CASE tool that automates the later (back-end) activities in systems development.
- **Integrated CASE (I-CASE) Tool:** A CASE tool that spans activities throughout the entire systems development life cycle.



**Figure 19.6** Types of CASE Tools.

Source: (Senn, 2004).

### 3.4 UNIFIED MODELING LANGUAGE (UML)

- *Unified Modeling Language (UML)* is a standard method/technique for visualizing, describing, and documenting the details of an IT application. It is being used more extensively in industries to assist in systems analysis.
- *Actor*: Anyone or anything that will interact with the application.
- *Activity Diagram*: Shows the flow of control in an application.

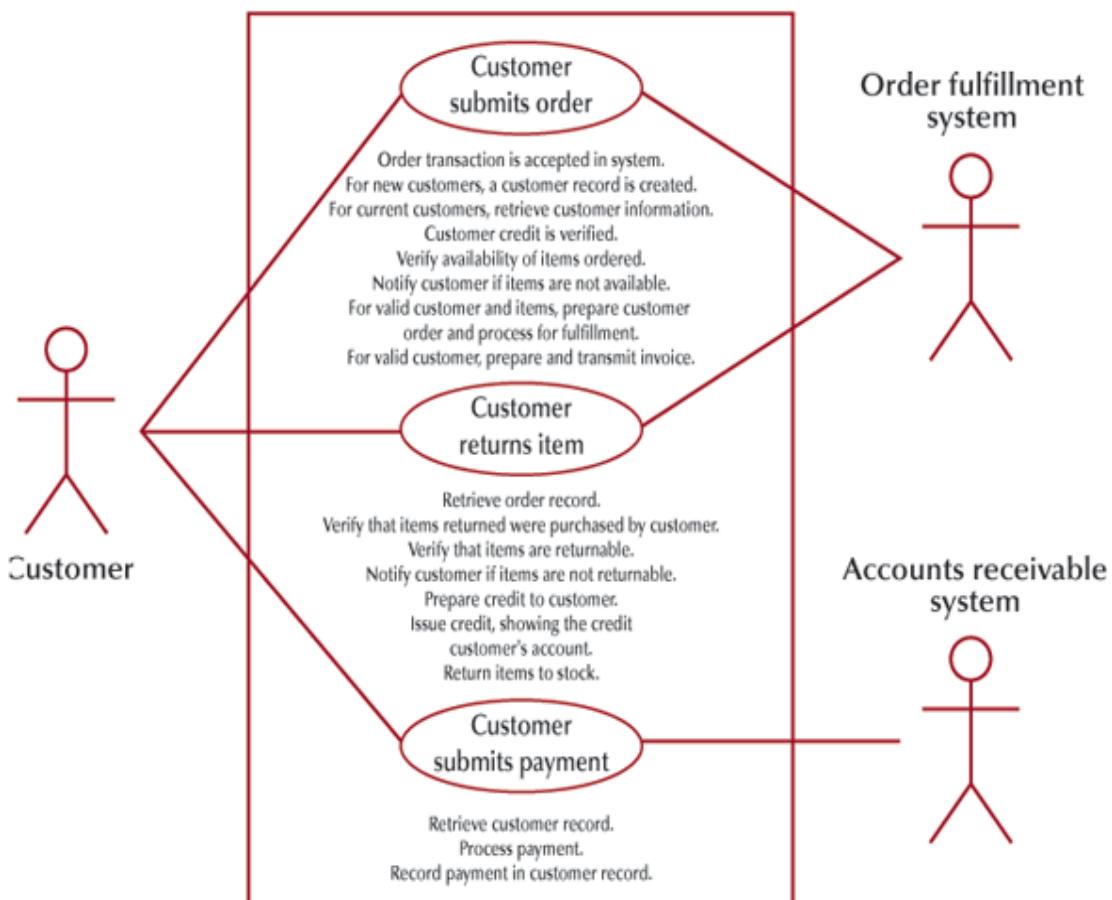


**Figure 19.7** Actors in Mail Order Use CASE.

Source: (Senn, 2004).

- **Use Case Diagram**: Provides context for the system, illustrating the actors, the use cases, and the flow or interaction between use cases and actors.
  - *Use Case*: Identifies the sequence of activities performed for an actor.
- **Use Case Description**: Describes the use case in ordinary language, including its identifying name and actors.

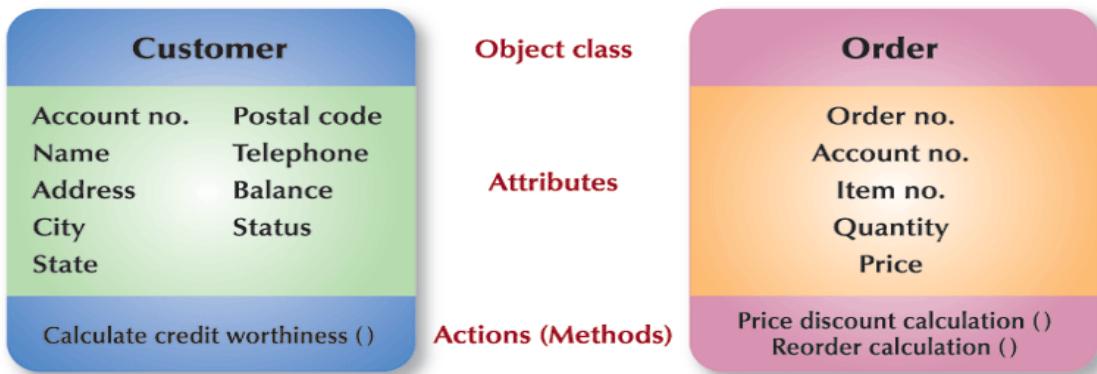
## Customer transaction



**Figure 19.8** Use CASE Description.

**Source:** (Senn, 2004).

- **Class Diagram:** Describes an object class, including the class name, attributes, and methods.
- **Other UML Diagrams**
  - Sequence Diagram
  - State Transition Diagram
  - Component Diagram



**Figure 19.9** Class Descriptions for Customer and Order Objects.

Source: (Senn, 2004).

## 4.0 CONCLUSION

When creating an enterprise application, it is the responsibilities of the System Analyst to use the required tools and techniques to make the software system to perform on different computer and communications hardware.

## 5.0 SUMMARY

In this unit we learnt that the System Analyst use the following tools and techniques to make an IT application accessible to end users in an organistaion.

- Techniques
  - Interviews, Questionnaire, Document Examination/Record Inspection, Observation, Sampling and Dataflow Diagram (DFD)
- Tools
  - Computed-Aided Systems Engineering/Computer-Aided Software Engineering (CASE)
  - Unified Modelling Language (UML)

## **6.0 TUTOR MARKED ASSIGNMENT**

- a. In a DFD chart what does the arrow stand for?
- b. What are the data collection techniques the System Analyst use.
- c. State the two basic tools the System analyst used when creating an ICT project.
- d. What are the two types of interview conducted by a System Analyst during analysis?

## **7.0 FURTHER READINGS/REFERENCES**

- Norton, P. (2003). *Computing Fundamentals* (5<sup>th</sup> Edition). United States of America: Glencoe/McGraw-Hill.
- O'Leary, T.J., O'Leary, L. I. (2004). *Computing Today*. New York, US: McGraw-Hill
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## **MODULE 4 MANAGING INFORMATION AND COMMUNICATION TECHNOLOGY APPLICATIONS IN THE ENTERPRISE.**

### **UNIT 20 PROJECT MANAGEMENT**

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## 1.0 INTRODUCTION

In Unit 19 you learnt about the tools used to make an ICT application available for end-users for easy sharing of resources. This unit will introduce you to the process involved in managing an IT project, from starting to completion.

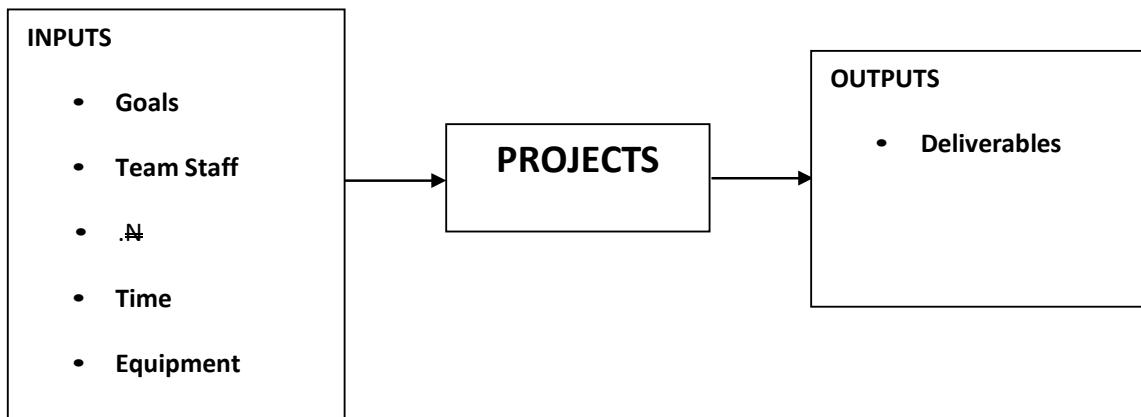
## 2.0 OBJECTIVES

After this unit, you should be able to:

- Break a complex project into manageable sub-projects
- Assign responsibility/ownership of project components
- Set reasonable milestone's for the completion of major tasks
- Develop and complete a project plan

## 3.0 MAIN CONTENT

Project management is the art of matching a project's goals, tasks, and resources to accomplish a goal. To accomplish a goal one need limited time, money, and resources (human and machinery). One can think of a project as a process that involves inputs and outputs. Successful projects require doing the right things, with the right tools, and in the right way.



**Figure 20.1** Simple Project Management System.  
Source: (MITOPENCOURSEWARE, 2008)

### **3.1 MANAGING A PROJECT**

#### **3.1.1 STAGES OF A PROJECT AND HOW TO COMPLETE THEM**

##### **Stage 1: Defining the goals of the project:**

Starting a project with the correct goal(s), make it easy to accomplish the goal(s). This must be a team activity to ensure that everyone is given the opportunity to contribute and "buy-in" to what is going to happen. At the end of this stage, every team member should have an understanding of what must be accomplished.

This part of the project should end with a document that lists the goals with a short statement providing some detail about the success rate and a vital few requirements that define the goal(s) to be accomplished. It also prevents teams from performing unnecessary iteration and improvement on a goal(s) which has been sufficiently accomplished.

##### **Stage 2: Define project tasks/activities:**

Each goal or sub-set of goals should be matched to the tasks required to accomplish them. This is best done by listing the goals on the left side of a sheet of paper, then writing the tasks to their right. The **group** should agree that the specify task will accomplish the goals as per required in the definitions for success the team laid out in the previous stage.

##### **Stage 3: Determine and verify resource requirements:**

Resources are those things which are needed to accomplish the project goals. Resources may include, but are not limited to:

- People
- Time
- Money
- Space
- Computers
- Software, e.t.c.

The most important component of determining resource requirements is to be realistic. One of the most common mistakes project managers make is to underestimate the amount and type of resources required. This leads to projects that run over budget and fall behind schedule. DO NOT attempt to do any of the following:

- Squeeze a project into a shorter time frame to please your boss
- Cut corners to minimize resource requirements
- Plan on a best-case basis, i.e. "If everything goes correctly, we will finish on time."

Determine what you need to get the job done correctly, on time, and on budget. It is not a bad idea to build in a safety margin here. This is often referred to as "padding". For instance, one might multiply the estimated time to complete a task/project by say 20% to allow for additional time to deal with unexpected occurrences. The amount of padding usually depends on the certainty one has as to how effectively the resources can be used. One should keep padding to a minimum.

Once the requirements have been set, it is important to verify that the team will have access to them.

#### **Stage 4: Identify risks and develop mitigation (backup) plans:**

Projects always involve a finite amount of uncertainty (risk) that may lead to problems and surprises during the project. Dealing with surprises requires more time, energy, and money than originally planned. Risk management can help reduce the likelihood and affects of risks. Risk management is important as it helps the team accomplish the project with as little trouble as possible.

As a professional scientist, engineer, or project manager, you will be required to help get the job done. Excuses (whether real or imaginary) generally do not buy any sympathy. For instance, in the event of a surprise problem which causes project delays, it is all too easy to deflect responsibility with victim phrases such as, "I did my part, but the other guy did not." or "We had an unexpected problem which caused us to fall behind schedule." Managers, professors, CEOs typically do not look favorably on people who invoke victim phrases. As a result, people who fall back on these types of phrases, even if they are true, typically do not go far in this world. You must learn how to deal with surprises and adversity, not be pushed around by them.

By becoming a member of a team, each member dedicates themselves to the success of the **TEAM**. If you are waiting on a team member to accomplish a task and they are behind, it is your responsibility to help them in any way you can. If you cannot help them, you must make sure they get the help to accomplish their task. The victim phrase does not absolve you of any responsibility, rather it makes you look like you are not a team player.

Risk management can be a complex process, for our purposes. You may want to pay special attention to risks that are so great, that they could "kill" the whole project. A member of the group should be responsible for monitoring this risk throughout the project.

#### **Stage 5: Develop a schedule**

A schedule is the arrangement of tasks, people responsible for these tasks, and a timeline for a project. **Pert charts and Gant** charts are examples of useful tools used in scheduling activities. They allow the team to look at the architecture (structure) of the project and easily

identify responsibilities. The charts can serve as a document that people use in their planning as a visualization tool to see how tasks depend on each other.

The basic format of a gant chart consists of a listing of tasks on the left hand side, followed by the start date, number of days to complete, and a finish date. Each task should be assigned one or more owners. To the right of the text listing is a graphical representation of the task duration in the context of the project time line.

After the chart is made, look for conflicts of resources. For instance, make sure that team members are not assigned too many tasks during a given time period. For instance, in the schedule bellow, Lisa appears to be busier than her team mates on July 2<sup>nd</sup> and 3<sup>rd</sup>. Also make sure that different tasks which require the same machines or rooms are not scheduled for use at the same time. Make the changes and obtain agreement from the group that this is the schedule that is to be followed. It might be wise to review the risks during this time and adjust parts of the schedule if it would help.



**Figure 20.2:** Gant Chart

Source: (MITOPENCOURSEWARE, 2008)

Microsoft project is also a project management tool. Project Management usually follow the system development life cycle (SDLC) phases as discussed earlier in unit 18.

### Stage 6: Execute the schedule

Every team member should know what they have to do and should have the right resources to get the job done. They should know what the risks are and have back up plans in case of trouble. During this stage, the project manager is responsible for coordinating, though group members should communicate among themselves as required. If a group member feels he is going to go over time or budget, it is their responsibility to bring it up to the group as soon as possible. This way, resources can temporarily be shifted to help keep the team member on schedule.

