

An Introduction to the Use of
**LIBRARY, STUDY SKILLS
&
INFORMATION AND
COMMUNICATIONS
TECHNOLOGY**

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LIBRARY & INFORMATION

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PREFACE

An Introduction to the Use of Library, Study Skills and Information & Communications Technology is a culmination of over ten years of undergraduate teaching. In the current global system where knowledge/information has increasingly become virtual, it is imperative for students at all levels to be conversant with the library as well as the computer. Any library user, nowadays, should be able to use the computer effectively to locate physical and electronic resources in the library. The user, when necessary, should be able to access online resources and other materials in the library even from the comfort of a bedroom.

Although there may exist an abundance of literature on Library, Computer and Information studies as specific disciplines, there is arguably a dearth of such that are specifically tailored towards the General Studies curricula in Nigerian Universities and even Polytechnics and Colleges of Education. Hence, this book is principally written in line with the National Universities Commission benchmark for the General Studies programme. It also fulfils the relevant benchmarks of the National Board for Technical Education (NBTE) and the National Commission for Colleges of Education (NCCE).

The 17-chapter book is essentially in three sections: Section I which dwells on the Use of Library comprises the first eight chapters and is a detailed insight into definitions, structures, types, historical developments, and functions of libraries, understanding the meaning of a book, library catalogues, classifications, reference materials, etc.

Section II, comprising the next three chapters, exposes

the reader to basic study skills including referencing and bibliographic citations as well as Copyright and its implications. Section III comprises the last six chapters and introduces the students to the basics of computer technology. Emphases are on Computer Applications, Hardware technology, Storage devices, Software, Communication and Internet services.

We are grateful to all the students at Igbinedion University, Okada, National Open University of Nigeria, and the University of Ibadan whom we are fortunate to have interacted with, and who, over the years, constituted our 'laboratory' for 'testing' the manuscript of this book. We are grateful to Dr. Georgina Ekpenyong, Deputy University Librarian and Adetoun Oyelude, Chief Cataloguer, both of Kenneth Dike Library, University of Ibadan for reading the manuscript and making useful suggestions. We thank Clement Mamudu, Head of Department of English at Igbinedion University Okada, for editing the manuscript and facilitating its publication. We however take responsibility for all errors or omissions that may be associated with the book.

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Section I

**USE OF
LIBRARY**

Chapter One

INTRODUCTION TO LIBRARY

A **library** is an organized collection of resources which are made accessible to a defined community or audience for reference or borrowing purpose. It is a repository of information resources both in print and non-print formats, arranged systematically so as to ease retrieval for a library user. The library provides physical or digital access to material, and may be a physical building or room, or a virtual space, or both. A library's collection can include books, periodicals, newspapers, manuscripts, films, maps, prints, documents, microform, CDs, cassettes, videotapes, DVDs, e-books, audio books, databases, and other formats. Thus, the library is a room where books are kept and arranged orderly; **it is** a collection of literary documents kept for reference or borrowing, it is a depository built to contain books and other materials for reading and study.

Libraries have been identified as one of the key elements for open access to information, which is crucial to educational and self-development. Public and institutional collections and services may be intended for use by people who choose not to or cannot afford to purchase an extensive collection themselves, people who need material or information resource no individual can reasonably be expected to have, or who require professional assistance with their research. Librarians are always available to

interpret information needs and answer research queries. Libraries also often provide a place of silence for studying.

A library is a place where a wide range of information is kept to enhance or boost the knowledge of those whose consult or use them, this is why librarians are called custodians of knowledge. All the above are different definitions of the Library. However a library is defined, it connotes different meanings to different people. Thus, a library can be defined in several ways but in all, a library is a place where information is stored for easy retrieval by users. This simply defines what a library is and it embraces other definitions of library.

The central and main mission of a library is to collect, organize, preserve, and provide access to knowledge and information. In fulfilling this central mission, libraries all over the world preserve a valuable record of culture that can be passed down to succeeding generations. Libraries are an essential link in this communication between the past, present, and future. Whichever form the cultural record is contained either in books or in electronic formats, libraries ensure that the record is preserved and made available for future use. Libraries provide people with access to the information they need to work, play, learn, and govern.

People in many other professions use library resources to help them do their work better. Library resources are also used to gain information about personal interests or to obtain recreational materials such as films and novels. Students use libraries to supplement and enhance their classroom experiences and to develop good reading and study habits. Public officials use libraries to research legislation and public policy issues.

Definitions of the library by (Islam, 2004) are as follows:

- (i) As a learned institution equipped with treasures of knowledge maintained, organized, and managed by trained personnel to educate the children, men and women continuously and assist in their self-improvement through an effective and prompt dissemination of information embodied in the resources.
- (ii) As an enabling factor to obtain spiritual, inspirational, and recreational activities through reading, and therefore the opportunity of interacting with the society's wealth and accumulated knowledge.
- (iii) An instrument of self-education, a means of knowledge and factual information, a center of intellectual recreation, and a beacon of enlightenment that provides accumulated preserved knowledge of civilization which consequently enriches one's mental vision, and dignifies his habit, behavior, character, taste, attitude, conduct, and outlook on life.
- (v) As a place in which literary and artistic materials, such as books, periodicals newspapers, pamphlets, prints, records, and tapes, are kept for reading, reference, or lending. In a digital sense, a library may be more than a building that houses a collection of books and other materials, for example, the Internet has opened up an avalanche of online and electronic resources for accessing documents on various fields of interest.
- (vi) As a collection of texts, images, etc., encoded so as to be stored, retrieved, and read by computer.

Other definitions of the library are given below:

- (i) Omojuwa (1993) described the library as an enabling

factor to obtain spiritual, inspirational, and recreational activities through reading, and therefore the opportunity of interacting with the society's wealth and accumulated knowledge.

- (ii). The online Dictionary, Thesaurus and Encyclopedia described the library as a place in which literary and artistic materials, such as books, periodicals newspaper, pamphlet, prints, records, and tapes, are kept for reading, reference, or lending.

It is noteworthy to state that libraries are in two forms; the physical and the virtual library. This is because the modern day library is information and communication technology (ICT) driven. It uses ICT means to access and retrieve resources which are mainly electronic in nature. Unlike the traditional/conventional library that sits in one physical place, the virtual library is a library without walls. It is a digital library that any user can access from a remote area without physically visiting the library. The collections are basically electronic or physical.

Online Glossary defined digital library as a collection of text, images, etc., encoded so as to be stored, retrieved, and read by the computer. Furthermore, a digital library is a collection of documents in organized electronic form, available on the internet or on CD ROM disks. It is the traditional/conventional physical library that provides a basis for digital library. Thus, libraries have shifted from just being physical to virtual; libraries are not just a room or place where books and information materials are kept anymore, but also a virtual space where information are kept for users. A web definition for virtual library is that which exists

solely in electronic form or on paper, the building blocks required for such a library may not exist, and the chemical steps for such a library may not have been tested. The library of today and the library of the past are regarded as a common meeting place for generations. This is where old and young, men and women, students and teachers, and authors together to read together, take part in discussion groups to learn, etc. Today's libraries have become feel-good places for everyone.

CHARACTERISTICS OF THE LIBRARY

All libraries, whether university, college, high school, public or private libraries exist for the purpose of providing a service to the people. In addition to being a repository for books and other materials catalogued and kept in an orderly fashion, the library also stands as a link between the user and the information they need, so they play a major role in providing the users with the materials they require when needed.

The University library is an Information Services Unit, providing electronic cataloging, electronic on-line public access catalogue, electronic acquisition and serials control, electronic inter-library loan, and electronic circulation services. The various characteristics of the library are discussed below:

1. Libraries are places of education.

Libraries are places where people go to seek information and quench their thirst for knowledge. And because libraries offer free access to information to everybody, they can be referred to as places of education. Depending on the needs of users or information seekers, libraries are always and readily accessible and available to answer all queries and keep the user informed

and satisfied. Without the Library, an institution of learning is not complete.

2. Libraries are dynamic institutions.

Libraries are techno-savvy, they are always on the forefront of the information age, updating their resources and services to suit present and most recent needs of the society. In a world where new inventions are made frequently and in a society that is information rich, libraries are information smart and ready, and they help ensure a society where everyone is information literate and enlightened. Libraries serve all purpose when it comes to information; any kind of information needed is readily available. They are not biased in subjects or any field or area, they serve all and sundry.

3. Libraries bring the world close to you.

Libraries are unique, in person (physically) and online (electronically). They are equipped with varieties of information to educate the world. There is nowhere else one can have access to nearly any type of information both on the Web and in print as well as reference services and assistance in finding information. With just a snap of your finger you have all the information you need whether electronically or physically. Libraries are information rich and always ready to give. University and research libraries are always available to offer access to countless opportunities through their extensive collections and wide-ranging resources available to quench the thirst of students and researchers. If the classroom is the first stop in the undergraduate experience, the library is the next destination. There can be no learning or learning institutions without a library. In our information society, librarians offer professional duties like

collaboration with faculty and students to provide guidance on navigating electronic and print resources. University and research librarians are active partners in educating students, offering new perspectives, developing curricula, and facilitating innovative research projects.

AIMS AND OBJECTIVES OF THE USE OF LIBRARY COURSE

The use of Library course is made compulsory for students because of the importance of the library to their academic pursuit. The importance of the library to any educational institution makes it a duty for the University library to organize this course to extensively familiarize and equip students with the knowledge they need to use the library. The library builds the course in a way that students will not find it difficult navigating through its rich collection of resources. If students are not exposed to the course at the beginning of their studentship, the organization of the library collection and various resources becomes very confusing and this could deter or kill their interest in using the library. This explains why the course is made compulsory from the first and is taught by professional librarians.

At the end of the use of library course, students should be able to:

1. Differentiate between the academic library that serves them and other types of libraries and also know their different functions.
2. To know the various resources available for use in the library and also how to locate them

3. To know how to navigate the electronic databases in the library and also know how to use other popular search engines to look for materials.
4. Search both the OPAC and the catalogue cards with the basic knowledge of the Library of Congress Classification Scheme
5. Search various databases with the relevant skills to fine tune search terms for better and relevant search results.
6. Conduct a research excellently with the available and relevant resources
7. Know and adhere to the rules and regulations of the library to foster a conducive environment for research.

Chapter Two

UNDERSTANDING THE MEANING OF A BOOK

Any text, fiction or edited compilation of written words, having certain structural parts and some bibliographic information can be regarded as a book. A book can be a compilation of bits of information by an author(s) or editor(s) on a particular subject. A book has to have certain structural parts and also some bibliographic information which are listed below:

Bibliographic information contained in a Book

- * Author(s)
- * Title
- * Volume or edition
- * Publisher
- * Place of publication
- * Year of publication
- * Pagination
- * ISBN

Structural Parts of a Book

Books usually follow an order when published; the structural part of a book can be grouped into the following:

1. The Binding

The binding is the part of the book that holds the book together and at times carries the title of the book and also

some designs that makes the book attractive. The cover of the can be soft or hard. The spine of the book which serves as the trunk of the book carries the call number which is given after cataloguing the book.

2. The Preliminary Pages

These are the pages that introduce the book; the pages come before the main text of the book. They include:

a. The Title Page

This page contains information about the title, author, publisher, place of publication and year of publication of the book.

b. The Copyright Page or the Verso

This page is next after the title page, usually at the back or verso of the title page. This is page that contains the year of publication, publisher, copyright date, publishers' address, ISBN and also catalogue in print (CIP) if available for the particular book.

c. The Introductory Statement Pages

These pages contain the foreword, the preface, the introduction, the acknowledgement page and the table of contents page:

* **Foreword**

A foreword is a brief introductory statement about the subject and/or scope of the book, and is typically written by someone other than the author of the book.

It comes before the preface and usually states some interaction between writer of the foreword and the book's author or the story that the book tells.

* **Preface**

The preface is a brief introduction to the book usually

written by the author. It describes why the author wrote the book, the research methods adopted and perhaps some acknowledgments if they have not been included in a separate section. It may also establish the author's qualifications and expertise as an authority in the field in which he/she is writing. Again, a preface is far more common in nonfiction titles and should be used only if necessary in fiction works.

* **Acknowledgments**

An acknowledgment page includes the notes of appreciation to people who provided the author with support or help during the writing process or in his/her writing career in general. This section may also include any credits for illustrations or excerpts if not included on the copyright page.

* **Introduction**

The introduction describes something about the main text that the reader should know before proceeding to read the book. Unlike a preface, which usually addresses the qualifications of the author, an introduction refers to the main body of the work itself. For example, if there are questions at the conclusion of each chapter, here is where the author might prepare the reader and give tips on how best to use them. The introduction may also describe, in more detail than a preface, the research, methods and overall concept of the book.

* **Table of contents page**

This is a list of the chapters and sections into which

the book is divided and the pages upon which the sections appear. It is usually organized according to the order in which the chapters or sections appear and gives a preliminary view or a brief summary of the contents of the book.

3. The Text

This is the main body of the book. It contains the subject matter of the book. It is usually divided into chapters and sections with their titles and headings.

4. The Auxiliary Pages

These are the other parts of the book after the text and they are listed below:

* Appendix

An appendix includes any data that might help clarify the text for the reader but would have disrupted the flow of the main text had it been included in an earlier part of the book. A list of references, tables, reports, background research and sources, are also included here.

* Notes

If the main text in a work requires notes to amplify or document certain passages throughout the text, they are arranged in a notes section by chapter. Footnotes would more likely be included in the references section.

* Glossary

A glossary comprises alphabetically arranged words and their definitions. If a terminology that is not generally known to the average reader or if new words or phrases are coined to explain ideas, a glossary clarifies it.

* Bibliography or References

Both the bibliography and reference sections list the

sources for works used in a book. The sources are arranged alphabetically by the author's last name.

* **List of Contributors**

For a work done by more than one author where only the volume editor's name appears on the title page, a list of contributors is useful and needed.

* **Index**

The index is an alphabetically ordered list of words and terms used for referencing text. These may be author or subject indexes, or list of important words, terms or names that appear in the book with their corresponding pages.

Chapter Three

HISTORICAL DEVELOPMENT OF LIBRARIES

The first form of library that existed was known as oral library. It was passed on from mouth to mouth and preserved in people's memories. The major weakness of this form of library was that it was not documented and thus many of the information it contained tended get lost over time. The necessity to preserve and disseminate records for future generations made ancient civilizations to begin to seek ways to preserve their records in different formats.

The earliest known written materials were first put together in Mesopotamia more than 5,000 years ago. They were written in clay tablets. Later papyrus scrolls emerged and as civilization came, the Greeks, Romans, Assyrians and Egyptians kept their records in this format (papyrus scrolls). Papyrus scrolls were later replaced by parchment codex in the middle ages and these were used by the Roman Catholic Church to keep their records, especially as libraries were mostly located inside the monasteries and taken care of by monks.

In 1450, Johannes Gutenberg invented the movable type printing press and handwritten books were replaced with printed ones. Institutions of learning were established along with libraries as knowledge began expanding and by 1500 several universities were founded and they all had some form of library

DEVELOPMENT OF THE PUBLIC LIBRARY IN NIGERIA

Public libraries, as storehouses of information, are set up to provide free service to everyone in the society. A public library serves the community and is generally referred to as the layman's library or university. It is essentially a service-oriented institution with set goals to be achieved within the resources made available by the parent institution, usually, the government or other corporate organizations or agencies (Olanlokun & Salisu, 1993). The public library is essentially established to cater for the information needs of the public. It is a medium of education with regard to the roles it plays, such as information roles, political roles, educational roles, research roles and economic roles, amongst others. Today, there are several public libraries in Nigeria.

Public libraries officially took off in the defunct Northern Region of the country following the enactment of relevant enabling laws (Saliu, 1999). The Northern Regional Government of Nigeria, had in 1952, set the ball rolling by passing a law for the establishment of a regional library. This necessitated the creation of reading rooms spread across the Region. The rooms continued to serve the reading public until the outbreak of the civil war in 1967.

Meanwhile, the first Public Library law was promulgated by the defunct Eastern Regional Government. The United Nations Educational, Scientific and Cultural Organization (UNESCO), after its seminar on public libraries which was held in Nigeria in August 1953 at the then University College (now University of Ibadan) Ibadan, later became involved in a pilot project with the Eastern Regional government to establish a

library board in the area. In a survey of public libraries in Nigeria, Saliu stated that "the Eastern Regional Government established a Regional Library Board in 1955 to render library services to the people of the Region". By 1959, the headquarters of the Eastern Nigerian Library Board (which had been established in 1955) was completed.

In 1962, work on the National Library started and on the 6th of November 1964, the National Library was officially opened for use by the general public. This followed the enactment of the National Library Act earlier in the year, which Act accorded the new National library a legal status. Meanwhile, the Nigerian Civil War broke out in 1967, and the reading rooms that were created by the Northern Regional Government were upgraded to regional (public) libraries. Although the Northern Region was 'broken' into six states in 1967 and later to nineteen states in 1976, the libraries continued to provide services in the various provinces while some of the new states established their own Library Boards. Similarly, some states were created out of the Eastern Region in 1967. The East Central State Library Board was created in 1971 by Edict No. 17; the Rivers State Library Board was established via Edict in 1971, and the South-Eastern State Library Board was created by an Edict in 1973. These Boards were charged with the responsibility of providing library services to the people of their states. Since 1976, there has been further restructuring and changes in the names of the states in this area. New names are Anambra, Enugu, Imo, Ebonyi, Rivers, Cross-River, Akwa Ibom, and Bayelsa states. These states have their respective library boards charged with the duty of providing library services to their citizens.

LIBRARIES AND THE INTERNET

Libraries all over the world are experiencing changes and these changes have influenced the way librarians discharge their duties. The world has turned into a global village; hence professions and professionals are adjusting their activities to accommodate – and be accommodated within – this change. With the development of information and communication technology (ICT), libraries are no longer seen as just physical books that are kept in physical places for users to come and access. Users are no longer required to visit a library physically in order to access it.

From the concept of custodian, the Library/Information professionals are now engaged in different sectors as content developers, knowledge managers, cybrarians and so on. This is due to the sea of change in the information world. The information world is now undergoing a transition. Presently, the world is shifting from a Library-centered to an information-centered society. Resources are shifting from paper-based documents to predominantly digital documents, that is, using search engines, online databases, data mining, etc (Halder, 2009:93).

Both physical and electronic materials are relevant for information gathering. The 21st century user though prefers getting information online because of the ease of gathering and sorting electronic information. But it is very important to seek the help of skilled librarians to navigate these online information in order to be certain that they are coming from an authentic source. Unlike the physical books that can easily be authenticated, the World Wide Web is full of garbage that users are not aware of and cannot easily discern.

Information professionals/ experts can help users solve

problems that they may encounter while trying to harness quality information on the internet. They do this by pointing users in the right directions, giving them guidance as to the best ways to search, advising them on the correct ways of using the information they find, and a whole lot more.

The internet and other sources of information will be discussed under the topic electronic library in another chapter of the book.

IMPORTANCE OF LIBRARY IN EDUCATION

Library is like a storehouse of knowledge. Books in different and almost all subjects/topics are found in the library, be it history, geography, or even science fiction - a library has it all. All schools and colleges have a library. A library is like the whole world encompassed in just one room. Without a library a school or university will not be complete. There can be no education without the use of books, and books can only be preserved and managed in the library. Education and library are two indivisible concepts, they are both fundamentally and related and they co-exist with each other. One cannot be separated from the other, and the existence of one is impossible without the other. None of them is an end in itself; rather both of them together are a means to an ultimate end. It is very essential to the education and school system. Any problem or unanswered query will be found in one of the books stored in the library.

With the onset and advancement of technologies virtual libraries are created. These types of libraries are present in many colleges today. Libraries are an integral part of the education system and one is incomplete without the other. They complement each other perfectly well.

The role of library resources in education is to:

- * Facilitate the planning and implementation of learning programs that will equip students with the skills necessary to succeed in a constantly changing social and economic environment. Through resource-based programs, students acquire skills to collect, critically analyze and organize information, problem-solve and communicate their understandings.
- * Provide and promotes quality fiction to develop and sustain in students the habit and enjoyment of reading for pleasure and to enrich students' intellectual, aesthetic, cultural and emotional growth.
- * Cater for differences in learning and teaching styles through the provision of and equality of access to, a wide range of materials, fiction and non-fiction, print, audio, video and digital.
- * Provide educators with access to relevant curriculum information and professional development materials within and outside the educational system; and opportunities to cooperatively plan implement and evaluate learning programs which integrate information resources and technologies. (Usoro&Usanga, 2007)

Libraries are as important as education itself. Library services imply both availability and accessibility of library resources, facilities and services to the user and the willingness and ability of readers to use the facilities and services. Information is power and access to information is indispensable to individual advancement as well as corporate educational development. Individuals need the library for effective learning for lifelong education, the aim of basic education is to equip

individual with such knowledge, skill, and attitude that will enable them to:

- * Live meaningful and fulfilling lives
- * Contribute to the development of the society.
- * Derive maximum social economic and cultural benefits from the society and
- * Discharge their civil obligation.

INCULCATING THE HABIT OF READING

Reading is regarded as one of the most enriching habits that help an individual develop both academically, socially, culturally and all generally in life. It is not just a hobby or a pass time that entertains, but it is also an educational activity and hence brings to you a vast reservoir of knowledge. Reading increases the drive for knowledge and inspires people to gain more information. Thus a library is a treasure of valuable books for the people to use and gain from it.

Chapter Four

TYPES AND FUNCTIONS OF LIBRARIES

The importance of the library to the society cannot be over-emphasized; the library plays diverse roles in ensuring availability of information which helps to maintain stability and balance in the society. The library serves as the instrument that bridges the gap between information and the people, in other words, the library stands in between the people and the information they need. This is why librarians are referred to as the custodians of knowledge. Whichever form a library takes, whether, physical or electronic, they play a very crucial and important role in the society. All libraries however have major and similar functions they perform as follows: they collect and preserve information, they organize the information gathered for easy retrieval and lastly they disseminate the information stored to users. The historical evolution of libraries and the dynamic nature of different human activities account for the types of libraries that exist today. Basically, seven types of libraries will be discussed.

1. **Public Library**

Public libraries are owned and funded by government, and they serve the community where they are located with information services. Public libraries should cater for the social,

educational and recreational needs of the community they serve. Public Libraries perform these functions below among others:

- a. they facilitate informal self-education of all people in the community ;
- b. they enrich and further develop the subjects on which individuals are undertaking formal education ;
- c. they meet the informational needs of all ;
- d. they create and further develop civic sense and habits of the citizens
- e. they support the educational, civic, and cultural activities of groups and organizations ;
- f. they encourage wholesome recreation and constructive use of leisure time
- g. they provide children, young people, men and women opportunity to:
 - * educate themselves continuously,
 - * keep abreast of progress in all fields of knowledge, and
 - * maintain freedom of expression and constructively critical attitude to all public issues and world affairs.

It is a publicly funded institution that provides books for loan by all and sundry - from the very old to the very young. It is usually divided into Lending and Reference, and the Lending stock is split between fiction and non-fiction. The threat to the public library comes partly from the fact that fewer people now read for pleasure, and those who do are more likely to buy their books than borrow them from the library, and, on the non-fiction and reference sides, information is easily and quickly obtainable from the World Wide Web and the internet, without the need to

make a trip to the library.

The internet is phasing out the need for public libraries but not at an extreme level as of yet. There are still many activities, resources and information that are needed from public libraries and have therefore not ceased to exist despite the impact of the internet. Experts agree that within the next few decades, the numerous technologies available and the growing demand for the internet will cause public libraries to become non-existent, but there is still a long journey from today for that to happen.

2. Academic Library

Libraries that belong to institutions of higher learning like universities, polytechnics, colleges of education, colleges of technology or agricultures etc. are referred to as academic libraries. They cover the spectrum from libraries in higher institutions of all sizes, through to those of major universities and research institutions. They have something of a captive audience, in that the institutions they serve are dedicated to teaching and learning, and the libraries' role is to provide access to the sources of information from which that teaching and learning can develop.

Academic libraries are under threat, because they cost money to stock and to run, and a school or university has to make a decision as to the proportion of its funds to devote to its library. Academic libraries are therefore bending over backwards to add increasingly more value to the services they provide.

Academic libraries are run by professional/academic librarians because the expertise of a professional/academic librarian is essential in the process of translating a vaguely worded enquiry into the true needs of the enquirer and then into the solution that will best satisfy those needs.

3. Special Library

These are libraries that serve a particular institution that has a specific role to play, and they will therefore tend to be "one subject" libraries. For example, they could serve a hospital, or a law practice, or an industrial company. They also vary in size, depending in part on the size of the institution they serve.

The special library has been historically, and remains today, an integral, functioning unit of the organization in which it is found, dedicated to the proposition that it exists only to offer the information which the organization needs in order to build, prosper, advance, and achieve its ultimate ends.

