Emerging Trends in Library and Information Science

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CHAPTER FIVE

COMPUTER HARDWARE AND SOFTWARE

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Introduction

The computer is one of the most revolutionary and powerful tools ever developed! It is making a tremendous change in every facet of our lives. In this unit you will be introduced to the computer and its peripheral devices. Trends in the historical development of computer hardware will also be examined.

Overview of a computer

A computer can be defined as an electro-mechanical device that accepts, stores and processes data according to instructions coded into it, without any human intervention. From this definition we can deduce that a computer does what it is told. This means it can execute a programmed list of instructions and respond to new instructions that it is given. If a computer fails to perform a particular task, then the programmed instruction is faulty and not the computer. I am sure you have heard of garbage-in garbage-out. Snyder (2006) posited that compared to human being computers:

- have no imagination or creativity
- are not purposeful
- have no intuition
- no free will.

The first fully electronic computer was developed in the early 1940s;, they were huge machines that required teams of people to execute a task and could only execute one task at a time. Compared to those early machines, today's computers are thousands of times faster, smaller in size such that they not only fit on your desk, on your lap, but also on our palm. Computers work through an interaction of hardware and software, which we will be discussing in details.
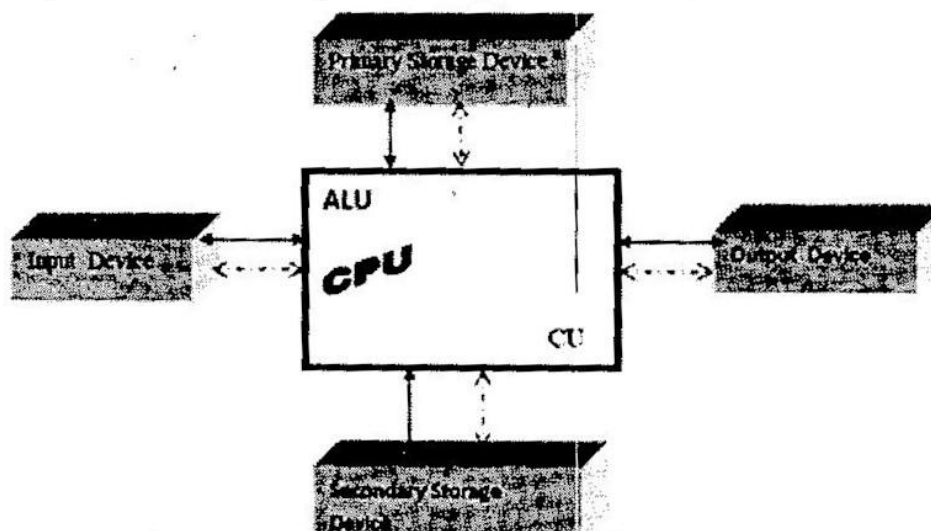
Anatomy of computer hardware

To better understand computers let us take a look at the anatomy of its hardware. The hardware refers to the parts of a computer that you can see and touch, including the case and everything inside it. Some of the major parts of a personal computer include the Central Processing Unit (CPU), the input device, the output device, primary and secondary storage devices.

a.   **Central processing unit:** The CPU also known as a **processor** or **microprocessor** is responsible for handling all instructions and calculation it receives from other hardware components in the computer and programmed instruction executed on the computer. Two typical components of a CPU are the

following:

i.   The arithmetic logic unit *(ALU)*, which performs all arithmetic computations, such as addition and multiplication, and all comparison operations.

ii.   The control unit *(CU)*, which extracts instructions from the computer memory, decodes and execute them calling on the ALU when necessary.

b.   **Input device**: Input devices allow you to enter instruction to the computer. The most popular input devices are keyboard; mouse, joystick, scanners and computer screen.

c.   **Output devices**: These devices display or produce results for you. The video display and printer are the primary ones. Other types of output device include plotters.

d.   **Primary memory** is temporary storage used by the CPU to store results of calculations or files brought in from the hard drive. Memory is very fast and volatile which means it loses its information when power is removed. The primary memory is called Random Access Memory (RAM). It is designed to be able to feed information to the processor at high speed so the processor isn't slowed down too much while waiting for it. The amount of RAM used in modern computers is expressed in megabytes (MB) and gigabytes (GB). A gigabyte (1GB) is 1024MB.

e.   **Secondary Storage device**: The secondary storage particularly hard disk drive is an important component of the computer such that without access to it the processor is crippled. The hard disk stores programs and data when they are not in immediate use by the computer. These devices retain information magnetically and are not as fast as memory but can store much more data. Unlike the primary memory they do not lose their information when power is removed. When you want to use your word processing program, for example, the computer loads the instructions that are stored on the hard disk that tell the computer how to run it, from long-term storage (your hard disk) into short-term memory.