Each group member should document their activities. This is important as human memory is shaky at best and it is likely that each team member will be required to recall details of their activity. There is nothing more frustrating to a manager than to hear an employee say, "I can't remember what I did." If one can't remember, how can the team trust that what they did was correct? Documentation is the responsibility of the team members and will often be a saving grace for them.

It is likely that surprises and conflicts may occur during the course of the project. It is important to remember that it is the team's responsibility to make the project happen. If there are problems, the team should help figure them out. If there are conflicts, the team should act together to resolve them. This can be facilitated by regular meetings (daily, weekly, monthly, whatever is practical) of the team. At the meetings the team should review the schedule and the status (complete or not complete) of the project goals. Once the goals are accomplished, the project is complete.

### **Stage 7: Finish the project and assessing performance**

After the goals have been achieved, it is good practice to evaluate the performance of the project team. This is where a good deal of learning and experience is gained. It will help prevent similar problems in future projects.

## **4.0 CONCLUSION**

Project Management provides the basic skills and knowledge needed to effectively manage a group project through project scheduling, understanding and handling risk. Project management can be managed by either an IT staff or a Specialist with management skills or by Software (Microsoft project).

## **5.0 SUMMARY**

In this unit, you learnt that:

- Project management is a team work
- Responsibilities should be shared among team members
- Project Managers are designed to schedule, plan, and control project resources.
- Pert charts and Gant charts are tools used in scheduling activities
- Having a vision, setting a goal and working towards achieving it reduces missing target.

## **6.0 TUTOR MARKED ASSIGNMENTS**

- a. In the project management steps outline which is the most important? And why?
- b. Why do you need a backup plan(s) in project management?
- c. What do you consider to be the basic inputs in a project?
- d. What are the don't(s) in planning a project?

## **7.0 FURTHER READINGS/REFERENCES**

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- Smith, J. (2009). *Jan's Web Work and Experiments*. Retrieved August 15, 2009, from <http://www.jegsworks.com>.
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## **MODULE 4 MANAGING INFORMATION AND COMMUNICATION TECHNOLOGY APPLICATIONS IN THE ENTERPRISE.**

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## **1.0 INTRODUCTION**

In Unit 16, you learnt about the WWW, in unit 19 you were introduced to how applications are made open to users at the enterprise level. This unit will introduce you to how to an emerging trend, however, it is to free users from owning and storing applications by using Web-based applications.

## **2.0 OBJECTIVES**

By the end of this unit, you should be able to:

- Distinguish between the purposes of XML in Web-enabled applications.
- Identify the six advantages of XML.
- Explain the potential benefit of Web services to enterprises IT applications.
- Identify how Web based application work

## **3.0 MAIN CONTENT**

### **APPLICATION SERVICE PROVIDER (ASPS)**

Special web sites, called Application Service Providers (ASPs), allow access to their application programs. To use one of these Web-based applications, you would connect to the ASP, copy the application program to your computer system's memory, and then run the application. Most ASPs provide access to a wide range of application programs and charge a fee for their services

### **3.1 HOW WEB-BASED APPLICATION WORK**

#### **Step 1: Connect**

The user connects to a Web-site known as application service provider (ASPs). While some ASPs are free, most charge a fee to access and to use their applications. These applications may be general purpose application such as Microsoft Office applications or specialized applications such as Web authoring programs. The user then requests a specific application to use.

### **Step 2: Download**

The Application Service Provider (ASP) downloads or sends a copy of all or part of the requested application to the user. This copy is stored unto the user's hard disk drive and is ready to be run. The copy will remain their either for a specific period of time or until the user runs and then exits the program.

### **Step 3: Run**

The user runs the application form his hard disk drive. For example a user might download Microsoft Word document and use it to create a document.

### **Step 4: Save and Exit**

When the user has completed work with the application, the created files can be saved on the user's computer system and/or at the ASP. The user then exits the application program.

### **Step 5: Remove Application**

Once the user has exited the program, the program is automatically erased from his/her hard disk and is not available to be run again. If the user wants to run the program again he/she must start again with **step 1**.

## **3.2 PROCEDURES OF USING WEB-BASED APPLICATION**

**Registration:** several ASP sites exist on the Web and some of their services are free. One of the best known site is WebOS. Their only requirement is that you register for their services.

**Accessing Applications:** each time you connect to the WebOS site and log in, your Web-based desktop will appear. It will display numerous icons that can be used to access Web-based applications. These include notes, personal information manager, calendar, and a variety of games.

**Web-Based Desktop:** the Web-based desktop looks and operates like the traditional windows desktop. It consist of a variety of icons that are used to load and run applications.

### 3.3 FORCES BEHIND WEB-ENABLED SYSTEMS

*Web-enablement:* The tendency of systems developers to incorporate features of the Internet in enterprise systems.

- ***Widespread Use of Browsers***
  - New computers shipped with Web browsers
  - Large installed base of browser users
  - Browsers appearing on other IT devices
- **Flexibility**
  - *Plug-ins:* Software programs that extend the capabilities of your Internet browser, giving it added features.
- **Universal front-end application**
- ***Legacy System***
  - *Legacy System:* Refers to the many mainframe, midrange, client/server or PC applications that are used to manage business functions.
- ***Interconnected Enterprises***
  - ***Interoperability:*** The perfect exchange of data and information in all forms (data, text, sound, and image, including animation) between the individual components of an application (hardware, software, and network).
  - ***Heterogeneous Applications:*** May be written in different programming languages, run on different types of computers, and use varying communications networks and transmission methods.

#### 3.3.1 EXTENSIBLE MARKUP LANGUAGE (XML)

Developers can design their own customized markup languages for describing data.

- ***Structure of XML***

```

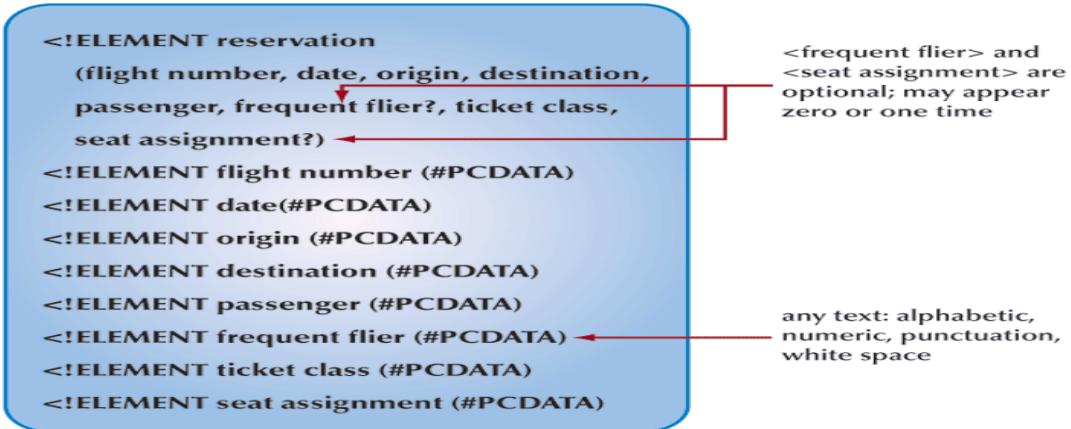
<?xml version="1.0"?>
<reservations>
  <flight number="DL56">
    <date>"10122004"</date>
    <origin>Tokyo</origin>
    <destination>Atlanta</destination>
    <passenger>Migel Gutierrez</passenger>
    <frequent flier>"3116545682"</frequent flier>
    <ticket class>first class</ticket class>
    <seat assignment>4F</seat assignment>
  </flight number>
</reservations>

```

**Figure 21.1** Sample XML code for Airline flight Reservation.

Source: (Senn, 2004).

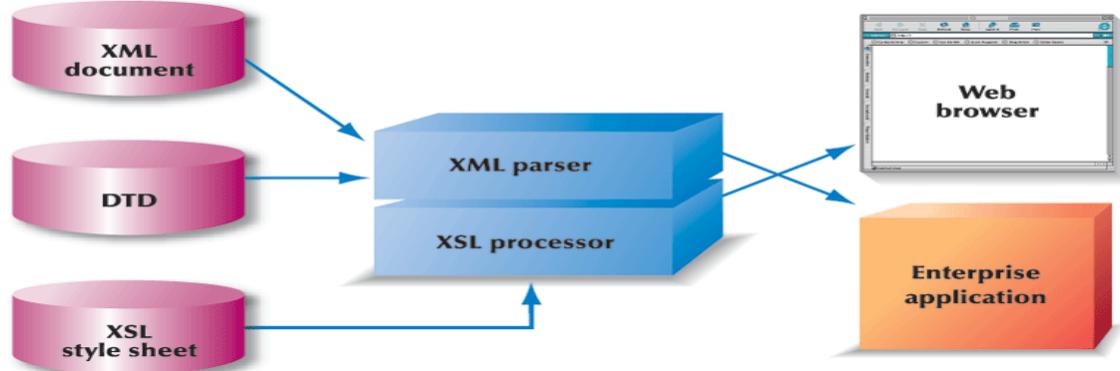
- **XML Advantages**
  - Web-based
  - Extensible
  - Computer and software platform independent
  - Facilitates end-to-end application integration
  - A public, license-free standard
  - Has widespread vendor support
- **Document Type Definition (DTD):** Defines the vocabulary (or standard) to make the data easily understandable and useable.



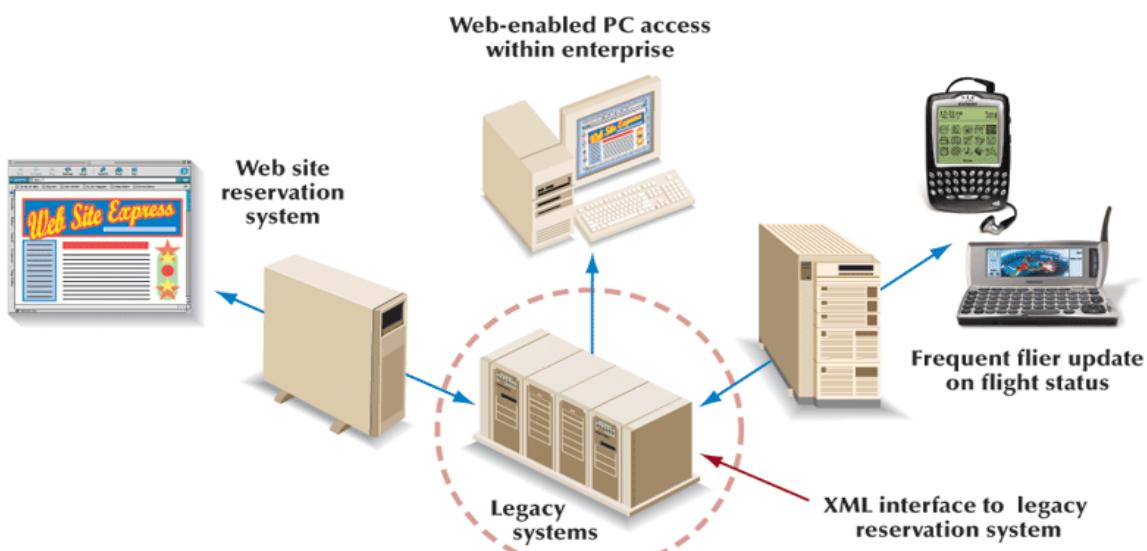
**Figure 21.2** Sample Document Type Definition (DTD).

Source: (Senn, 2004).

- **Presentation Using XML Style Sheets**
  - **XML Style sheet Language (XSL):** Created by developers or publishers of XML data to manage the display and presentation of information in a document.
- **Processing XML**



**Figure 21.3** Processing of XML Components.  
Source: (Senn, 2004).



**Figure 21.4** XML interface for Web-enabled Legacy System.  
Source: (Senn, 2004).

### 3.3.2 WEB SERVICES

**Web Services** are Modular Internet applications that perform a very specific function or task.

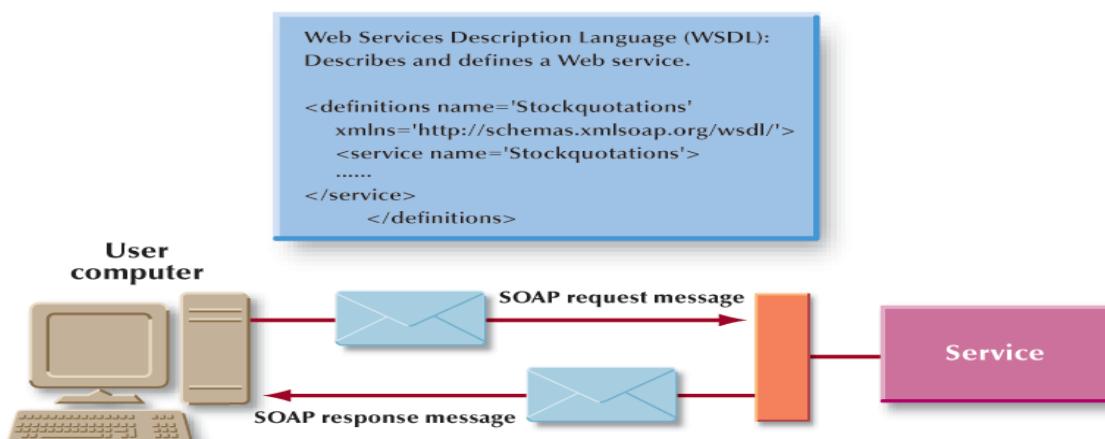
- **Simplified Object Access Protocol (SOAP):** The protocol used by an application to invoke a Web service located on another computer.