4. Private Library

A **private library** is a library under the care of private ownership, as distinct from that of a public institution, and is usually only established for the use of a small number of people, or even a single person. As with public libraries, some people put stamps, stickers or embossing to show ownership of the items. Some people sell their private libraries to established institutions such as the Library of Congress, or, as is often the case, bequeath them thereto after death, through a will.

5. School Library

A **school library** is a library within a school. Secondary and primary schools in Nigeria create a library in their schools where students, staff, and often, parents of have access to a variety of resources. The school library has a paramount goal to ensure that all members of the school community have equal access to books and reading and to information technology. It is at this level of education that an enviable reading habit is inculcated in youths. A school library serves the purpose of coordinating all

the reading materials used in the school.

The school library is integral to the teaching and learning process of any primary and secondary school. The school library facilitates the classroom teachers' work and ensures that pupils have access to resources that are relevant to their work.

School library programs and services seek to:

- * Make available a conducive space for reading and learning. They provide pupils with comfortable infrastructure and also make the reading space very colourful and attractive; in this way the interest of the young pupil is drawn and retained.

- * Prepare pupils ahead to be able to meet up with the skills needed to succeed in this ever growing, challenging and changing technological, social and economic environment we live in.

- * Plan, implement and evaluate in collaboration with the class teachers programs that will aid pupils in analysing and organising information.

- * Inculcate enviable reading habits in pupils.

- * Make provision for quality fiction that will help promote and sustain the habit of reading for enjoyment or pleasure, which will further enrich their knowledge.

- * Make provision for a wide range of curriculum resources such as fiction and non-fiction, digital, print, audio and video to cater for differences in learning and teaching styles.

- * Make adequate provision for teachers to have access to curriculum information and other materials that will help them develop their professional skills.

6. National Library

A **national library** is a library that is specifically established by the government of a country to serve as a

repository of information for that country. They seldom allow citizens to borrow books like the public libraries. They stock numerous rare, valuable and works that are very significant to the country they serve.

The national library has a major goal which is to fulfill the common international goal of universal bibliographic control by ensuring the bibliographic control of all the documents published in that country or talking about that particular country. The national library is also responsible for collecting a nation's literature through the legal deposit law as a requirement for copyright protection and then assigns ISBN and ISSN to published works. It also coordinates other libraries throughout the country.

7. Electronic Library

Electronic Library as the name implies is the electronic form of information, it could be in CD's that come with books, or it could be digitized copies of physical books or it could be internet based electronic databases. Whichever form it takes, an electronic library is virtual in nature.

The advent of digital resources has greatly expanded the walls of libraries. Now, libraries have resources such as e-books and online databases that can be accessed on the move by users, this simply means that they are not limited to physical locations within the library. Databases, in particular, are useful for researchers because they allow them to search for information using various search terms to define their search, users can search by topic category, author, date or other useful traits. However, many of the best databases are have to be subscribed to by paying a sum.

Databases may specialize in a certain field such as medicine, business, or engineering. These databases provide access to not only historical information but also specialized information on the particular field or subject they serve or represent; they also provide information that is not easily found through search engines like Google. The in-depth and historical information makes these databases one of the most valuable resources in the library. One of the advantages electronic information has over books is that it saves space, as a very large content of information can be carried in a small disc or flash drive. Internetbased electronic resources also allow a user to carry his library around, thereby making learning mobile and easy.

Mobile learning has become a major focus in education, mobile technology has really changed the way people learn and want to learn, the learning environment is gradually shifting from the physical to the virtual, the onus now rests on educators to harness from the benefits of mobile learning and also tackle the various problems posed by this new way of learning.

CHARACTERISTICS OF AN ELECTRONIC LIBRARY

One of the characteristic of the electronic library is the fact that it is easy for research queries to be answered. If a user is working on a particular area of research, the online electronic databases allows a user to key in his query and all articles related to his work from various journals would be displayed for the user to choose from.

Below is a general overview of an electronic library:

- * Access to vast digital libraries and information services
- * Aids easy navigation through various electronic resources

- * Collection is arranged in a way to suit individual and specific queries
- * Search aids can operate within a particular database and can allow redirection to other collections of information connected by networks worldwide.
- * Online Selective Dissemination of Information (SDI) services
- * Makes e-borrowing easy and supports inter library loan services
- * Online research services allowing patrons to pose questions and get e-answers from librarians
- * It allows the use of various computing equipment like the computer, mobile phones, tablets and so on to access information
- * It saves space; a large volume of information can be carried in a small space like a micro SD card.
- * The library can be carried around and used anywhere and at anytime

LIST OF SOME ONLINE ELECTRONIC RESOURCES

NAME OF DATABASE	URL ADDRESS	REMARK
AGORA	http://www.aginternetwork.org	Access to global online research in Agriculture. The AGORA program, set up by the food and Agriculture organization of UN (FAO) together with

		major publishers, enables developing countries to gain access to an outstanding digital library collection in the field of food, agriculture, environmental science and related social sciences.
HINARI	http://www.who.int/hinari	Health Inter Network Access to Research initiative, the HINARI program, set up by WHO together with major publishers, enables developing countries to gain access to one of the world's largest collections of biomedical and health literature.
EBSCOHOST	http://www.search.ebscohost.com	Provides access to several databases, e.g. Medline, Academic primer, Newspaper resources, social sciences, etc.

LEXISNEXIS	http://www.lexisnexis.com/us/inacademic	Federal & State cases, Shepard's citations. Landmark cases, Supreme court briefs, Federal statutes, Codes & regulations, Law reviews, Legal references, Patents, Tax law.
BIOONE	http://www.bioone.org	Bioone is a global, non-profit collaboration, bringing together scientific societies, publishers and libraries to provide access to critical, peer-reviewed research in the biological, ecological and environmental sciences.
SCIENCE DIRECT	http://www.sciencedirect.com	It covers Physical Sciences and Engineering, Life Sciences, Health Sciences & Social Sciences and Humanities.

E-JOURNALS	http://www.e-journals.org	E-journals is part of the World Wide Virtual Library. It provides links to world electronic journals.
ASSR:ARAB SOCIAL SCIENCE RESEARCH	http://www.assr.org	ASSR is the network engine of the Arab Institute for Studies and Communication (AISC). Site provides a platform for the AISC's centres and pulls resources to facilitate Social Science research in the region.
INASP PERI	http://www.inasp.info/peri/electronic.html	INASP negotiates access to as many required resources as possible with content owners publishers through the PERI programme.
AFRICAN JOURNALS ONLINE	http://www.ajol.info/	African Journal Online (AJOL) is a service that provides access to African published research, and increase worldwide knowledge of indigenous scholarship.

BIOMED CENTRAL	http://www.biomedcentral	BioMed is a publisher of more than 150 peer-reviewed open access journals.
BMJ PUBLISHING GROUP	http://www.biomedcentral	BMJ Group publishes BMJ (British Medical Journal), a number of journals covering major medical specialties and a growing number of online and events products for the healthcare profession.
RESEARCH PAPER IN ECONOMICS	http://www.respec.org	Research papers in Economics to enhance the dissemination of research in economics.
POPLINE	http://www.popline.org	POPLINE (Population information online) the world's largest databases on reproductive health.
INASP HEALTH LINKS	http://www.inasp.info/health/index.html	INASP works towards a future where all healthcare providers
JSTOR	http://www.jstor.com	A journal store with resources on ALL subjects

JAPEE DIGITAL	http://www.jaypeedigital.com	Explore Health Sciences and Collections of Medical E-Books, medical images, Surgical videos and Journals
PROQUEST	http://www.search.proquest.com	Covers journal articles in all disciplines.
DOAJ	http://www.doaj.org	This service covers free, full text, quality controlled scientific and scholarly journals. There are 2411 journals in the directory. Currently 708 journals are searchable at article level. It is an open access database.
BOOKBOON	http://www.bookboon.com	Free access E-Book
INTECHOPEN	http://www.intechopen.com	Intechopen is a pioneer and world's largest multidisciplinary open access publisher of books covering the fields of Science, Technology and Medicine, free online access to e-journals and E-books.

GLOBAL DEVELOPMENT NETWORK	http://www.gdnet.org	GDNet supports the generation and sharing of local social science research by providing a number of web and email based services to help researchers produce, share and disseminate their work.
WORLD BANK GROUP	http://www.worldbank.org	It is an open access electronic resource database.
PUBMED CENTRAL	http://www.pubmedcentral.nih.gov	PubMed Central is the U.S. National Institute of Health(NIH) free archive of biomedical and life sciences journal literature
E-JOURNALS	http://www.e-journals.org	E-journals is part of the World Wide Virtual library. Provides links to world electronic journals
DOAB	http://www.doab.org	Free Access E-Books

ERIC	www.eric.ed.gov	<p>ERIC (Educational Resources Information Center) is a comprehensive database containing abstracts of journal articles, reports, curriculum guides, conference proceedings, etc. It covers all areas of education at all age and grade levels. ERIC Documents 1993+ are now freely available online</p>
MATHSCINET	http://www.ams.org/	<p>MathSciNet is the online version of the AMS publications. Mathematical Reviews from 1940 to present and current mathematical publications</p>

Depending on users' institution of study, some of these databases could be available if subscribed to by the institution, some of them allows for individual subscription e.g. SCIENCE DIRECT while some of them are open access databases. This is by no means an exhaustive list but it gives a description of some available online databases.

ORGANISATION OF A LIBRARY

A library usually consists of four main divisions; these are the technical services division, the reader services division, the collection development/acquisition division and the systems/media division. Each of these divisions have sub-units which help the main division to function properly. Below is a list of the main divisions and their sub-units with explanations on how they function and the duties they perform.

A. The Technical Services Division

The technical services division of a library consists of three main units namely cataloguing and classification, reprography and the serial services units and is usually headed by a Deputy University Librarian.

i. Cataloguing and Classification Unit

The cataloguing and classification unit of a library is responsible for organizing the collection of the library using a classification scheme. Usually the cataloguing and classification unit duties are often referred to as "behind the scene" because their duty is aimed at creating access and easy retrieval of information resources available in the library. Their duties can be summarized as follows:

- a. Descriptive cataloguing.
- b. Allocation of class marks to suit the subjects of each information resource.
- c. Creating multiple access points to information resources through title, author and subjects to make it almost impossible not to locate the material in the library.
- d. Maintaining the catalogues of the library, both the manual (card catalogue) and electronic (OPAC) catalogues.
- e. Spine labelling and preparation of information resources for the shelves.

The unit is a very important one in the library as it involves a very high level of professionalism to work there. If a book is not properly catalogued, it becomes lost to users and since the library will not want this to happen, the cataloguing unit of every library is treated specially to ensure quality output of work.

ii. Serials Services Unit

The serials unit of a library is in charge of managing periodical materials acquired by the library for easy access to users. The periodical materials include journals, newsletters and newspapers. The unit performs among others the under listed duties:

- a. Processing of journals and other periodicals received by allocating subjects and class marks to properly place them on the shelves for easy retrieval.
- b. Stamping and taking records of newspaper received and also monitoring the use and circulation of the newspapers.

- c. Managing journal and newspaper subscription of the library.
- d. Updating of records of journals in the kardex.
- e. Maintaining the electronic entries of journals for OPAC access
- f. Preparation of journal and other periodicals for binding and safe keep.
- g. Attending to research queries of users using both the physical and electronic journals.

This is another unit that is very important in the library as they perform several technical jobs that needs professionalism.

iii Reprographic Services Unit

This unit consists mainly of the bindery, and photocopy section of the library. The bindery section is in charge of binding worn out books and also repairing mutilated books. The photocopy section helps with the photocopy of materials that cannot be taken out of the library, mostly journals, reference materials, maps, charts and so on. Most academic libraries in Nigeria use this unit to generate funds to run the library as users are charged a token for rendering these services.

B. The Collection Development /Acquisition Division

As the name implies, this is the unit that is responsible for building the collection of the library through acquisition of materials that are needed and relevant to the users of the library. Their duties include checking the collection of the library before deciding on items that need replacement or extra copies. In an academic library, the departments are consulted to give a list of relevant materials to their course; they are aided by publishers

catalogs sent to them by the collection development unit. When the list is received, the collection development committee sits to look at them with the help of subject librarians and those recommended materials are sorted and another list of the approved materials by the committee is forwarded for purchase. When the purchased materials are received, they are recorded, stamped and given accession numbers to distinguish them, they are thereafter sent to the cataloguing section for further processing.

C. The Readers Services Division

The Readers Services Division of the library deals mainly with the users' needs, they are in charge of getting the end product of the technical services division to the users. This division consists of the reference unit, the circulation unit and the reserved books unit. The division is usually headed by a Deputy University Librarian who is also responsible for overseeing the smooth running of satellite libraries (college/faculty libraries).

i. Circulation Unit

The circulation unit of the library is in charge of getting books properly arranged on the shelves, shelf-reading to ensure that books are properly placed on the shelves, giving out books on loan to patrons and charging overdue fines for books that are returned late. This unit is in charge of registration of students for the use of the library, they also organize orientation programs for fresh students to familiarize them with the library.

ii. Reference Unit

The reference unit of the library is where materials on specific and special information are kept. Examples of

reference materials include among others encyclopedias, almanac, dictionaries, year books, almanacs and thesis that were written in the university. These materials are consulted by users in the reference section because they are not to be taken out of the library. Users are guided by the reference staff on where to get specific information using the reference tools mentioned above.

iii. Reserved Books Unit

This section contains in some cases extra copies of books on the open shelf. If a user is in need of a book that is on loan, such a user is referred to the reserved book unit to consult the book there. Books that are safely kept in that unit of the library cannot be loaned to users because they serve as backup. Somelibraries also keep books that are withdrawn but still have some relevance in this unit; users are allowed to consult them there.

D. System/Media Division

This is the division of the library that houses all the electronic records of the library. The electronic section of the library is managed from here. They are in charge of making sure the library management system is running smoothly and a backup of the library databases is taken care of by staff of the unit.

Chapter Five

TYPES OF LIBRARY MATERIALS

Although libraries are usually associated with books and book related material, they have other research resources for users, many of which are beyond the scope of what is easily accessible at home or on the internet because of their quantity and complexity. Moreover, while libraries have a plethora of both physical and digital resources, some of their most valuable assets are their human resources. Skilled librarians are knowledgeable about availability of information, their source and authenticity and they can make your research efforts easier, interesting and more efficient.

Today's libraries are repositories and access points for all types of information in print, audio, and visual, including maps, prints, CDs, cassettes, videotapes, DVDs, videogames, e-books, audio books (microfilm/microfiche), documents, and many other electronic resources. Libraries often provide facilities to access to their electronic resources and the Internet. Libraries of today are being redefined as places where unrestricted access to information in many formats and from many sources are made available. Library services are being extended beyond the physical walls of a building, by provision of materials accessible by electronic means, and by providing the assistance of competent librarians in navigating, analyzing and then mining relevant information with a variety of digital tools.

These library resources play significant roles in educational advancement:

- I. Human resources (Librarians/information professionals)
- II. Physical resources. These include:
 - * The library building, a very decent and conducive environment for learning and teaching, working computers, printers etc
 - * Book materials like periodicals, newspapers etc.
- III. Digital resources

Human Resources

One of the most valuable assets of any library in the world are skilled librarians who evaluate all of their libraries' resources, including helping users to access them. They also help to determine whether the said resources are the appropriate given users specific needs or interests. Because various types or resources are housed in the library, users may not discover what they need until they have spent a lot of time exploring what is available. Asking a librarian for help can often save users time because librarians are trained to navigate through online databases and books on the shelves to answer the query of users in no time. Librarians can also help users quickly learn to use technology or software, such as microfiche readers or database search programs, which you may need to complete your research.

Physical Resources

Physical resources are divided into two parts as seen and explained below:

- a. **Library building, conducive environment for learning and teaching, computers, printers etc.**

Libraries provide a space for users to sit and access resources. Their responsibility among others is providing a very conducive environment for learning. Apart from the physical building, libraries also make sure their users have access to computer and other equipment like photocopy machines, printers and all other physical equipment that make their visit to the library worthwhile.

b. Book materials like periodicals, newspapers etc.

Libraries house a number of resources that readily available for users to locate, handle and use at will. These physical resources include periodicals, magazines, newspapers, maps, and manuscripts, though some may not be available for borrowing, depending on each library's policy. In addition, many libraries provide media resources such as films, prints, CDs, cassettes, and videos which can be accessed by users during their visit. Of course, libraries also have books on a variety of subjects/fields and often have inter-library loan arrangements with other libraries, this is done to further satisfy their users' needs. If a book that is not on the shelf is needed by a user, all the user needs to do is ask a librarian to order it for him/her, if possible. Some libraries can also arrange inter-library loans of media resources, too. Below is a breakdown of these materials:

Digital Resources

The advent of digital resources/libraries has greatly expanded and changed the way libraries look and work. Libraries now have resources such as e-books and online databases which can be accessed anywhere and at any time within and outside the library. Online databases are very useful for researchers because

they make searching through vast information easier by allowing users to search for information by topic, category, author, date or other useful traits. This search style makes the user get information that is directly related to his/her work in less time.

UNIVERSITY OF IBADAN LIBRARY

Chapter Six

LIBRARY CATALOGUE

Whatever careful and scholarly the methods used in building a collection, without expert guidance to its access and use, the collection remains difficult to access. Cataloging and classification helps the user to access library materials with ease and as such, it is a major area in the library where attention is focused. Cataloguing and Classification techniques have been in use as long as libraries have existed, and their value in the so-called information age has been enhanced by the use of computers.

The function of the catalog is to identify all the items in a collection and to group like items together. All the great libraries of the ancient world seem to have had lists and inventories, whether kept on clay, stone, papyrus, parchment, palm leaves, or bamboo strips. Examples may be found in museums throughout the world. A catalog can also be referred to as an inventory or bookkeeping of the library's contents. If an item (a book) is not found in the catalog, the user may continue his/her search at another library.

Types of Catalogue

Catalogues are generally described and grouped into the under listed categories:

1. Dictionary Catalog

This is a catalogue type in which author, title, subject, and

other entries are filed in a single alphabetical sequence or order.

2. Divided Catalogue

This catalog is also in alphabetical sequence but with subject, author/title entries in separate files. This form has increased in popularity, and many libraries have divided their former dictionary catalogs, recognizing the growing value of the subject approach.

3. Classified Catalogue

The classified or classed catalog, as its name suggests, has all the entries filed in the sequence of a classification scheme—that is, in a systematic order of subjects—but separate alphabetical files link names of authors and of subjects to the notation symbols of the classification scheme used in the main file. The chief advantage of a classed catalog is that the entries are related subjects grouped together in the file; thus, a subject search can be made much more simply than in a catalog based on the alphabet. In addition, when different languages are used, the sequence of entries in a classed catalog does not alter, as is the case with the dictionary.

4. Union Catalogue

This is a record of the holdings of more than one library, it is cooperatively compiled by these libraries and it aids inter library loan.

Vehicles for Catalogue

The types of catalog differ on the basis of the information provided in the entries, but the actual physical form may also vary. Below are different types of catalogues used by libraries as vehicles for the main catalogue.

1. Book Catalogue

It is a book containing a list of the bibliographic information of a library holding arranged in a systematic way to ease access.

2. Computerized Catalogue

A computerized catalogue offers a more practicable approach because the storage capacity and the operating speed of even small machines overcome the main drawbacks to card services: delays in production and the labor of filing the cards when they arrive. Computer technology makes it possible for the details of any document to be entered into a file at any point and then to be transmitted to a central data file from which other libraries can obtain details by means of telecommunications links. The process is demonstrated by the revised Machine-Readable Cataloging Project, known since its revision in 1968 as MARC II. Library users find no difficulty in consulting such on-line catalogs, and many prefer them to the more cumbersome, if more familiar, form of cards in drawers. Not only do they enable library patrons to search for books containing a particular word or combination of words in the title, but the patron also can narrow a subject search by finding books that are on two or more topics. The information from the catalog can be alphabetized or put in order by year of publication and printed out as a book list.

3. OPAC (Online Public Access Catalog)

The system that accommodates the above mentioned type of search is known as OPAC (on-line public access catalog). The OPAC has been expanded in many libraries to include information about journal articles and sometimes about the community served by the library. The job of cataloger, once highly dedicated to the task of describing library materials for the

production of a catalog, is now focused on producing an information retrieval tool that will be of general use to the library's patrons.

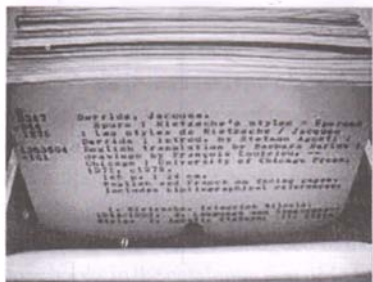
The online public access catalogue is the computerized form of the traditional card catalogue. It is much easier and faster to use the OPAC to search a library's holdings since it is computerized and therefore uses less of human efforts.

4. Card Catalogue

The traditional card catalogue which is 3×5 inches (7.5 ×12.5cm) card in size contains the bibliographic information of the materials held in the library. These cards are filled in an alphabetical order and they are kept in a cabinet for users to access. The card catalogue is can easily be added or removed during filing and updating, it is flexible and provides see or see also references. See Figures 1 and 2 below:



A Card Catalogue Cabinet

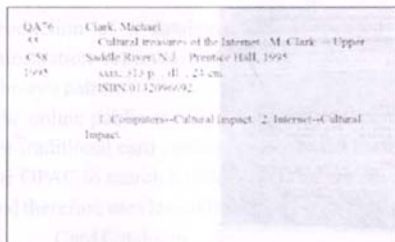


File of 3×5 cards

There are different types of card catalogue in the library, but the common ones include:

* Author Card

The author catalog is a type of card which contains the major bibliographic details of a library material sorted alphabetically according to the authors' or editors' names of the entries. They are organized by the last name/surname of the author. If a book is co-authored, the author listed first is the one who appears on the card catalog. Names of other authors may be included depending on the space available. After the author's name, the title of the book and publishing information like place of publication, name of publisher/s and the date of publication or the copyright date are listed. The bottom of the card contains a list of three to five main subjects that correspond with the book. The card in the author catalog also contains information on how to locate this book in the library, this is provided in the form of a specific call number located on the top left hand side of the card and also printed on the spine of the book. See the illustration below for an example of an Author card.



Author Card

* Title Card

The title card has one major difference from the author card, unlike the author card that leads by author, the title card provides an easy way for a person to find and access a specific book or multimedia holding by its title. Though the title card contains all of the same information that the author catalog contains, but the information is rearranged on each card entry. Instead of the author listed at the top of the card, the title of the book is listed, followed by the author's name, publishing information and lastly the subjects.

* Subject Card

The subject card has the subject as the main entry; the subject of the book is used to enter the book into the catalogue. It organizes all of the library holdings by the main subjects of the title. Because titles often fall under more than one subject category, the library may choose to have multiple entries for the same book. Other libraries choose to only list a single main subject in capital letters on the top of the card for each book in the subject card catalog. The arrangement depends on the policy of each library, whichever suits and helps serve their users better.

* Shelf-list Catalog

A shelf-list is a type of card catalog guide that libraries often use for organization of their records/holdings, although it is not usually accessible to the public. The shelf-list combines all title, author and subject cards to provide a complete inventory of what the library has on its shelves. It helps cataloguers to locate books that are already catalogued in the library, and repetition of those books in the catalogue is avoided.

- Specialized Shelf-list Catalogs

Specialized shelf-list catalogs are created for large holdings of music, scientific research and other special collections. The specialized shelf-list makes it easy for librarians to locate relevant materials for patrons. Specialized shelf-list can also help locate items that are not part of the general collection.

An instruction on how to use the card catalogue cabinet to locate a book is explained below:

1. Find the drawer marked with the first letter of the title of the book you would like to find. Drawers are marked with letters and arranged alphabetically. For example, if you are looking for the title "Purple Hibiscus," find a drawer labeled with the letter "P" or containing the letter "P," such as "H-P." Remember not to use articles (a, an, the) at the beginning of a title. For example, if you are looking for "The thing around your neck," look for it under the letter "T," which stands for "thing". The article "The" is disregarded.
2. Open the drawer and search for the title of the book. The cards are arranged alphabetically and are held in place by a metal rod see Fig 2 above. Usually there is enough room

in the drawer to flip the cards and read them easily. The information on the card contains the title of the book, its author, publication date and publisher. The call number for the book can usually be found on the left side of the card. This is the number you would use to find the book in the library.

3. Follow the same procedure for author and subject searches. Search for an author by finding the drawer marked with the first letter of the author's last name. For example, "Adichie, Chimamanda," would be in the drawer marked with a "A." Note that authors' surname appears first before other names. Subject searches may be more of an effort if you don't know the controlled language librarians use. For example, if you are searching for "movies," you won't find it under "movies" or "film" but under "Motion Pictures." If you search the other two words first, you'll find a card that reads "For movies, see Motion Pictures." Then you must search for "Motion Pictures" under "M" in an entirely different drawer.