The figure 1 depict how the computer components relate

Figure 1: Physical structure of a digital computer

ALU   –   Arithmetic Logical Unit
CU   –   Control Unit
CPU   –   Central Processing Unit Input and output Signal
Control signal

Historical Development of Computer Hardware

The history of computers starts out about 2000 years ago(Jeremy, 1993). However for the purpose of this class we will trace the historical development of computer from 1940 to present date, which is often discussed in terms of generation. Each generation of computer is characterized by a major technological development that fundamentally changed the way computers operate. The five major categories are:

i.   First Generation - 1940-1956: Vacuum Tubes

John P. Eckert, John W. Mauchly, in collaboration with Moore school of Electrical Engineering of University of Pennsylvania built the first general-purpose electronic, known as ENIAC (Electrical Numerical Integrator And Calculator) in 1942.Executable instructions were created using machine language, the lowest-level programming language understood by computers, to perform operations. Punched cards and paper tape were the source of input while output was displayed on printouts through specific wiring and switches that controlled the flow of computations through machine. Computers in this generation could only solve one problem at a time. Other characteristics included:

a. use of vacuum tubes for circuitry   b. use of magnetic drums for memory
c. very large in size and taking up entire rooms   d. very expensive to operate
e. use a great deal of electricity   f. generated a lot of heat hence malfunctioned easily

ii.   Second Generation - 1956-1963: Transistors

The invention of Transistors in 1947 and its widespread use in computers in the late 1950's ushered in the second generation of computers. A transistor is a small electronic device that, like vacuum tubes, can be used to control the flow of electricity in an electronic circuit, but at a tiny fraction of the weight, power consumption, and heat output of vacuum tubes. The transistors made computers to become smaller, faster, cheaper, more energy efficient and more reliable than their first-generation predecessors. Second-generation computers still relied on punched cards for input and printouts for output, however, machine language was replaced by symbolic or assembly language which allowed programmers to specify instructions in words and symbols.

Second-generation computers were the first computers that stored their instructions in their memory, which moved from a magnetic drum to magnetic core technology. In addition to the assembly language used in the generation Common Business-Oriented Language (COBOL) and Formula Translator (FORTRAN) were programming languages also introduced during the second-generation.

iii.   Third Generation - 1964-1971: Integrated Circuits

In the third generation, the key technological event was the development of

computers based on the integrated circuit (IC). The IC incorporated many transistors and electronic circuits on a single chip of silicon called semiconductors, which drastically increased the speed and efficiency of computers. Instead of punched cards and printouts, users interacted with third generation computers through keyboards and monitors and interfaced with an operating system, which allowed the device to run many different applications at one time with a central program that monitored the memory. Integrated circuits made it possible to create smaller, inexpensive computers that more organizations could afford to buy.

iv.   **Fourth Generation - 1971-Present: Microprocessors**

The fourth generation of computers is marked by the use of Very Large Scale Integrated (VLSI) circuits. With this technology it was possible to place the equivalent of more than 5,000 transistors on a single chip-enough for a processing unit. What in the first generation filled an entire room could now fit in the palm of the hand. In the early 1970s, Intel Corporation designed the Intel 4004 chip, a microprocessor chip that holds the entire control unit and arithmetic-logic unit of a computer Microprocessors made computers more powerful, compact, reliable, and affordable. As a result, it gave rise to personal computer (PC) revolution and also moved out of the realm of desktop computers and into many areas of life as more and more everyday products began to use microprocessors. This also made it possible for computers to be linked together to form networks, which eventually led to the development of the Internet. All the Higher level languages like C and C++, DBASE. etc. were used in this generation.

v.   **Fifth Generation - Present and Beyond: Artificial Intelligence**

The goal of fifth-generation computing is to develop devices that respond to natural language input and are capable of learning and self-organization. This generation is based on parallel processing hardware and AI (Artificial Intelligence) software. Advancement in technology resulted to the development of Ultra Large Scale Integration (ULSI) circuit which replaced the Very Large Scale Integrated (VLSI) used in the fourth generation computer. With ULSI, it was possible to produce microprocessor chips with ten million electronic components

Classification of Computers

Computers can be classified according to *purpose, data handling* and *functionality*. Let's start by looking at the computers according to purpose:

Computers According to Purpose:

Computers are designed for different purposes. They can be used for either general or specific purposes. General purpose computers are designed to perform a range of tasks. They have the ability to store numerous programs, and can be used for various applications from scientific to business applications. The computers we use in schools, banks and home are general purpose computer. Specific purpose computers on the other hand are designed to handle a specific problem or to perform a specific task. A set of instructions is built into the machine. Hence, they cannot be used for

other applications unless their circuits are redesigned, that is, they lack versatility. However, being designed for specific tasks, they can provide the result very quickly and efficiently. These computers are used for car tracking, satellite tracking and air traffic control.