**Figure 21.5** Interplay between Web Services Participants.

**Source:** (Senn, 2004).

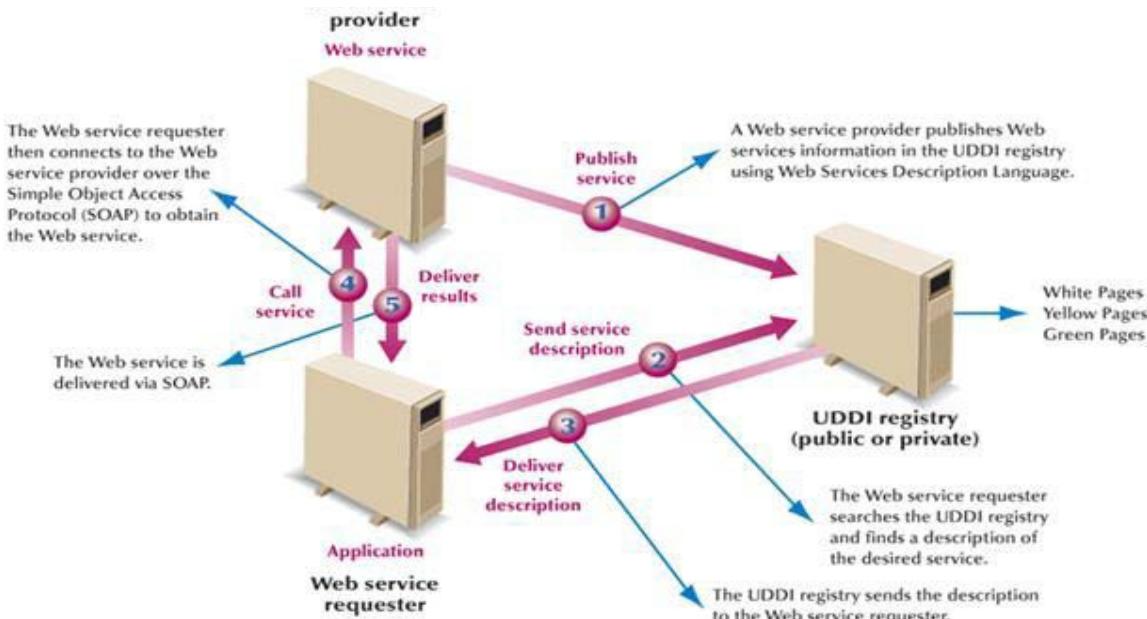
- **Web Services Description Language (WSDL):** Describes the capabilities offered by a specific Web service as well as the protocols and formats the service uses.



**Figure 21.5** Web Services Description Language (WSDL).

**Source:** (Senn, 2004).

- **Universal Description, Discovery, and Integration (UDDI):** A worldwide directory for registering, finding, and using Web services.
  - *Yellow Pages:* Describe the services offered by UDDI.
  - *Green Pages:* Describe how an application can use the Web Services.



**Figure 21.7** Universal Description, Discovery, and Integration (UDDI).  
**Source:** (Senn, 2004).

**Table 21.1** Technologies of Web Services and Principles

S/No.	Technology	Acronym	Function
1	Extensible Markup Language	XML	XML is a set of rules for creating tags that describe the layout and content of Web data.
2	Simple object access protocol (sometimes known as services oriented Architectural Protocol)	SOAP	Protocol for invoking remote Web services objects using XML
3	Universal Discover, Description and Integration	UDDI	XML-based public directory services that provides information about available Web services
4	Web Service Description Language	WSDL	Protocol that describe the capabilities of a Web service object

**Source:** (Senn, 2004).

## **4.0 CONCLUSION**

Some suggest that Web-based applications may replace traditional application software sometime in the future. They point out that Web-based applications offer advantages beyond universal access to software and to data. One advantage is that user may no longer need to upgrade software on their hard disk when a new version becomes available. One challenge of the Web-based applications relates to privacy and security of personal data stored as an ASP.

## **5.0 SUMMARY**

In this unit you learnt that:

- The concepts of Internet and WWW brought a lot of opportunities, where you can exchange documents and now use applications on the fly.
- Web based applications provide and ease to the high cost of maintaining software and the ICT department of most organizations.
- One challenge relates to privacy and security of personal data stored as an ASP.
- To use the Web application you need to- Register, Access the application and the Web-Based Desktop

## **6.0 TUTOR MARKED ASSIGNMENT**

- a. What is the different between Web based application and personal/enterprise applications?
- b. What are Heterogeneous Applications?
- c. What are the basic Technologies of Web Services and their Principles?
- d. What are the Advantages of XML?

## **7.0 FURTHER READINGS/REFERENCES**

- Norton, P. (2003). *Computing Fundamentals* (5<sup>th</sup> Edition). United States of America: Glencoe/McGraw-Hill.
- O'Leary, T.J., O'Leary, L. I. (2004). *Computing Today*. New York, US: McGraw-Hill
- Senn, J. A. (2004). *Information Technology: Principles, Practices, Opportunities* (3<sup>rd</sup> Edition). New Jersey, US: Pearson Prentice Hall.

## **MODULE 4 MANAGING INFORMATION AND COMMUNICATION TECHNOLOGY APPLICATIONS IN THE ENTERPRISE.**

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## **1.0 INTRODUCTION**

In module 1: you learnt about how data is being processed, module 2: how data is housed, and module 3: how data is distributed. This unit will introduce you to the flow of data in a business organization to achieve an optimum goal.

## **2.0 OBJECTIVES**

After you have read this unit, you should be able to know:

- The types of Information System and their Characteristics
- The Generic Competitive Strategies in Business
- The strategic role of an IT
- What is Enterprise Resource Planning System

## **3.0 MAIN CONTENT**

**Information System:** A system in which data and information flow from one person or department to another.

### **3.1 ENTERPRISE INFORMATION SYSTEMS**

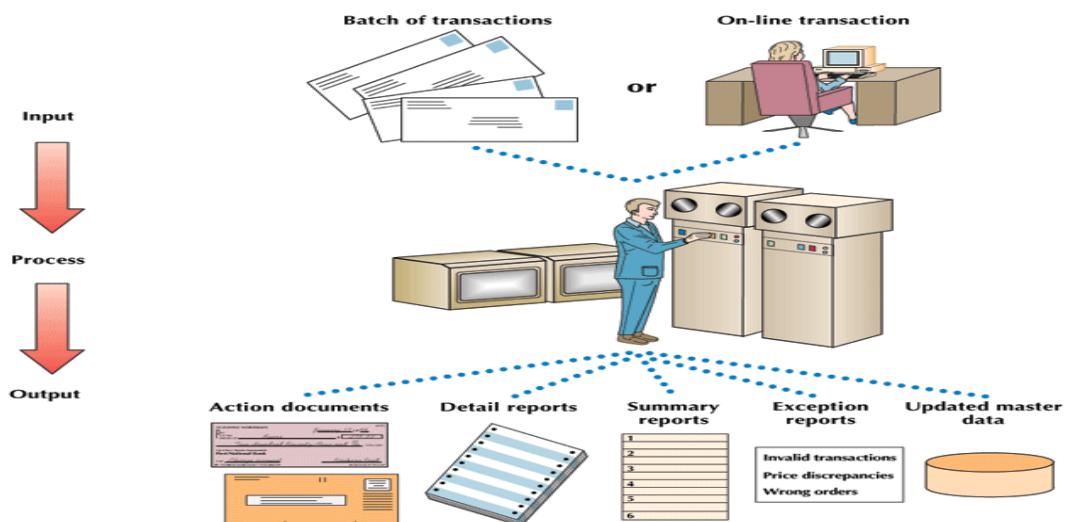
- ***Enterprise Information System/Business Information System:*** Used to refer to the family of IT applications that underlies the activities of running and managing a business.
- ***Transaction-Processing System (TPS):*** A shared business information system that uses a combination of information communication technology and manual procedures to process data and information and to manage transactions.

#### **3.1.1 THE TRANSACTION-PROCESSING SEQUENCE AND TPS OUTPUT AND REPORTS**

- ***Action Document:*** A document designed to trigger a specific action or to signify that a transaction has taken place.
- ***Detail Report/Transaction Log:*** A report describing each processed transaction.
- ***Summary Report:*** A report that shows the overall results of processing for a period of time or for a batch of transactions and includes a grand total for all listed transactions and the average transaction amount.
- ***Exception Report:*** A report that lists unusual, erroneous, or unacceptable transactions or results.
- ***Updated Master Data:*** An adjustment of all records in a system in response to a processed transaction.

## Characteristics of TPS

- Processes high volume of similar business transactions
- Supports multiple users in routine, everyday transactions
- Use relatively simple procedures to control processing and to ensure accuracy
- Produces documents and reports
- Updates files and databases



**Figure 22.1** The Transaction-Processing Sequence and TPS Output.  
Source: (Senn, 2004).

### 3.1.2 MANAGEMENT INFORMATION SYSTEM (MIS)

Management Report System/Management Information System (MIS) a business information system designed to produce the information needed for successful management of a structured problem, process, department, or business.

#### Characteristics (MIS)

- Uses data captured and stored as a result of transaction processing
- Reports data and information rather than details of transaction processing
- Assist managers in situations, evaluating conditions, and determining what actions need to be taken.
- Supports recurring decisions
- Provides information prespecified reports formats, either in print or on-screen.

**3.1.3 DECISION SUPPORT SYSTEM (DSS):** a business information system designed to assist in decision making where the decision process is relatively unstructured and only part of the information needed is structured in advance.

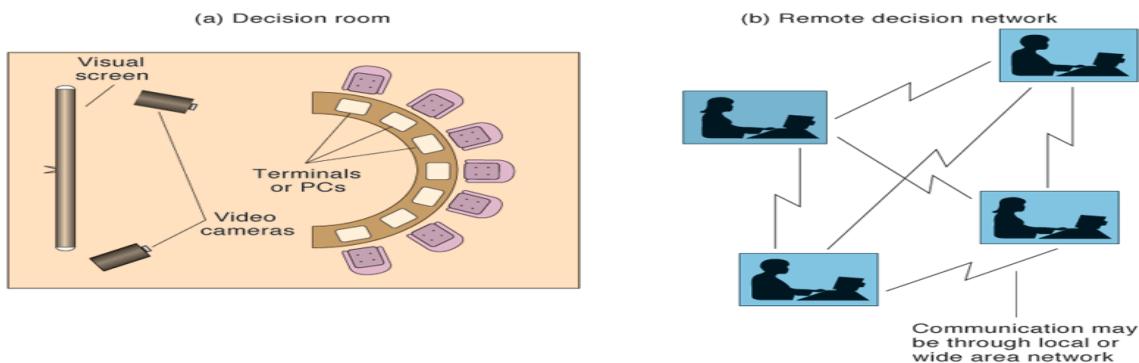
#### **Characteristics DSS**

- Assist people who make decisions where information requirements are not known in advance.
- Support problem solving and decision making where the situation is only partly structured
- Provides information needed to define and solve the problem
- Works both with files and database, as well as with people working online with the system.
- Provides information in a format determined by the recipient at the time of need.

**3.1.4 GROUP SUPPORT SYSTEM (GSS):** a business information system that permits people to process and interpret information as a group, even if they are not working face-to-face.

#### **Characteristics GSS**

- Supports situations that are not fully structured
- Assists in analyzing the problem under consideration
- Is used by groups or team rather than individuals
- Emphasizes communication and generation of ideas and information
- Permits communication among team members at different locations, who participate through communication networks
- Involves a facilitator who keeps the group focused on the problem at hand and draws ideas out of group members
- Generates a database of the group's questions, comments, and ideas rather than a traditional report.



**Figure 22.2** Group Support System (GSS).  
Source: (Senn, 2004).

### 3.1.5 EXECUTIVE SUPPORT SYSTEM

Executive Support System (ESS)/Executive Information System (EIS) is an interactive business information system designed to support executives that is capable of presenting summary information on company and industry activities.

#### Characteristics ESS

- Offers quick, concise updates of business performance
- Permits scanning of data and information on both internal activities and the external business environment
- Highlights significant data and information in summary form
- Allows the user to access data supporting the summary information

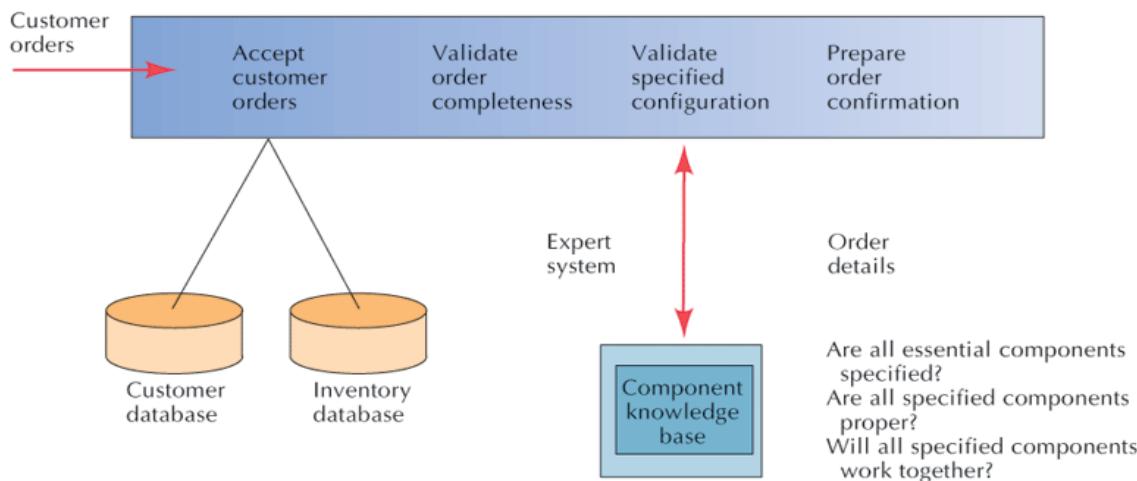
### 3.1.6 EXPERT SUPPORT SYSTEM

- **Expert Support System/Expert System:** A business information system that uses business rules, regulations, and databases to evaluate a situation or determine an appropriate course of action.
- **Rule Base/Knowledge Base:** A database of rules in an expert system.

#### Characteristics Expert System

- Diagnoses problems and may recommend a cause of action
- Computes data and applies the expertise of a human specialist to a situation

- Has a limited scope of application
- Relies on rule base
- Processes data entered by people interacting with the system as well as details retrieved from other information systems.