To make the search easier, it is better to be equipped with the title or author of the book, search using the subject would need professional guidance and advice by the librarians.

Chapter Seven

CLASSIFICATION

Classification involves systematic grouping of information sources by subject contents and translation of the subjects into codes of ordinal numbers. These numbers represent definite subjects areas and serve as abbreviation for the name of the subjects they represent. The codes are called “**call number**” or “**class mark**”.

Classification schemes are the main tool in classifying or grouping information sources for easy retrieval. They are publications containing systematically listed terms or notations representing discipline and sub-disciplines. They aim at assisting Librarians to organize Library resources, and also assisting the users in locating desired information sources easily and quickly.

Class Mark

The Class Mark is the number assigned to a book according to the Library of Congress Cataloguing and Classification Scheme (LC). The professional librarians in academic libraries are to determine the number that places the book in the correct subject by using the Library of Congress Classification Schedule. For Example you can have **QD33.2** as a class mark. But when the author cutter is added to it, it becomes the call number as explained below.

Call Number

The call number is a combination of the Class Mark and the Author Cutter. If the book assigned the above Class Mark **QD33.2** is written by Okeke, Lillian, the author cutter could be **O33** depending on the author cutter table used by the library. When the author cutter is added to the above Class mark, it becomes **QD33.2.O33**. The date of publication of the book is also added depending on the policy of the library, you can have **QD33.2.O33 2013** if the book was published in 2013. This whole combination becomes the Call number which is attached to the spine of the book. It is with the call number that a book is called up or located on the shelf.

How to Find Books on the Shelf

After checking the card catalogue cabinet or the online public access catalogue (OPAC), whichever is applicable, a user then goes to the shelves to locate the book using the skill demonstrated below:

QD
33.2
.O33
2013

Read call numbers line by line.

QD

Read the first line in alphabetical order:

A, B, BF, C, D... Q, QA, QB, QC, **QD**, M, ML...

2395

Read the second line as a whole number:

1, 2, 3, 5, 20, 21, 22, 30, 31, 32, 33, **33.2**, 33.4, 40...

.033

The third line is a combination of a letter and numbers. Read the letter alphabetically. Read the number as a decimal, eg:

.O33 = .33 .O724 = .724

Some call numbers have more than one combination letter-number line.

2013

The last line is the year the book was published. Read in chronological order:

2009, 2010, 2011, 2012, 2013...

CLASSIFICATION SCHEMES

Classification is a process of grouping information materials according to the subjects they belong to using a particular classification scheme. There are several classification schemes in use worldwide. Five different types of classification schemes will be discussed here. They are:

BLISS Bibliographic Classification (BC)

Dewey Decimal Classification (DDC)

Library of Congress Classification (LC)

Moy's Classification Scheme for Law Books (MC)

Universal Decimal Classification (UDC)

Bliss Bibliographic Classification

The Bliss Bibliographic Classification (BC) is a library classification system that was developed in 1953 by an American named Henry E. Bliss (1870–1955). The first edition was published in four volumes between 1940 and 1953. Although originally devised in the United States, it was more commonly adopted by British libraries. A second edition of the system (BC2) has been developed in Britain since 1977.

Outline of Bliss Bibliographic classification Schedules

- * 2/9 - Generalia, Phenomena, Knowledge, Information science & technology
- * A/AL - Philosophy & Logic
- * AM/AX - Mathematics, Probability, Statistics
- * AY/B - General science, Physics
- * C - Chemistry
- * D - Astronomy and earth sciences
 - o DG/DY - Earth sciences
- * E/GQ - Biological sciences
- * GR/GZ - Applied biological sciences: agriculture and ecology
- * H - Physical Anthropology, Human biology, Health sciences
- * I - Psychology & Psychiatry
- * J - Education
- * K - Society (includes Social sciences, sociology & social anthropology)
- * L/O - History (including area studies, travel and topography, and biography)
 - o LA - Archaeology

- * P - Religion, Occult, Morals and ethics
- * Q - Social welfare & Criminology
- * R - Politics&Public administration
- * S - Law
- * T - Economics&Management of economic enterprises
- * U/V - Technology and useful arts (including household management and services)
- * W - The Arts
 - o WV/WX - Music
- * X/Y - Language and literature
- * ZA/ZW - Museology

Dewey Decimal Classification

The Dewey Decimal Classification was designed and published in 1876 by Melvin Dewey. It is a system of library classification made up of ten classes, each divided into ten divisions, each having ten sections. Practically, there are only 99 of 100 divisions and 908 of 999 sections in total, as some are no longer in use or have not been assigned.

The scheme is numeric in nature, that is, it uses only numerals with decimals to form its notations. The scheme is mostly used by small libraries.

Outline of Dewey Decimal Classification Schedules

- Class 000 –099 Computer Science, Information & General Works
- Class 100 – 199 Philosophy and Psychology
- Class 200 – 299 Religion
- Class 300 – 399 Social sciences
- Class 400 –499 Language

Class 500 –599	Science
Class 600 – 699	Technology
Class 700 –799	Arts & recreation
Class 800 –899	Literature
Class 900 – 999	History & geography

The Library of Congress Classification (LCC)

This is a system of library classification developed by the Library of Congress. It is used by most research and academic libraries in the Nigeria and several other countries. The Classification Scheme was developed by Herbert Putnam in 1897, just before he assumed the librarianship of Congress. It was designed specifically for the purposes and collection of the Library of Congress to replace the fixed location system developed by Thomas Jefferson. The scheme divided the entire spectrum of knowledge into 26 classes and “A” class for general works. The classes in the scheme are published in separate schedules. It makes use of mixed notation, that is, the classes are designated with symbols or notation by letters of Alphabets A-Z, (without letters I, O, W, X, Y,) and Arabic numerals. Library of Congress Classification Scheme is used by academic libraries in Nigeria. Below is a general outline of the main classes and also a breakdown of the Library of Congress Classification Scheme.

Outline of Library of Congress Classification Schedules

- A General works
- B Philosophy, Psychology, Religion
- C History
- D History (General, Europe, Asia, Africa
- E History (North and South America)

- G Geography, Tourism, Folklore, Anthropology,
Recreation, Customs
- H Social sciences
- J Political science
- K Law
- L Education
- M Music, books on music
- N Fine arts
- P Physiology, languages, literature
PJ-PM Language and literature of Asia, Africa etc
- PQ African literature in English, juvenile
literature
- Q Science
- R Medicine
- S Agriculture
- T Technology
- TA Engineering (General)
Civil Engineering (General)
- TC Hydraulic Engineering
- TD Environmental Technology
Sanitary Engineering
- TE Highway Engineering
Roads and Pavements
- TF Railroad Engineering and Operation
- TG Bridge Engineering
- TH Building Construction
- TJ Mechanical Engineering and Machinery
- TK Electrical Engineering
Electronics
Nuclear Engineering

TL	Motor Vehicles Aeronautics Astronautics
TN	Mining Engineering Metallurgy
TP	Chemical Technology
TR	Photography
TS	Manufactures
TT	Handicrafts, Arts and Crafts
U	Military Science
V	Naval Science
Z	Bibliography, Library Science

Below is a breakdown of the Library of Congress Classes A-Z into sub classes. The breakdown is necessary because it will give a better understanding of the scheme since it the mostly used by academic institutions.

Class A- General Works

- * Subclass AC – Collections. Series. Collected works
- * Subclass AE – Encyclopedias
- * Subclass AG – Dictionaries and other general reference works
- * Subclass AI – Indexes
- * Subclass AM – Museums. Collectors and collecting
- * Subclass AN – Newspapers
- * Subclass AP – Periodicals
- * Subclass AS – Academies and learned societies
- * Subclass AY – Yearbooks. Almanacs. Directories
- * Subclass AZ – History of scholarship and learning. The humanities

Class B – Philosophy, Psychology, Religion

- * Subclass B – Philosophy (General)
- * Subclass BC – Logic
- * Subclass BD – Speculative philosophy
- * Subclass BF – Psychology
- * Subclass BH – Aesthetics
- * Subclass BJ – Ethics
- * Subclass BL – Religions. Mythology. Rationalism
- * Subclass BM – Judaism
- * Subclass BP – Islam. Bahaim. Theosophy, etc.
- * Subclass BQ – Buddhism
- * Subclass BR – Christianity
- * Subclass BS – The Bible
- * Subclass BT – Doctrinal Theology
- * Subclass BV – Practical Theology
- * Subclass BX – Christian Denominations

Class C – Auxiliary Sciences of History

- * Subclass CB – History of Civilization
- * Subclass CC – Archaeology
- * Subclass CD – Diplomatics. Archives. Seals
- * Subclass CE – Technical Chronology. Calendar
- * Subclass CJ – Numismatics
- * Subclass CN – Inscriptions. Epigraphy
- * Subclass CR – Heraldry
- * Subclass CS – Genealogy
- * Subclass CT – Biography

Class D – World History (except American History)

- * Subclass D – History (General)

- * Subclass DA – Great Britain
- * Subclass DAW – Central Europe
- * Subclass DB – Austria – Liechtenstein – Hungary – Czechoslovakia
- * Subclass DC – France – Andorra – Monaco
- * Subclass DD – Germany
- * Subclass DE – Greco-Roman World
- * Subclass DF – Greece
- * Subclass DG – Italy – Malta
- * Subclass DH – Low Countries – Benelux Countries
- * Subclass DJ – Netherlands (Holland)
- * Subclass DJK – Eastern Europe (General)
- * Subclass DK – Russia, Soviet Union, Former Soviet Republics – Poland
- * Subclass DL – Northern Europe, Scandinavia
- * Subclass DP – Spain – Portugal
- * Subclass DQ – Switzerland
- * Subclass DR – Balkan Peninsula
- * Subclass DS – Asia
- * Subclass DT – Africa
- * Subclass DU – Oceania (South Seas)
- * Subclass DX – Gypsies

Class E – American History

Class F – Local History of the United States and British, Dutch, French, and Latin America

Class G – Geography, Anthropology, Recreation

- * Subclass G – Geography (General). Atlases. Maps
- * Subclass GA – Mathematical geography. Cartography

- * Subclass GB – Physical geography
- * Subclass GC – Oceanography
- * Subclass GE – Environmental Sciences
- * Subclass GF – Human ecology. Anthropogeography
- * Subclass GN – Anthropology
- * Subclass GR – Folklore
- * Subclass GT – Manners and customs (General)
- * Subclass GV – Recreation. Leisure

Class H – Social Sciences

- * Subclass H – Social sciences (General)
- * Subclass HA – Statistics
- * Subclass HB – Economic theory. Demography
- * Subclass HC – Economic history and conditions
- * Subclass HD – Industries. Land use. Labor
- * Subclass HE – Transportation and communications
- * Subclass HF – Commerce
- * Subclass HG – Finance
- * Subclass HJ – Public finance
- * Subclass HM – Sociology (General)
- * Subclass HN – Social history and conditions. Social problems. Social reform
- * Subclass HQ – The family. Marriage. Women
- * Subclass HS – Societies: secret, benevolent, etc.
- * Subclass HT – Communities. Classes. Races
- * Subclass HV – Social pathology. Social and public welfare. Criminology
- * Subclass HX – Socialism. Communism. Anarchism

Class J – Political Science

- * Subclass J – General legislative and executive papers

- * Subclass JA – Political science (General)
- * Subclass JC – Political theory
- * Subclass JF – Political institutions and public administration
- * Subclass JJ – Political institutions and public administration (North America)
- * Subclass JK – Political institutions and public administration (United States)
- * Subclass JL – Political institutions and public administration (Canada, Latin America, etc.)
- * Subclass JN – Political institutions and public administration (Europe)
- * Subclass JQ – Political institutions and public administration (Asia, Africa, Australia, Pacific Area, etc.)
- * Subclass JS – Local government. Municipal government
- * Subclass JV – Colonies and colonization. Emigration and immigration. International migration
- * Subclass JX – International law, see JZ and KZ (obsolete)
- * Subclass JZ – International relations

Class K – Law

- * Subclass K – Law in general. Comparative and uniform law. Jurisprudence
- * Subclass KB – Religious law in general. Comparative religious law. Jurisprudence
- * Subclass KBM – Jewish law
- * Subclass KBP – Islamic law

- * Subclass KBR – History of canon law
- * Subclass KBS – Canon law of Eastern churches
- * Subclass KBT – Canon law of Eastern Rite Churches in Communion with the Holy See of Rome
- * Subclass KBU – Law of the Roman Catholic Church. The Holy See
- * Subclasses – KD/KDK - United Kingdom and Ireland
- * Subclass KDZ – America. North America
- * Subclass KE – Canada
- * Subclass KF – United States
- * Subclass KG – Latin America – Mexico and Central America – West Indies. Caribbean area
- * Subclass KH – South America
- * Subclasses KJ-KKZ – Europe
- * Subclasses KL-KWX – Asia and Eurasia, Africa, Pacific Area, and Antarctica
- * Subclass KU/KUQ - Law of Australia and New Zealand
- * Subclass KZ – Law of nations

Class L – Education

- * Subclass L – Education (General)
- * Subclass LA – History of education
- * Subclass LB – Theory and practice of education
- * Subclass LC – Special aspects of education
- * Subclass LD – Individual institutions – United States
- * Subclass LE – Individual institutions – America (except United States)
- * Subclass LF – Individual institutions – Europe
- * Subclass LG – Individual institutions – Asia, Africa,

Indian Ocean islands, Australia, New Zealand, Pacific islands

- * Subclass LH – College and school magazines and papers
- * Subclass LJ – Student fraternities and societies, United States
- * Subclass LT – Textbooks

Class M – Music

- * Subclass M – Music
- * Subclass ML – Literature on music
- * Subclass MT – Instruction and study

Class N – Fine Arts

- * Subclass N – Visual arts
- * Subclass NA – Architecture
- * Subclass NB – Sculpture
- * Subclass NC – Drawing, Design, Illustration
- * Subclass ND – Painting
- * Subclass NE – Print media
- * Subclass NK – Decorative arts
- * Subclass NX – Arts in general

Class P – Language and Literature

- * Subclass P – Philology, Linguistics
- * Subclass PA – Greek language and literature, Latin language and literature
- * Subclass PB – Modern languages, Celtic languages
- * Subclass PC – Romanic languages
- * Subclass PD – Germanic languages, Scandinavian languages

- * Subclass PE – English language
- * Subclass PF – West Germanic languages
- * Subclass PG – Slavic languages and literatures. Baltic languages. Albanian language
- * Subclass PH – Uralic languages. Basque language
- * Subclass PJ – Oriental languages and literatures
- * Subclass PK – Indo-Iranian languages and literatures
- * Subclass PL – Languages and literatures of Eastern Asia, Africa, Oceania
- * Subclass PM – Hyperborean, Native American, and artificial languages
- * Subclass PN – Literature (General)
- * Subclass PQ – French literature – Italian literature – Spanish literature – Portuguese literature
- * Subclass PR – English literature
- * Subclass PS – American literature
- * Subclass PT – German literature – Dutch literature – Flemish literature since 1830 – Afrikaans literature – Scandinavian literature – Old Norse literature: Old Icelandic and Old Norwegian – Modern Icelandic literature – Faroese literature – Danish literature – Norwegian literature – Swedish literature
- * Subclass PZ – Fiction and juvenile belles lettres

Class Q – Science

- * Subclass Q – Science (General)
- * Subclass QA – Mathematics
- * Subclass QB – Astronomy
- * Subclass QC – Physics
- * Subclass QD – Chemistry

- * Subclass QE – Geology
- * Subclass QH – Natural history – Biology
- * Subclass QK – Botany
- * Subclass QL – Zoology
- * Subclass QM – Human anatomy
- * Subclass QP – Physiology
- * Subclass QR – Microbiology

Class R – Medicine

- * Subclass R – Medicine (General)
- * Subclass RA – Public aspects of medicine
- * Subclass RB – Pathology
- * Subclass RC – Internal medicine
- * Subclass RD – Surgery
- * Subclass RE – Ophthalmology
- * Subclass RF – Otorhinolaryngology
- * Subclass RG – Gynecology and Obstetrics
- * Subclass RJ – Pediatrics
- * Subclass RK – Dentistry
- * Subclass RL – Dermatology
- * Subclass RM – Therapeutics. Pharmacology
- * Subclass RS – Pharmacy and materia medica
- * Subclass RT – Nursing
- * Subclass RV – Botanic, Thomsonian, and Eclectic medicine
- * Subclass RX – Homeopathy
- * Subclass RZ – Other systems of medicine

Class S – Agriculture

- * Subclass S – Agriculture (General)
- * Subclass SB – Horticulture. Plant propagation. Plant

breeding

- * Subclass SD – Forestry. Arboriculture. Silviculture
- * Subclass SF – Animal husbandry. Animal science
- * Subclass SH – Aquaculture. Fisheries. Angling
- * Subclass SK – Hunting

Class T – Technology

- * Subclass T – Technology (General)
- * Subclass TA – Engineering Civil engineering (General).
- * Subclass TC – Hydraulic engineering. Ocean engineering
- * Subclass TD – Environmental technology. Sanitary engineering
- * Subclass TE – Highway engineering. Roads and pavements
- * Subclass TF – Railroad engineering and operation
- * Subclass TG – Bridges
- * Subclass TH – Building construction
- * Subclass TJ – Mechanical engineering and machinery
- * Subclass TK – Electrical engineering. Electronics. Nuclear engineering
- * Subclass TL – Motor vehicles. Aeronautics. Astronautics
- * Subclass TN – Mining engineering. Metallurgy
- * Subclass TP – Chemical technology
- * Subclass TR – Photography
- * Subclass TS – Manufacturing engineering. Mass production
- * Subclass TT – Handicrafts. Arts and crafts
- * Subclass TX – Home economics

Class U – Military Science

- * Subclass U – Military science (General)
- * Subclass UA – Armies: Organization, distribution, military situation
- * Subclass UB – Military administration
- * Subclass UC – Military maintenance and transportation
- * Subclass UD – Infantry
- * Subclass UE – Cavalry. Armor
- * Subclass UF – Artillery
- * Subclass UG – Military engineering. Air forces
- * Subclass UH – Other military services

Class V – Naval Science

- * Subclass V – Naval science (General)
- * Subclass VA – Navies: Organization, distribution, naval situation
- * Subclass VB – Naval administration
- * Subclass VC – Naval maintenance
- * Subclass VD – Naval seamen
- * Subclass VE – Marines
- * Subclass VF – Naval ordnance
- * Subclass VG – Minor services of navies
- * Subclass VK – Navigation. Merchant marine
- * Subclass VM – Naval architecture. Shipbuilding. Marine engineering

Class Z – Bibliography, Library Science

- * Subclass Z – Books (General). Writing. Paleography. Book industries and trade. Libraries. Bibliography
- * Subclass ZA – Information resources (General)

Moys Classification Scheme

This classification scheme was designed by Elizabeth Mary Moys (1992-2002). It is alphanumeric and can cater for emerging subject areas in law. The scheme is designed to fit into a library that utilizes Library of Congress Classification (LCC). The main reason for this is that LCC had not fully developed the K class (the class for Law) at the time when the Moys system was developed. In addition, LCC is the main classification system used in academic libraries. This is why the scheme adopted the same notation style used in the LCC Class K. The subclasses and enumeration are very different in the two systems, though. As with LCC, a set of numbers follows the class letters to indicate specific subject areas (however there is notably less use of decimal points in the Moys system than in LCC).

Outline of Moys Classification Schedules

Class K	Journals and reference books
Class KA	Jurisprudence
Class KB	General and comparative law
Class KC	International law
Class KD	Religion legal system
Class KE	Ancient and medieval law
Class KF	Common law, primary materials, British Isles
Class KG	Common law, primary materials, America
Class KH	Common law, primary materials, Australasia
Class KL	Common law, treaties, general
Class KM	Common law, treaties, public law
Class KN	Common law, treaties, private law
Class KP	Preferred jurisdiction
Class KR	Africa

Class KS	Latin America
Class KT	Asia and Pacific
Class KV	Europe
Class KW	European community law
Class KZ	Non-legal subjects

Universal Decimal Classification Scheme

The Universal Decimal Classification (UDC) was developed in the 19th century by the Belgian bibliographers Paul Otlet and Henri La Fontaine. It is a bibliographic and library classification which provides a systematic arrangement of all branches of subjects. They are organized in a manner in which knowledge fields are related and inter-linked.

Outline of Universal Decimal Classification Schedules

- 000 Prolegomena. Fundamentals of knowledge and culture. Propaedeutics
- 001 Science and knowledge in general. Organization of intellectual work
- 002 Documentation. Books. Writings. Authorship
- 003 Writing systems and scripts
- 004 Computer science and technology. Computing
 - 004.2 Computer architecture
 - 004.3 Computer hardware
 - 004.4 Software
 - 004.5 Human-computer interaction
 - 004.6 Data
 - 004.7 Computer communication
 - 004.8 Artificial intelligence
 - 004.9 Application-oriented computer-based techniques
- 005 Management

- 005.1 Management Theory
- 005.2 Management agents. Mechanisms. Measures
- 005.3 Management activities
- 005.5 Management operations. Direction
- 005.6 Quality management. Total quality management (TQM)
- 005.7 Organizational management (OM)
- 005.9 Fields of management
- 005.92 Records management
- 005.93 Plant management. Physical resources management
- 005.94 Knowledge management
- 005.95/96 Personnel management. Human Resources management
- 006 Standardization of products, operations, weights, measures and time
- 007 Activity and organizing. Information.
Communication and control theory generally (cybernetics)
- 008 Civilization. Culture. Progress
- 01 Bibliography and bibliographies. Catalogues
- 02 Librarianship
- 030 General reference works (as subject)
- 050 Serial publications, periodicals (as subject)
- 06 Organizations of a general nature
- 069 Museums
- 070 Newspapers (as subject). The Press. Outline of journalism
- 08 Polygraphies. Collective works (as subject)
- 09 Manuscripts, Rare and remarkable works (as subject)

Chapter Eight

REFERENCE MATERIALS

A reference material is a good starting point when looking for information and definitions. Reference materials include dictionaries, encyclopaedia, bibliographies, maps and atlases, yearbooks, handbooks and manuals, directories etc. Reference materials are those items most likely to be useful in answering reference questions. For this reason, they are often held by libraries as resources which are either non-circulating or circulating under strict limitations, depending on the policy of the library. A brief outline of the most common types of reference materials is presented below:

i. Almanac

The almanac is a yearly publication that gives information about specific facts, statistical data, tables of comparative information, and organized lists of basic reference information related to people, places, events, etc.

ii. Atlases

Atlases contain an organized group of physical, political, road, and/or thematic maps.

iii. Bibliographies

Bibliographies contain one or more lists of resources and materials sharing some common attribute such as location, publishing date, subject, etc. A good bibliography should include all pertinent bibliographic data.

iv. Dictionaries

Dictionaries contain words of a given language and other information such as their origin, pronunciation, and definitions.

v. Directories

It is a book containing list of information about people and/or organization of some type. Other information such as addresses, phone numbers, email addresses, etc.

vi. Handbook

This is a book that contains an abundance of information related to a particular subject. This is one type of reference material that needs to be circulating in order to serve the user well.

vii. Indexes

Indexes contain information necessary for locating information in a given specific item or a type of resource. They help to locate information in periodicals, anthologies, newspapers, etc.

viii. Encyclopedia, General

Encyclopedias contain an alphabetically arranged listing of a broad range of subjects with basic and specific information for each entry. General encyclopedias provide a good basis for the beginning stages of research. They are also helpful resources for ready reference questions.

Encyclopedia, Subject

These contain the same type of information and organized like a general encyclopedia. The entries are limited to those that fall within the subject encyclopedia's scope of coverage.

ix. Manual

This is a book that deals with details of how something is done: e.g. Manual on Clinical Procedures.

x. Gazette

The gazette is an official document containing important information about decisions that have been made by the government.

xi. Yearbook

The year book is a yearly publication that gives details of happenings and occurrences in the previous year.

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Section II

STUDY SKILLS

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Chapter Nine

STUDY SKILLS

Study skills are a set of skills and learning tactics that aid students in organizing, processing, and utilizing information successfully. Students usually fail at learning, not because they lack the capacity, but because they do not have enough know-how in areas like planning and organizing, reading and writing skills and examination technique.

Indications that students need help in developing study skills include spending too much time studying, taking class notes that are hard to understand or have the wrong information, deferring large projects or tasks, inability to identify what is essential in a text, or inability to remember what they have read. Adequate familiarity with and practice of study skills helps students to study faster, smarter and longer, answer exams with confidence, and study for exams more effectively, fight boredom, increase their rate of success and live a better school and university life.