Computers according to data handling

Computers are analog, digital or hybrid. Analog computers work on the principle of measuring, in which the measurements obtained are translated into data. Modern analog computers usually employ electrical parameters, such as voltages, resistances or currents, to represent the quantities being manipulated. Such computers do not deal directly with the numbers. They measure continuous physical magnitudes (e.g. temperature, pressure and voltage), which are analogous to the numbers under consideration. For example, the petrol pump may have an analog computer that converts the flow of pumped petrol into two measurements: the quantity of petrol and the price of that quantity.

Digital computers are those that operate with information, numerical or otherwise, represented in a digital form. Such computers process data into a digital value (in strings of 0s and 1s). They give the results with more accuracy and at a faster rate.

Hybrid computers incorporate the measuring feature of an analog computer and counting feature of a digital computer. For computational purposes, these computers use analog components and for storage, digital memories are used.

Computers According to Functionality

Based on functionality which include physical size, performance and application areas, computers are generally classified into four major categories: micro, mini, mainframe and super computers

i.   A *microcomputer* is a small, low-cost digital computer, which usually consists of a microprocessor, a storage unit, an input channel and an output channel, all of which may be on one chip inserted into one or several PC boards. The microcomputer is generally the smallest of the computer family. They include *desktop, laptop* and *hand-held* models such as personal digital assistants (PDAs).

ii.   A minicomputer is a small digital computer, which normally is able to process and store less data than a mainframe, but more than a microcomputer, while doing so less rapidly than a mainframe but more rapidly than a microcomputer. Minicomputer is designed to meet the computing needs of several people simultaneously in a small- to medium-sized business environment. It is capable of supporting 4 to about 200 simultaneous users. It serves as a centralized storehouse for a cluster of workstations or as a network server. Mini computers are usually multi-user systems, therefore, they are used in interactive applications in industries, research organizations, colleges and universities.

iii.   A mainframe is an ultra-high-performance computer made for high-volume, processor-intensive computing. Mainframes are the second largest (in capability and

size) of the computer family. It allows its user to maintain large information storage at a centralized location and is able to access and process this data from different computers located at different locations.

iv.   The super computers are very costly, hence it is rarely used. Its capacity is abnormally high, it cannot be compared with any other computers in capacity, function, speed, accuracy, language, etc. They have operations done in parallel, rather than sequential. They are employed for specialized applications that require immense amounts of mathematical calculations. The chief difference between a super computer and a main frame computer is that a super computer channels all its power into executing a few programs as fast as possible. But mainframe uses its power to execute many programs concurrently.

Characteristics of a Computer

The following characteristics of a computer has made it an indispensable tool in information work:

i.   *Speed*: Computers are capable of carrying out the task with enormous speed. It takes only few seconds for calculations that we take hours to complete. You will be surprised to know that computer can perform millions (1,000,000) of instructions and even more per second

ii.   *Accuracy*: When it comes to very complex mathematical or scientific problem the computer's accuracy has no substitute. The degree of accuracy of computer is very high and every calculation is performed with the same accuracy. The errors in computer are due to human and inaccurate data

iii.   *Diligence*: Computers are machines that do not get tired or 'lose concentration' like human beings.. It can work for hours without creating any error. Due to this capability, it overpowers human being in routine type of work

iv.   *Versatility*: Computers are versatile in that they can perform almost any task, provided they are given the appropriate instructions. It means the capacity to perform completely different type of work. You may use your computer to search the library catalogue. Next moment you may use it for inventory management.

v.   *Storage*: Computers can store enormous quantity of information, which is expressed in terms of Kilobytes (or) Mega Bytes (MB) or giga Bytes (GB). It is achieved through its primary storage and through secondary storage. The Hard disks, Compact Disc(CD), Flash Drive, Memory stick and Magnetic Tape storage are examples of secondary storages. These large volumes of storage occupy much lesser space compared to paper documents and this aspect of computers makes them more powerful.

Computer software
Introduction

Software is a collective term for computer programs, and you will recall in Unit I, we discussed the role software play in getting tasks done. In this Unit we will build on

that by examining in details the two main categories of software – systems software and application software.

Overview of computer software

The computer performs tasks like storage, retrieval and organization of information as well as operations such as addition, subtraction, division and multiplication only when we instruct it to do so. The central processing unit of the computer acts in accordance with the instructions. These instructions are called software and also known as programs. Without software the computer hardware will not function. It is responsible for controlling, integrating, and managing the hardware components of a computer. For example, software instructs the hardware what to display on the your screen, what kinds of input to take from the user, and what kinds of output to generate. Thus, software communicates with the hardware by organizing the control sequences, and the hardware carries out the instructions defined by the software.