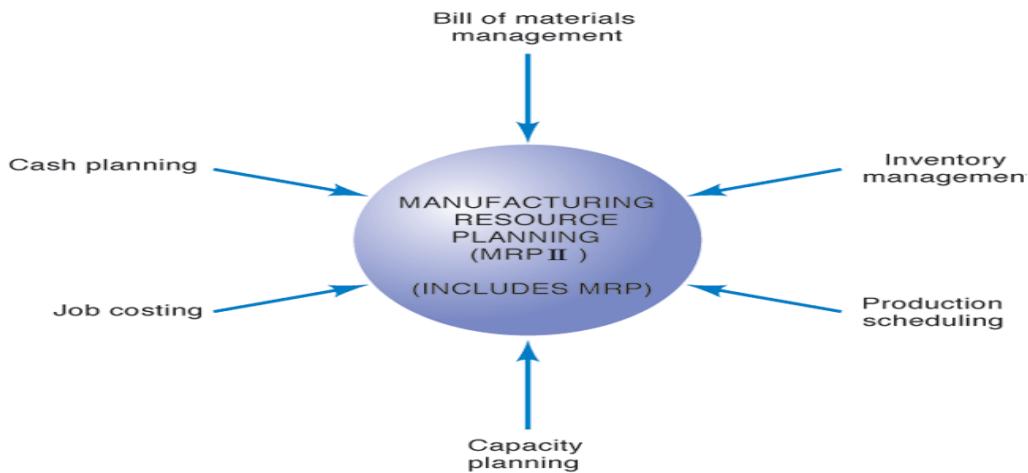


**Figure 22.3** Expert System Embedded in Order Entry Portion of an Auto Manufacturing System.

**Source:** (Senn, 2004).

### 3.2 IT FOR MANUFACTURING, AUTOMATION AND CONTROL

- **Computer-Integrated Manufacturing (CIM):** A manufacturing system that uses computers to link automated processes in a factory to reduce design time, increase machine utilization, shorten the manufacturing cycle, cut inventories, and increase product quality.
- **Manufacturing Cell:** A group of machines working together in computer-integrated manufacturing.
- **Material Requirements Planning (MRP):** A system that tracks the quantity of each part needed to manufacture a product; essentially, an important component of MRP II.
- **Manufacturing Resource Planning (MRP III):** An advanced MRP system that ties together all the parts of an organization into the company's production activities.



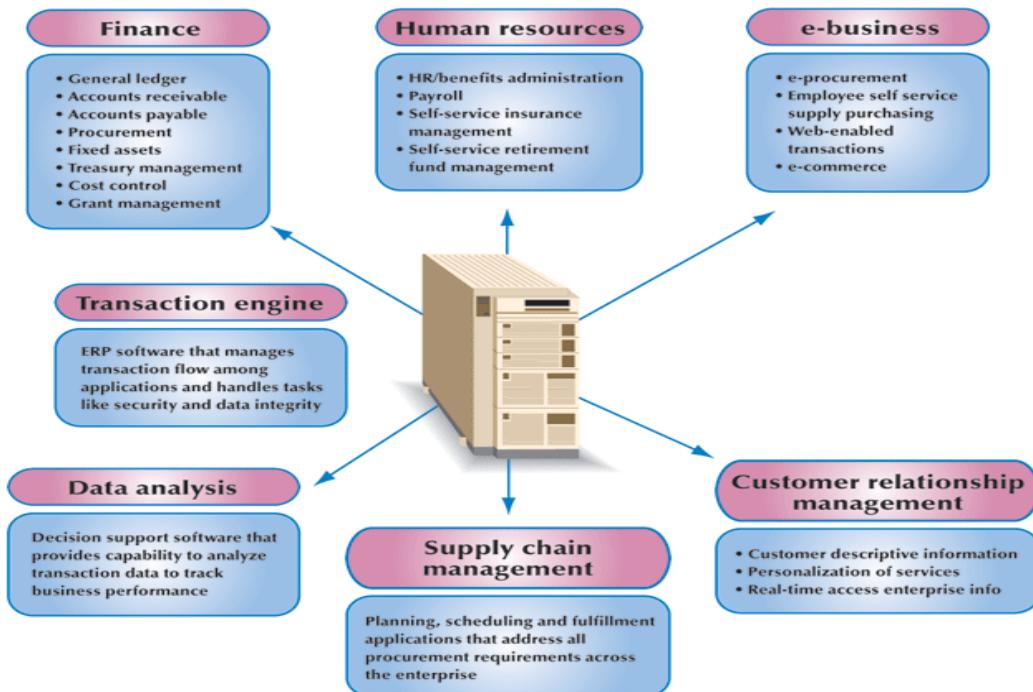
**Figure 22.4** The Components of Manufacturing Resource Planning.

Source: (Senn, 2004).

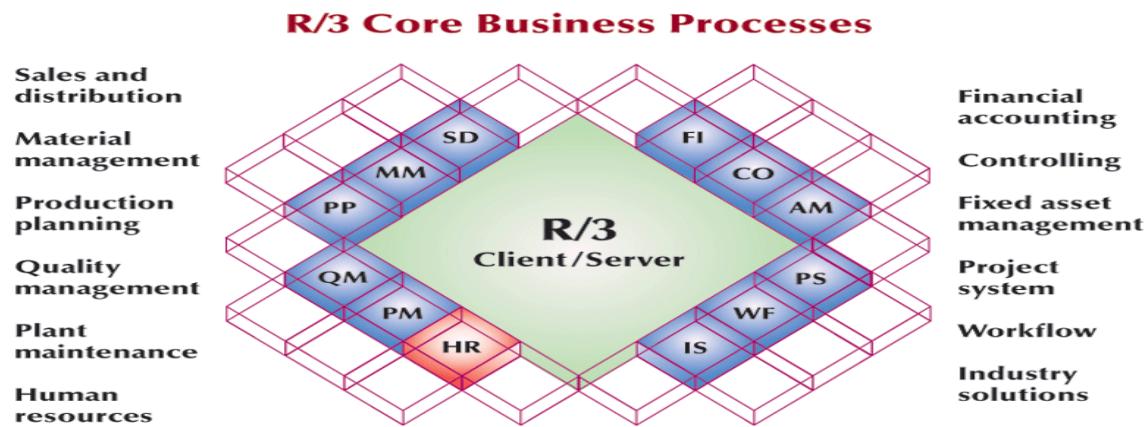
- **Computer-Aided Design (CAD):** A system that uses a powerful computer graphics workstation to enable product designers and engineers to draw design specifications on a display screen.
- **Computer-Aided Manufacturing (CAM) Systems:** A system that relies on IT to automate and manage the manufacturing process directly.
- **Flexible Manufacturing:** A manufacturing system that automatically sets up machines for the next job, thus reducing setup time and making smaller job runs feasible.
- **Concurrent Engineering:** A design and manufacturing method in which team members work across their departmental functions to evaluate the activities of many departments and manage the product development process.
- **Robot:** A computer-controlled device that can physically manipulate its surroundings.
- **Computer Vision System:** A system that uses computer sensors to detect shapes, images, and varying levels of detail.

### 3.3 ENTERPRISE RESOURCE PLANNING SYSTEM

- **Enterprise Resource Planning (ERP) System:** Large scope, unified application programs that integrates many transaction processing and information systems application features.



**Figure 22.5** Enterprise Resource Planning System Integrates Functions.  
**Source:** (Senn, 2004).



**Figure 22.6** Modular Structure of SAP's R/3 ERP Software.  
**Source:** (Senn, 2004).

### 3.4 STRATEGIC ROLE OF ICT

- **Strategic Information System:** Information technology application that changes the way a firm competes, providing a capability so valuable that it enables the firm to gain a substantial competitive advantage against its competitors.

- **Competitive Advantage:** Occur when an enterprise has the ability to outperform rivals on a primary performance goal – often profitability – or some other dimension.

### 3.4.1 COMPETITIVE STRATEGY

The means by which a firm seeks to gain an advantage over its competitors.

- **Low-Cost Leadership:** Offers an enterprise great flexibility in dealing with any suppliers that raise their prices to the firm, as well as buyers seeking to drive down the prices they pay.
- **Product Differentiation**
  - **Differentiation:** A product that is perceived by customers as having unique features in comparison to competitive items.
- **Focus on a Market Niche**
  - **Market Niche:** A focal point for a product or service; it is a subset of the entire industry or segment of the market.



**Figure 22.7** Three Generic Competitive Strategies.

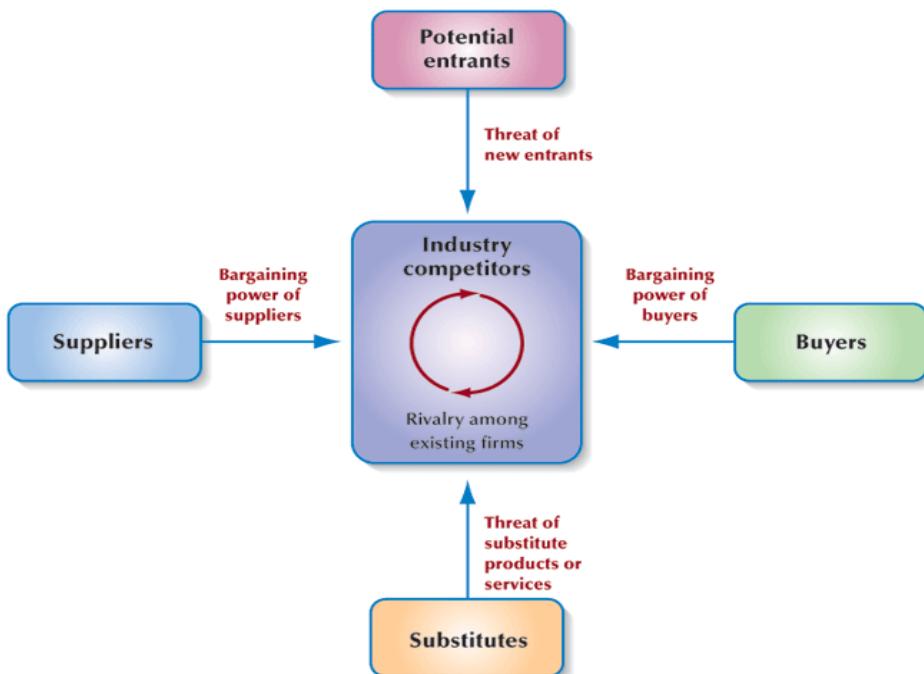
Source: (Senn, 2004)

**Table 22.1 Generic Competitive Strategies in Business**

STRATEGY	DESCRIPTION
Low cost leadership	<ul style="list-style-type: none"> <li>Out perform other firms in the industry by providing products or services at a lower cost than competitors while sustaining or exceeding quality and services levels they provide</li> <li>Provides competitive advantage when dealing with suppliers and buyers, and when offering substitute products or services</li> </ul>
Product differentiation	<ul style="list-style-type: none"> <li>Provides a product or services that is generally recognized as distinct from competitors.</li> <li>Results in brand loyalty and avoids the necessity to take a low-priced position; also effective in competing against substitutes.</li> </ul>
Focus on a market niche	<ul style="list-style-type: none"> <li>Identify and compete in a market segment in which competitive advantage may be gained by concentrating on a specific buyer group, product line, or geographical area.</li> <li>Provides advantage of better service to customers, often at lower costs, while producing better customer loyalty.</li> </ul>

Source: (Senn, 2004).

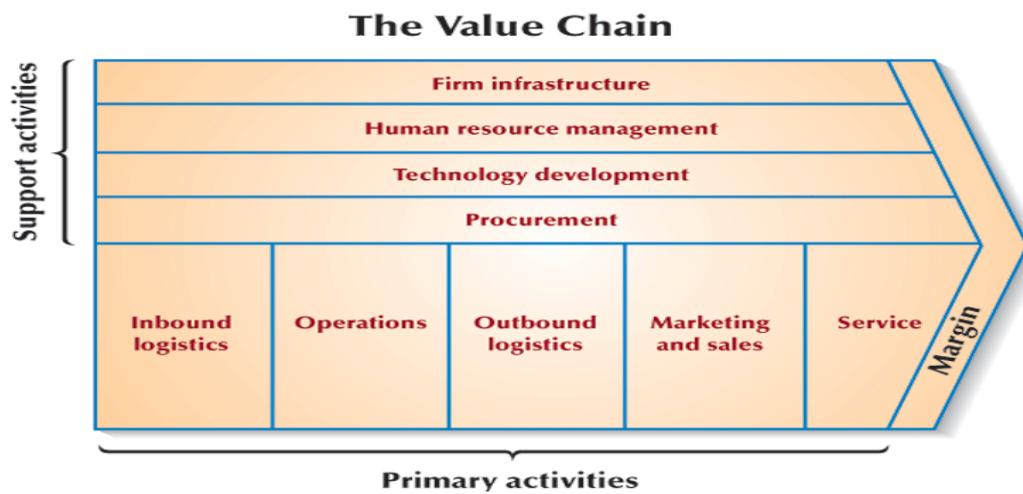
### Competitive Forces



**Figure 22.8** The five Forces Influencing the Advantage a Firm can Gain.  
Source: (Senn, 2004).

### 3.4.2 VALUE CHAIN

- **Value Chain:** A set of activities that is relevant to understanding the bases of cost and potential sources of differentiation of a firm.
- **Primary Value-Chain Activities:** The basic business processes fundamental to any industry.
  - Inbound Logistics
  - Operations
  - Outbound Logistics
  - Marketing and Sales
  - Service
- **Support Value-Chain Activities:** Those activities that occur to facilitate the primary activities.
  - Procurement
  - Technology Development
  - Human Resource Management
  - Firm Infrastructure



**Figure 22.9** The Value Chain.

Source: (Senn, 2004).

### 3.5 CREATING A STRATEGIC ROLE FOR INFORMATION SYSTEMS

To determine whether information technology can be developed to serve a strategic role, ask the following five questions:

- Change the basis of competition?
- Build barriers to new entrants?
- Build in switching costs to customers?
- Strengthen a firm's power in dealing with suppliers?
- Generate or serve as new products?

## **4.0 CONCLUSION**

Managing a business Information System require providing technical resources and generating the information that the business need to run effectively and efficiently. This is achieved by making data and information to flow in an organization through functional areas and between management levels.

## **5.0 SUMMARY**

In this unit, you learnt that:

- Shared business information system uses a combination of information communication technology and manual procedures to process data and information and to manage transactions.
- Business information system can permits people to process and interpret information as a group.
- Business information system uses business rules, regulations, and databases to evaluate a situation or determine an appropriate course of action.
- Business information systems establish set of activities that are relevant to understanding the bases of cost and potential sources of differentiation of a firm.
- Business information system is a firm that seeks to gain an advantage over its competitors.

## **6.0 TUTOR MARKED ASSIGNMENT**

- a. What are the characteristics of the management information systems?
- b. What are the technologies used in the manufacturing industry?
- c. Define value chain.
- d. What are the questions asked when creating a strategic role for an IS.

## **7.0 FURTHER READINGS/REFERENCES**

- Norton, P. (2003). *Computing Fundamentals* (5<sup>th</sup> Edition). United States of America: Glencoe/McGraw-Hill.
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## **MODULE 4 MANAGING INFORMATION AND COMMUNICATION TECHNOLOGY APPLICATIONS IN THE ENTERPRISE.**

### **UNIT 23 ISSUES IN INFORMATION TECHNOLOGY**

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## **1.0 INTRODUCTION**

In all the previous units you have been learning about the merits of ICT. This unit will discuss about the demerits and the measures put in place to overcome them.