RELEVANT STUDY SKILLS

As stated above, studying involves set of skills that must be practiced and mastered. Some of these skills include:

- a. Planning and Organizing
- b. Note Taking Skills
- c. Reading Skills

- d. Examination Technique
- e.
- a. **Planning and Organizing**
 - i. **Set goals:** Set precise and clearly defined goals, which are **realistic and practicable**. Examine your present circumstances and decide what you need to achieve your target. Also have an alternative to achieve your goal in case you have to change your plans.
 - ii. **Make priorities:** identify tasks that are pressing and important and focus on them. Sort tasks out in order of priority, and then dedicate the most time to the most important tasks. Avoid focusing on the simple, easy tasks or allowing too many interruptions to your work.
 - iii. **Break tasks down into steps:** Break tasks down into steps so as to accomplish them one step at a time. Try to complete one task before moving to the next. Review your progress towards your goals as often as you can, and revise your plans as appropriate to take account of unexpected changes.
 - iv. **Avoid Procrastination:** Do not put off the things that you should be doing at present till a later time.
 - v. **Deal with stress:** Formulate **effective strategies to deal with pressure**. For example, taking exercise, relaxation techniques, sharing problems with friends, working with a group (tutorial groups), etc.

- vi. **Positive Attitude: Learn how to take a positive attitude especially when** things are not working out. Do not be afraid of making mistakes, but learn from them.

b. Reading Skills

- i. **Have clear reading goals:** this will considerably increase your reading effectively. Not everything in print will be of use to you at each point in time. Use reading goals to choose and prioritize information in line with the task in hand.
- ii. **Allocate daily reading time:** Daily allocate a particular time for reading and revisions of what you did in class during the day.
- iii. **Find a place to read where you can concentrate:** Choose a place that is quiet, where there will be few distractions from radio, TV or other noises. There should be good natural or artificial light, sufficient heating and ventilation, a comfortable chair and enough table space to work on.
- iv. **Take regular breaks from reading:** take a break whenever you are getting bored or tired.
- v. **Evaluate your reading habits:** identify areas where you need to improve. Do you "say" the words you're reading? Do unfamiliar words slow down your speed and understanding? Do you read every word?
- vi. **Use your eyes efficiently:** do not read aloud, or re-read unnecessarily. Read phrases and not every

single word. If you cannot see well, make sure your eyes are by a professional

vii. **Increase your vocabulary:** keep a dictionary near you when reading, make a list of new words, and use the dictionary to find out the meaning and the origin of words.

viii. **Match your speed to what you are reading:** Note that studying needs closer, slower reading, while leisure does not.

ix. **Improve your reading speed:** Practice for about 15 to 30 minutes each day, checking your rate in words-per-minute. Check your comprehension by summarizing what you read. Ideally, you want to read faster while maintaining your understanding. Therefore, use the same type of materials each time you practice to provide the consistency needed for meaningful practice.

x. **Use reading strategies:** You may also use reading strategies to improve your reading skills. The commonest types of reading strategies are the **SQ3R** and **SQ4R**. SQ3R stands for **survey, question, read, recall and review** while SQ4R stands for **survey, question, read, recite, review and reflect**.

c. **Note Taking Skills**

i. Attend lectures regularly.

ii. Keep the notes for one class separate from other classes.

iii. **Make sure to take clear notes.** Concentrate on main ideas, themes, and concepts, and take down

facts, examples, illustrations, or methods that will help you to remember the main point(s) of the lecture.

- iv. Review your notes immediately after the class. At this time you can modify, organize, add, delete, summarize, or clarify misunderstandings.
- v. Use consistent, understandable abbreviations whenever possible.
- vi. Leave spaces for words, ideas, or dates that you didn't catch but can fill in later.
- vii. Put question marks in the margin of your notebook to indicate where you need to do further research, either on your own or by seeking help from the lecturer or other classmates.

d. Examination Techniques

- i. Make sure you take enough sleep and are well rested before examinations
- ii. Make sure you have all the items needed for the examination before entering the hall e.g. spare pens and pencils, sharpeners, erasers, calculators, etc.
- iii. Read the instructions carefully in order to avoid answering the wrong question or misunderstanding what is required.
- iv. Gauge the time you should allocate to each question based on the length of the exam and the marks allocated to each question in order avoid spending too much time on less important questions. It is better to begin with the questions

- you know best so as to build your confidence.
- v. Read the questions carefully so as to understand the *meaning* of the questions. Make sure to pay attention to significant words and phrases.
 - vi. Do not be in a hurry to write. Plan your answers, in line with the how the question is framed.
 - vii. Write legibly. Students often lose marks because the examiner is unable to read their answers.
 - viii. Attempt all required questions. If you need to answer four questions in an exam, and you only answering three automatically reduces your maximum possible mark. Make sure your answers are clear and to the point.
 - ix. Put emphasis on important points. Using diagrams to highlighting important points can help to save time and in some cases, is more appropriate than words alone.
 - x. In case you find yourself going blank, do not panic. Stop writing, breathe deeply, try to relax, and after some time, gather your thoughts and try again.
 - xi. Leave enough time to read over your answers and to check for grammatical errors and spelling or other mistakes.

Chapter Ten

REFERENCING AND BIBLIOGRAPHIC CITATIONS

Referencing is the practice of acknowledging the intellectual work of others whenever a researcher uses such work in his or her research or when students use it in their assignments. Students in institutions of higher learning are expected to engage in vigorous research, and such vigorous research will include the examination of the ideas and theories, models and practices that already exist in the field in which the research is being conducted. Such ideas taken from the works of other people are expected to be referenced or cited. Similarly, when students present their long essays or dissertations at undergraduate and postgraduate levels, such referencing is a crucial aspect of such presentations.

Referencing research work or assignments is made mandatory in institutions of higher learning. Each institution has developed its own rules regarding the conduct of citations and referencing, referencing styles to be used, when and how to reference and the implications of non-compliance with these rules. However, there are some referencing principles that are common to all institutions. This chapter will examine these principles, and also some referencing styles that are generally used.

THE PRINCIPLES OF REFERENCING

According to Colin Neville (2010), the practice of referencing is based on five main principles:

1. The Principle of Intellectual Property:

This means that when referencing, the researcher must bear in mind that the intellectual output and hard work of the writers consulted in his/her work must be appropriately acknowledged.

2. The Principle of Access:

Referencing must be such that it enables the readers of his/her work to easily and quickly locate the documents reference was made to in the work. This helps the reader to use the same sources in his own work and also facilitates the spread of knowledge.

3. The Principle of Economy:

When referencing, as much information as necessary about the various materials used in the research must be given. This is to help users of the work locate the materials as well as reduce lengthy explanations in the work and speed up the process of reading it.

4. The Principle of Standardization:

This refers to the need to maintain a uniform, easily recognizable standard when referencing, in order to facilitate easy access to the works that were referenced. For this purpose, various referencing styles have been formulated for the different fields of knowledge e.g. the APA Reference Style (American Psychological Association) for the Social Sciences and the MLA Reference Style (Modern Language Association) for the Humanities.

5. The Principle of Transparency:

This refers to the need for clarity in the terms and expressions used in citing the works used. For example, when abbreviating, easily understood terms should be used e.g. the use of “*ed.*” as abbreviation for “*editor*” or “*edited*”.

THE IMPORTANCE OF REFERENCING

Referencing is important for a variety of reasons:

1. Referencing helps to trace the origin of ideas and place them within their proper historical, cultural, and geographical context. Knowing the origin of ideas helps to understand what informed their formulation, and this helps in making appropriate use of them. Thus a student may discover that an idea postulated by a particular writer have become obsolete, having been overtaken by subsequent discoveries in the particular field. As students progress in their studies and come against conflicting claims by reputed authors, they soon realize that ideas postulated by these authors are not infallible simply because they are printed. They learn to challenge ideas, look for flaws in arguments and for exceptions to general rules.
2. Referencing helps to build a web of ideas. A student conducting research in a particular field of knowledge should realize that others have worked, to a greater or lesser extent in that field. Referencing helps to build a framework of the ideas that already exist in the field and this can then be used as the foundations for the student's research.

3. It helps students to formulate their own ideas. After consulting, examining and comparing ideas postulated by different authors in the field of research, the student is able to formulate his own arguments, opinions and ideas, which may be in agreement or disagreement with established ideas.
4. It helps to distinguish the student's ideas from that of someone else: readers know what idea is yours and what idea is another person's.
5. It helps to cite different points of view and this adds depth to the student's work.
6. It helps to emphasize an opinion, an argument or an idea that you agree or disagree with.
7. It helps to highlight a point by quoting the original source.
8. It helps to integrate all the relevant information used for the student's work by assessing, comparing, contrasting or evaluating it, and this shows that the student understands the topic being researched.
9. It provides validity for arguments presented in the students work. A student must present reliable evidence in the form of facts, definition, statistics and other data to support their arguments. Referencing the sources of these supporting data validates them and also helps tutors and other users of the work to check for themselves the validity of the arguments, their relevance and originality to the subject being discussed.

10. It informs people of the scope and depth of the research that accompanied the work being referenced. It is a reflection of the variety, width and depth of the sources, ideas, arguments and opinions consulted to arrive at the conclusion being presented. This serves to further reinforce the conclusion arrived at as it shows that it is a result of careful and in depth research.
11. It gives tutors and other users of the work the opportunity to expand their own knowledge by leading them to the various resources used by the student for his work, giving them the opportunity to use this information for their own purposes.
12. It serves as an acknowledgement and appreciation of the intellectual efforts of others. Most times, authors of works consulted in any research have spent time, energy and resources in researching, preparing and making them available for use by others by putting it in the public domain. Referencing their work is an acknowledgement that the user is indebted to these authors.
13. It prevents violation of ownership rights of authors of the ideas used in the work. Using someone's work or ideas without giving credit to the original authors of the idea amounts to a violation of the author's ownership of the idea. Sometimes, violation of these rights is a punishable offence under copyright laws.
14. It gives a reflection of the ideas that influenced your arguments and conclusions. Tutors in grading a student's papers, are interested in knowing the ideas that shaped or

influenced his arguments and conclusions. This influences how the work is graded by the tutor.

15. It is a requirement for grading a student's work, i.e. presentation of the sources of the ideas and arguments contained in a work or assignment is an important aspect of the grading process. As a matter of fact, some tutors will award mark not only for the presentation of references used in a work, but also for their accurate and correct presentation in line with requisite referencing styles used by the department or in the institution.
16. It helps to avoid plagiarism. When a student uses the work of another in his research and does not acknowledge the original author, he is said to have plagiarized the author's work. Charges of plagiarism in an academic work are serious indeed and in most institutions of learning, they attract dire sanctions, including suspension and outright expulsion. The subject of plagiarism has been comprehensively discussed in another chapter of this book.

What information should be referenced?

Not all information used in a research must be referenced. The information that should be referenced is that which has been presented by their respective authors in the public domain in the form of writings, recordings, films, and so on. The information being referenced must be such that can be located, read, heard or seen by another person who wants to find the same source. For example, a personal telephone conversation may be used in research work, but may not be referenced. The list of information

that can be referenced includes the following:

1. Books. These may be books written by one author, books written by more than one author, or an edited book with contributions from several authors.
2. Legal documents.
3. Journal articles.
4. Newspaper articles.
5. Reports of various kinds: these may be official reports from government departments, a university working paper, etc.
6. Learned papers presented at conferences and seminars.
7. Notes supplied by a tutor or lecturer.
8. Internet sources, for example, weblogs, email correspondence, etc.
9. DVD and CD databases.
10. Radio, television, video/audio cassettes, CDROMS.
11. Cinema films, theatre plays, and other creative productions.
12. Illustrations..
13. Works of art and designs

Criteria for Choosing Sources to be used for Research

When choosing the sources to be used for a particular research or work, one must consider how reliable the particular source being used is. This is what gives credence, authority and support to the research being done. To ensure that the source being used is reliable, certain things must be considered:

*** Relevance and bias**

In doing this certain points must be considered:

- * To what extent is the source relevant to the work

being done?

- * Does the source give a comprehensive and in depth view of the subject or does it give a partial and restricted view?
- * Is the language used balanced and objective?
- * Does the author treat arguments of other authors that oppose his view with respect? If not, why?

* **Currency of the source**

- * When was the source originally published?
- * Has the author changed or revised his views since the date of the original source? If so, when, why and how?
- * Does the author's view agree with that of other authors in the field who hold the same position as the author?

* **Accuracy**

In considering the accuracy of the source, its authority must be considered. Points to consider include;

- * The credibility of the source i.e. is it from a peer reviewed journal or a reputable publisher?
- * Do other authors in the field of knowledge make reference to that particular source?
- * Do you consider the source credible in the light of what you know about that field of knowledge?

* **Coverage**

- * **Are these topics successfully addressed, with clearly presented arguments and adequate support to substantiate them?**
- * Is the target audience identified and appropriate for your needs?

When to Reference

These following are instances when information used in a work must be referenced:

1. When tables, statistics, diagrams, photographs or other illustrations are included in an assignment or research work.
2. When theories, models or practices associated with a particular author are used in an assignment.
3. When direct quotations or definitions are used in an assignment.
4. When paraphrasing another person's work that is outside the realm of common knowledge.
5. To give weight or credibility to an argument presented in an assignment or research work.
6. When emphasizing a particular theory, model or practice that has found a measure of agreement among, or supported by several authors.

When not to Reference

The following are instances where information used in research work should not be referenced:

1. When presenting historical overviews:

When you use information drawn from a variety of sources to summarize what has happened over a period of time, and the information is not likely to be disputed, there is no need to reference these sources. An example is a presentation of the historical overview of military rule in Nigeria. However, if you are using just one source to give the historical overview, the source must be referenced.

2. When presenting your own experiences

There is no need to reference your own experiences and personal observations that are used in your assignment or research work, although it should be clearly indicated that they are your personal experiences and observations.

3. When presenting an information that you have already referenced

When repeating an idea or information that you have earlier presented in your work and have referenced, you do not need to reference it again.

4. When presenting summaries and conclusions

A lot of times, assignments or research work contain a summary or conclusion of the work that has been done. There is no need to reference the summary or conclusion again as the main work has already been referenced. The exception is where you are using the conclusion to introduce a new idea or point of view not previously contained in the main work and you are using a particular source to emphasize or support that new point of view, the source should be referenced.

5. When presenting an information that is common knowledge

When particular information is such that is commonly accepted by the general public it does not need to be referenced. The information must contain a generally undisputed fact that is not restricted by copyright and your statement of the information is not

likely to be significantly disagreed with. For example, that Chinua Achebe is a writer is common knowledge in Nigeria and does not need to be referenced. Common knowledge is of two types i.e. common knowledge that is in the public domain and common knowledge that is in a particular subject area or discipline. For example, the birth and death dates of public figures, (e.g. Nelson Mandela), or generally accepted dates of military, political, literary and other historical events is common knowledge that is in the public domain, while the process of photosynthesis, or osmosis is common knowledge within the field of biology.

Differences between Citation, References and Bibliography

The terms citation, references and bibliography are sometimes used interchangeably. However, although they are all methods referencing, they are different from each other, used for different purposes. Their placement in the research work is also different from each other. There are usually two aspects of referencing, i.e. the **in-text reference** and the **end-of-the text reference**. The in-text reference is located within the body of the work and it points out that a section of the research work was drawn or taken from another source, while the end of text reference is usually placed at the end of the document and consists of a list of all the works consulted during the course of the research. Another name for in text reference is citation while end of text reference can either be an end note, a reference list or a bibliography.

1. Citation

A citation is a quick note inserted in the body of your research work that shows that a quotation, paraphrase or summary included in your work is the idea of a third party. Citations or In-text referencing are usually of three types;

- i. The Author Date Citation
- ii. The Footnote Citation
- iii. The Numeric Citation

i. Author Date Citation:

The author date citations are made by stating the surname of the author followed the year of publication in parenthesis before or after the quotation, the summary or the paraphrase. See the examples below:

Example 1:

According to Neville, (2010)

"The basic principle of referencing is to support and identify the evidence you use in your assignments"

Example 2:

By referencing, the writer's primary aim is to direct readers to the source of the evidence used for his or her work, either through the inclusion of the name of the source, or an identification number in the body of the work. (Neville, 2010).

The first example above is a direct quotation. In it the writer placed the citation before the quotation, although he could place it after the quotation, as may be convenient and fitting for the structure of the work. In the second example which is a summary, the citation is placed after the summary of the idea.

ii. Footnote Citation:

A footnote is a notation used to mark places where the work of another author has been used in your research. It is usually put at the foot or bottom of the page with additional markers placed within the page showing where each footnote is located. Footnotes are usually numbered consecutively throughout the body of the research work. They include the information required in references and bibliography depending on the referencing manual style used. See the example below:

-
1. Neville, C., *The Complete Guide to Referencing and Avoiding Plagiarism* (England: Open University Press: 2010), 194
 2. Waterhouse, B., *Art of Referencing* (New York: Routledge: 2010), 25.

iii. Numeric Citation:

The numeric citation is similar to the footnote to the extent that it places markers (which show the places where the work of another author has been used), in form of bracketed numbers within the body of the work. However, the citation which the numerical markers refer to is not placed at the foot of the page as is done in a footnote. Instead they appear in the reference list at the end of the document, in the order in which they are placed in the body of the work. The reference list of a numerical citation is not arranged in an alphabetical order according to the surname of the authors, as is usually done in references. Rather, it is arranged

according to the numerical order in which they appeared in the body of the work. See the example below:

Example 1:

By referencing, the writer's primary aim is to direct readers to the source of the evidence used for his or her work.[1] either through the inclusion of the name of the source, or an identification number in the body of the work.[2]

References

1. Neville, C., *The Complete Guide to Referencing and Avoiding Plagiarism* (England: Open University Press: 2010), 194
2. Waterhouse, B., *Art of Referencing* (New York: Routledge: 2010), 25.

2. References

A reference is a list at the end of a research work, which show all the works cited by the writer in his or her research. It usually contains the surname and initials of the author of the cited work, the title of the cited work, the year of publication, the edition statement (i.e. whether it's a second, third or other edition), the name of publishers, the place of publication, and the pages the pages on which the information used can be found. A reference is usually arranged in alphabetical order and left unnumbered, except when being used for a numerical citation. See the example below:

Example:

References

- Spatt, B. (1999). *Writing from sources* (5th ed.) New York: St. Martin's Press, pp. 98 119; 364 371.

Neville, C., (2010). *The complete guide to referencing and avoiding plagiarism* (2nd ed.) England: Open University Press, pp.194.

Waterhouse, B. (2010). *Art of referencing*, New York: Rutledge, pp. 25

Works contained in a reference list are usually arranged in alphabetical order according to the surname of the authors. A reference list usually follows a specific reference style e.g. APA, MLA, etc., and this determines the order in which all the information listed above will be arranged.

3. **Bibliography**

A bibliography is similar to a reference, but is much broader. While a reference is a list of all the works cited in the research, a bibliography is a list of all the works consulted in making the research, whether such work is cited or not cited. Bibliography is useful in pointing readers to other materials that can be consulted in order to gain a broader view of the ideas that were discussed in a research. A bibliography contains the same information a reference and is arranged in the same way.

4. **Endnote**

An endnote is a reference, explanation, or comment placed at the end of an article, chapter, or book. An endnote has the same characteristics as a footnote, the difference being that it is not located at the foot of the page like a footnote, but rather at either the end of the chapter or the end of the book itself.

Hanging Indents

It must be noted that most of the reference styles whether APA, MLA, Chicago, etc. use a special style known as hanging indents in their bibliographies and references. This is a style

whereby the first line of each paragraph is of regular length while the rest of the lines in the paragraph are indented. This applies only to bibliographies and references alone, and not to footnotes and endnotes. See the example below;

Example 1:

Neville, C., *The Complete Guide to Referencing and Avoiding Plagiarism* 2nd ed. (England: Open University Press Ltd: 2010), 194

Example 2:

Francis Robinson, ed., *Cambridge Illustrated History of the Islamic World* (Cambridge: Cambridge University Press, 1996), 250

STANDARDS FOR REFERENCING

1. Completeness:

References must contain the full details of the work being referenced, (i.e. the surname and initials of the author, the title, the year of publication, the edition, the name of the publishers, the place of publication, and the pages) such that anyone searching for the work will be able to locate it with ease.

2. Correctness:

The information provided must be accurate; otherwise readers of the work will not be able to locate it. For example if the wrong surname or initials or publisher is given in the reference, the reader will be unable to locate the work.

3. Appropriateness:

The referencing style used must be appropriate to the work.

Certain fields of knowledge have reference styles associated with them. Also institutions of higher learning usually specify the reference style to be used in each of their departments.

4. Consistency:

There must be consistency in the reference. A single reference style must be used throughout the work.

Tips on How to Reference

1. It is good to gather all of the information required to construct the reference at the time you are gathering the information or the ideas. This is particularly important when referencing an electronic source such as a website where the address or content may change at any time.
2. Always keep the reference details with the information from that source throughout your research. If the information becomes separated from the reference details it may take a very long time to sort out the confusion. Remember that quotations in particular also require a page number so that they can be validated by another person.
3. Make sure that you know which referencing style your department or lecturer requires you to use. The style required may vary between institutions, publications, departments and even between different lecturers within a department. Often marks are allocated purely for the accuracy of the referencing on an assignment. Also note that journal articles and conference papers will only be accepted for publication if the correct referencing style has been used.
4. Make sure that you know how to properly apply the referencing style required. The punctuation and font used (italic,

normal, bold) is highly important, as is the order of the details within the reference. The information required in different parts of the document, and the placement of this information, varies between styles.

5. Allow plenty of time to incorporate the references into your work and to check and double check the correctness of the information and the arrangement of the references.

Types of Referencing Styles

Types of referencing styles include:

- * Chicago (or Turabian) used in many fields
- * MLA used in the Humanities
- * APA used in the Social Sciences, Education, Engineering and Business
- * CSE used in the Biological Sciences
- * AMA used in the Biomedical Sciences, Medicine and Nursing
- * ACS for Chemistry
- * AMS for Mathematics and Computer Sciences.

Some Abbreviations Used in Referencing

There are some abbreviations used in referencing to make a research work neater especially when you are referring to the same quote, author or piece of work over and over again. They also help you to avoid having to type out the whole reference over and over again:

1. **Et al:** this is a Latin phrase "*et alia*" which means "and others" and it is used when referring to more than two writers, e.g. see Bush, Jones et al.
2. **Et seq.:** it is a Latin phrase, "*et sequentes*" which means

"and the following." It is commonly used by lawyers to include numbered lists, pages or sections after the first number is stated. For example, "the provisions guiding the conduct of Documentary Evidence are found in the Evidence Act, Section 1204, etseq."

3. **Op. cit.:** it is a Latin phrase, "*opere citato*", meaning "*in the work previously cited*". It is used in an end note or footnote to refer to an author that has been previously cited. It saves writing the full details out each time.
4. **Ibid:** is an abbreviation for the Latin "*Ibidem*" meaning "*in the same place*". It is used to refer to the same author and source (e.g., book, journal) in the immediately preceding reference i.e. when a particular author is cited consecutively, instead of writing his name over and over again, the word "Ibid." is used.
5. **q.v.:** is an abbreviation for the Latin phrase "*Quod Vide*" which means "*see this as well*". It is used to direct a reader to another part of a book or article for further detailed information.
6. **P. and pp.:** These stand for page and pages. So p. 7 and pp. 234-250 means page 7 and pages 234-250 respectively.
7. **Cf.:** This is an abbreviation for the Latin word "*confer*", which means "*bring together*" or "*compare with*". It is used to refer to other material or ideas which may provide similar or different information or arguments.

Chapter Eleven

COPYRIGHT AND ITS IMPLICATIONS

Copyright is a part of a bundle of rights known as Intellectual Property Rights. Intellectual property rights are rights conferred by law which protect properties that are not tangible (unlike properties like houses, land, clothes, jewelry, etc.), but are products of the human intellect. Conferment of intellectual property rights is based on the rationale that productivity is the keystone of success and that the primary way of encouraging productivity is by giving people the right to be compensated for their creativity. Intellectual property thus ensures certain minimum safeguards of the rights of authors over their creations, by granting its holder a legal monopoly on the use and commercial exploitation of his or her original work of authorship.

Under Nigerian intellectual property rights laws, intellectual property rights consist of Patents, Trademarks and Copyrights. Patents are grants made by the government which confer upon an inventor the sole right to make, use and sell that invention for a particular number of years. Examples of such inventions include the revolving door, yam pounder, pen with scanner, foldable bicycle etc. On the other hand, Trademark is the right granted by law to a manufacturer to make sole use of any name, symbol, figure, letter, word or mark, adopted and used by him to distinguish his or her goods from those manufactured or sold by others. Examples of trademarks include Jacuzzi, Vaseline, Kleenex, Lycra and Formica. Trademarks and patents

are usually registered with a patent and trademark office to ensure their exclusive use by the owner. The third category of rights – Copyright - is a right given by law to creators of literary, dramatic, musical and artistic works and producers of cinematograph films, broadcasts and sound recordings, to reproduce all parts of their work, distribute copies, prepare new (derivative) versions of the work, and to perform and display the work in public, to the exclusion of all others.