Computer software is written by a well versed programmer or group of programmers and generally in high level language which is readable by human being, interpreted and executed by the computer.
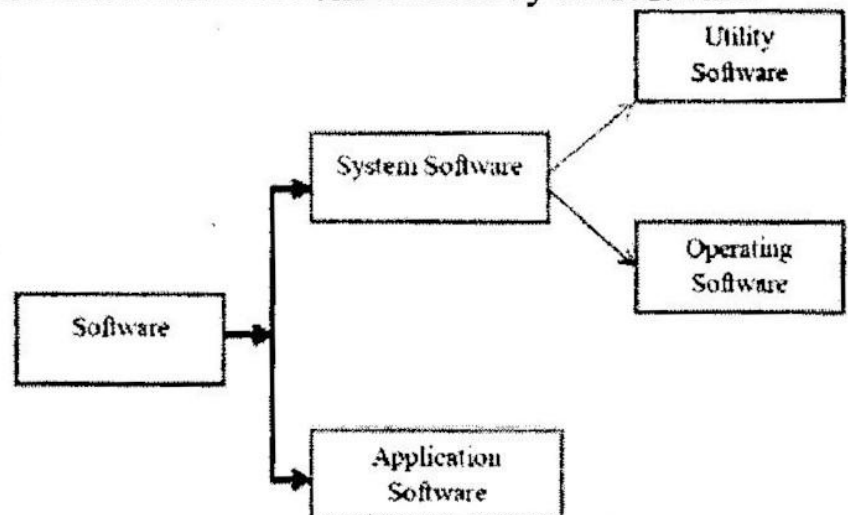
Systems Software

System software is a term referring to any computer software which manages and

Figure 2: Categories of Software

controls the hardware so that application software can perform a task. They include the operating system and all the utilities that enable the computer to function and mange computer resources at a low level. System software can be essential to the functionality of other applications. Specific kinds of system software include loading programs, operating systems, device drivers, programming tools, compilers, assemblers, linkers, and utility software. System Software is used to control and manage computer devices and operations. The system software is categorized into:

Utility software: This include device drivers, which are special control programs that help the operating system know how to work with other electronic devices or work with particular devices better. Drivers not only improve device control but also add support for new standards. If you do not have a device driver for some component such as printers, scanners and cell phone, you will not be able to work with it or access it using the computer. Utility software also include programs with a limited capability, which can be used to maintain a smooth running of the computer system.

Various examples include file management, diagnosing problems and finding out information about the computer etc. Some of the most popular types of utility software include the following: Antivirus software, Anti-spyware software, Compression utilities, Defragmentation utilities, Backup software and Communications software

Objectives of operating systems

Operating Systems (OS) provide the basic platform that brings the PC to a point where it can work with application programs and interface with users. Every general-purpose computer must have an operating system to run other programs. An operating system controls the way in which the computer system functions. In order to do this, the operating system includes programs that

- initialize the hardware of the computer system
- provide basic routines for device control
- provide for the management, scheduling and interaction of tasks
- maintain system integrity and handle errors

Modern Operating systems generally have the following three major goals:

1.   To hide details of hardware by creating abstraction: An abstraction is software that hides lower level details and provides a set of higher-level functions. An operating system transforms the physical world of devices, instructions, memory, and time into virtual world that is the result of abstractions built by the operating system. There are several reasons for abstraction, which include:

a.   The code needed to control peripheral devices is not standardized. Operating systems provide subroutines called device drivers that perform operations on behalf of programs, for example, input/output operations.

b.   The operating system introduces new functions as it abstracts the hardware. For instance, operating system introduces the file abstraction so that programs do not have to deal with disks.

c.   The operating system transforms the computer hardware into multiple virtual computers, each belonging to a different program. Each program that is running is called a process. Each process views the hardware through the lens of abstraction.

2.   The operating system can enforce security through abstraction. To allocate resources to processes (Manage resources):An operating system controls how processes may access computer resources to use and complete its task.

3.   Provide a pleasant and effective user interface :The user interacts with the operating systems through the user interface and usually interested in the "look and feel" of the operating system. The recent trend has been toward increasingly integrated graphical user interfaces that encompass the activities of multiple processes on networks of computers.