## **2.0 OBJECTIVES**

After you have read this unit, you should be able to:

- Identify the types of security breaches, sources of security breaches, and ways to protect a system against intrusion
- Describe the importance of ethics in the use of information technology
- Describe the concern over piracy of digital content.
- Understand the reliability of IT systems

## **3.0 MAIN CONTENT**

### **3.1 SECURITY**

Security is the means of safeguarding and protecting an enterprise's information technology assets, that is by keeping away from criminals, natural hazards, and other threats, while a breach is a breakdown in security.

- Site Security
  - Resource Security
  - Network Security
  - Service Security
- **Security Program:** The policies and protective measures that will be used, the responsibilities of individuals involved in maintaining security, as well as the responsibilities of those who abide by established security policies.
  - **Harden:** Designing a security program to a potential IT target, making the level of effort greater than the value of breaking into a system, network, or facility.

#### **3.1.1 TYPES OF SECURITY BREACH**

- **Intrusion:** Forced and unauthorized entry into a system.
- **Interception:** Aimed at preventing the capture of data and information transmitted over an enterprise network or other communications link.

### **3.1.2 RESULTS OF SECURITY BREACH**

- Destruction of Resources
- Corruption of Data and Applications
- Denial of Services
- Theft of Services
- Theft of Resources
- ***Denial-of-Services Attack:*** Depriving, usually intentionally and temporarily, an enterprise or its users of the services they would normally expect to have, usually involving a network service (such as e-mail) or access to a location on the network (such as a Web site).
- **Internet Scam:** are fraudulent or deceptive acts or operations designed to trick individuals into spending their time and money with little or no return. Common scams include identity theft, chain letters, auction fraud, vacation prizes, and advance free loans. Almost all Internet scams initiated by mass e-mails.
- **Malicious programs:** also known as malware (malicious software), include viruses, worms, and Trojan horse.
  - ***Viruses*** migrate through networks and operating systems and most attached to programs and databases.
  - ***Worms*** are special viruses that self replicate to slow or stop a computer's operation
  - ***Trojan Horses*** are programs that come into a computer system disguised as something else. While not a virus, Trojan horses deposit viruses onto unsuspecting computer systems.

### **3.1.3 SOURCES OF SECURITY BREACH**

- **Employees**

This is the largest category of computer and enterprise criminals where an employee (insider) who gain access to certain records or files without prior permission in order to tamper (manipulate figures, steal records or damage files).

- ***Identify Theft:*** Loss of personal identity through a security breach.

- **Computer Viruses**

- ***Virus:*** A hidden program that alters without the user's knowledge, the way a computer operates or that modifies the data and programs stored on the computer.

- **Hacker and Crackers:** Hackers gains access to a system illegally for fun and challenge while crackers do it for malicious purpose.

- **Organised Crime:** including counterfeiting and forgery.
- **Terrorist:** Someone who conducts a “premeditated, politically motivated attack against information, computer systems, computer programs, and data, which results in violence against non-combatant targets by sub-national groups or clandestine agent.” A terrorist usually cause potential crime to satellites and wage economic warfare.
  - **Cyberterrorism:** Terrorist attack on computer facilities in companies that rely on IT to produce their services.

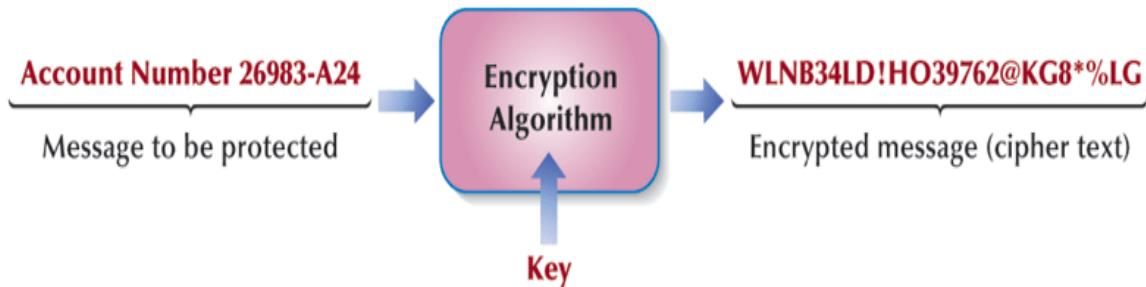
### **3.1.4 SECURITY MEASURES**

Security involves keeping enterprise hardware, software, data and programs safe. Some measures are encrypting messages, restricting access through passwords and firewalls, anticipating disasters (hot sites are emergency facilities; cold sites are empty shells), backing up data and storing the data in a safe remote location.

The general Security Policies and Procedures are:

- Change access passwords frequently
  - Restrict system use
  - Limit access to data
  - Set up physical access controls
  - Partition responsibilities
  - Encrypt data
  - Establish procedural controls
  - Institute educational programs
  - Audit system activities
  - Log all transactions and user activities
- **Virus Protection Software/Antivirus**
    - Norton
    - Bit defender
    - Kaspersky
    - Avast
    - Panda
    - PC Cillin
  - **Digital Signatures**
    - **Digital Signature Encryption:** Relies on a mathematical coding scheme designed to foil a virus’s attempt to attack programs and data.

- **Encryption**

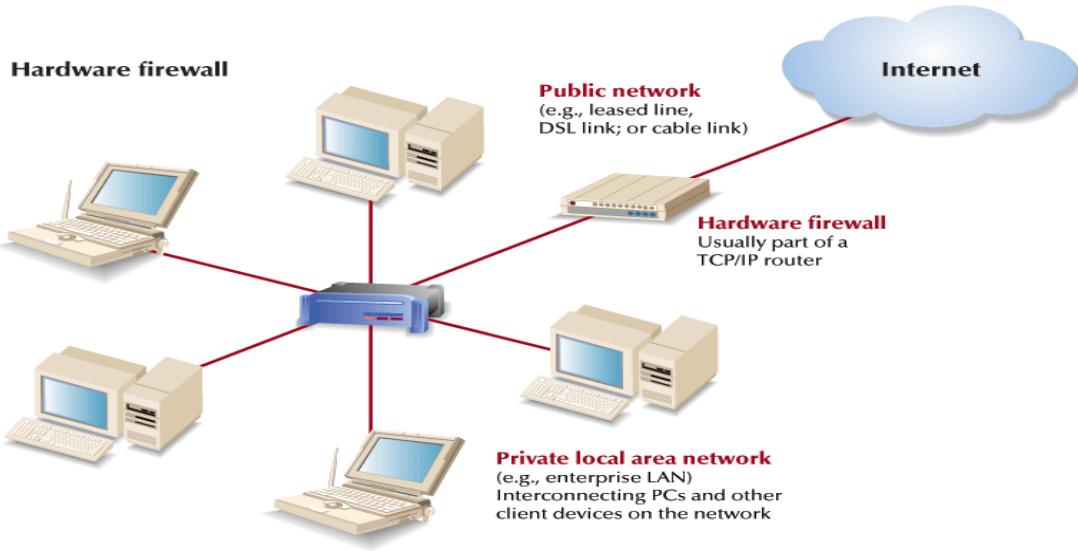


**Figure 23.1** Encryption Procedure for Protecting Data and Messages.

**Source:** (Senn, 2004).

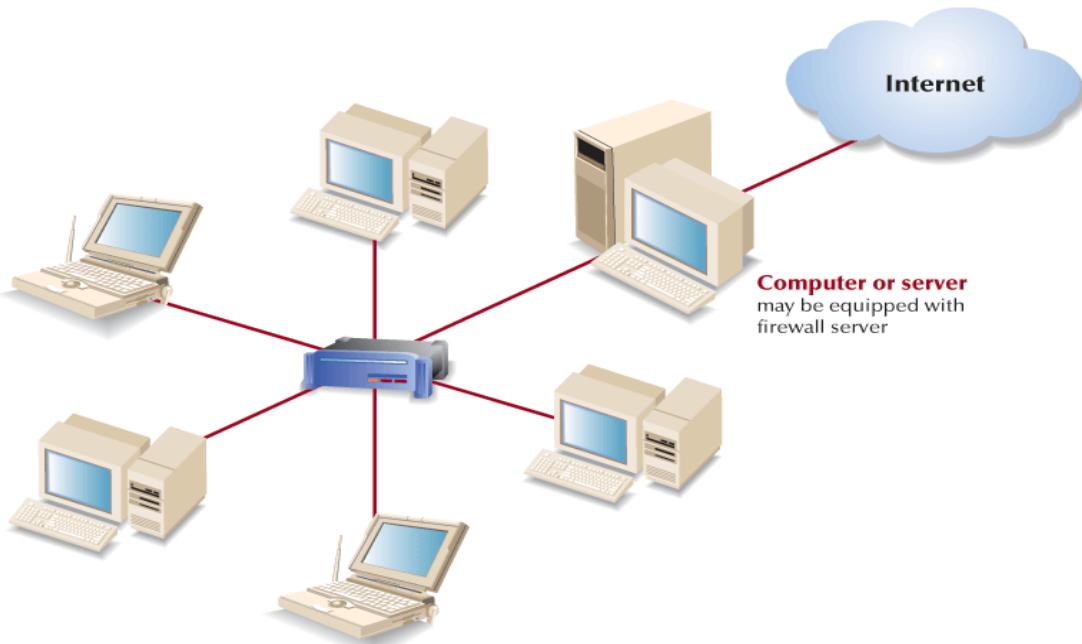
### Methods of Encryption

- **Public Key Infrastructure (PKI):** A public key is made available in a directory that all parties can search. Thus a sender wishing to transmit a secured message searches a *digital certificate* directory to find the recipient's *public key*, using it to encrypt the message.
- **Secure Electronic Transaction (SET):** An adaptation of public key encryption and the digital certificate (which the industry calls an electronic wallet) for securing financial transactions over the Internet.
- **Pretty Good Privacy (PGP):** A program used to encrypt and decrypt e-mail and to encrypt digital signatures, so the recipient knows the transmission was not changed along the way.
- **Virtual Private Network (VPN):** A way to use a public telecommunication infrastructure, such as the Internet, to provide secure communication between individuals or client computers at remote locations and an enterprise network.
- Virtual Private Network
- **Tunneling Protocols:** By encrypting data at the sending end and decrypting it at the receiving end, the protocols send the data (and if an enterprise chooses, the originating and receiving network addresses as well) through a *tunnel* that cannot be *entered* by data that is not properly encrypted
- **Firewall:** A special-purpose software program located at a network gateway server.
- **Proxy Server:** Act as an intermediary between a PC and the Internet, separating an enterprise network from an outside network



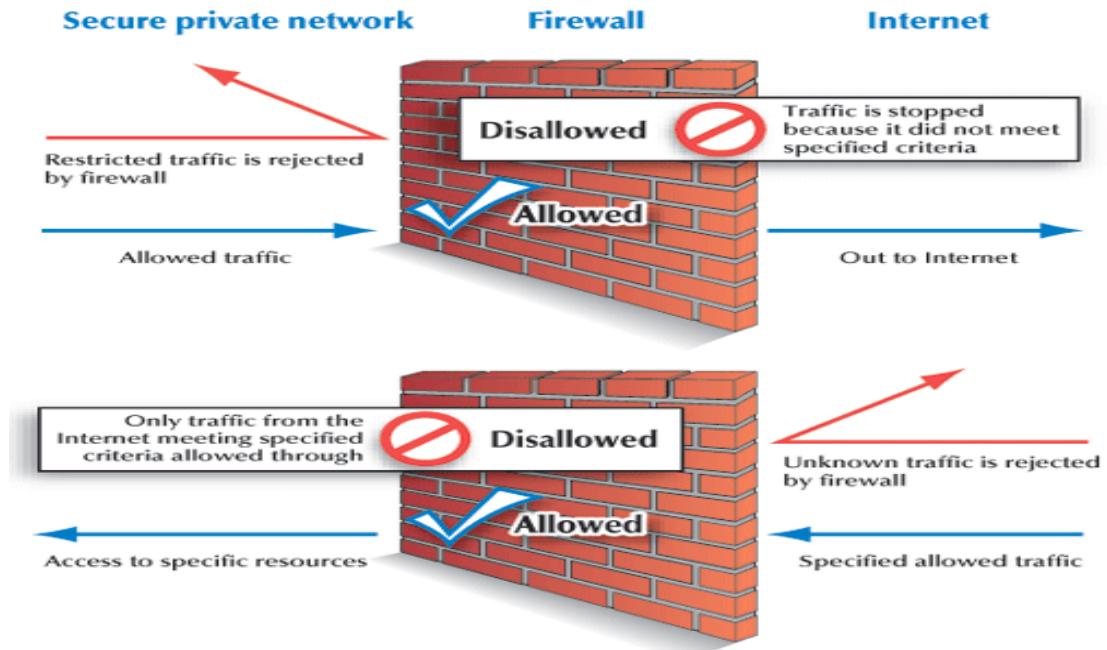
**Figure 23.2** A Hardware Firewall Protecting Against Unauthorized Access to a Private Network.

**Source:** (Senn, 2004).



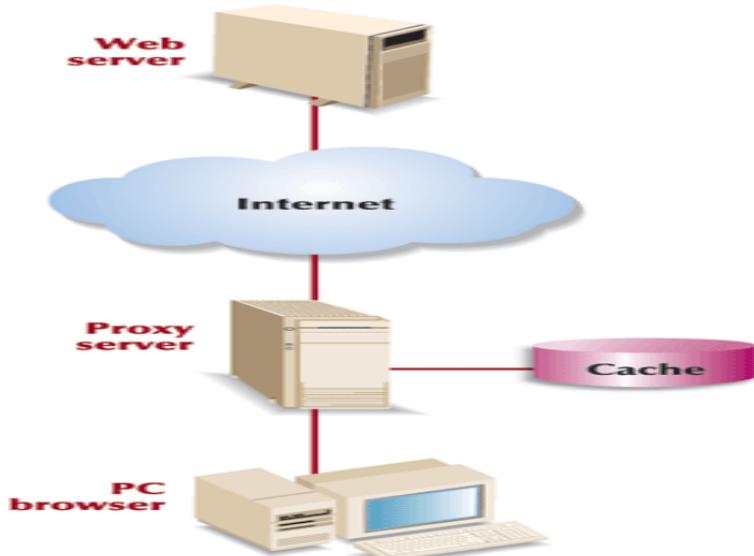
**Figure 23.3** A Computer Firewall Protecting Against Unauthorized Access to a Private Network.

**Source:** (Senn, 2004).



**Figure 23.4** An overview of a Firewall Protecting Against Unauthorized Access to a Private Network.

Source: (Senn, 2004).



**Figure 23.5** Proxy Servers.

Source: (Senn, 2004).