Before any intellectual creation can be protected by copyright, it must be fixed in a tangible medium of expression from which it can be perceived, reproduced or otherwise communicated either directly or with the aid of any machine or device. For example, an idea for a novel cannot be protected by copyright, unless the said idea has been committed into writing as a manuscript or has been published, or is in any other fixed medium. Likewise, the composition of a tune in one's head is not subject to copyright protection, the said tune must have been recorded or committed to writing as a music score.

Copyright is secured automatically upon creation of the work and putting it in a fixed medium of expression. As such, the moment an idea for a novel is committed to paper as a manuscript; it automatically falls under the protection of the copyright laws. No special registration is needed for the creator to enforce his or her rights under the copyright laws. However, registration of copyright in a particular work is evidence of ownership, in case such ownership is contested in the law courts.

There are certain circumstances under which people who are not the authors or holders of copyright to particular creative works may exercise one, some or all of the rights granted to the copyright owner.

The first instance is where a license has been obtained from the author or the copyright holder. Such license may be granted to exercise either one or a combination of some of the rights granted to the author. A good illustration can be found in the

copyright statement usually contained in published books, quoted as follows;

*“All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the publisher's **prior consent**”*

Or

*“This book is sold subject to the condition that it shall not, by way of trade or otherwise, be lent, resold, hired out, or otherwise circulated without the publisher's **prior consent** in any form of binding or cover, other than that in which it is published and without a similar condition including this condition being imposed on the subsequent purchaser”*

The “prior consent” mentioned above is usually in the form of a license granted by the holder of the copyright, or his authorized agent or representative, in most cases, a publisher, to the prospective user of the work. The grant of a license in this regard is usually based a formal agreement between the copyright holder and the person applying for the license, and also on monetary compensations.

Secondly, under the provision allowing compulsory licenses, a copyright owner's permission is not required provided that the user follows certain procedures, takes permission from the government and pays fees set by law. Such user must also pay royalties to the copyright owner from the proceeds of the sale of the work.

The third instance is where the copyrighted material has come into the public domain. Copyright in any material is usually granted for a specific number of years and at its expiration, the works come into the public domain. This means that the work

may be used for any lawful purpose, including commercial purposes, without obtaining a license from the author. This is shown in the table below.

Period for Holding Copyright

Type of Work	Period of Copyright Expiration
Literary, musical or artistic works other than photographs	<p>a. 70 years after the end of the year in which the author dies.</p> <p>b. In case of joint or multiple authors, 70 years after the end of the year in which the last author dies.</p> <p>c. In case of the government or a body corporate, 70 years after the date in which the work was first published.</p>
Cinematograph films and Photographs	50 years after the end of the year in which the work was first published
Sound recordings	50 years after the end of the year in which the recording was first made
Broadcasts	50 years after the end of the year in which the broadcast first took place.
Anonymous works	70 years from the end of the year in which the work was first published. However, if the author becomes known, the copyright expiration period will be calculated as stated in 1-4 above as may be appropriate.

The fourth instance is specified under the provision for fair dealing. The doctrine of fair dealing provides for the use of copyrighted work, including some reproduction of the work, without obtaining the copyright owner's permission, if certain conditions are met. What is usually considered is the purpose and character of the proposed use and this includes whether such use is of a commercial nature or for non-profit, educational purposes.

Thus, under the Nigerian Copyrights Act, for the proposed use to be protected by the doctrine of fair dealing, it must either be for a non-commercial purpose of research, private use, criticism or review or report of current events and this is subject to the condition that if the use is public, it shall be accompanied by an acknowledgement of the title of the work and its authorship.

In Nigeria, penalties for copyright violation range from payment of monetary compensation to the copyright owner and payment of fines to the government to prison sentence. In the United States, a person found guilty of copyright infringement may be imprisoned for up to a maximum of 10 years. In Nigeria, Copyright is protected and regulated by the Nigerian Copyrights Act, Cap C28, Laws of the Federation of Nigeria (LFN) 2004.

COPYRIGHT AND PLAGIARISM

Plagiarism has been equated with violation of copyright, whereas, they are two different concepts. Copyright infringement involves using someone else's creative work without authorization or compensation, if compensation is appropriate. Plagiarism on the other hand is using someone else's work without giving proper credit to the author.

On the surface, plagiarism and copyright both have a

great deal in common. This is because most works that can be plagiarized could also be copyrighted. In fact, many acts of plagiarisms also amount to copyright infringements. However, not all plagiarisms are copyright infringements and not all copyright infringements are plagiarisms.

Plagiarism does not have to include copyright infringement. For example, William Shakespeare's plays are not copyrighted because they are now in the public domain. Even though it would technically be legal to copy from one of those plays, it would still be plagiarism if credit is not given to Shakespeare. On the other hand it is illegal to copy sections of someone else's copyrighted work without permission, even if you give the original author credit for the work.

Copyright infringement is punishable under the law. However, an act of plagiarism is not punishable under the law except that act also amounts to copyright infringement.

What is plagiarism?

The Oxford English Dictionary defines plagiarism as

“The wrongful appropriation or purloining, and publication, as one's own. The ideas or expression of ideas... of another”

Plagiarism simply is the use of another person's work, without acknowledging them as the authors of the work; in such a manner that it looks as if you are the person who created the work. According to the University of Bradford, when using other people's work, they must be given credit for:

- * Facts that they discovered;
- * Ideas that they discussed;
- * Photographs that they took;
- * Computer codes written by them;

- * Designs or diagrams drawn by them;
- * Models built by them.

And that people who create

- * Books;
- * Websites;
- * Newspaper articles;
- * Journal articles;
- * Television programmes;

must also be given credit for the work done by them.

What plagiarism is not

The rule against plagiarism does not mean that a person cannot use the work of another author in his or her research or assignments. It only means that anytime one uses such work, there must be an indication that the work belongs to another.

Types of plagiarism

1. Copy and Paste:

This involves lifting a sentence or a significant phrase, word for word, from another person's work without using quotation marks or acknowledging the source.

2. Word Switch:

This involves taking a sentence from another's work and switching around a few words.

3. Self-Plagiarism: this occurs when one presents a previous work done by one as new work, or uses a significant portion of such work without stating that it is part of one's previous work.

4. Style Plagiarism:

Style plagiarism entails following another person's work

sentence by sentence, or paragraph by paragraph, even though none of the sentences may be exactly like the original work or arranged in the same order. In such an instance, the author's reasoning style is being copied and he must be given credit for his work.

5. Metaphor Plagiarism:

Metaphors are used to make an idea clearer. They are therefore an important part of an author's creative style. When using a metaphor that was used by another in one's work, such people must be given credit.

6. Idea Plagiarism:

When the author of a particular work expresses a creative idea or suggests a solution to a problem, the idea or solution must be clearly attributed to the author.

Other ways in which students plagiarize:

- a. By downloading a free research paper from the internet
- b. By buying a research paper from the commercial paper mill
- c. Paying someone to do the research for them
- d. Copying from classmates instead of doing their own research
- e. Faking a citation, this entails referring to a non-existent source

Reasons why students plagiarize

- a. Many students do not understand what plagiarism is
- b. Some know what plagiarism is, but do not think it is wrong

- c. Students prefer to take short cuts, especially when they already have a heavy work load. They will rather prefer to copy an assignment than do original research work.
- d. Students are faced with many choices, both academic and recreational and in most cases they prefer to choose recreation, which is more pleasurable, leaving them with little or no time to do their research.
- e. Lack of confidence in their own ability.
- f. Poor time management and planning skills
- g. Fear of failure

HOW TO AVOID PLAGIARISM

1. Paraphrase

When you find information that you need to use in your research, read it and present it in your own words. Make sure you do not present it word for word.

How to paraphrase

- a. When reading, try to understand the passage as a whole
- b. Summarize the material in such a way as to bring out the point that you want to use to illustrate your paper
- c. Use your own word to describe what the original source said

2. Cite

A citation is a quick note inserted in the body of your research work that shows that a quotation, paraphrase or summary included in your work is the idea of a third party. Citing a source is one of the ways to avoid plagiarism. When citing, you must make

sure that your method of citing conforms to that prescribed by the referencing style used by your institution or your department.

3. Quote

Using quotations is another way to avoid plagiarism. However, when quoting, you must take care to quote exactly as the paragraph or sentence appears in the original work. Quotes must be used sparingly and only when necessary. Below are some guidelines to making quotations;

When to quote:

- a. When you need to show that the authority supports the point you are making
- b. When you need to state the position or the argument that you are writing a criticism or a commentary on
- c. When you need to include a specially moving or significant language in your work
- d. To present a particularly well stated passage whose meaning would be lost or changed if paraphrased or summarized

Other ways to avoid Plagiarism

1. Get educated about plagiarism
2. Understand the benefits of citing sources
3. Make sure you understand the assignment given to you. Where you do not understand, ask questions in class. If this is not sufficient, you may meet the tutor after the class for further explanations
4. Break down the assignment into different topics and gather sufficient materials for each of the topics, such that there are a wide variety of materials to be consulted.
5. Plan and manage your time.

CONSEQUENCES OF PLAGIARISM

1. One major consequence of plagiarism is that perpetrators lose the opportunity to acquire good research and writing skills on how to evaluate sources, take careful notes, select appropriate quotations, paraphrase, and give credit to others for their ideas and words.
2. Plagiarism jeopardizes the integrity of the grading system. It is also unfair to students who do their own work.
3. Plagiarism undermines the principle of academic integrity on which the academic world is grounded. All knowledge depends on previous knowledge and academic integrity is maintained by prudently crediting others for their ideas and works.
4. Accusations of plagiarism can cause a student to fail the course or assignment and have to redo it. In extreme cases, such student maybe suspended or even expelled. Many schools suspend students for their first violation and expel them if the offence is repeated.
5. Where a professional, business person, politician, or public figure commits plagiarism, the consequences include being fired or asked to step down from their current positions, being blacklisted from getting another position, destruction of their reputation and good name, loss of public stature and loss of any subsequent meaningful political or professional career.
6. Plagiarism could also have legal repercussions. An author has the right to sue a plagiarist. Some plagiarism may also be deemed a criminal offense, possibly leading to a prison sentence.

In the case where an author sues a plagiarist, the author may be granted monetary restitution. In the case where a journalist works for a magazine, newspaper or other publisher, or even if a student is found plagiarizing in school, the offending plagiarist could have to pay monetary penalties.

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Section III

INFORMATION & COMMUNICATIONS TECHNOLOGY (ICT)

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Chapter Twelve

THE BASICS OF COMPUTER TECHNOLOGY

DEVELOPMENT OF MODERN INFORMATION TECHNOLOGY (IT)

The 20th century is seen as the information age, whereby Information Technology (IT) is the focus of everyday activities and every area of human life. IT is driven by the use of computers i.e. it is a technology that uses computers to gather, process, store, protect, and transfer or disseminate information. It involves the development, maintenance and use of computer systems, software and networks for the processing and distribution of data. With the aid of IT, computers have become an essential part of most human activities. We use computers to write letters, make calculations, take pictures, watch videos, market goods and services, and communicate with people over long distances. In modern times, it is common to use the term Information Communication Technology (ICT), because it is unimaginable to work on a computer that is not, at one point or the other connected to a network. Today's societies are being gradually transformed by the growth and development of the IT and this compulsorily requires that people acquire the requisite knowledge and competence to cope with the challenge.

What is a computer?

A computer is an electronic device that takes raw data as input from the user, processes the data using a set of instructions (known as programs), and gives out results (output), which it also saves for future use. A computer is able to process numerical and non-numerical data. It has different parts or components with each performing specific functions. These functions combine to accomplish the various tasks that the user makes the computer to perform. All computers, no matter their size or model, perform five major operations:

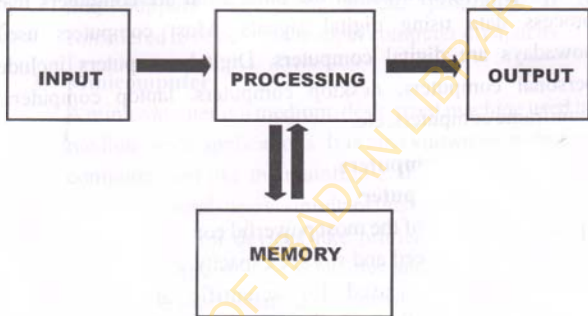
1. They accept instructions or data from the user. Such data can be in form of letters, numbers, images, sound, etc. This is known as input.
2. They store the data.
3. They process the data in the manner required by the user.
4. They give out results after processing. This is known as output.
5. Finally, they control all the operations inside themselves.

The operations listed above are controlled by three main units of the computer, namely the Control Unit (CU), the Memory Unit (MU) and the Arithmetic Logic Unit (ALU).

1. **The Control Unit (CU):** This unit supervises the process of input, output, processing and storage of data. It decides when to start receiving data, when to stop, where to store the data, etc. It takes care of the step by step processing of all operations done by the computer.
2. **The Memory Unit (MU):** This unit stores all the data and instructions inputted into the computer.
3. **The Arithmetic Logic Unit (ALU):** This unit performs all computer operations that have to do with additions,

subtractions, multiplications, divisions, logic and comparison. The ALU and the CU of the computer are jointly known as the computer's Central Processing Unit (CPU), which acts as the brain of the computer.

Below is a diagram illustrating how the computer works:



Simple illustration of how a computer functions

Computers have some advantages over traditional means of information storage, processing and retrieval. These advantages include:

1. High accuracy
2. Superior speed of operation
3. Large storage capacity
4. User-friendly features
5. Portability
6. Economical on the long term

TYPES OF COMPUTERS

Computers can be categorized into two major types, based on their functions: Analog and Digital computers. Analog computers process data using the analog signal, a continuous signal whose quantities are based on decimal number systems. Examples of analog computers include the Abacus and the Slide rule. Digital computers on the other hand are computers that process data using digital signals. Most computers used nowadays are digital computers. Digital computers include personal computers, desktop computers, laptop computers, mainframe computers, etc.

Types of digital computers

1. Super Computer

This is one of the most powerful computers used today in terms of speed and storage capacity. It is very expensive and mostly used for scientific and engineering applications that must handle very large databases, or do a great deal of computation or both. A supercomputer may comprise of a single computer unit, but in most cases it consists of multiple high performance computer systems working together as a single unit. It usually occupies a large room space, has a minimum word length of 64bits and high power consumption. A single super computer is the equivalent of 4,000 computer units.

2. Mainframe Computer

The mainframe computer is a very large computer which capable of supporting hundreds and even thousands of users at a time, as it has different terminals that can be shared simultaneously by multiple users. It is used to

process large amounts of data at a very high speed; for example, it is used in banks, hospitals, airports, railway stations and by insurance companies, in fact wherever there is need to rapidly process information about millions of people. Mainframes are considered to be more powerful than super computers in some ways, because they support more simultaneous programs. It is considered to be next to the super computer in capacity.

3. Minicomputer

A minicomputer is a medium, desk-sized machine used in medium scale applications. It is also known as midrange computer, and like the mainframe, it is also designed to support several users simultaneously. It also supports faster peripheral devices like printers and scanners. It possesses large storage capacities and operates at a fast speed. It is used when the volume of data to be processed is moderately large for example, processing data in a medium-sized organization. It is also used as servers in LANs (Local Area Networks), and can communicate with mainframe computers.

4. Microcomputer

A microcomputer is the least powerful of the computer categories, especially when compared with supercomputers, mainframes and minicomputers. It uses a microprocessor as its central processing unit. A microprocessor is a silicon chip that contains a CPU embedded in it. Microprocessors control the logic of most of the digital devices that we use today. Microcomputers can be used by only one person at a time.

Common examples include chips used in TVs, washing machines, cars, clock radios, fuel injection systems for automobiles and personal computers. It is interesting to note that most of the computers that we use today are microcomputers.

The Different Models of the Microcomputer

a. Personal Computers

A personal computer is designed for use by a single person. It usually supports word processing, spreadsheet calculations, database management and so on. Although it is used by individuals, it can also be used by computer networks. A personal computer comes in different forms, i.e. it can be a desktop computer, a laptop or a netbook etc.

b. Desktop Computers

A desktop computer is the most commonly used type of personal computer. It is not designed for portability, and is usually set up in a semi-permanent location. It has a systems unit that houses most of the components used by it to perform its functions; that is, the motherboard, disk drives, the Universal Serial Bus (USB) ports, switch mode, power supply, and add-on cards. Most modern desktops have either a tower or a flat-bed CPU which can stand either on the desk or on the floor, a flat screen monitor, of between 19-21 inches, and wired or wireless mouse and keyboards. If one of its components spoils, it can

be replaced without buying a new computer. Some desktop computers employ touchscreen technology for user input.

c. Workstations

A workstation is a desktop computer that has a more powerful processor than the usual desktop. It also has additional memory and enhanced capabilities for performing special tasks, e.g. 3D graphics, game development, etc.

d. Servers

A server is a desktop computer which is connected to other computers and provides services to them over a network. It usually has a powerful processor, large hard drives and lots of memory.

e. Laptops

A laptop, also known as a notebook, is a portable computer that combines the processor, hard drive, memory, display, keyboard and pointing device or trackball into a single, battery operated unit, slightly bigger than a hardcover notebook. It is called a laptop because it can be placed on the laps, opened and used wherever you are e.g. on a train, in the office, in class etc. A laptop is more powerful than desktops, and usually more expensive. It can work for 4-6 hours when the battery is fully charged.

f. Netbooks

A netbook looks like a laptop, but is slightly smaller, with 9-10 inch screens, and very lightweight, weighing between 2-3 pounds. Its

small size also makes it extra-portable, and this gives it an advantage over the laptop, although it has less processing power than the laptop. It is also cheaper than the laptop. It can be used in all the ways that a laptop can be used, except that it does not have a CD or DVD drive built into it like the laptop, although it has facilities whereby a separate CD or DVD drive can be connected to it externally.

g. Personal Digital Assistant (PDA)

A PDA is slightly smaller than a paperback novel, very lightweight, and combines voice recognition, personal organizational tools and communication capacities in a small package. It uses flash memory for storage and usually relies on either soft keys, pen or touchscreen technology for user input, and memory cards for data storage. Nearly all PDAs have the ability to connect to the Internet and connect to other computers wirelessly.

h. Palmtops

A palmtop is a PDA that is small enough to fit into the palm of one's hand. It is also called a hand-held computer. It is kept for personal use, e.g. for taking notes, developing a list of friends keeping track of dates, agendas, etc.

i. Tablets

Although a tablet may sometimes come with a detachable keyboard and a rotating screen, most of the time, it is a small flat, slate-like computer,

with no moving parts and with a 7-10 inch color screen, using a touch screen or pen technology for input. It can be used for all desktop and laptop functions, and is usually referred to as a Tab.

j. Mobile phones

A mobile phone is a portable electronic device used for instant communication. In recent times, mobile phones have developed into multi-functional devices that can carry out a majority of the functions that the computer executes. Additional mobile phone functions include short text messaging (SMS), Internet access, electronic mail or email, calculators, clocks and calendars, audio and video recording and playback, photographic display, etc.

k. Smartphones

A smartphone is basically a mobile phone that can be used for most of the functions that a computer performs. It combines most of the functions of phones, PDAs, cameras, camcorders and computers in a single electronic device. To function properly, a smart phone uses operating systems, which are the basis of application development. It also has computer applications like word and spreadsheet, media player, a camera, GPS navigation, address book, diary, calendar etc. It can connect wirelessly to the Internet, and usually comes with a touchscreen or small keyboard for input.

1. Wearable computers

This is the latest trend in computing. Wearable computers have common computer applications (Internet, database management, multimedia applications, etc.) integrated into items that are worn on the human body, like watches, eyeglasses and even clothing. A good example is the Google Glass, a program in the process of being developed by Google in the form of hands-free, head-mounted computers wearable in the form of eyeglasses.



Google Glass

Chapter Thirteen

HARDWARE TECHNOLOGY

COMPONENTS OF A COMPUTER

A typical computer consists of both hardware and software components. The hardware components of the computer are its physical components. They are the parts of that can be seen and touched. The software on the other hand is the non-physical components of the computer. They consist of the sets of programs that the computer's hardware components use to carry out the computer user's tasks or instructions. The computer hardware components consist of 2 major categories and this is based on their location and the operations they perform:

- a. The internal hardware components and
- b. The external hardware components.

The computer's internal hardware components can be found inside the computer's casing, and they include the motherboard, the Central Processing Unit (CPU), the hard disk, the various storage drives, various expansion cards, the various ports etc. The computer's external hardware components include the external input and output devices (sometimes referred to as the **I/O devices**), the external storage devices, and the computer's external communication and networking devices. The computer's external hardware can also be called the **peripheral devices** because they exist on their own as separate units and they need to be connected to the computer's Central Processing Unit (CPU)

through one medium or the other before they can work with or be used by the computer.

A. The Internal Hardware Components of the Computer

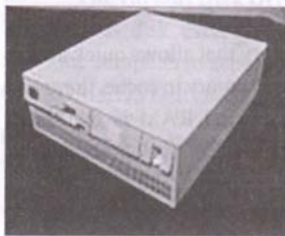
The internal hardware components of the computer are the hardware components which are not located on the outside of the computer, but are housed inside a casing attached to the computer's monitor. The computer's casing can either come in a flatbed shape or a tower shape and it holds together and protects all these internal components, which include the CPU, the hard drives, and the various extension cards and so on. For a better clarification, these internal components are:

a. The Casing or Housing

The casing cannot strictly be called an internal hardware component of the computer because it houses all the other internal hardware components. However, it is itself is a hardware component of the computer because it also can be seen and touched. It not only houses all the internal hardware components of the computer, it also protects them. It is manufactured in either the tower form or the flatbed form. The tower form is placed in a vertical position on the desk and it comes in three sizes – mini tower, mid tower and full tower. The flatbed casing on the other hand is placed horizontally on the desk.



Tower Casing



Flatbed Casing

b. The Motherboard

The motherboard is a flat board placed or fixed inside the computers casing. It connects the CPU and all the other internal hardware components of the computer together. It also contains all the slots and sockets that everything else plugs into e.g. the slot for the graphics card, sound cards, network cards and modems etc. It controls all the electronic signals that are passed between the components of the computer and can be likened to the central nervous system in the body.

c. The Central Processing Unit (CPU)

The CPU performs the same functions that the brain performs in a computer. It contains the computer's processor which is made up of the arithmetic logic unit that performs calculations, the control unit that controls the flow of information, and the registers which store small amounts of data just before and after they are processed. The processor is also responsible for handling all the instructions and calculations that is received from the hardware components and the software programs of the computer. The larger the processor, the more calculations it can make per second and the quicker it can return the results to the relevant hardware and software of the computer.

d. Cache

This is a small capacity memory that allows quick access to data. By storing data from working memory in cache, the speed of communication between processor and RAM is increased. Usually, three levels of fast cache are used by microprocessors to store often used data - L1, L2 and L3.

c. Memory

The computer's memory consists of the random access memory (RAM) and the read only memory (ROM). The RAM memory is the area where the computer holds all the calculations that it does during the time that it is switched on or connected to a power supply. It provides the computer with space to do all its calculations quickly. Once the computer finishes its calculations and is switched off, the data, except when saved by the user to a more permanent memory like the ROM or the hard disk, is wiped of the RAM. This is why the RAM is called **volatile memory**. The amount of RAM available determines the type of software that can be run on the computer and how much data can be manipulated at any given time. The ROM on the other hand is more permanent than RAM. Data stored on the ROM is non-volatile; that is, it is not lost when the computer is switched off. For example the BIOS is stored in the ROM. Data stored in the ROM cannot be changed. To do so requires a special operation.

f. Hard Disk/Drive

The hard drive is used for permanent storage of all data on the computer. Information is stored in the form of a series of numbers saved on the actual disk. Once saved, the information will remain on it even when it is switched off. Data can only be removed from the hard disk if the user deletes it or if there is a disk failure.

h. The various Disk Drives

The various disk drives located inside the computer's casing allow the computer to accept and use external storage devices like CD-ROMs, DVD-ROMs, floppy disks, etc.

h. The Expansion Cards

The expansion cards include:

- * **Sound card**

The sound card generates and allows sounds to come out of the computer. Nearly all computers are manufactured with already built-in sound cards.

- * **Video card**

The video card (also known as the graphics card, graphics accelerator card or display adapter card), generates and transfers pictures or images to the computer's monitor.

- * **TV card**

The TV card allows the user to watch television on the computer. Once the TV card is present, the user can plug an Ariel into it and tune in to available TV stations.

- * **Network card**

The network card is also known as the network adapter, the network interface card (NIC) or LAN adapter. It allows computers to communicate over a computer network.

- * **USB card (Universal Serial Bus Cards)**

The USB card allows the computer to expand the number of ports that are already on the computer.