Types of Operating Systems

Windows, Mac and Unix are the three major operating systems used by computer

users around the world. Windows has the highest user base, followed by Linux and Mac. So irrespective of the computer you are using it must have either of the three as operating systems running. The internal architectures of these OS are different, which also result in a difference in the types of hardware and software that the three can support.

a.   **Windows:** The Windows operating system is graphical user interface that was developed by Microsoft in 1985. Complicated tasks on Windows can be performed with a few clicks of a mouse only. Even a layman who has never used computers can learn how to use Windows in relatively short time interval. Windows has the highest user base, and correspondingly, most software vendors develop software packages, tools and utilities based on this operating system. So, whatever task users may need to perform, chances are that they will find multiple tools or utilities to assist them in the task. The downside of Windows OS is that it is not free.

b.   **UNIX:** Unix was created in the late 1960s as a multiuser, multitasking system for use by programmers. The philosophy behind the design of Unix was to provide simple, yet powerful utilities that could be pieced together in a flexible manner to perform a wide variety of tasks. Linux is flavor of Unix operating system for personal computers. Linux can be installed on a PC just having the bare minimum resources. However, the real problem with Linux mostly lies in its lack of user-friendliness. While Linux does have a good graphical user interface, users still have to use the command line to perform many tasks. Command lines only accept textual commands that must be typed by hand, and are often too complicated for novice users. Unix operating systems and its various flavor like Linux, Red Hat, Suse and Fedora are free.

c.   **Mac:** Mac, also known as Macintosh refers to a brand name that covers a series of personal computers developed by Apple Inc. Apple produces Mac hardware and has its own operating system that comes packaged with all the Macs. These computers are considerably more expensive than other PCs. Even an entry level Mac can cost almost twice the amount required to assemble a Windows PC. Price is a major setback, and so is the hardware support of this OS. Mac OS X can only work on computers built specifically for the operating system. No other type of computer can run a Mac OS X.

Application software

Applications software is a set of programs, which are specifically written to provide the user a precise functionality like solving a specific problem. Similarly, any tool that functions and is operated by means of a computer, with the purpose of supporting or improving real work is regarded as application software. In other words, it is the subclass of computer software that employs the capabilities of a computer directly and thoroughly to a task that the user wishes to perform. It is important to note that for each particular task there is a specific application software that is best suited for it.

Typical examples of computer application software are word processors, spreadsheets, media player, database applications, etc.

a.   ***Document processing software***: Document processing software assists you with composing, editing, designing, printing, and electronically publishing documents. The three most popular types of document production software are word processing, such as Microsoft Word; desktop publishing, such as Adobe PageMaker; and Web authoring, such as Microsoft FrontPage. This course material was developed using a word processing document.

b.   ***Spreadsheet software***: Spreadsheet software provides tools to create electronic spreadsheets, called worksheets. A spreadsheet uses rows and columns of data to create a model or representation of a real situation. In addition to using spreadsheets to organize information and make calculations, you can also use it to turn data into a variety of graphs and charts. Spreadsheet software was initially popular with accountants and financial managers who dealt with paper-based spreadsheets, but spreadsheet software was quickly discovered by others who realized the benefit of spreadsheets for projects that require repetitive calculations.

c.   ***Presentation software***: Presentation software supplies the tools you need for combining text, photos, clip art, graphs, animations, and sound clips into a series of electronic slides. Electronic slides can be displayed on a computer monitor for one-on-one presentation or displayed using a projection device for large audiences. Presentations can be printed for hand-outs and even posted on the Internet. Presentation software is extremely popular in the business world, where it's used for all types of presentations – from small departmental meetings to huge conventions. Presentation software is also widely used by instructors and students to create slides for use in classroom lectures and presentations. Presentation software typically includes tools for creating speaker notes that help the presenter remember important information to supplement the slide display.

d.   ***Database software***: A database is a collection of data that is stored on one or more computers. A database can contain any sort of data and can be stored on personal computers, servers, and hand-held computers. Database software helps you enter, find, organize, update, and report information stored in a database. Database software stores data as a series of records, which are composed of fields that hold data. When you register for this program you must have entered your bio-data and academic data on a database driven application software, which can store, organize and retrieve the data fast. Example of database software include Micro-soft Access, Oracle, Coldfussion, MySQL, ProSQL.

e.   ***Graphics software***: Graphics software is designed to help people create, manipulate, and print graphics. There are several types of graphic software, including: Paint software, Photo editing software, Drawing software, Corel Draw, AutoCAD.

f.   *Create videos and music Software:* Computers can work with several video file formats, including QuickTime (MOV), RealMedia (RM), Audio Video Interleave (AVI), and Moving Pictures Experts Group (MPEG). Video editing software provides a set of tools for transferring video footage from a camcorder to a computer, clipping out unwanted footage, assembling video segments in any sequence, adding special visual effects, and adding a sound track.

g.   *Library applications software*: These are software used in the automation of various library activities. Library automation software is used for the automation of key library functions: acquisitions, serials, cataloging, online catalog (OPAC), circulation, and collection management. Library automation software include Innovative Interface. Inc., VTLS, and SirsiDynix, T-series and Alice for windows, Koha and Evergreen. Other activities in the library such as digitization of local content use library application packages such as dSpace, E-print, Fedora etc.

Computer network
Introduction
Originally, computers were designed only for individual users, but technology has made it possible to be interconnected to work together. A computer network is the connection of more than one computer for the purpose of sharing resources. In this Unit we will examine how networks operate and how the computers use them to communicate.