## **3.2 RELIABILITY**

**Reliability:** The assurance that computers and communications systems will do what they should when they should.

### **3.2.1 ENSURING IT SERVICE RELIABILITY**

- **Fault-tolerant Computer:** A computer designed with duplicate components to ensure reliability.
- **Uninterruptible Power Supply (UPS) System:** A system that ensures the continued flow of electricity when the primary source of power fails.
- **Disaster Recovery Plan:** A procedure for restoring data lost when a system stops functioning.
- **Off-site Backup Facility:** A backup computer center located away from a company's main facility.
  - **Hot Site:** A fully equipped backup computer center to which a company can take its backup copies of data and software and resume processing.
  - **Cold Site:** A backup facility outfitted with electrical power and environmental controls so that it is ready for a company to install a computer system.

## **3.3 ETHICS**

Ethics are guidelines for moral computer use. The standards of conduct and moral behavior that people are expected to follow are:

- **Privacy** – concerns collection and use of data about individuals
- **Accuracy** – relates to the responsibility of those who collect data to ensure correctness.
- **Property** - relates to who owns the data.
- **Access** – relates to the responsibilities of those who have data to control and who is able to use it.

### **3.3.1 ETHICS AND ICT USAGE IN BUSINESS**

- E-mail Privacy
- Software Licenses
- Software Copyrights
- Hardware Access
- Intellectual Property Ownership
- File Access
- Data Ownership

### **3.3.2 ETHICS CHALLENGE**

- Developing a Code of Ethics
  - Informed Consent
  - The Higher Ethic
  - Most Restrictive Action
  - Kantian Universality Rule

- Descartes' Change in Rule
- The Owner's Conservative Rule
- The User's Conservative Rule
- **Social Responsibility:** The concept that businesses need to balance their commitments to investors, employees, customers, other businesses, and the communities in which they operate.

### 3.4 PRIVACY

#### What is Privacy?

Privacy in IT is the term used to refer to how personal information is collected, used, and protected.

#### 3.4.1 SPAM AND PRIVACY

- **Spam:** Unsolicited e-mail.
- **Opt-in E-mail/Permission-based E-mail:** If customers check a box agreeing to receive postings about the company's products, they have actually given approval for the mailing.
- **Cookies:** are specialized programs deposited onto your computer system that record sites visited, activity at sites and other information.
  - **Traditional cookies** – monitor activities at a single site
  - **Ad network cookies** – also known as adware cookies, monitor activities across all sites visited
  - **Web bugs** – programs typically hidden within the HTML codes as a graphic image. They migrate whenever an unsuspecting user visits a web site containing a Web bug or open an infected e-mail message.
  - **Computer monitoring** – record every activity and keystroke made on your computer system. Also known as sniffer programs and keystroke loggers, these programs are used by businesses, CIA, SSS, FBI, private investigators and others.

A new program known as spy ware removal programs has recently evolved designed to detect Web bugs and monitoring software.

#### 3.4.2 PRIVATE NETWORKS

Many organizations monitor employee e-mail and computer files using special software called **snoopware**. Most online information services restrict libelous, obscene, or other offensive material.

### 3.5 DIGITAL PIRACY

- **Digital Piracy:** The making of illegal copies of copyrighted information.

#### 3.5.1 PROTECTING AGAINST SOFTWARE PIRACY

- **Software Piracy:** The making of illegal copies of software.

- **Software Copyright Protection**
  - **Copyright:** Legal protection of original works against unauthorized use, including duplication.
- **Copy Protection:** A software protection scheme that defeats attempts to copy a program or makes the copies software unreliable
- **Software Site Licensing**
  - **Site License:** An agreement under which a software purchaser pays a fee to the manufacturer to make a specified number of copies of a particular program.

### **3.6 PUBLIC DOMAIN SOFTWARE**

- **Public Domain Software:** Any non copyrighted software that can be used by the general public.
- **Shareware:** Software that is given away and freely distributed. The developer retains ownership, asks users to register with the owner, and requests a nominal fee for using the program.

### **3.7 ERGONOMICS**

Ergonomics is the study of human factors related to things people use, including computers.

- Physical health problems and their solutions include:
- Eyestrain and headache – take frequent breaks; avoid glare on the monitor.
- Back and neck pain – use adjustable chairs, tables, monitor stands, keyboards, and footrests.
- Repetitive Strain Injury (RSI), also known as repetitive motion industry, includes carpal tunnel syndrome – take frequent breaks, use good posture; adopt healthy lifestyle; use ergonomic keyboards.

### **3.8 THE ENVIRONMENT**

Microcomputers are the greatest users of electricity in the work place. The Energy Protection Agency EPA has established the Energy Star Program ESP to promote energy efficient computer use to reduce or eliminate hazards. The computer industry has responded with the concept of the GREEN PC.

#### **The Green PC**

The basic elements of the green PC include:

- System units with energy-saving processors, sleep-mode capability, efficient adapters, and no cooling fans.
- Display units that replace CRT displays with flat panels, use special power-down monitors, and use screen savers software.
- Manufacturing that eliminates or reduces the use of harmful chemicals such as chlorofluorocarbons (CFCs), nickel, and other heavy metals.

## **Personal Responsibility**

As a responsible computer user, you can help protect the environment by:

- Conserving energy by turning off computer systems at night and using screen-savers.
- Educating yourself and others about ecological dangers and using ecologically sound products.
- Recycling paper, computer boxes, packaging materials, printer cartridges, and floppy disks.

## **4.0 CONCLUSION**

To be a competent and knowledgeable ICT end user you need to be aware of the potential impact of technology on people and your surrounding. You need to be sensitive and knowledgeable about personal privacy, organizational security, ergonomics, and the environmental impact of technologies.

## **5.0 SUMMARY**

In this unit you learnt that:

- Security involves keeping enterprise hardware, software, data and programs safe.
- Reliability is the assurance that computers and communications systems will do what they should when they should
- *Privacy* refers to how personal information is collected, used, and protected.
- Ethics are guidelines for moral computer use.

## **6.0 TUTOR MARKED ASSIGNMENT**

- a. What are the sources of security breach
- b. Differentiate between security and breaches
- c. What are the measures put in place to avoid software piracy?
- d. What are the measures taken to ensure ICT service reliability?

## **7.0 FURTHER READINGS/REFERENCES**

- Norton, P. (2003). *Computing Fundamentals* (5<sup>th</sup> Edition). United States of America: Glencoe/McGraw-Hill.
- O'Leary, T.J., O'Leary, L. I. (2004). *Computing Today*. New York, US: McGraw-Hill
- Senn, J. A. (2004). *Information Technology: Principles, Practices, Opportunities* (3<sup>rd</sup> Edition). New Jersey, US: Pearson Prentice Hall.

## **MODULE 4 MANAGING INFORMATION AND COMMUNICATION TECHNOLOGY APPLICATIONS IN THE ENTERPRISE.**

### **UNIT 24 CAREERS IN ICT.**

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## **1.0 INTRODUCTION**

In the previous units you learnt about the world of Information and communication technology. This unit will take you round the various positions and professionals in the ICT world.

## **2.0 OBJECTIVES**

After you have read this unit, you should be able to know:

- How to build a Career in ICT
- How to update your professional Curriculum and become marketable
- Which ICT field is related to you work or field of specialist?
- Who to contact when you have a job at hand

## **3.0 MAIN CONTENT**

### **3.1 CAREERS**

A few important career development paths are:

#### **a. Webmaster**

Webmasters develop and maintain Web sites and web resources. The job may include backup of the company Web site, updating resources, or developing of new resources. Webmasters are involved in the design and development of website. Part of their job may also include monitoring and updating the interface design. Some webmasters monitor traffic on site. Webmasters may also work with marketing personnel to increase the site traffic and may be involved in development of Web promotions.

#### **b. Computer Trainers**

Computer trainers instruct new user on the latest software or hardware. They are usually expected to prepare new materials for instruction and may be asked to write and maintain course manual. A position may also include design and development of a website for the course. Computer trainers typically teach new users how to use the latest software and hardware. Experience with the most popular business software is an advantage.

#### **c. Desktop publisher**

Desktop publishers use computers to format and create publication-ready material. They may create books, magazines newsletter, and newspapers on computers using special applications software's large part of the job is designing page layout, importing text, and manipulating graphics. Most desktop publishers work for companies that handle commercial printing accounts.

#### **d. Computer support specialist**

Computer support specialists provide technical support to customers and other users. They may also be called technical support specialist or help desk technicians. They manage the everyday problems faced by computer users. They resolve common networking problems and may use troubleshooting programs to diagnose problems.

**e. Computer technician**

Computer technicians may repair and install computer components and systems. They may work on everything from personal computers to mainframe servers or printers. Some Computer technicians are responsible for setting up and maintaining computer networks. Experience computer technicians may work with computer engineers to diagnose problems and run routine maintenance on complex systems.

*Certification* – CompTIA's A+ hardware examination and Network+

**f. Data entry**

Data entry workers input customer information, lists, and other type of data. Input devices are typically limited to keyboards, mice, and scanners. Because the accuracy of recorded data is so important, data entry workers are often required to verify the accuracy of data they and others have entered.

**g. Technical writers**

Technical writers prepare instructional manuals, technical reports, and other scientific or technical documents. Most Technical writers work for software firms, government agencies, and research institutions.

**h. Software engineers**

Most Software engineers analyse user need and create application software. Software engineers usually have experience in programming, but focus on the design and development of programs using the principles of mathematics and engineering. They rarely write codes themselves.

**i. Network administrator**

Network administrator manages a company's LAN and WAN networks. They may be responsible for the design, implementation and maintenance of networks. Responsibilities usually include the maintenance of both hardware and software relating to a company's intranet and internet networks. Some are responsible for planning and implementing the security measures as well.

*Certification* - Microsoft Certified Systems Engineer (MCSE), Certified Novell Administrator (CNA), and Certified Novell Engineer (CNE).

**j. Cryptographer**

Cryptography is the science of disguising and revealing encrypted information. In ICT cryptography means keeping any intercepted information private. For example information like financial data, banking and credit card information used in online shopping or private e-mail and correspondence. Cryptographers design systems, break systems, and do research on encryption.

**k. Information system manager**

Information system managers oversee the work of programmers, computer specialists, system analysts, and other computer professionals. They create and implement corporate computer policy and systems. These professionals consult with management, staff and customers to achieve goals.

### **I. Database administrators**

Database administrators use database management software to determine the most efficient ways to organize and access a company's data. They are responsible for maintaining database security and backing up systems.

*Certifications* – MySQL Server, Oracle, and Sybase.

### **m. Systems analyst**

A Systems analyst follows the steps described in the systems development life cycle. Analysts plan and design new systems or reorganize a company's computer resources to best utilize them.

### **n. Computer programmers**

Computer programmers create, test, and troubleshoot programs used by computers. Programmers may also update and repair existing programs.

*Certifications* – Java, C++, Visual Basic and knowledge of SQL.

## **3.2 OTHER AREAS OF EXPERTISE/ORGANAIATION**

- Hardware
  - Cisco Products
  - D-link
  - Linksys
- Software
  - Microsoft Products
  - Linux (Red Hat, Unbutu, and Fedora) – Open Source: Free
- Database
  - Oracle
  - MySQL - Open Source: Free
- Web design
  - PHP - Open Source: Free
  - Dream Weaver

## **4.0 CONCLUSION**

Knowing the ICT positions and their responsibilities help you to prepare your CV and make yourself marketable.

## **5.0 SUMMARY**

In this unit we learnt that

- Most ICT professions does not require a degree in Computer Science
- Professional Certifications will boost your CV.
- You can start today and develop a career in ICT
- Some key position requires knowledge in two or three field.

## **6.0 TUTOR MARKED ASSIGNMENT**

- a. Which fields are related in terms of hardware?
- b. Which IT positions are unique?
- c. Which IT position requires knowledge in all fields?
- d. Which IT position is a top level position?

## **7.0 FURTHER READINGS/REFERENCES**

- Norton, P. (2003). *Computing Fundamentals* (5<sup>th</sup> Edition). United States of America: Glencoe/McGraw-Hill.
- O'Leary, T.J., O'Leary, L. I. (2004). *Computing Today*. New York, US: McGraw-Hill
- Senn, J. A. (2004). *Information Technology: Principles, Practices, Opportunities* (3<sup>rd</sup> Edition). New Jersey, US: Pearson Prentice Hall.

# **SOLUTIONS TO THE TUTOR MARKED ASSIGNMENTS (TMA)**

## **UNIT 1: INFORMATION COMMUNICATION TECHNOLOGY: PRINCIPLES, PRACTICES, AND OPPORTUNITIES**

a. What is Information and Communication Technology? List its three main components.

### **ANS**

A term used to refer to a wide variety of items and abilities used in the creation, storage, and dispersal of data and information. Its three main components are computers, communications networks, and know-how.

ICT three main components are:

- Computers; used to process data into information,
- Communications networks; transmission of information,
- Know-how; the technology used for the transmission

b. List five ways by which information can be transmitted.

### **ANS**

- Writing
- Typing
- Printing
- Telephone
- Telex
- Radio
- Television
- Fax
- Satellite
- Computer
- E-mail

c. Name the three stages of information evolution.

### **ANS**

- *Agricultural Age*: The period up to the 1800s, when the majority of workers were farmers whose lives revolved around agriculture.

- ***Industrial Age:*** The period from the 1800s to 1957, when work processes were simplified through mechanization and automation.
- ***Information Age:*** The period that began in 1957, in which the majority of workers are involved in the creation, distribution, and application of information.

d. Why do we need computers to process data and information?

**ANS**

Information is the life wire of today's organisations, especially business and industry. Every organisation, regardless of its size and purpose, is concerned with processing data in order to provide current and accurate information. Employees at every level within most organisations use the computer, communication devices or results from these in the performance of their everyday duties.

Organisations today now require tools that will enable them to get relevant information easily and on time. A simple answer to this question is that traditional and manual methods of processing data have now become inadequate for handling information needed for today's business organisations

## **UNIT 2: ESSENTIALS OF COMPUTING**

a. List the four categories of hardware with examples.

**ANS**

These devices that make up the hardware are classified into one of four units depending on the role they play in the computer system as follows:

- Input devices (Keyboard, Mouse, Scanner, Camera etc)
- Output devices (Printers, plotters etc)
- Storage (Hard disk, floppy disk, CD, flash drives etc)
- System unit (SU).

b. Define an operating system and an application program.

**ANS**

### **Operating System**

An operating system is an integrated set of control programs designed to manage computer resources and maximise the overall operating effectiveness of the computer system. Practically speaking, operating systems determine the way we are able to use computers.