- * **Card reader**

A card reader comes in-built as an added port on the

computer. It allows the computer to read memory cards from devices like a camera.

i. Ports

A port is an interface, or a physical location on the computer's motherboard, through which the computer can communicate with or connect to external devices like printers, modems, flash drives, joysticks and terminals. The different types of ports utilized by the computer include:

* **Parallel Port**

This is a parallel communication physical interface that is used for transmitting fast data over short distances. It is mostly used to connect printers to a computer and is therefore called a printer port.

* **Serial Port**

This is a serialized communication interface located on the motherboard and it is used to transmitting slow data over long or extensive distances. It is used by dial-up modems or serial mice.

* **USB (Universal Serial Bus Port)**

The USB port is used to connect devices such as digital cameras, speakers, scanners, (i.e. peripheral devices) etc. to the computer.

* **Firewire**

The Firewire port is used to connecting computers to audio-video devices (digital cameras, microphone etc.).

* **Ethernet Port**

The Ethernet port, also known as the network port is used for networking and fast Internet connections.

Data moves through it at a speed of 10 megabits, 100 megabits or 1 gigabit depending on what speed the network card on the computer supports. They have little monitor lights that blink whenever they are being used.

j. Fan

This is a small fan located on the computer's motherboard which keeps the internal components cool and well ventilated, otherwise, they can overheat and their parts be damaged.

j. Heat sink

The function of the heat sink is to cool the computer's CPU and other internal hardware devices of the heat that is usually produced during their normal activities.

k. Power supply

The power supply provides the computer with power by converting the alternating current (AC) supplied by the wall connection to direct current (DC) for the computer to use.

A. The External Hardware Components of the Computer

The external hardware components of the computer consist of the input and output devices (**I/O devices**):

1. Input Devices

These are devices that are used to enter data and instructions into the computer. They translate the user's instructions into signals that the computer can understand and interpret. Without input devices, users will not be able to interact with the computer. Examples include the computer keyboard, the pointing devices, the imaging devices and the audio input devices, etc.:

a. The Keyboard

The keyboard is a flat, plastic board which uses an arrangement of buttons or keys (consisting of alphabetical characters, punctuation symbols, numbers, and a variety of function keys) to insert data into the computer. The user has to press and hold the keyboard's various keys either simultaneously or in sequence in order to input data into the computer. Types of keyboard include the standard keyboard as described above, the laptop keyboard, the thumb-sized keyboard, the foldable keyboard and the gaming and multimedia keyboard and the virtual keyboard.



A Standard Keyboard

- * **Laptop keyboard** – a slightly smaller version of a standard keyboard, built in with the laptop as a single unit.
- * **Thumb-sized keyboard** – a small external keyboard used for devices that require built-in keyboards e.g. PDAs and smartphones.
- * **Foldable keyboard**– this is made of very flexible rubber-like material, and is extremely good for use when one is on the move, for example when

travelling. It can be rolled up and unrolled again when needed.

- * **Gaming and Multimedia keyboard**— a compact keyboard with additional features for the convenience of gamers.
- * **Virtual keyboard**—this is not a physical keyboard. A software is used to simulate all the properties and functionality of an actual keyboard. It thus performs all the functions of a standard keyboard.



Foldable Keyboard

Keyboard Layouts

The buttons or keys on the computer keyboards are laid out in various formats, depending on the type of use the keyboard will be put to. For example:

- * **QWERTY** – this is the most common keyboard layout and is used by English speaking countries.
- * **DVORAK** – this layout is sometimes used instead of the QWERTY because it increases typing speed and minimizes errors. It is able to do this because it uses less finger motion than the QWERTY.
- * **QWERTZ** – this layout is mostly used European countries (except the French speaking ones). For example Germany, Hungary and the Czech Republic use the QWERTY layout.

- * **AZERTY** – the AZERTY layout is mostly used by French speaking European countries e.g. France, Andorra, etc.

a. Pointing Devices

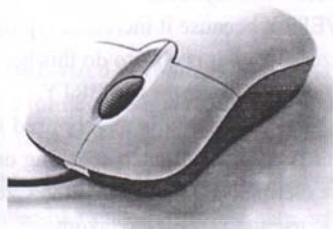
Pointing devices are input devices that allow the user to select items on the display screen of the computer and input them into the computer. There are three types of pointing devices:

- * Devices that are based on a rolling ball.
- * Devices that are based on touching a surface, and
- * Devices that are based on a moving stick.

i. Devices that are based on a rolling ball

* **Mouse:**

A mouse is a device used to control the movement of the cursor on the display screen of the computer. There are two types of mouse i.e. the mechanical mouse and the optical mouse. The mechanical mouse has a rubber ball which can roll in all directions on its underside, and the mouse uses the movement of this ball to control the cursor on the computer's display screen. The optical mouse on the other hand uses a laser beam to detect the mouse's movement and control the cursor on the computer's screen.



Mouse

• **Trackball:**

A trackball is a pointing device shaped and positioned like a mouse lying on its back with a ball placed at its top. To control the cursor, the user rolls/moves the ball with either his or her thumb, fingers or palm. The trackball is useful where there is limited desk space, although it is not as accurate as the mouse.



Trackball

ii. **Devices that are based on touching a surface**

* **Touchpad:**

A touchpad is a small pressure and motion sensitive pad used as a pointing device on some portable computers like the laptop and the netbook. The user controls the cursor on the computer's display screen by moving a finger over the surface of the touchpad.

* **Graphics Tablet**

The graphic tablet (also known as the digitizer, the digitizing tablet, the drawing tablet or the graphics pad), is a hand-held device which allows the user to draw images, animations and graphics as if one is

drawing with pencil and paper. It can also be used to capture data and handwritten signatures.



Graphics Tablet

* **Touchscreen**

Some computers are manufactured with an electronic visual display, with sensors that can detect the presence and location of a touch within the display area. A user usually touches the computer's display surface with the fingers to control the cursor and to perform tasks on it. The touchscreen is a feature of most of the smartphones used today.

* **Light Pen**

A light pen comes in form of a stick or wand that is sensitive to light and is used in conjunction with the computer's CRT display. It works in the same way a touchscreen works, the difference being that the user does not use the fingers to control the cursor and perform tasks on the computer, but rather uses the light-sensitive wand or stick.

* **Stylus**

A stylus is an input device which is used with mobile devices and graphics tablets. It is a small pen-shaped

instrument that is used much the same way as a light pen.

iii. Devices that are based on a moving stick

*** Joystick**

A joystick comes in the form of a stick-like device like a vertical lever mounted on a base. It is mainly used for computer games and for ultrasound scanners at hospitals.

*** Gamepad**

A gamepad, also known as a joy pad, is a pointing device which is connected to and used with a computer or a gaming system. It usually has numerous buttons on it and may even have one or two mini-joysticks.

c. The Imaging Devices

These are devices that are used to input images into the computer. They include:

*** Digital Camera**

Digital cameras are the conventional cameras used today. They are used to take and store pictures in electronic format instead of onto a film like was previously done. The quality of pictures taken in this manner is usually better than those taken with traditional film cameras. This is because the pictures can be edited on the computer before they are printed. The cost of producing pictures with digital cameras is also cheaper than that of the traditional camera.

*** Webcam:**

Webcams are hardware cameras connected to

computers as a peripheral device, or built into the computer unit (e.g. a laptop). It allows the user to take pictures like a digital camera. It also allows anyone connected to the Internet to see pictures and videos of another user or objects.

* **Optical Scanner**

An optical scanner is used for capturing, storing, analyzing, displaying, printing and manipulating images. (all activities which have to do with image processing). They allow the user to take pictures of textual material and convert it to a digital file which the computer is able to read and display. Optical scanners are of three types i.e. the flatbed scanner, the sheet-fed scanner and the hand-held scanner. The flatbed scanner is similar to a small flat elongated box. The handheld scanner on the other hand is used for documents that are less than a page wide. It is also good for small pictures, but difficult to use for entire pages. Sheet-fed scanners are similar to flatbed scanners, the difference being that in a sheet fed scanner, it is the document that is moved while the scan head is immobile. This model is usually utilized when there are documents containing large volumes of pages to be scanned.

* **3-D Scanner**

A 3-D scanner is used to analyze real world objects and collect data on its shape and appearance, in order to construct digital 3-dimensional images.

* **Fingerprint Scanner**

This is a device that can scan and save a user's

fingerprint. It verifies the user or enters the required password information by scanning their fingerprints.

* **Barcode Reader**

A barcode is a small image of parallel lines and numbers that is usually affixed to items like identification cards, or postal mail to identify a particular product number, person, or location. A barcode reader is designed to read a barcode and print out the details of the product, or input the product into a database.

* **Optical Character Recognition (OCR)**

OCR is a technology that enables the computer to convert different types of documents, such as scanned paper documents, PDF files or images captured by a digital camera into editable and searchable data. For example it can be used to scan documents printed out from a computer back into it, even if such document is no longer on the computer's hard drive.

* **Magnetic Ink Character Recognition (MICR)**

An MICR reads texts printed with magnetic ink. It is used exclusively by banks to print checks. Its advantage is that it is difficult to forge documents printed with it, and it can still be read after it has been folded or written on. However, it is very expensive and can only accept a few character sets.

* **Magnetic Stripe Reader (MSR)**

A magnetic stripe reader is a device used to read information printed on the magnetic stripe at the back of a credit or debit card. The stripe usually contains

information about the owner of the card, e.g. his/her account number, the bank branch code, etc. MSRs are often used at supermarkets and shopping malls. They are also known as Electronic Point of Sale (POS) Machines.

d. Audio Input Devices

*** Microphone**

A microphone is a peripheral hardware device which is connected to the computer and allows users to input audio information into the computer.

*** Midi-keyboard**

A midi-keyboard is also known as a Musical Instruments Digital Interface (MIDI). It is a piano-like keyboard device that is used to send signals to a computer, which in turn produces digital sounds that resemble the usual musical instruments.

9. Output Devices

Before a computer can bring out outputs, it must have output devices connected to it. These devices are used by the computer to return processed data or information back to the user. Output devices display, print or transmit the results of the processing of information by the computer's memory. They include:

a. The Visual Display Unit/Monitor

The VDU or Monitor is a very important output device, because users interact more intensively with it than any other device on the computer. It displays the information inputted into

the computer by the user, and the information outputted by the computer. It does this by using the computer's video adapter card which converts the information from the format used by the computer into a format that can be displayed on the monitor. Monitors are of different types based on their technology and how they function. Examples include:

* **CRT Monitor**

The CRT Monitor is also known as the Cathode Ray Tube. It looks like a television and also uses the same technology as the television. It operates via a large vacuum tube known as the cathode ray tube.

* **LCD Monitor**

The LCD monitor is also known as the liquid crystal display. It displays images by using the light modifying properties of liquid crystals.

* **LED Monitor**

A LED (Light-Emitting Diode) monitor is a type of technology which uses light diodes to illuminate the screen in one of two different ways, or a combination of both; that is, edge lighting (a method whereby white LED lights are gathered around the rim of the screen and dispersed evenly) or a confined darkening option whereby LED lights are spread out evenly behind the screen. It does not use cold-cathode technology and fluorescent technology like the CRT monitors.

* **OLED Monitor**

The OLED display is based on an organic substance used as the semiconductor material in LEDs. Organic thin films are inserted between two

conductors and an electrical current is applied to this structure. This makes it to discharge a bright light and this creates the display. Because OLED displays donot need backlighting, they are usually thinner and they weigh less than other display technologies.

An important aspect of the monitor's functioning is its resolution. The resolution determines the quality of the images displayed by the monitor. Most monitors have a resolution of 800×600 pixels. However, there are high-end monitors that have resolutions of 1024×768 , and even 1280×1024 pixels. Thus, monitors can be either low resolution or high resolution.

b. The Printer:

The printer is a peripheral hardware that is used to print or make physical copies of documents created by the computer. Some printers can only print out documents sent to them in black and white while others can print out the documents in a variety of colors. Printers can either be impact printers or non-impact printers.

i. Impact Printers

Impact printers work like the traditional typewriter. They use a kind of striking action. These types of printers are slow and noisy, and usually have mechanical failures. Their print qualities also have a low resolution. Examples of impact printers include the Dot Matrix Printer, the Daisy Wheel Printer and the Line Printer.

*** Dot Matrix Printer**

A Dot matrix printer is an inexpensive and easily adaptable printer. When printing, its print head physically hits the paper through a ribbon and

produces text or images by an arrangement of dots. It is loud, very slow and produces low print quality.

* **Daisy Wheel Printer**

The daisy wheel printer prints with the aid of a disk made of plastic or metal on which characters stand out in relief along the outer edge. The disk is rotated until the preferred letter is facing the paper. Then a hammer strikes the disk, making the character to hit an ink ribbon, leaving an imprint of the character on the paper. The daisy wheel can be to print different fonts. Daisy-wheel printers cannot print graphics and cannot change fonts unless the print wheel is physically removed and changed to the desired font. They are also noisy and slow, printing from 10 to about 75 characters per second.

* **Line Printers**

Line printers are impact printers which have a mechanism that allows multiple characters to be simultaneously printed on the same line. Early models of line printers used a rotating drum covered with letters which when lined up with a ribbon, are imprinted by a series of hammers against the paper. Later models improved the printers' speed and reliability by placing the letters on a series of rotating bands or chains, and using improved electromagnetic technology to move the hammers. Because of the nature of the print mechanism, line printers are much faster than dot-matrix or daisy-wheel printers, with speeds of between 100-3800 lines per minute. However, they tend to be quite

loud, have limited multi-font capability, and often produce lower print quality than more recent printing technologies.

ii. **Non-Impact Printers**

Non-impact printers are printers that print without striking the paper. They are noiseless when compared with impact printers, and faster because of the absence of moving parts in their print head. They print images that have better resolution quality than impact printers. Two examples of non-impact printers are the laser jet printer and the inkjet printer.

* **Laser Jet Printer**

A laser jet printer uses a laser ray to produce the desired image on a drum. The light of the laser then alters the electrical charge on the drum and the drum is rolled through a reservoir of toner, which is picked up by the charged portions of the drum. Finally, the toner is transferred to the paper through a combination of heat and pressure. Laser jet printers produce high quality prints. They are also extremely fast and quiet. They are also easily operated, (i.e. user- friendly). A fast laser jet printer can print 200 pages per minute in monochrome (black and white) and 100 pages per minute in color prints.

* **Inkjet Printer**

An inkjet printer creates images on paper by spraying ink on the paper through up to 64 tiny nozzles. Images generated by inkjet printers are not as sharp as those of the laser jet printer. Also, although the inkjet

printer is also quiet, it is not particularly fast. It is however less expensive than the laser jet printer.

c. Plotter

A plotter is an output device that functions like a printer and uses an electronically controlled pen, pencil, marker, or other writing tool which can be lowered, raised and moved across paper to form continuous lines it to draw a design onto or images across the paper. A plotter is able to draw high quality images on very large pieces of paper, for example 3 foot wide by 10 foot long. Plotters are used by engineers, architects and map-makers to draw plans of buildings, diagrams of machines or large scale maps. There are two types of plotter, i.e. the flatbed plotter and the drum plotter. The flatbed plotter is small in size and usually kept on tables for easy access. It holds the paper while the pen moves over it. A drum plotter on the other hand is big in size, uses paper of unlimited size and rolls the paper over a cylinder to create images. There is also the Pinch-Roller Plotter which is a combination of both the flatbed and the drum plotters.

d. Speaker

Speakers are output devices that are connected to a computer's sound card and the computer uses to send out audio information. It allows users to listen to music, conversations and other audio information from the computer.

e. Multimedia Output Devices

These are computer based integration of text, sound and still images, and digitized motion video. Examples include VCRs, CD players, DVD players, video and

audio recording equipment, etc. which are incorporated into the computer units.

f. Head Phones:

Head phones are computer output devices that bring out the sound output from the computer. They function in the same way as the speakers except that they are worn over the head by a user, such that only one person at a time can hear the audio output produced by them.

g. Projectors:

A projector is an output device that takes the images displayed by the computer's monitor and projects or displays a large version of it onto a flat, usually white surface. Projectors are often used in classrooms, meetings, presentations or places where a large number of people need to see the computer's output at the same time.

h. External Storage Devices

The computer's external storage devices include the magnetic tapes, magnetic disks, optical disks, and so on. These will be discussed more extensively under storage devices.

i. External Communication and Networking Components

The external communication and networking hardware of the computer include the cables, the network cards, the different connection devices like the hub, the switches and so on. Again these will be more extensively discussed under computer networks.

Chapter Fourteen

STORAGE DEVICES

INTRODUCTION

Storage is a physical material in which items are kept. A storage medium in a computer is a physical material or a computer hardware in which the data that is contained in the computer is stored. Computer storage holds items such as data, instructions, and information for the computer's future use. With its storage, a computer can back up data, move data, process data, share data, store data and secure data. Storage is one of the core functions and fundamental components of the computer.

Computer storage is measured in bytes, kilobytes (KB), megabytes (MB), gigabytes (GB) or terabytes (TB). A byte is one character of information and it comprises of 8 bits. A kilobyte is 1024 bytes, a megabyte is 1024 kilobytes, a gigabyte is 1024 megabytes, and a terabyte is 1024 gigabytes.

TYPES OF STORAGE

Computer storage is most of the time categorized into four different types: Primary storage, Secondary storage, Tertiary storage and Online storage.

Primary Storage

Primary storage is also known as the memory of the computer. It is contained in one or more chips on the computer's

motherboard and is closely connected to the computer's Central Processing Unit (CPU). It serves as a temporary holding place for data and instructions while they are being processed. A computer's memory is mostly volatile. This means that the information contained in it is lost once power is removed from the computer. However there are a few types of computer memories that are non-volatile; that is, they retain information contained in them even when power is removed from the computer. These will be examined later.

The computer's memory constantly feeds the CPU with data to process. Thus it is needs to be quite fast. Because memory needs to be fast, it is rather expensive, compared to other types of computer storage which are much slower and this makes it limited in capacity, since the cost per bit of storage is high. High quality computers usually have fast processors and lots of quick memory. Computer memory is almost always based on semiconductor technology.

Types of Primary Storage

1. Random Access Memory (RAM)

This memory is called the RAM because it takes the same amount of time to directly access one location of the memory as the other. The RAM is the main working memory of the computer. For instance, when you switch on your computer, the operating system loads from its disk, already installed in the disk drive, and copies into the RAM. Data, Information and programs stored in the RAM are volatile.

2. Cache

This is a small capacity memory which allows quick

access to data. It stores data from working memory in cache, and thereby increases the speed of communication between processor and RAM.

3. Read Only Memory (ROM)

This is a special type of memory chip which holds software that can only be read and not written to. It usually contains programs that had been "burned" into the computer at the time of manufacture and these are usually instructions that tell the computer what to do when it starts up. An example of ROM is BIOS (Basic Input and Output System), which is used by the computer to establish communication when it is switched on. The ROM is non-volatile.

4. Programmable Read Only Memory (PROM)

This is a type of ROM, but is left blank and programs and data can be written on it with the aid of special machines, but only once. Once PROM is programmed, its contents cannot be changed. A PROM is a non-volatile storage.

5. Erasable Programmable Read Only Memory (EPROM)

The EPROM is a type of PROM that can be erased and reprogrammed. It is usually erased by exposing it to ultra violet light or sunlight, through a window above the EPROM chip. It can be erased and reprogrammed several times although its contents do not last as long as that of the ROM or PROM. It is also non-volatile and must be protected from sunlight at all times.

6. Electrically Erasable Programmable Read Only Memory (EEPROM)

It is usually used to store codes and is similar to EPROM in all ways except that it can only be erased through electrical means.

Secondary Storage

Secondary storage serves as an addition to the computer's primary storage and is used in computers to overcome the limitations of primary storage. Typically, secondary storage is used to back up primary storage (or memory), through replication – that is- the holding of a secondary copy of the data permanently, such that whenever the primary storage needs them (i.e. whenever the computer is switched on), it can call for them from the secondary storage.

Secondary storage has virtually unlimited storage capacity because the cost per bit is low. It is usually used to store large volumes of data on a permanent basis. Its operating speed is far slower than that of primary storage. It is also known as auxiliary memory.

Types of Secondary Storage

There are two main types of secondary storage i.e. the Sequential Access Storage Devices and the Direct Access Storage Devices. An example of the sequential access storage device is the magnetic tape while examples of direct access storage devices include the computer hard disk, floppy disks, CD-ROM, DVD, flash drives and memory cards.

1. Sequential Access Storage Devices

These are storage devices that store data by sequencing the data through different locations before finally placing it into the selected storage location. The data stored in

these devices can only be recovered in the same sequence in which it was stored. As a result of the way in which data is stored and recovered, the access time for information stored in these devices usually differ, based on the storage location of the data and the various locations that the data needs to be sequenced through. This type of storage is suitable for applications or information that needs to be processed in sequence, for example, data records that need to be processed one after another. Sequential access storage devices are usually slower than direct access storage devices. The main example of a sequential access storage device in a computer is the magnetic tape.

a. Magnetic Tapes

Magnetic tapes are used to store data outside the computer system. They are magnetically coated plastic ribbons, usually $\frac{1}{2}$ inch or $\frac{1}{4}$ inch wide and 50-2400 feet long, on which data can be encoded. Data is recorded on its coated surface in form of tiny invisible magnetized and non-magnetized spots and it is stored either in reels, in small cartridges or in cassettes. Tapes for computers are similar to tapes used to store music. They are the least expensive of all the storage mediums and are mostly used to back up the data contained in computer.



Magnetic Tape

Advantages of Magnetic Tapes

- * Magnetic tapes can be erased and reused many times.
- * They are less expensive than other storage mediums
- * The cost per bit of storage for magnetic tape is very low
- * Their storage capacity is almost unlimited because as many tapes as needed can be used to store very large data groups
- * Tape reels and cartridges are compact and lightweight
- * They are portable i.e. they can be easily moved from one place to the other
- * Very large amount of data can be stored in a small storage space
- * Can be used to transfer data among computers that are not linked together

Disadvantages of Magnetic Tapes

- * Due to the sequential nature of storage and retrieval of data from the, they cannot be used to store data that need to be accessed randomly
- * They have to be stored in a dust free environment because specks of dust on the tapes can cause tape-reading errors
- * They must be stored in locations with precise temperature and humidity levels
- * Magnetic tapes can get easily warped and this will result in loss of data.
- * They have to be correctly labeled else useful data stored on a particular tape can be easily erased by in error.

2. Direct Access Storage Devices

These types of storage allow direct access to data stored in them - that is - data in any location can be selected, stored and accessed at random and in a more immediate manner. With these types of storage, it takes the same amount of time to access data from one location as from any other location. These types of storage are suitable for direct processing applications like on-line ticket booking systems, on-line banking systems, etc. Examples include magnetic disks, optical disks and memory storage devices.

A. Magnetic Disks

Magnetic disks are small spherical metal or plastic plates which have a magnetizable iron oxide coating and read and write heads that can move over the surface of the disk while the disk spins underneath it. Data is recorded on the

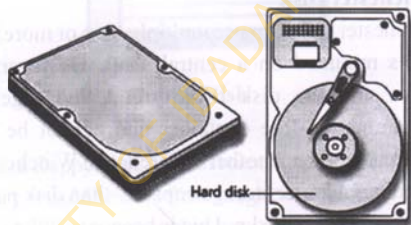
disk in form of tiny invisible magnetized and non-magnetized spots on the coated surface of the disk. Magnetic disks are usually stored in a specially designed envelope or cartridge or several of them can be stacked together in a sealed, contamination-free container. Types of magnetic disks include computer hard disks and floppy disks.

* **Computer Hard Disk**

This is a round, flat piece of inflexible metal, (usually aluminum), coated with magnetic oxide and usually fixed inside the cabinet of the computer's CPU (Central Processing Unit). Hard disks come in different sizes, usually from 1 inch in diameter to 14 inches in diameter. It is the commonest form of computer storage used today, in fact, the major and usually the largest storage device located in the computer system. It stores all the programs that are used to operate the computer, (except the computer start-up programs that are burned into the computer ROM during manufacture). The hard drive also stores all the computer's data files and this include documents of all kinds, graphics, audio and video files, etc. and organizes all the files into folders and directories.

It is usually (but not always) permanently mounted inside the computer. When mounted in the computer, it is called an internal hard disk. Internal hard disks are usually bigger, faster, less portable and less expensive than external hard disks. The hard disk rotates while

recording data and the rotation speed is measured in units of revolutions per minute (rpm). The usual speed of a hard disk is 3600 revolutions per second. Due to its large storage capacity, computers usually have multiple drives (locations) for storing files. The hard drive is generally the “C” drive. The other drives are also locations for external storage of files. Drives are generally labeled sequentially, i.e. A, C, D, E, F, G, etc. the “B” drive is no longer used. The “A” drive is used to save data from a floppy disk.