Overview of computer network
The purpose of computer network is to share resources between two or more computers, for instance computers might be networked together to share a printer, hard drive, Internet or, software application. Networked computers communicate and share resources either through wired or wireless connection. A library may have over 100 computers that need to be able to access the same applications (library application, office suits). Rather than purchasing and installing the same applications 100 or more at a time the library can install just a copy of the software on a computer server and share it. The three main kinds of computer networks are local area network (LAN), Metropolitan Area Network (MAN) and Wide Area Network (WAN). The communication inside a WAN is dependent on Hubs. A WAN network covers a town, country or regions. LAN is the interconnection of different hubs, routers and other networking devices in a specific place joined with a cabling system. MAN network covers the range of a limited metropolitan area.

Advantages of computer network to information work
I.   *Speed*:   Networks provide a very rapid method for sharing and transferring files. Without a network, files are shared by copying them to flash disks/CD-ROM, then carrying or sending the disks from one computer to another. This method of transferring files in this manner is very time-consuming, unreliable

and susceptible to computer virus .

ii.   ***Cost:*** The network version of most software programs are available at considerable savings when compared to buying individually licensed copies. Besides monetary savings, sharing a program on a network allows for easier upgrading of the program. The changes have to be done only once, on the file server, instead of on all the individual workstations.

iii.   ***Centralized software management.:*** One of the greatest benefits of installing a network at a library is the fact that all of the software can be loaded on one computer (the file server). This eliminates that need to spend time and energy installing updates and tracking files on independent computers throughout the building.

iv.   ***Resource sharing:*** Sharing resources is another area in which a network exceeds stand-alone computers. Most libraries cannot afford enough laser printers, fax machines, modems, scanners, and CD-ROM players for each computer. However, if these or similar peripherals are added to a network, they can be shared by many users.

v.   ***Flexible access:*** Library networks allow students to access their files from computers throughout the school. Students can begin an assignment in the Library, save part of it on a public access area of the network, then go to the media center after school to finish their work. Students can also work cooperatively through the network.

vi.   **Security:** Files and programs on a network can be designated as "copy inhibit," so that you do not have to worry about illegal copying of programs. Also, passwords can be established for specific directories to restrict access to authorized users.

There are two types of networks

a.   ***Peer-to-peer network:*** A network is referred to as peer-to-peer if most computers are similar and run workstation operating systems. It typically has a mix of Microsoft Windows 9X, Me, Windows XP Home Edition, Windows XP Professional, Windows Vista, Windows 7, and Windows 8. In a peer-to-peer network, each computer holds its files and resources. Other computers can access these resources but a computer that has a particular resource must be turned on for other computers to access the resource it has. For example, if a printer is connected to computer A and computer B wants to printer to that printer, computer A must be turned on.

b.   ***Client/server network:*** A computer network is referred to as client/server if (at least) one of the computers is used to "serve" other computers referred to as "clients". Besides the computers, other types of devices can be part of the network. In a client/server environment, each computer still holds (or can still hold) its (or some)resources and files. Other computers can also access the resources stored in a computer, as in a peer-to-peer scenario. One of the peculiarities of a client/server network is that the files and resources are centralized. This means that a computer, the server, can hold them and other computers can access them. Since the server is always

On, the client machines can access the files and resources without caring whether a certain computer is On. Another big advantage of a client/server network is that security is created, managed, and can effectively enforced. To access the network, a person, called a user must provide some credentials, including a username and a password. If the credentials are not valid, the user can be prevented from accessing the network. The client/server type of network also provides many other advantages such as centralized backup, Intranet capability, Internet monitoring, etc.

Concepts of information management
Introduction
Organizations all over the world are struggling with continued expansion of information. In some organizations information is doubling by the year creating problems for organizing, retrieving and storage. In this unit we will examine the life cycle of information management which is defined as the collection and management of information from one or more sources and the distribution of that information to one or more audiences.

Overview of information management
Information Management is the application of management principles to the acquisition, control, dissemination and use of information relevant to the effective operation of organizations of all kinds. It is also an umbrella term that encompasses all the systems and processes within an organization for the creation and use of corporate information. In recent times, most organizations manage their vast information with the use of computer system to control and preserve their information base. The perception of this view is that there is a correlation between information management and how decision makers and managers carry out their functions. It has helped to identify the needs which enable an organization to effectively provide relevant, needed and timely information to users. Information management has a profound unifying effect on the use of information throughout an organization. It identifies records and their managers, and reports on progress made on a regular basis. It also facilitates accessibility to the relevant information created to be of great boon to an organization.