The implication of this is that users do not have to learn how to work with particular makes of computers but with particular OS. Once a user can use an OS, he can work on all computers that use those Operating systems. Examples of Operating systems in the market today include:

### **Application Software**

Application software consists of a number of programs designed to perform specific tasks for users. A computer program giving instructions for the steps involved in preparing and printing bills for the amount of water, gas and telephone used is a good example of applications software.

Applications software may be provided by the computer manufacturer or supplier, but in some cases the users produce their own applications software called user programs (e.g. payroll programs, stock control programs etc).

c. Define four OS you know

**ANS**

- **MS-DOS-** Microsoft Disk Operating System; commonly called DOS and it is used with a single microcomputer.
- **NOVELL-** Used in a network environment, where many computers are linked together to share resources.

- **UNIX-** used in a multi-user environment where many people can use one big computer at the same time.
- **Windows Operating System-** Used with a single microcomputer or in a network environment. Its graphical interface enables the user to have fun while communicating with the computer. Some software's are Window-driven such as 95, 98, Me, XP, Vista and Windows NT are self-sufficient.

d. Define the four kinds of systems program you know.

The four kinds of system programs are operating systems, utilities, device drivers, and language translators.

- **Operating Systems (OS):** coordinates resources, provide an interfaces between users and the computer, and run programs.
- **Utility (service programs)** performs specific tasks related to managing computer resources.
- **Device Drivers:** This is a program developed by the manufacturer of a device or computer hardware component to make the devices work on different software platforms. The examples of such devices are network interface cards (NIC), sound cards, printers, and other computer peripherals.
- **Language Translator:** converts programming instructions written by programmers into a language that computers can understand and process.

### **UNIT 3: THE SYSTEM UNIT**

a. List the four elements to be considered when determining processor speed?

#### **ANS**

In determining Processor Speed, four elements are considered::

- System Clock
- Bus Width

- Word Size
  - Available Memory
- b. What are the functions of the Central Processing Unit (CPU)?

**ANS**

The Central Processing Unit (CPU) is known to be the brain and the computational unit of the System Unit (SU). It performs the following major functions;

- Co-coordinating the activities of all units or devices associated with the computer system.
  - Accepting and executing instructions to cause the computer system unit to perform tasks.
- c. What is the difference between the System Unit and the Central Processing Unit?

**ANS**

The difference between the SU and the CPU are:

- The SU house the CPU and other hardware components.
  - The CPU is the component in the SU that contains the Microprocessor in charge of all the computations and logics.
- d. Define Grid Computing?

**ANS**

***Grid and Cloud Computing:*** A process that harnesses idle time on computers and then uses them to provide processing for an application that needs more speed and capability than may be available on a single computer, or even on a supercomputer

**UNIT 4      INPUT DEVICES**

a. List three pointing devices

**ANS**

Mouse/mice

Joystick

Light pen

Stylus

b. Which category of device is the Optical Character Recognition (OCR)?

**ANS**

It is a scanning device

c. What are the basic functions of a mouse?

**ANS**

- clicking,
- double clicking
- dragging
- right clicking
- scrolling
- pointing

d. What category of device is the joystick and what is it used for?

**ANS**

The Joystick is a pointing device used for playing computer games.

**UNIT 5        OUTPUT DEVICES**

- a. Briefly define an output device

**ANS**

Output devices are devices through which computer transmits information to the outside world. Output devices work to transform information processed in the computer, which is in machine form, to human understandable forms e.g. text, pictures etc. With the aid of output devices information can be viewed, heard, and printed. Example of output devices are:

- b. Discuss the use of a data project and list its types.

**ANS**

***Data Projector:*** Equipment connected to the computer's display output port by a data cable that is used to show the contents of a computer video display on a movie screen.

- ***Liquid Crystal Display (LCD) projector***
- ***Digital Light Processing (DLP) Projector.***

- c. What does RGB stands for in a monitor?

**ANS**

***RGB Display:*** A video screen display with the ability to create 256 colors and several thousand variations on these colors by blending shades of red, green, and blue.

- d. Define the following: film recorder, speaker and laser printer.

**ANS**

- Film Recorder: An output device that transforms an electronic image on a computer screen into a film image.

- Speakers: - Speakers are connected to computers through Sound cards, so as to listen to voice outputs.
- Laser Printer: A nonimpact printer that uses laser beams to print an entire page at once.

## UNIT 6        STORAGE AND MEMORY

- a. What does SAN stands for in storage?

### **ANS**

SAN stands for Storage Area Network

SAN is a high-speed network or system that allows different kinds of storage devices, such as tape drives and disk arrays, to be shared by all users through network servers.

- b. What are the other magnetic disk storage systems?

### **ANS**

- **USB Drives:** Consisting of flash memory and a USB connection, it can read and write data when connected to the computer's USB port.
- **Zip Drive:** A removable storage device that uses hard-shelled removable Zip disks, which can store up to 750 MB of information.
- **Super Disk:** A storage alternative developed by Imation (originally part of 3M Corp.) that has a capability of 120 MB.

- c. Is memory and storage the same? Explain.

### **ANS**

NO- memory and storage are not the same the same

Although the functions of storage and memory are similar, they work in different ways.

- There is more room in storage than in memory, just as there is more space in a file cabinet than on a table top.

- Contents are retained in storage when the computer is turned off, whereas the program or data you put into memory disappear when you shut down the computer
- Storage is very slow compared to memory, but it is much cheaper than memory.

d. What does the following means in memory?

**ANS**

- ***Byte:*** A storage location in memory; the amount of memory required to store one digit, letter, or character.
- ***Kilobyte/K-byte/KB/K:*** One thousand bytes.
- ***Megabyte/M-byte/MB/Meg:*** One million bytes.
- ***Gigabyte/G-byte/GB/Gig:*** One billion bytes.
- ***Terabyte/T-byte/TB:*** One trillion bytes.
- ***Address:*** An identifiable location in memory where data are kept.

**UNIT 7: DATABASES**

a. What is a database?

**ANS**

A database is a single organized collection of structured data, stored with minimum duplication of data items so as to provide a consistent controlled pool of data. There are two types:

- **Flat databases** - A database that consists of a single table. E.g. Spreadsheets.
- Relational Databases – Multiple joined tables. E.g. Access.

b. List two reasons for using database.

**ANS**

The following are reasons for using a database:

- Enterprise Database: Large multiuser database systems developed and maintained by IT professionals.
- Personal Database (PC Database): Typically reside on personal computers and are designed to support a particular function.
- Storing Data
- Retrieving Data
- Query/Querying: A question to be answered by accessing the data in a database.
- Editing: Adding, deleting, or changing the data about companies.
- Organizing Data
- Distributing Data and Information

c. What is Database Normalisation?

**ANS**

Database Normalisation is the process of structuring data to minimise duplication and inconsistencies, by breaking down a single table into two or more tables and defining relationships between those tables. The three levels in normalising a database are:

- First Normal Form (1NF): There should be no repeating groups in a table. For example, say you have a students table with the following structure:
- Second Normal Form (2NF): No non-key fields may depend on a *portion* of the primary key.
- Third Normal From (3FN): No fields may depend on other non-key fields. In other words, each field in a record should contain information about the entity that is defined by the primary key.

d. What are the steps taken to design a Database Application?

**ANS**

Database Application is a computerized database routine for collecting, retrieving, or manipulating data to meet recurring needs.

- *Study the Problem*
- *Determine the Requirements*
- *Design the Database*
- *Create the Database*
- *Design the Application*
- Create the Application
- *Test the Application*

**UNIT 8: DATABASE MANAGEMENT SYSTEM (DBMS)**

a. What is a DBMS?

**ANS**

Database Management System (DBMS): A program that makes it possible for users to manage the data in a database in order to increase accessibility and productivity. Some examples are: MS Access, dBase, FoxPro, Paradox, Approach, MySQL, and Oracle.

b. What are the advantages of using a Multidimensional Database?

**ANS**

***Multidimensional Database*** extends two dimensional relational tables to three or more dimensions sometime called **hyper cube**.

Advantages include:

- Conceptualisation – database provides an intuitive model for complex data and relationships.

- Processing Speed – analyzing and querying is faster.
- c. What is the difference between a Database and DMS?

**ANS**

A database is a single organized collection of structured data, stored with minimum duplication of data items so as to provide a consistent controlled pool of data, while a Database management system is a program which lets you manage information in databases. It also controls the interface between the user and the data in the database.

- d. Who is a DBA?

**ANS**

**Database Administrator (DBA)**

This is a person who acts as a special manager managing the database usually a staff in the organisation. The DBA is also responsible for preparing manuals for the users of the system describing the facilities the database offers and their uses and designing the data dictionary.

**UNIT 9        DATABASE QUERIES**

- a. What are the modes of operation of a Query language?

**ANS**

Queries languages have two basic modes of operation:

– **Terminal Monitor Mode**

The user is able to use query language at a terminal, in the same way a command language interpreter is used. Ad-hoc queries are formulated to obtain data from databases.

– **Embedded Query Language**

The query language statements are included within the code of programs written in some other programming language, eg. C or Oracle, and effectively become part of the program, hence the term “embedded query language”.

b. What does the acronym SQL means? List its statement type

**ANS**

SQL means Structured Query Language

SQL basic statements are:

- SELECT Statements
- INSERT Statement
- UPDATE Statement
- DELETE Statement

c. What are the two types of queries you know?

**ANS**

- Query by example (QBE) and
- Structural query language (SQL).

d. List the two types of query windows in MsAccess.

**ANS**

- Query Design View Window
- Query Code View Window

**UNIT 10: ENTERPRISE DATABASES AND DATA WAREHOUSES**

a. What are the Concurrency Procedures followed in Data Warehousing?

**ANS**

The Concurrency Procedures are:

- **Concurrent Data Sharing:** A database procedure that allows several users to access the database simultaneously.
- **Nonconcurrent Data Sharing:** A database procedure that allows individuals to access a database only when no other person or application is processing the data.
- **Record Locking:** A concurrency procedure that prohibits another user from accessing or altering a records that is in use.
- **File Locking:** Used in systems that store unstructured information and have file-level sharing.
- **Deadlock:** A situation in which each user of a database is waiting for the others to unlock a record.

b. List the functions of a DBMS

**ANS**

*The Functions of DBMS are:*

- Integrating Databases
- Reducing Redundancy
- Sharing Information
- Maintaining Integrity
- Enabling Database Evolution

c. Identify the two most common distribution strategies used for database systems. Explain each

**ANS**

*The Distribution Strategies are:*

- **Geographic Distribution Strategy:** A database distribution strategy in which the database is located in a region where the data and information are used most frequently.
- **Functional Distribution Strategy:** A database distribution strategy in which the database is distributed according to business functions.

d. What items must be taken into account when designing a distributed database system?

**ANS**

*Design Factors are:*

- Storage Costs
- Processing Costs
- Communication Costs
- Retrieval and Processing
- Reliability
- Frequency of Updates and Queries

## **UNIT 11 COMPUTER NETWORKS**

a. What are the Advantages of Using Networks?

**ANS**

There are many possible advantages of using networks. The basic ones are:

- The sharing of resources (e.g computers and staff) and information
- The provision of local facilities without the loss of central control
- The even distribution of work, processing loads, e.t.c
- Shared risk and mutual support.
- Improved and more economic communication facilities in general, e.g. including voice communications.

b. What does ISO means? How many layers are there in the OSI?

**ANS**

ISO means **International Standard Organisation (ISO)**. The **Open Systems Interconnectivity (OSI)** model has seven layers from the lowest to the highest as follows;

- **The physical control layer** is the level of electrical connections, signal transmission and data in raw form.
- **The data link layer** is the level at which data is transmitted in small units using suitable protocols to control and correct transmission.

- **The network layer** is the level which provides control among adjacent sending and receiving points in a network.
- **The transport layer** is the level which provides an end-to-end service between host computers. It deals with addressing, error controls and regulated data transfer.
- **The session layer** is the level which handles the establishment of connections between host and the management of the dialogue
- **The presentation layer** is the level which handles the standard forms for presenting data, e.g. the layouts used for VDU displays.
- **The presentation layer** is the level which the user has control over in determining what data is to be transmitted and how it is to be sent or received.

c. List the two types of network connection you know.

**ANS**

There are two basic types of network connections:

- Physical connections and
- Logical or virtual connections

d. Why do you join computers and other devices to form a network?

**ANS**

The objectives of setting up a network is:

- To use hard discs, modems, printers, and other devices connected to other computers on the network.
- To let other people access your hard discs, modems, printers or other devices connected to your computer on a network.
- To gain access to files, folders, and other resources on other computers connected to the network, &
- To let other people on the network access files, folders and other resources on your computer.

## **UNIT 12      NETWORKING TECHNOLOGIES**

- a. Identify the types of Network Technology?

**ANS**

- *Local Area Network (LAN)*: A network that interconnects computers and communications devices within an office or series of offices; typically spans a distance of a few hundred feet to several miles.
- *Wide Area Network (WAN)*: A network that connects sites dispersed across states, countries, or continents.

- b. What is Network Topology?

**ANS**

A network topology is the geometric arrangement or layout of computers in a network. The following types of layouts are common:

- Point-To-Point Network Topology
- Bus Network Topology
- Star Network Topology
- Ring Network Topology, and
- Tree Network Topology.

- c. The \_\_\_\_\_ topology is a circular network with a computer in the center.

**ANS**

Star

- d. Which type of wide area network is faster than the local area network

**ANS**

***Metropolitan Area Network (MAN)***: A network that transmits data and information over citywide distances and at greater speeds than a LAN.

- e. Define high speed LAN.

**ANS**

### **High-Speed LAN Technologies**

Today's growing fast-changing networks are like growing communities; the traffic they create tends to cause congestion and delays. To alleviate these problems, you can install higher-speed LAN technologies in your network that move traffic more quickly and offer greater data-carrying capacity than Ethernet.

## **UNIT 13 COMMUNICATIONS NETWORKS**

- a. What is a communication network?

### **ANS**

***Communications Network:*** A set of locations, or nodes, consisting of hardware, programs, and information linked together as a system that transmits and receives data and information

- b. List three network service applications you know.

### **ANS**

- Electronic Data Interchange (EDI).
- Videotex.
- Videoconferencing
- Work Group Conferencing.
- Electronic Bulletin Board
- Electronic Funds Transfer (EFT).
- Voice Mail
- Electronic Mail

- c. What do you understand by the term network channels?

### **ANS**

Network channels are medium used in a communication network. They are the physical or cableless media that link the different components of a network.

– Physical Channel

– Wireless Channel

d. List the five Types of Transport Technology you know

**ANS**

– Frame Relay.