An Internal Hard Disk

Hard disks are of 3 types, i.e. Zip Disks, Disk Packs and Winchester Disk.

i. Zip Disks

These are hard disk that use a single plate encased in a plastic cartridge. They can be portable or fixed as part of the computer component. A portable zip disk can be carried to the computer system, connected to it for the

duration of use and when work is done, disconnected and kept in a safe place.

ii. Disk Pack

These consist of multiple hard disk plates mounted on a central shaft. The disk pack drive has a separate read and write head for each usable disk surface (the upper surface of the topmost disk and the lower surface of the bottom disk is not used). Disk packs have to be mounted on the disk drive before they can be used, and can be removed and kept in a safe place when not in use.

iii. Winchester Disk

Winchester disk also use multiple (two or more) hard disk plates mounted on a central shaft. However, the disk plates and the disk drive are sealed together in a contamination-free container and cannot be separated from each other. Another difference in Winchester disk is that it has a larger storage capacity than disk pack for the same number of disks. This is because all the surfaces of the Winchester disks are used for data recording, resulting in greater data density.

*** Floppy Disk**

These are circular pieces of flexible plastic coated with magnetic oxide. It is also known as a diskette. They are usually protected by either a plastic or vinyl jacket to protect them from contamination of the sensitive data stored in them. They are used to store data and transfer them from one computer to the other. Floppies are called high density disks because they can hold large amounts of data. There are 2 types of floppy disks:

- a) The 3 ½ inch floppy i.e. its diameter is 3 ½ inches , and it is enclosed in a hard, plastic jacket
- b) The 5 ½ inch floppy i.e. its diameter is 5 ½ inches and it is enclosed in a flexible vinyl jacket.



A Floppy Disk

When using a floppy disk, certain rules must be observed;

- i. They should be kept from magnetized items
- ii. They should not under any circumstances be bent or folded.
- iii. The surface of the floppy disk must not be touched
- iv. Floppies should not be stacked one on top of the other
- v. They should be kept from heat and moisture (or humid atmosphere)
- vi. They should be kept in cases to protect them from dust
- vii. Avoid erasing and inputting data on floppies as much as possible.

Advantages of Magnetic Disks

- * They are more suitable for storing a wider range of applications than magnetic tapes. This is because

they support direct and random access of data unlike magnetic tapes which only support sequential access of data

- * The random access characteristic peculiar to them allow them to be used simultaneously by multiple users as a shared device. A magnetic disk is not suitable for such use because of its sequential access character
- * They are suitable for both online and offline storage of data i.e. both when the computer is on and when it is off
- * Except for a Winchester diask, the storage capacity of a magnetic disk is virtually unlimited since as many disks as are necessary can be used for storing large data sets
- * The cost per bit of storage is very low because their low cost and high data recording density.
- * They can be used and erased many times
- * Floppy disks and Zip disks are easy to handle and store. This is because they are compact and light in weight. This also enables very large amount of data to be stored in a small storage space and makes them portable from place to place.
- * They are less vulnerable to contamination due to careless handling or unfavorable temperature or humidity than magnetic tapes.

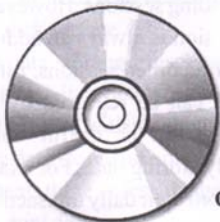
Disadvantages of Magnetic Disks

- * They are less efficient to be used for sequential processing of data

- * It is more difficult to maintain security of information stored in a magnetic disk.
- * A disk crash or drive failure often results in loss of the entire data stored in them. This is especially true of Winchester Disks. Materials that can cause a head crash include human hair, fingerprints, dust particles and smoke particles.
- * Some of them are not easily portable e.g. Disk Pack and Winchester Disk
- * They are usually more expensive than the magnetic tape
- * Zip Disks, Floppy Disks and Disk Packs must be properly labeled to prevent accidental erasure of important data.

B. Optical Disks

Optical disks are circular disk that are coated with metal or some other material that is highly reflective. They are also known as laser disks or optical laser disks. This is because it uses laser beam technology for reading and writing data unto the disk. It is a high capacity random access medium which can store large amounts of data in a limited space. The most popular optical disk uses a disk of 5.25 inches in diameter with a storage capacity of about 650 megabytes.



Optical Disk

Types of optical disks

* **Compact Disk – Read Only Memory (CD-ROM)**

These are packaged as shiny, silver colored metal disks of 5 ¼ inches (12cm) in diameter. They come from their suppliers pre-recorded (or pre-stamped), through a process known as mastering and the information stored in them cannot be altered. It is an excellent medium for distributing large amounts of data in electronic form, at a low cost. For example, it may be used for distributing electronic versions of conference proceedings, electronic journals and magazines, books, and multimedia applications such as video games. It is also used by software vendors to distribute software to their customers.

* **CD- Recordable (CD-R) or Write One Read Many (WORM)**

It is the same as CD-ROM, and data can be written on it only once, but the difference is that data written on it can be read many times. It also has the same storage capacity as the CD-ROM. It allows users to create their own CD-ROM by using a CD-R drive that can be attached to the computer as a regular peripheral device. Data written on its surface can be recorded in multiple reading sessions. However, any session after the first session is always an addition and cannot be alter earlier recorded sessions. Information recorded on a CD-R can be retrieved by any ordinary CD-ROM drive. It is useful for archiving, i.e. permanently storing data. For example, many banks use it to record their daily transactions.

* **CD- Read/Write (CD-RW)**

A CD-RW is the same as CD-R. It has the same storage capacity and also allows users to create their own CD-ROM disks by using a CD-R drive that can be attached to the computer. Data is also recorded on it in multiple sessions too. However, data written on it can be erased and written afresh.

* **Digital Video Versatile Disk (DVD)**

It looks the same as a CD-ROM, but has a capacity of 4.7GB or 8.5GB. It is designed primarily to store and distribute movies. It can store a large amount of data/movies. It allows storage of video in the 4:3 or 16:9 aspect ratios in MPEG-2 video format using NTSC or PAL resolution. Its audio is usually Dolby® Digital (AC-3) or Digital Theatre System (DTS) and can be either monaural or 5:1 Surround Sound.

Advantages of Optical Disks

- * Its cost per bit of storage is very low, because it has a low cost and enormous storage density
- * It is an ideal storage for reading large blocks of sequential data, like music
- * It is a more reliable medium of storage because it does not have or need read heads that rub against or crash into the disk surface
- * It has a data storage lifespan of more than 30 years, which make it a better medium for archiving data when compared with magnetic tapes or disks
- * Because data stored on optical disk is most of the time permanent, there is less danger of accidental erasure of important data.

- * It is compact, lightweight, easy to handle, store and take from place to place.

Disadvantages of Optical Disk

- * It is mostly used for permanent storage. Once data is recorded on it, it cannot be erased, so an optical disk cannot be reused.
- * Speed of an optical disk is slower than that of magnetic disk
- * An optical disk requires a more complicated drive mechanism than other storage.

C. Memory Storage Devices

Most memory devices are storage devices that can be used to store computer data. They are sometimes regarded as tertiary storage devices:

- * **Flash Drive/Pen Drive.**

A flash drive is a relatively new secondary storage device which is based on flash memory. It is a self-powered plug and play device that simply plugs into a Universal Serial Bus (USB) port of a computer and allows easy transfer of data from one computer to the other. It enables the user to read, write, copy, delete and move data from the flash drive to the hard disk drive of the computer and back again, if necessary. It is treated like a removable drive. It usually comes in various shapes, sizes and designs. It is usually available in storage capacities of 1GB – 16 GB or even more.



Flash Drive

* **Memory Card/SD Card:**

A memory card is similar to a flash drive, but is in card shape. It is also a plug and play removable device that simply plugs into a port on the computer. It is an especially useful form of storage for electronic devices like cameras, music players and mobile phones. It is also available in storage capacities of 1GB-16GB or even more.

Advantages of memory devices

- * Compared to hard drives, they use little power, have no fragile moving parts, and for most capacities are small and light.
- * Data stored on them is impervious to mechanical shock, magnetic fields, scratches and dust. These properties make them suitable for transporting data from place to place and keeping the data readily at hand.

- * Most personal computers support memory devices. This is because they implement the USB mass storage device class so that most modern operating systems can read and write to them without installing device drivers.

Disadvantages of memory devices

- * Memory devices can sustain only a limited number of write and erase cycles before they fail.
- * Because of their small size they are easily misplaced, left behind, or otherwise lost. This is a particular problem if the data they contain are sensitive.
- * Memory devices are more expensive per unit of storage than large hard drives.
- * Memory devices, particularly, the flash drive's design usually involves a retractable USB plug. Because it is a moving part, wear and tear may damage or break the USB plug. And because little protects the flash drive, there is also the potential for bending the relatively soft metal of the USB plug, which renders the device useless.
- * Over time files stored on memory storage devices can become corrupted and unreadable. This may be a result of sharing the drive with many different computers.

D. Mass Storage Devices

These are storage systems that have several trillions of bytes of data storage capacity. They use multiple units of storage media as a single storage device. The commonest types are **Disk Array**

which uses magnetic disks, **Automated Tape Library** which uses a set of magnetic tapes and **CD-ROM Juke Box** which uses a set of CD-ROMs. They are also sometimes referred to as **Tertiary Storage Devices**.

* **Disk Array**

This is a set of hard disks and hard drives with a single controller, mounted in a single box and forming a single large storage unit. It is commonly known as **RAID (Redundant Array of Inexpensive Disks)**. It provides for enhanced storage capacity and enhanced performance and enhanced reliability. Enhanced storage capacity is achieved by the use of multiple disks while enhanced performance is achieved by its use of parallel data transfer technique from the multiple disks. Enhanced reliability is achieved through its use of the mirroring technique or striping. The mirroring technique is a technique that makes exact copies of files onto hard disks. In striping, a file is partitioned into smaller parts and different units of the file are stored on different disks.

* **Automated Tape Library**

This is a set of magnetic tapes and magnetic tape drives with a controller, mounted in a single box and forming a single storage unit. A tape library can accommodate up to several hundreds of magnetic tapes, bringing the storage capacity of the single storage unit into several hundred terabytes. It is typically used for archiving data, and as online data back-up device for automate back-up in large computer centers.

* **CD-ROM Juke Box**

This is a set of CD-ROMs and CD-ROM drives with a single controller, mounted in a single box and forming a single large storage unit. A large CD-ROM Juke Box can accommodate up to several hundred CD-ROM disks, bringing its storage capacity to hundreds of terabytes. It is used for archiving read-only data in such applications as on-line museums, digital libraries, on-line encyclopedias, etc.

Advantages of Mass Storage Devices

- * They can be used to store software applications that are not accessed frequently.
- * They are less expensive per unit of storage, compared to other types of storage.
- * They can be used to backup critical data.
- * They provide additional storage capacity to existing drives.
- * They are an extremely efficient data storage solution and can be employed for storing data for all types of organizations

Disadvantages of Mass Storage Devices

- * The major disadvantage of mass storage systems is portability i.e. they are not easily movable from one place to the other.

E. Online storage

Online storage is a service provide by commercial data centers. It refers to the practice of storing electronic data with a

third party service accessed via the Internet. It can also be called hosted storage, Internet storage or cloud storage. Some vendors store only a particular kind of data, such as photos, music or backup data, while others will allow users to store any type of file. A user usually signs up for their service and they provide him with some storage space on their data center that is available 24/7 through the internet. Most of these vendors offer a small amount of storage for free with additional storage capacity available for a fee, usually paid on a monthly or annual basis. Examples of vendors include Dropbox, Google Cloud Storage, Google Drive, Apple iCloud and Microsoft SkyDrive’

Advantages of Online Storage

1. **Cost** –Online storage services reduce much of the cost associated with traditional backup methods, providing ample storage space in the cloud for a low monthly fee.
2. **Invisibility** – it is invisible to the extent that it does not take up valuable space at home or in the office.
3. **Security** – Storing confidential or sensitive information in the cloud is often more secure than storing it locally, especially for businesses. With online storage services, data is encrypted both during transmission and while at rest, ensuring no unauthorized users can access the files.
4. **Automation** –Online storage services make the tedious process of backing up easy to accomplish through automation. You simply select what and when you want to back up, and the service does the rest.
5. **Accessibility** – with online storage, you can access your account from any internet connection, whether you're on a mobile browser or your work computer.

- 6. Syncing** – Syncing ensures your files are automatically updated across all of your devices. This way, the latest version of a file you saved on your desktop is available on your smartphone.
- 7. Sharing** – online storage services allow quick and easy sharing of files with just a few clicks. Whether it is a single photo or an entire folder with hundreds of documents. This is because information stored in them is easily accessible through the internet.
- 8. Collaboration** – Online storage services are also ideal for collaboration purposes. They allow multiple people to edit and collaborate on a single file or document.
- 9. Protection** – Cloud storage serves as an added layer of data protection for important and irreplaceable files. Backups are kept in a secure location that is physically removed from the originals.
- 10. Recovery** – In the event of catastrophic data loss, they provide backups of all original files stored with them.

Disadvantages of online storage

1. Cost

Online storage service is costly, compared with hard drive which holds more storage space, can be used indefinitely, and costs less. If you store much information, online storage may be cost too much.

2. Loss of Service

When you store information on a hard drive it remains in storage until you erase the hard drive or a malfunction causes the information to be lost. In the interim, you can back-up that information to be stored for later use. If the online storage

company you contract with suddenly goes out of business, or is hacked your data could be lost or compromised unless you quickly transfer it.

3. **Internet dependent**

Files need to be accessed through the internet. Transmission speed is also dependent on internet connection. If the file to be uploaded is very large, but the internet speed is really slow, much time will be wasted waiting until the

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Chapter Fifteen

COMPUTER SOFTWARE

WHAT IS SOFTWARE?

Computer software is a general term for the various types of programmes that are used to operate a computer and its related devices. They are a collection of instructions which enables the user to interact with a computer and have it perform specific tasks for them. Software enables the user to instruct the computer system to perform specific functions that provide value for the user.

How are software created?

Software, or computer programs, are written or developed. The process of writing or developing computer programs is called programming, and the individuals that perform these tasks are called programmers. A computer programmer or several programmers writes software instructions using a programming language that tells the software how to work. Once the program is completed it is compiled into a language that the computer understands. A computer program usually includes documentation, which is the written description of the functions of the programs. Documentation is an important aspect of software creation because it helps the user to operate the computer system and also helps other programmers to understand what the program does and how it does it.

Computer software can be purchased at a local retail store and is usually packaged in a box containing the software disks (the software comes already loaded on disks e.g. floppy, CD, or DVD), the accompanying manuals for its installation and maintenance, the warranty and other necessary documentation. The user only needs to insert the disk into the appropriate drive and follow the instructions for installation as contained on the accompanying manual. A lot of times, software come preprogrammed for installation, so that once the disk is inserted, set-up files will appear and only need to be run by the user to start the installation of the software. Software can also be downloaded onto the computer from the internet. Once downloaded, set-up files will also be on the computer.

In addition to purchasing software, there are also thousands of free software (otherwise known as **freeware**) available for download on the internet. However, care must be taken when downloading freeware, as some of them may have malicious software attached to them that can constitute a danger to the computer. There is also the shareware or trial software, which gives the user a few days to try the software before buying it. After the trial period expires the user will be asked to enter a code or to register the product before he or she can continue to use it. The user usually has to pay money to buy the code or to be registered.

Types and Uses of Computer Software

There are generally two categories of software- systems software and applications software. Systems software are the programs that control and manage the basic operations of the computer e.g. logging on, booting or loading, shutting down and

so on. System software serves basically as intermediary between computer hardware and application software. It provides important self-regulatory functions for the computer e.g. loading itself, when it is first turned on, managing hardware resources such as secondary storage for all applications, and providing commonly used sets of instructions for all applications to use.

1. Systems Software

Systems software is of 3 categories:

i. Operating Systems (OS):

The operating system is one of the most fundamental of the programs on the computer. It controls the internal operation of the computer's hardware, manages all the devices connected to the computer, allows data to be saved, retrieved, and allows other programs to run on the computer. Examples of operating systems include Windows XP, Windows Vista, Mac OS, Linux, etc. There are four main tasks that an operating system is responsible for;

- * It provides a user interface between the user and the computer. The user interface allows the user to give commands to the OS.
- * It gives instructions to the computer hardware, such as the printer and monitor.
- * It manages the way in which the computer stores data and applications.
- * It keeps track of different jobs. For example, if the user is using both a spreadsheet and a word processing application at the same time, the OS will run both of these applications and let the user switch back and forth between them.

ii. Utility Programs:

Utility programs are programs that perform specialized tasks that enhance or improve the computer's basic operations or safeguards data. Utility programs are generally fairly small. Examples of utility programs include:

- * Anti-virus applications which protect the computer from the damage that can be caused by malicious software like viruses and similar programs. Examples include Avira, Sophos, Kaspersky, Norton, etc.
- * Compression utilities which make files smaller for either for storage or for sending over the Internet, and then return them to normal size.
- * Data recovery utilities which attempt to restore data and files that have been damaged or accidentally deleted.
- * Disk defragmenters which reorganize the data stored on disks so that it is more efficiently arranged.
- * Firewalls which prevent unauthorized access to computers connected to a network such as the Internet e.g. Windows Firewall that is included with Microsoft Windows.
- * Internet browsers like Mozilla Firefox, Microsoft Internet Explorer, Opera, Safari etc.

iii. Software Development Tools

Software development tools are the programs that programmers use to create, modify and test software. Examples of these include assemblers, compilers, interpreters, etc.

2. Application Software

These are the programs that users use for everyday tasks. They are the programs that users spend most of their time running on the computer. Examples include:

- * Word processing application for creating documents that are attractively formatted. A word processor can be used to perform a variety of actions on documents e.g. type, set the font (i.e. the type, size and style), edit the existing format, check spelling grammar, save and print a document. Examples of word processing software include Microsoft Word, Corel Word Perfect and Sun Star Office Writer.
- * Spreadsheet application for creating documents to organize and manipulate numerical data. An example is Microsoft Excel.
- * Database applications for developing databases that can organize, manipulate, save and retrieve large amounts of information. Examples include **Oracle, FileMaker Pro, Microsoft Access, Microsoft SQL Server, SAP and MySQL.**
- * Presentation applications generally used to create slide shows for business and academic purposes. These slides incorporate text, graphics and sometimes even embedded audio and video. Examples include Microsoft PowerPoint, Apple Keynote, OpenOffice Impress, Corel Presentations, Adobe Persuasion, Flowboard, Kingsoft Presentation and Prezi.

- * Graphics applications for creating and manipulating visual images on a computer. They can either be **painting packages** or **drawing packages**. Examples include MS Paint, PC Paintbrush, Adobe Photoshop, CorelDraw, Micrographix Designer and AutoCAD.
- * Communications programs like e-mail, web browsers, chat rooms, groupware, video conferencing, instant messaging and faxing software for sending and receiving messages.
- * Multimedia applications for creating video and music.

MALICIOUS SOFTWARE

Malware (malicious + software) is a software, which invades an operating system, whether through human mistake or due to shortcomings of the operating system and software support, with malicious intentions. It is intentionally designed to perform some unauthorized and often harmful and undesirable act in a computer. Malicious software includes:

* **Virus**

This is a malicious program self-replicating program which contains a code that copies itself and can infect other programs by modifying them or their environment. Once in a computer it seeks other files, and tries to infect them with the ultimate goal of spreading to other computers. Depending on what malicious code it contains, it may cause more or less damage to your computer.

* **Worms**

Worms are like viruses, they possess the ability of self-replication and also spread from computer to computer, but unlike a virus, they have the capability to travel without any human action. However, they cannot infect other programs. Their usual intent is to take control of your computer and allow remote control by opening the so-called, 'backdoor.'

* **Trojan horses**

The Trojan horse, at first glance may appear to be useful software but will actually do damage once installed or run on your computer. They usually trick the user into opening them because the user appears to be receiving legitimate software or files from legitimate source e.g. Trojan horses can be presented in the form of games or files in e-mail attachments. When a Trojan is activated on your computer, the results can vary. Some Trojans change your desktop, or add silly active desktop icons, or they can cause serious damage by deleting files and destroying information on your system, to allow remote control to your computer, allow spreading of viruses, send spam from the infected computer, etc. Unlike viruses and worms, they do not replicate themselves and they need to be executed before they can infect the computer.

* **Spyware**

Spyware is a type of malware that is installed on a computer without the knowledge of the owner in order to collect the owner's private information. It secretly monitors user activity on the Internet, collects data about them (email addresses, passwords, credit card numbers,

etc.), and transmits that information to someone else (most times the creator or developer of the spyware). The most common spyware infections usually occur while visiting suspicious sites with illegal or pornographic content.

* **Adware**

Adware is a program that uses collected data about a user in order to display advertisements in a way that is intrusive. It usually manifests itself in the form of many pop-up windows that display advertisements.

* **Hoax**

Hoax is a false message being spread by e-mail in order to deceive users. Their goal is to obtain data of, for instance, a bank account, or persuade users to pay some fees in order to win the lottery (which they never applied for), or pay costs of money transfers from an exotic prince to help him withdraw money from a country that is falling apart and, in return, will receive an impressive award, etc.

Signs of Malware in the Computer System

- * The computer's speed or performance slows down
- * The computer's screen freezes
- * Computer keeps rebooting over and over again
- * An entire disk or drive is erased or corrupted
- * Unexplained messages appear on the screen.
- * The computer's browser homepage changes itself
- * Unexplained printing problems occur
- * Operating system software appears to be modified
- * Application software appears to be changed
- * Valuable information stolen from the computer (e.g.

- credit cards numbers, passwords, trade secrets etc.)
- * Services made unavailable (e.g. email, websites, etc.)
- * Computer cannot run an anti-virus software or update the definition file of the anti-virus software;
- * Reduction on available system memory or disk space;
- * Unknown or newly created files, programs or processes appear on the computer;
- * Abnormal restarts or shutdowns of the computer.

Under what circumstances can computers be infected by viruses?

- * Installing or opening a file or an attachment of a spam email from an untrusted source;
- * Visiting a malicious website, such as a fraudulent website

Preventive Measures

- * Keep the operating system updated.
- * Install anti-virus software or anti-malicious code software with the latest virus definition files.
- * Enable the real time detection feature and schedule a weekly full scan.
- * Install and enable a personal firewall.
- * Install the latest security patches.
- * Enable the automatic updating feature for downloading and installing the latest security patches and malicious code definition files.
- * Backup your programs.

SOFTWARE MAINTENANCE

1. Clean out all cookies and caches left behind from browsing on the computer. These cookies and caches can amount to

gigabytes of wasted space; as such they must be deleted. The disk clean up utility included in Windows systems can be used to do this. Other freeware programs such as CCleaner also perform the same function and they can be downloaded from the internet.

2. Search and destroy malicious software on your computer periodically. This is done by conducting periodic virus scans with the aid of antivirus software to ensure that malicious software has not been sneaked into the computer. There are a lot of antivirus software available on the market for this.
3. Defragment the computer's hard drive monthly to keep the computer running smoothly. Defragmentation has to do with reorganizing the data stored in the hard disk so that they can be more efficiently arranged. There are plenty of tools that come with the operating software which can be used to defragment. The Help page of the computer system contains step by step instructions on how to do this. There are also many tools on the internet that can be downloaded for this purpose e.g. Magical Defrag is a tool that automatically defragments the computer's hard disk during periods of inactivity.
4. Uninstall programs that are no longer being used from the computer. Also delete all files that are not being used. The more free space that a computer has, the faster it operates.
5. Always run your computer on UPS as this will help to protect it from electric surges.
6. Be careful when plugging USB, Ethernet, speakers, printers, flash drives and other peripheral devices into the computer, as ports can be easily damaged from careless placement of devices.

GENERAL 'DOS' AND 'DON'TS' ABOUT THE COMPUTER

Dos:

- * Always shut down the computer properly, following the guidelines provided the computer programs and the manufacturer's manual.
- * Do regular disk scan to check computer hard disk for damage.
- * Delete all files that you no longer need from your computer.
- * Use antivirus software to protect your computer
- * Back up all data on the computer regularly on external hard drives to ensure that you have a copy in case something happens to the hard disk

Don'ts:

- * Do not eat or drink around the computer
- * Do not use magnets around the computer
- * Do not put the computer in extremely hot or cold locations
- * Always follow the instructions manual that came with the computer when performing operations on it.
- * There are also help files on the computer which give directions on how to perform different operations on the computer.

How to clean the computer

- * Computers do not need to be cleaned too often if kept in a clean environment.
- * Clean the computer when it looks dirty or when a device (i.e. mouse) does not work right.
- * The two items that need cleaning most on the computer

are the screen and the mouse.

- * Use a slightly damp cloth to wipe the surfaces that need to be cleaned.
- * For cracks and tight places, use a slightly damp cotton swab.
- * When cleaning the keyboard, first use compressed air to remove pieces of paper and dust from under the keys.
- * When cleaning the computer screen, after wiping with damp cloth, use dry cloth to wipe again. Then use a fabric softener cloth to wipe the screen slightly. This helps to remove static charges from the screen.