Information management life cycle
Information Management life cycle is a comprehensive approach to managing the flow of an information system's data and associated metadata from creation and initial storage to the time when it becomes obsolete and deleted. It automates the processes involved, typically organizing data into separate tiers according to specified policies, and automating data migration from one tier to another based on those criteria. The seven stages comprising the life cycle of information management is explained by library and archives Canada as follows:

Stage 1: Planning: Planning is an activity that reflects a wide variety of inputs. Good planning is the key to success of every initiative, large or small. This is the stage where IM practitioners and managers plan measures to support Information life cycle. The most important aspect of Stage 1 is to recognize that any plan is better than no plan. Like many, you may be just beginning the process of incorporating IM into your regular planning cycles. Others may be looking to strengthen their understanding of IM and its principles and practices. Regardless of which stage you are at, undertaking planning to set the stage for effective IM within your initiatives is a best practice that you should feel proud of.

Stage 2: Collection, Creation, Receipt and Capture: This is the stage where information is initially created or obtained. This could include their creation by a member of an organisation at varying levels or receipt of information from an external source. It includes correspondence, forms, reports, drawings, computer input/output and/or other sources. Information centers have the duty of managing and conserving their collectives adequately, conservation in the operations which are intended to prolong the life of an object by forestalling or remedying deterioration. The most important aspect of Stage 2 is to recognize that information assets have been generated and to encourage employees to assess the value and role of the information at the moment of creation within a recognized framework that makes it easy to support applicable legislation and departmental policies. Good information organisation is a critical aspect of supporting timely and accurate information exchange.

Stage 3: Organisation: Organisation facilitates access to materials. Information is organised according to a structured set of business rules and information technology requirements. These rules and requirements prescribe the ways in which records and information must be stored and handled over time in order to support each organisation's unique policies, procedures, mandates and legislation. This is the stage where information is organised for effective use, dissemination, maintenance and disposition. The most important aspect of Stage 3 is the presence and consistent application of IM guidelines.

Stage 4: Use and Disseminate: This is the stage where information is actively used and shared. All the other Stages support this important phase of the IM life cycle. The purpose of disseminating information is to encourage the sharing of wider spread of information. It makes the retrieval of relevant information more likely and allows new insights to be created by relating disparate items of information. The separation between information provider and user should be dissolved to collaborate as partners in the dissemination and value adding of information to help ensure that the best information is seen by the right persons in the organisation. Also, to encourage users to be active participants, it should be made easy for commentaries and evaluation.

Effective use and dissemination of information yields timely, accurate and available information that is accessible by those who need it when needed for better comprehension.

Stage 5: Maintenance, Protection and Preservation: Maintenance entails filing, retrieval and transfers. During this stage Information is managed to ensure credibility and quality. The requirements for proper maintenance are often unique to each organisation's policies, procedures, mandates and legislation. For example, records related to history or law may be managed differently than records that provide broad information. Preservation is the maintenance of information resources so that they can be related to the original condition as applicable. The primary goal of preservation is to prolong the existence of an official property. At this stage, the information framework is placed within a larger management framework that allows systems to collate each individual record over time. Stage 5 deals with records and information right up until they are no longer active and hence become ready for disposition.

Stage 6: Disposition: Disposition is the final stage of information management in which a record is either destroyed or permanently retained. In other words the records have reached the end of their life cycles. This is a critical decision stage that is guided by legislation affecting records of archival value, concepts of legal control, and departmental records disposal plans. The most important aspect of Stage 6 is avoiding the wrongful disposition of records. It is important to deal with records as soon as it is determined that they no longer have business value to the organisation to avoid the costly buildup of stored backlogs of records.

Stage 7: Evaluation: This is the stage where the opportunity is taken to really assess how well IM programmes are doing in effective IM life cycle and to take corrective actions to obtain better results in the future. This is a permanent and ongoing part of the cycle and an important factor in continuous improvement. IM practitioners and managers actively evaluate the effectiveness of their IM strategies and processes. Using a number of different evaluation tools, the objective is to assess where programs have been strong and where they have been weak, so that changes can be made in the next planning cycle to achieve better results. The most important aspect of Stage 7 is having specific performance targets that your IM programs are trying to achieve. In *Stage 1: IM Planning,* key metrics for performance were established, ideally against benchmark results. The concept of benchmarking or taking a measure of how your programmes are performing against set measurement criteria is important in order to be able to see if you have made gains or losses in your IM programme effectiveness. Each time a new measure is taken, it can be compared to the earliest and first benchmark, to the last performance measure and to the target objective. As they become available, you may even be able to compare the effectiveness of your programs to external organisations and those who have achieved recognition for best practices.

Some business benefits of information management

The potential benefits of good Information Management will be gained in the following areas:

1.   Reducing administrative labour cost: Less actual time moving information around and outside the library and information centers saves massive amounts of staff time and labour cost.