– Asynchronous Transfer Mode (ATM)

– Digital Subscriber Line (DSL)

– Integrated Services Digital Network (ISDN)

– Switched Multimegabit Data Services (SMDS)

## **UNIT 14        ENTERPRISE AND WIRELESS COMMUNICATIONS NETWORKS**

a. What is security in WLAN

**ANS**

**Wireless LAN Security:** the safeguarding of the network against unauthorized access.

- ***Wired Equivalent Privacy (WEP):*** A system of security protection that is a standard for encrypting data (converting the data into a protective code) over an 802.11 b wireless network.
- ***Service Set Identity (SSID):*** An encrypted code keyed into the LAN devices, so that only devices with similar code can access the network resources.

b. List the four types of wireless communication networks

**ANS**

– Cellular Communication Service

– Wireless LAN (WLAN)

– Bluetooth Personal Area Network/Personal Area Network

- Wireless Data Networks
- c. Who is a Network Administrator?

**ANS**

- A Network Administrator is the ICT professional responsible the management of a network, consisting of those procedures and services that keep the network running properly.

- d. How many types of Enterprise Architectures do you know?

**ANS**

Enterprise Architecture is the structure of a communications network, which determines how the various components of the network are structured, how they interact, and when cooperation between the system's components is needed.

- Centralized Architecture
- Distributed Architecture
- Combining Architectures (Hybrid Network: combines centralized and distributed architectures )

**UNIT 15 ESSENTIALS OF THE INTERNET**

- a. Identify the main functions of the Internet.

**ANS**

The Internet and the Web are used by billion of users in different countries in the world to perform the following activities;

- Communicate
- Retrieve
- Research on the Web
- Shopping or Cybermalls

- b. When was the Internet launched and by who?

- The Internet, or the Net, was launched in 1969 by the Advanced Research Agency Network (ARPANET).
- c. What is the difference between e-mail, instant message, and chat session?

**ANS**

- ***E-mail or Electronic Mail:*** A service that transports text messages from a sender to one or more receivers via computer.
- ***Chat Session or Internet Relay Chat (IRC):*** A live interactive discussion in which parties on the network exchange ideas and observation electronically.
  - ***Portal:*** A gateway or hub site, such as Yahoo!, that provides chat rooms.
- ***Instant Messages:*** A combination of real-time chat and e-mail by which short text messages are rapidly exchanged over the Internet, with messages appearing on recipient's display screen immediately upon arrival.

- d. What is the difference between Intranets, Extranets and Internet?

**ANS**

**An intranet** is a private network within an organisation that resembles the Internet. Like the public Internet, intranets use browsers, Web sites, and Web pages. Intranets typically provide e-mail, mailing list, newsgroup, and FTP services accessible only to those within the organisation.

**An extranet** is a private network that connects more than one organisation. Many organisations use Internet technologies to allow suppliers and others limited access to their networks. The purpose is to increase efficiency and reduce costs.

**The Internet** is the world's largest network. It is like a giant highway that connects you to millions other people and organizations located throughout the world. The internet is a huge computer network available to nearly everyone with a microcomputer and a means to connect to it. The internet encompasses the intranets and the extranets too.

**UNIT 16 THE WORLD WIDE WEB**

a. When was the WWW launched and where?

**ANS**

The Web also known as the WWW and the World Wide Web was introduced in 1992 at the Center for European Nuclear Research (CERN) in Switzerland.

b. Explain the elements of a URL and the purpose of each.

**ANS**

**Uniform Resource Locators (URLs):** for browsers to connect to resources, the location or addresses of the resources must be specified. These addresses are called URLs. The first part presents the protocols (http://) used to connect to the resources while the second part presents the domain name (noun). The last part of the domain name following the dot (.) is the domain code (edu, ng).

The URL [http:// www.noun.edu.ng](http://www.noun.edu.ng) connects your computer to a computer that provides information about the National Open University of Nigeria, which is an educational institution located in Nigeria.

c. What do you understand by the terms downloading and uploading?

**ANS**

**Downloading** is the process of receiving a file from another computer while **Uploading** is the process of sending a file to another computer.

d. What are the three basic elements of an e-mail message?

**ANS**

A typical e-mail message has three basic elements: header, message and signature.

**The Header** appears first and include the following information:

- **Addresses:** addresses of the person sending, receiving, and, optionally anyone who is to receive copies. E-mail addresses have basically three main parts: the user's name, the domain name and the domain code. For example [dr\\_ahmed@noun.edu.ng](mailto:dr_ahmed@noun.edu.ng), the user's name is dr\_ahmed . The server providing services for Dr Ahmed is noun. The domain code indicates that the provider is an educational institution in Nigeria.
- **Subject:** A one line statement used to present the topic of the message. It also appears when a person checks his/her mail box.

- **Attachment:** these are documents, photos or worksheets attached and send together with the typed text in a mail. The file name usually appear on the attachment line if a message contains an attachment.

**The Message:** this is the short note written in text format and usually straight to the point.

**The Signature:** the signature line provides additional information about the sender: name, address, and telephone number.

## **UNIT 17 E-COMMERCE AND E-BUSINESS**

a. What are the three types of e-commerce?

**ANS**

- B2B
- B2C
- C2C

b. What are the three basic payments for electronic payments?

**ANS**

- Check
- Credit
- E-Cash

c. What is the greatest challenge for e-commerce development?

**ANS**

Security- when it comes to electronic payments during transaction.

d. Among the three types of e-commerce, which is the fastest growing business?

**ANS**

B2C used by small, large, and start-up companies.

- e-banking
- e-trading
- e-retailing

## **UNIT 18 LAUNCHING INFORMATION TECHNOLOGY APPLICATIONS PROJECTS**

a. What are ICT applications?

**ANS**

ICT applications are design for person and enterprise use:

- Designed for Shared Use
- Designed for Sharing Data Resources
- Designed to Connect a Variety of Users
- Designed for Larger Size and Scope

b. What are enterprise systems projects?

**ANS**

These are projects designed for organizations to promote efficient and safe use of data across the networks within their organizations.

- *Systems Development.*
- *Project Management*

c. Who is the most valuable player in ICT application projects and what are his competent skills?

**ANS**

The System Analyst is the key player in most IT application projects, because the System Analyst follows the steps described in the system life cycle. Analyst plan and design new systems or reorganize a company's computer resources to best utilize them. Analysts follow the systems development life cycle through all steps: preliminary investigation, analysis, design, development, implementation, and maintenance.

- Professional Skills
  - Problem Solving
  - Outcome Thinking
  - Creativity
  - Meeting Skills
  - Communication Skills

d. What is feasibility and whose responsibility is it in the IT department?

**ANS**

Feasibility is the measure of how beneficial or practical the development of an IT project will be to an organization.

It is the duty of a System Analyst to learn to think like a business manager and conduct a feasibility analysis of the proposed system and make recommendations to the management or users of the information system. Before carrying out the feasibility study, project objectives and terms of reference must be identified.

## **UNIT 19**

- a. In a DFD chart what does the arrow stand for?

### **ANS**

*Dataflow Diagram (DFD):* A chart showing the movement of data through a system.

The arrow shows the direction or data flow.

- b. What are the data collection techniques the System Analyst use.

### **ANS**

- Interviews
- Questionnaire:
- Document Examination/Record Inspection
- Observation
- Sampling:
- Dataflow Diagram (DFD)

- c. State the two basic tools the System analyst used when creating an ICT project.

### **ANS**

*Computed-Aided Systems Engineering/Computer-Aided Software Engineering (CASE)is a set of tools used in systems development to improve the consistency and quality of the system while automating many of the most tedious and time-consuming systems tasks.*

*Unified Modeling Language (UML)* is a standard vehicle for visualizing, describing, and documenting the details of an IT application. It is being used more extensively in industries to assist in systems analysis.

- d. What are the two types of interview conducted by a System Analyst during analysis?

**ANS**

- **Interviews**
  - **Structured Interview:** An interview in which the questions are prepared in advance and each interviewee is asked the same set of questions.
  - **Unstructured Interview:** An interview in which the questions may be prepared in advance, but follow-up questions vary, depending on the interviewees' background and answer.

**UNIT 20 PROJECT MANAGEMENT**

- a. In the project management steps outline which is the most important? And why?

**ANS**

**Defining the goals of the project:**

Starting a project with the correct goal(s), make it easy to accomplish the goal(s).

- b. Why do you need a backup plan(s) in project management?

**ANS**

Projects always involve a finite amount of uncertainty (risk) that may lead to problems and surprises during the project. Dealing with surprises requires more time, energy, and money than originally planned.

- c. What do you consider to be the basic inputs in a project?

**ANS**

- Goals
- Team Staff

- Money (₦)
- Time
- Equipment

d. What are the don't(s) in planning a project?

**ANS**

Do not underestimate the amount and type of resources required be realistic. This leads to projects that run over budget and fall behind schedule. DO NOT attempt to do any of the following:

- Squeeze a project into a shorter time frame to please your boss
- Cut corners to minimize resource requirements
- Plan on a best-case basis, i.e. "If everything goes correctly, we will finish on time."

**UUNIT 21 WEB BASED APPLICATION**

a. What is the different between Web based application and personal/enterprise applications?

**ANS**

Personal/Enterprise application programs are owned by individuals or organizations and stored on their computer system's hard disk. For the application to be used, a copy of the program (or part of the program) is read into the computer system's memory.

Web-based applications free users from owning and storing applications on their Computers. They now use applications on the fly. Web based applications provide and ease to the high cost of maintaining software and the ICT department of most organizations.

b. What are Heterogeneous Applications?

**ANS**

***Heterogeneous Applications:*** May be written in different programming languages, run on different types of computers, and use varying communications networks and transmission methods

c. What are the basic Technologies of Web Services and their Principles?

**ANS**

XML, SOAP, UDDI and WSDL

- Extensible Markup Language (XML) - is a set of rules for creating tags that describe the layout and content of Web data.
- Simple object access protocol (SOAP) - sometimes known as services oriented Architectural Protocol. Protocol for invoking remote Web services objects using XML
- Universal Discover, Description and Integration (UDDI) - XML-based public directory services that provides information about available Web services
- Web Service description Language (WSDL) - Protocol that describe the capabilities of a Web service object

d. What are the Advantages of XML?

**ANS**

- Web-based
- Extensible
- Computer and software platform independent
- Facilitates end-to-end application integration
- A public, license-free standard
- Has widespread vendor support

## **UNIT 22 INFORMATION SYSTEMS IN THE ENTERPRISE**

a. What are the characteristics of the management information systems?

**ANS**

Characteristics (MIS)

- Uses data captured and stored as a result of transaction processing
- Reports data and information rather than details of transaction processing
- Assist managers in situations, evaluating conditions, and determining what actions need to be taken.
- Supports recurring decisions

- Provides information prespecified reports formats, either in print or on-screen.

b. What are the technologies used in the manufacturing industry?

**ANS**

The IT technologies are:

- Computer-Integrated Manufacturing (CIM)
- Manufacturing Cell
- Material Requirements Planning (MRP)
- Manufacturing Resource Planning (MRP III)
- Computer-Aided Manufacturing (CAM) Systems
- Flexible Manufacturing
- Concurrent Engineering
- Robot
- Computer Vision System

c. Define value chain.

**ANS**

***Value Chain*** is set of activities that are relevant to understanding the bases of cost and potential sources of differentiation of a firm.

- Primary Value-Chain Activities
- Support Value-Chain Activities

d. What are the questions asked when creating a strategic role for an IS.?

**ANS**

To determine whether information technology can be developed to serve a strategic role, ask the following five questions:

- Change the basis of competition?
- Build barriers to new entrants?
- Build in switching costs to customers?
- Strengthen a firm's power in dealing with suppliers?
- Generate or serve as new products?

**UNIT 23      ISSUES IN INFORMATION TECHNOLOGY**

a. What are the sources of security breach

**ANS**

– **Employees**

- *Identify Theft:* Loss of personal identity through a security breach.

– **Computer Viruses**

- **Virus:** A hidden program that alters without the user's knowledge, the way a computer operates or that modifies the data and programs stored on the computer.

– **Hacker and Crackers**

- Gaining access to a system illegally for fun and challenge while crackers do it for malicious purpose.

– **Organised Crime**

- Counterfeiting and forgery.

– **Terrorist:**

- *Cyber terrorism:* Terrorist attack on computer facilities in companies that rely on IT to produce their services.

b. Differentiate between security and breaches

**ANS**

Security is the means of safeguarding and protecting an enterprise's information technology assets, that is by keeping away from criminals, natural hazards, and other threats.

Breach is a breakdown in security.

- **Intrusion:** Forced and unauthorized entry into a system.
- **Interception:** Aimed at preventing the capture of data and information transmitted over an enterprise network or other communications link.

c. What are the measures put in place to avoid software piracy?

**ANS**

*Software Piracy* is the making of illegal copies of software.

**The measures are:**

- **Software Copyright Protection**

- **Copyright:** Legal protection of original works against unauthorized use, including duplication.
- **Copy Protection:** A software protection scheme that defeats attempts to copy a program or makes the copies software unreliable
- **Software Site Licensing**
  - **Site License:** An agreement under which a software purchaser pays a fee to the manufacturer to make a specified number of copies of a particular program.

d. What are the measures taken to ensure ICT service reliability?

### **ANS**

The measures taken to ensuring it service reliability are:

- **Fault-tolerant Computer:** A computer designed with duplicate components to ensure reliability.
- **Uninterruptible Power Supply (UPS) System:** A system that ensures the continued flow of electricity when the primary source of power fails.
- **Disaster Recovery Plan:** A procedure for restoring data lost when a system stops functioning.
- **Off-site Backup Facility:** A backup computer center located away from a company's main facility.
  - **Hot Site:** A fully equipped backup computer center to which a company can take its backup copies of data and software and resume processing.
  - **Cold Site:** A backup facility outfitted with electrical power and environmental controls so that it is ready for a company to install a computer system.

## **UNIT 24      CAREERS IN IT**

a. Which fields are related in terms of hardware?

### **ANS**

**Computer Technician**

Computer Technicians repair and install computer components and system.

### **Network Administrator**

Network Administrators create and maintain networks.

- b. Which IT positions are unique?

### **ANS**

- **Technical Writer**

Technical Writers prepare instruction manuals, technical reports, and other scientific or technical documents.

- **Cryptographer**

Cryptographers design, test, and perform research encryption procedures.

- c. Which IT position requires knowledge in all fields?

### **ANS**

### **System Analyst**

System Analysts plan and design information system.

- d. Which IT position is a top level position?

### **ANS**

### **Information Systems Manager**

Information Systems Managers oversee the work of programmers, computer specialists, systems analysts, and other computer professionals.