2.   Reducing wasted time and mistakes: Access to constantly updated information from an easy to locate source prevents repetition of work on out of date documents. Staff can add and amend information efficiently and quickly.

Information Management Life Cycle

3.   Better collaboration: Projects requiring content and information from different departments and external parties benefit from easier access, greater team working and faster completion amongst on-site and co-located teams.

4.   Increased customer service: Responding to customers quicker with more complete and relevant information gains sales and retains clients.

5.   Compliance with regulation: Effective IM will reduce the cost of audits and assist in complying with regulations.

6.   Improved accuracy and consistency of information distributed to customers both inside and outside the organisation.

7.   Increased effectiveness of data used for business planning and execution.

8.   Organizational flexibility and agility needed to meet dynamic market demands.

9.   Improved quality control and supervision.
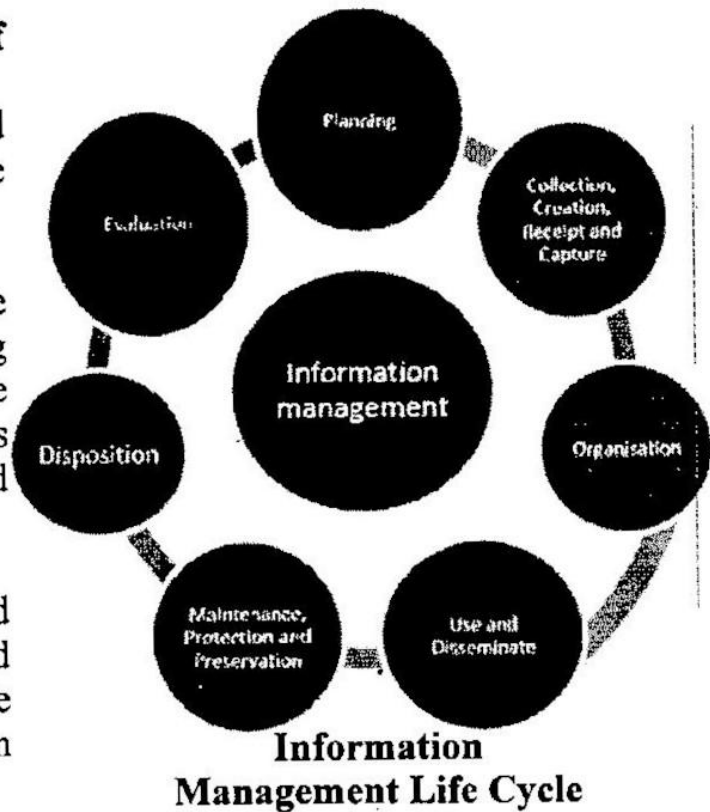
REFERENCES

Ashcroft L. and Watts C. (2004). ICT Skills for Information professionals in developing countries: perspective from a study of the electronic information environment in Nigeria . Retrieved on 11/03/2013 from: http://ww/.ifla.org/V/iflaj/IFLA-Journal-1-2005.pdf

Breeding M. (2011). A Cloudy Forecast for Libraries. Computers in Libraries Vol. 31(7). Retrieved on 6/4/2013 from http://www.infotoday.com/cilmag /sep11/Breeding.shtml

Breeding M. (2009).The Many Facets of Managing Electronic Resources. August 3, 2014. Information Today, Inc.

Computing. Special Publication 800-145. Retrieved 10/05/2013 from http://csrc.nist.gov/publications/nistpubs/800-145/SP800-145.pdf

Creeger M. (2009). Cloud Computing: An Overview. A summary of important cloud-computing issues distilled from Association of Computing Machinery (ACM) CTO Roundtables.

ITL Education Solution Limited (2011). Introduction to Computer Science. Retrieved on 14/06/2014 fromhttp://my.safaribooksonline. com/book/ electrical-engineering/computer-engineering/9788131760307 Accessed on 14/06/2014

James, R. (2005). Ten principles for Effective Information Management. Retrieved on 10th September, 2012. Available online at http://www.steptwo.com.au /papers/kmc_effectiveim/index.html

James, R. (2005). Ten principles for Effective Information Management. Retrieved on 10th September, 2012. Available online at http://www.steptwo.com.au/ papers/kmc_effectiveim/index.html

Jeremy M.(1993). "A Short History of the Computer" Retrieved on 14/06/2014 from http://www.jeremymeyers.com/img/comp/comp.pdf

Johnson et al. (2012). Key Issues for e-Resource Collection Development:

King, D. L., & Brown, S. W. (2009). Emerging trends, 2.0, and libraries. The Serials Librarian, 56(1e4), 32e43.

Odyssey Software (2008). Retrieved on 24/11/2012 from http://www.atlas-sys.com/products/odyssey/Retrieved 5/09/2012 from http://queue.acm.org/ detail.cfm?id=1554608