Most common health problems associated with computer use:

- * Injuries related to working with keyboard and mouse e.g. sprains (dislocation) / RSI (Repetitive Strain Injury)
- * Flickering screen or improper distance from a monitor may lead to vision impairment.
- * Improper seating and inappropriate use of chairs may lead to problems with the spine (due to position of a computer, desk and chair, which affect posture).
- * Improper use of artificial light, light amount, light direction etc. also has a significant impact on health, as it may also lead to vision impairment.

It is important to properly illuminate the places of work. In poor lighting conditions, a person gets tired easily (eyes hurt and tears up, headache occurs from unnecessary strain, etc.) and thus a noticeable drop in productivity occurs. Also, it can result in permanent visual impairment. For that reason, it is very important to have an adequate lighting, whether at home or office. Lighting

is just one of the factors affecting health, as well as productivity. Proper arrangement of equipment, table and chair significantly affect the body posture when working on a computer, and also has bearing on fatigue. Prolonged improper posture can often cause long lasting health problems with the spine and joints.

Regular equipment arrangement

- * Monitor must be kept away from the eyes approx. 50cm (cca: 20 inches)
- * Keyboard must be placed in front-wrists and ensure that wrists are in a straight position when using keyboards.
- * Mouse must be located next to the keyboard- with the forearm parallel with a desk.
- * Chair should be adjustable (seat and backrest), with armrests.

Other Recommendations:

- * Take regular breaks from work, get up and walk, often change position (5- 10 minutes every hour).
- * Exercise regularly.
- * Relax eyes by looking into the distance, (every 20min).
- * Rest arms (every 15min).

Chapter Sixteen

COMPUTER NETWORKS

A computer network consists of two or more computers that are linked together in such a way that they are able to share resources, (e.g. printers), exchange files and allow electronic communications. Computers on a network may be linked together with wired or wireless media. Wired media includes cables and telephone lines while wireless media may be radio waves, satellites or infra red light beams.

Types of Networks

Computer networks are sometimes classified based on their geographical span. A network span may range not more than a few meters apart e.g. between Bluetooth enabled devices, it may span across a whole building, with intermediate devices connecting all the floors of the building, it may span across a whole city, across multiple cities or provinces, or it can even consist of one network covering the whole world. The categories of network based on this classification include:

1. Personal Area Network (PAN):

A personal area network is the smallest range of networks and is very personal to the user. It consists of devices connected by Bluetooth or infra-red light beams. It has a connectivity range of up to 10 meters. Examples include wireless computer keyboard and mouse, Bluetooth enabled headphones and T.V. remote

controls.

2. Local Area Network (LAN):

This is a network which covers the inside of a building or group of buildings, and operated under a single administrative system. With a LAN, resources like printers, file servers, scanners, and the Internet can be shared among computers in the same building or group of buildings. A LAN can be connected to another LAN with the aid of telephone lines and radio waves. A system of LANs connected in this way is referred to as a WAN (Wide Area Network).

3. Metropolitan Area Network (MAN):

A Metropolitan Area Network is a network designed for a town or a city. It is larger than a LAN in terms of area coverage, but smaller than a WAN. A MAN is characterized by very high speed connections using co-axial cables, fiber optic cables and other digital media and may also be formed by a connection of LANs which may belong to different organizations.

4. Wide Area Network (WAN):

A Wide Area Network covers a relatively large geographical area. Computers connected through a WAN are usually connected through public networks e.g. telephone systems, and use high speed communication links e.g. satellite, microwave links, and telephone lines. The cost of setting up a WAN is usually high, compared to the other networks. The largest WAN in existence is the Internet.

NETWORK TOPOLOGIES

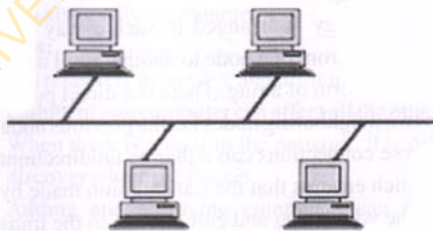
Topology refers to the shape of a network or network's layout; That is, the arrangement and mapping of the elements of a network to show the interconnection between the nodes. How the

different nodes in a network are connected to each other and how they communicate is determined by the network's topology. The topology of a network can be physical or logical. The physical topology refers to the physical design of the network including the devices, locations and cable installations. The logical topology on the other hand refers to how data is transmitted in the network.

There are five common topologies used to establish computer network connections, viz: the Bus, Ring, Star Mesh, Tree and Hybrid topologies.

1. Bus topology

In a Bus design, a single linear network cable known as the Bus or the backbone runs through a building or campus, and all the nodes (computers) are linked along this single linear cable. Each end of the cable is terminated using a special terminator. In this type of topology, if one node is damaged or develops a fault, all the other nodes may be affected as they all share the same cable for sending and receiving information. It is the least expensive of all the network designs.



Bus Topology

Advantages

- * It is reliable in small networks as well as easy to use and understand.
- * Compared to the other topologies, it requires the least amount of cables to connect the nodes together and is therefore the least expensive among them.
- * It is easy to extend the Bus topology in case there is need to add more nodes. The cables can be easily joined with a connector making a longer cable for more computers or nodes to join in.

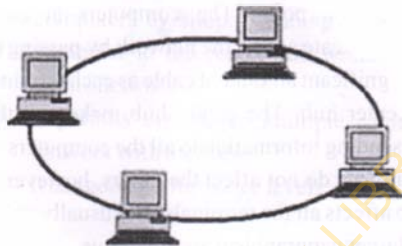
Disadvantages

- * Heavy network traffic can slow aa Bus down considerably. Any of the computers can transmit at any time and the networks do not coordinate when information is sent. As such, computers interrupting each other can use up a lot of bandwidth.
- * Each connection between two cables weakens the computer signal.
- * The Bus configuration can be difficult to find and this may cause the whole network to stop working.

2. Ring topology

A ring topology is arranged in such a way that all the network cables pass from one node to another until all the nodes are arranged in the form of a ring. There is a direct point to point line between two neighboring nodes i.e. the previous node and the next node. These connections can either be unidirectional or bi-directional, which ensures that the transmission made by a node goes through the whole ring and comes back to the transmitting node. A ring topology uses a token ring i.e. a small data packet

that is continuously passed around the network. When a node needs to transmit, it reserves the token, then attaches the data packet to it and passes it to the next node.



Ring Topology

Advantages

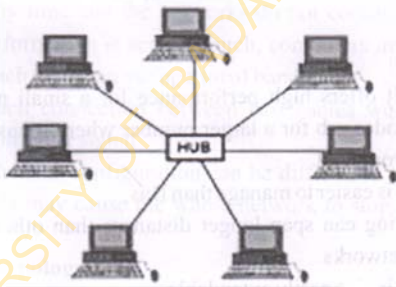
- * It offers high performance for a small number of nodes or for a larger number where it has the same work load.
- * It is easier to manage than Bus.
- * Ring can span longer distances than other types of networks.
- * It is also easily extendable.

Disadvantages:

- * It is relatively expensive and difficult to install.
- * Failure of one computer can affect all the others
- * When there is a fault in the network, it is difficult to discover where the fault is.
- * Adding and removing computers can disrupt the network.

3. Star topology

The star topology uses a center hub which is the host and through which all the nodes or components are connected. The center hub may be a computer or a simple switch or just a common connection point. The computers at each of the terminals communicate across the network by passing data to the hub. It uses a significant amount of cable as each terminal is wired back to the center hub. The center hub makes all the routing decisions i.e. sending information to all the computers. Failure of one of the terminals do not affect the others, however, failure of the center hub affects all the terminals. It is usually used in LANs which span a larger geographical area than Bus can cope with.



Star Topology

Advantages

- * It is more reliable – if one connection fails, it does not affect the others.
- * The center hub provides a good place to diagnose network faults. If one computer fails, the whole

network is not disturbed and the hub can detect the fault and isolate the faulty computer.

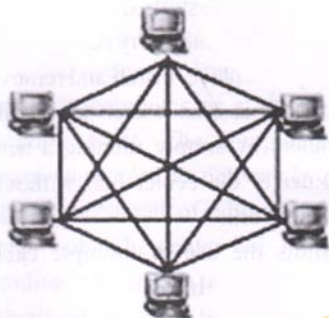
- * It is easy to replace, install and remove host and other devices. It is also easier to modify or add new computers by simply running a new line from the computer to the center hub without disturbing the whole network.
- * It permits the use of multiple cable types in the network with the hub.
- * It has good performance levels

Disadvantages

- * It is expensive to install. All network cables must be pulled to one central point thereby requiring more cable length than other topologies.
- * If the center hub fails, the whole network fails at once.
- * Many times, it requires an extra device at the center point or hub to rebroadcast or switch the network traffic.

4. Mesh topology

In a mesh topology, all devices are connected one to each other. There is no device that does not have a connection to another device in the network. This makes the cable requirements for installing a mesh topology to be high. Failure of one of the devices does not affect any of the others as they have other alternative connections or paths to the other computers.



Mesh Topology

Advantages

- * When one node fails, network can be redirected to another node.
- * Point to point link makes fault isolation and detection easy.
- * Privacy between computers can be maintained as messages travel along dedicated paths.
- * Alternate paths allow other computers to balance network load to other computers in the connection by using more than one of the connection paths.

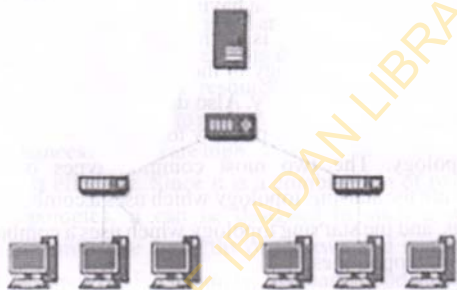
Disadvantages

- * It uses a high amount of cabling.
- * It requires a large amount of I/O (input and output) ports.

5. Tree topology

A tree topology is one of the most common structures for computer networking. It follows a pattern whereby only one route

exists between any two nodes on the network. The pattern resembles a tree with all the branches springing from one root i.e. there is a center hub from which hangs secondary hubs which are then attached to nodes. It can be likened to a hybrid topology i.e. a combination of star and bus topology. This is because resembles a group of star shaped networks connected to a linear bus backbone.



Tree Topology

Advantages

- * Installation and network configuration of tree topology is easy.
- * Its secondary hub feature allows more devices to be attached to the central hub.
- * It is less expensive to install, compared to mesh topology.
- * Faults in the network can be traced and isolated.

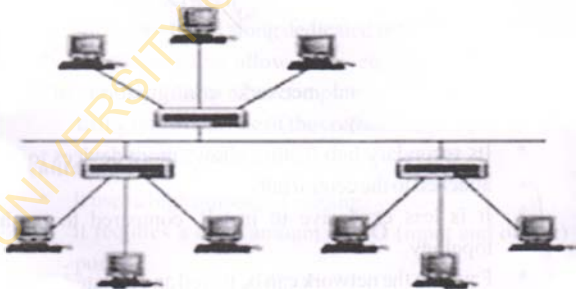
Disadvantages

- * Failure in the center hub brings the entire network down.

- * It requires more cabling than Bus because each node is connected to the center hub.

6. Hybrid topology

A hybrid topology is an integration of two or more different topologies to form a resultant topology which has many advantages of all the initial topologies (and sometimes some of their disadvantages), rather than having the characteristics of just one. For example, if there is a ring topology in one office department and a star topology in the other, connecting the two will result in a hybrid topology. Also designing a pattern which combines two or more of the primary topologies will result in a hybrid topology. The two most common types of hybrid topologies are the star-bus topology which uses a combination of star and bus, and the star ring topology which uses a combination of star and ring topologies.



Hybrid Star-Bus Topology

Advantages

- * Fault detection and troubleshooting in a hybrid topology is easy. The part with fault can be easily isolated from the rest and repaired without affecting the functioning of the other networks.
- * It is easy to increase the size of the network by adding new components without disturbing the existing architecture.
- * It is flexible i.e. the hybrid architecture can be designed in line with the requirements of the organization and can optimize available resources. Special care or attention can also be given to nodes where traffic is high and where chances of faults are high.
- * It is effective. Since it is a combination of two or more topologies, it can be designed in such a way as to maximize the strengths of the two and neutralize their weaknesses. For example, ring has a good data reliability (achieved by the use of tokens) while star has high tolerance capacity (each node is not directly connected to the other, but through a central device). these two qualities can be used effectively in a star-ring hybrid topology.

Disadvantages:

- * The complexity of a hybrid design can sometimes be a disadvantage because it is not easy to design. The configuration and installation has to be done with great care, and needs to be very efficient.
- * The used to connect two different topologies are very expensive. They are different from the usual hubs as they need to be intelligent enough to work with different

architectures and should continue to function even if one part of the network is down.

- * The infrastructure used to install a hybrid topology is costlier than usual. This is because a hybrid topology is usually larger in scale than simple ones, and it requires costly cables, cooling systems and sophisticated network devices.

NETWORK COMPONENTS

The essential components for computer networking are the network hardware, the various transmission media and the network software.

A. Network Hardware

1. Computer

The computer is the basic component of computer networks. Computers on a network can be divided into two categories i.e. the server and the client or nodes. The server is a computer of higher power and speed which distributes resources like to the other computers. The clients or nodes on the other hand are the computer systems which the server services. They access the resources from the servers. In peer to peer computer networks there are no servers.

2. Network Card

The network card is also known as a Network Interface Card (NIC), network adapter. It is a circuit board or chip which allows the computer to communicate to other computers on a network. It is the most important part of the network connection and can be an 8 bit card, 16 bit

card or 32 bit card. Each card has its own method of sending information (network protocol) through the cable. The most commonly used is Ethernet Protocol.

3. Modem

A modem converts digital signals (computer signals) from the computer into analogue signals for transmission and vice versa for reception over a telephone line. There are four basic types of modems for a Personal Computer - External, USB, Internal and Built-in modems. External and USB modems connected to the PC from outside; while Internal and built-in modems are located inside the PC. Present day modems have 56kbps (kilobits per second) speed.

4. Switch

Switches are basically bridges, but usually have multiple ports. Switches connect network segments, using a table of addresses to determine the segment on which a packet needs to be transmitted.

5. Hubs

A hub is used to connect multiple computers and devices via a dedicated cable. It is cheap and connections are easy. It generally has 4, 8, 12, 24 ports.

6. Router

These are used to connect networks and to determine the optimal path along which the network traffic should be forwarded. They are occasionally called gateways.

B. The Various Transmission Media

Communication of data and propagation and processing of signals is called transmission. Transmission signals travel from

the transmitter to the receiver via a path. This path is called a medium. Mediums can be guided or unguided. In a guided medium, data is sent along a physical path i.e. cables. There are several types of cables used to set up a network. The type of cable chosen for a network depends on the network's topology, protocol and size. The different types of cables used in networking are:

- a. Coaxial cables which resembles the cables that brings the TV signals to television.
- b. Twisted pair copper wire cable which looks like phone cable. They also come in two varieties - shielded and unshielded.
- c. Optical fiber cable
In unguided media, no wire is installed. The data communication is predominantly sent by radio waves and microwaves.

C. Network Operating Software

Network operating software (NOS) is a collection of software and associated protocols that allow a set of autonomous computers, which are interconnected by a computer network, to be used together in a convenient and cost effective manner. It is similar to any other operating system like windows, DOS, etc. except that it operates over more than one computer. It controls the operations of the network system, including who uses it, when they can use it, what they have access to, and which network resources are available. At a basic level, the NOS allow network users to share files and peripherals such as disks and printers. It also provides data integrity and security. Examples n can be categories of NOS include: The NetWare, LAN Manager, Solaris and Windows 2000 etc.

The main categories of network software are:

1. Peer to peer software
2. Client / server-based software

1. Peer to Peer Software

In peer to peer networking operating software, there is no central server. All computers in the network are equal. All computers have similar capabilities and resources. Users can share resources and files located on their computers and can access shared resources on other computers. Examples of Peer to peer network software are Windows XP, and Windows 98.

2. Client/ Server Based (Two Tier)

This software is in two parts. One part consists of functions and services which reside in one or more exclusive (dedicated) computers. This dedicated computer is called the server. It provides security and access to resources. The other part called 'client' resides on other computers (nodes / client). They access resources on the server. The network operating system allows multiple users to simultaneously share the same resources irrespective of physical location. Examples of Server based networking software are: Novel Netware, Windows NT, UNIX, Window 2000 etc.

3. Client Server Based (Three Tier)

Here a client-software is split into two parts:

- i) Browser (user-interface) (thin client)
- ii) Logic.

The logic which describes how to access and process data is moved to a new server.

Chapter Seventeen

COMMUNICATION AND INTERNET SERVICES

UNDERSTANDING THE INTERNET

The Internet is a worldwide computer network. It interconnects millions of computer networks worldwide, providing a global communication, storage and computation infrastructure. Hence, it is generally described as 'the information super-highway.' Some of the computing devices that the Internet connects to worldwide include traditional desktops, workstations and servers, and non-traditional devices like TVs, laptops and mobile phones. All these devices that are connected to the Internet are called hosts or end-systems. End systems are connected together by communication links. Communication links can be made of different kinds of physical and non-physical media. Physical media include co-axial cable, copper wire and fiber optics while non-physical media include microwaves and radio spectrum. The rate at which a particular link transmits data is called a bandwidth and is usually measured in bits per second. End systems are not usually connected to each other through a single link, but are indirectly connected to each other through intermediate switching devices known as routers.

How does a router work? It takes a chunk of information from one end system on one of its incoming communication links and forwards that chunk of information on one of its outgoing

communication links to the next end system. In computer register, this chunk of information is called a packet. The path that a packet takes from the sending end system is known as a route or a path through the network. The Internet uses a method known as packet switching which allows several communicating ends systems to share a path, or parts of a path at the same time.

End systems access the Internet through the Internet Service Providers (ISPs). These can be residential ISPs e.g. AOL, MSN, or University ISPs e.g. Stanford University, or corporate ISPs such as Ford Motor Company. Each ISP is also network of routers and communication links. These ISP provide different kinds of network access to end systems e.g. e.g. 56kbps dial-up modem access, cable modem access, broadband high speed LAN access and wireless access. The above mentioned ISPs are known as lower tier ISPs because they are all privately owned. The lower tier ISPs are inter-connected to each other through national and international ISPs which are also known as upper tier ISPs. Examples include UUNet and Spirit. The upper tier ISPs consist of high speed routers interconnected with high speed fiber optic links. All ISP networks whether lower tier or upper tier is managed independently run an IP Protocol and conform to certain principles.

What is a protocol? A protocol defines the format and order of the messages exchanged between two or more communication entities as well as the action taken on the transmission and the receipt of the message or of other event. The principal protocols used by the Internet are known as the TCP/IP (Transmission Control Protocol and Internet Protocol).

The public network (i.e. the global network of networks as described above) is the network that is typically referred to as

the Internet. There are also many private networks e.g. corporate or government networks called the **intranet**. They use the same type of hosts, routers, links and protocols as the public Internet. The difference is that they can only communicate within their private networks, (except the information is passed through firewalls which restrict the flow of information to and from the network).

HISTORY OF THE INTERNET

The internet has no single inventor; rather different aspects of it has been invented and improved upon by various scientists over time. The concept of the internet was first conceived at the USA's Advanced Research Projects Agency (ARPA) by a scientist named J.C.R. Licklider who saw the potential value of allowing computers to share information on research and development in scientific and military fields. But it was Leonard Kleinrock's (also of ARPA) theory of "packet switching" that formed the basis of internet connections, while Lawrence Roberts of the Massachusetts' Institute of Technology (MIT) was the first to connect a computer in Massachusetts with another in California and by this, showed the feasibility of wide area networking.

The internet, then known as ARPANET, was brought online in 1969 by ARPA with an initial connection of four major computers at universities in southwestern United States of America. They are University of California at Los Angeles (UCLA), Stanford Research Institute, University of California at Santa Barbara (UCSB), and the University of Utah. By 1970, MIT, Harvard University, BBN and SDC in California were added. The network grew steadily during the 1970's.

As packet switched computer networks multiplied, scientists found it difficult to integrate them into a single worldwide network. This problem was solved by Vinton Cerf who developed what he called the Transmission Control Protocol (TCP). Through the TCP, the world's computer networks could communicate with each other and scientists were able to use the internet to send files and data from one computer to the other.

In 1991, Tim Berners-Lee, a computer programmer from Switzerland invented what we know as the World Wide Web today. Through it computers were not only able to send files and data from one computer to the other through the internet, the internet itself became a web of information that anyone connected to it could retrieve.

In 1992 a group of researchers from the University of Illinois developed a browser named the Netscape. The Netscape provided an easy, user-friendly way of navigating the internet. Also, for the first time, internet users were able to see words and pictures on the same page.

The internet has continued to change since then. Today, we see many developments to the initial internet e.g. social networking sites, commercial websites, internet radio, real time telephony, etc. all these developments have the same thing in common, they are progressive improvements on better communication among people.

INTERNET AND COMMUNICATION

Communication is the flow of information from one person to the other (Axley, 1984). It has to do with the process, by which information is transferred by a sender to a receiver, through a channel in which the communicated information is understood

by both the sender and receiver (Wikipedia). The receiver then gives a feedback that enables the sender to know that the information has been understood. Communication scholars have identified five elements of communication which are the sender, the receiver, the message or information, the channel or medium and the feedback. There are several mediums through which communication can take place, and these include words, gestures, body language, sign language, paralanguage, touch, tone of voice, eye contact and the use of writing.

Communication is very important in day to day life because it forms the basis of decision making not only at the individual level, but also at the organizational and global level. Households, businesses, organizations and entire countries depend upon one level of communication or the other. Miscommunication can result in catastrophic consequences especially when it comes to global marketing, finance, economics, trade and war. Likewise, effective communication is the cornerstone of education. Without effective communication, ideas, directions, and even thoughts will be lost or misunderstood. In education, this can have serious repercussions. Students will not understand the lecture material and the teachers will not understand that a gap in communication is already forming, thereby defeating the purpose of the education process. Today the simple act of exchanging ideas has become one of the most important parts of human life and with its advent in the 20th century; the internet has become a major means through which communication takes place globally. Internet provides information and communication facilities and includes various forms of networks, e.g. commercial, educational, governmental and other networks. More than 100 countries are linked into the

network and through it; they exchange data, news, opinion and other information.

INTERNET COMMUNICATION TOOLS

Computer assisted communication is described by the term “virtual community”. Virtual communities are supported by different kinds of communication tools. Examples include emails, email lists, newsgroups, web chats, instant messaging and social network tools. New tools for internet communication are being invented constantly. This section will examine a few of these tools and how they are used:

- 1. Email:** this is a short name for electronic mail. Emails are information communication technology that uses technology to communicate a digital message from one computer to the other, over the internet. It allows messages to be composed and sent to an individual or a series of individuals. The messages transmitted may contain text, files, images and other attachments. Senders and receivers of emails do not need to be on the internet or connected to their mailboxes at the same time. This is because email servers use a store and forward system, whereby messages sent by one server are accepted, and stored to be accessed at leisure whenever the recipients are connected to their electronic mailboxes. Popular email platforms include Gmail, Hotmail, and Yahoo mail. Examples include Gmail, Hotmail and Yahoo mail.
- 2. Email lists:** These are also sometimes called listserve. The email list allows a group of people with common interests to communicate with each other by email using a

single email address. When people join an email list, their email addresses are added to the list. Thereafter, when one person on the list sends a message, the message goes to, or is received by everyone on the email list. The email list is a good way to communicate information to a large number of people. Email lists vary in size. They can be small, consisting of as few as 12 people, or they can be big, consisting of hundreds of people. Email lists are created and run through software designed specifically for that purpose, e.g. Listserve, ListProc, and Majordomo. These software allow the list owner or administrator to manage the list e.g. to add and remove subscribers, and to change other settings.

- 3. Newsgroups:** These are internet discussion forums that allow a group with common interests to gather and talk about their topics of interest. They work much like emails except that messages are sent to a central location where they are accessible to be read by anyone who is interested in the group. Unlike emails that are only visible to the sender and recipient, newsgroup messages can be read by anyone who visits the group that they are posted in. Newsgroups are excellent ways to store information, get answers and give opinions on various subjects, ranging from education to gardening. There are thousands of newsgroups on the internet and people from all over the world participate in them.
- 4. Web news:** This is a server side application that uses a web based to give the user access to internet news groups by allowing newsgroups to be displayed, accessed and

searched via web pages. Web news may also provide a web based news service which gives users access to news from anywhere on the internet. This is usually in form of a web based package which allows news processing to be handled via a web browser rather than a news client package. It allows users to access internet news from any web browser or machine.

- * It allows users to log into their news accounts
- * It provides a list of newsgroups or items of interest
- * It posts news items
- * It can be used to read news articles.

5. **World Wide Web** (or simply **Web**): This is a way of accessing information over the medium of the Internet. The Web uses the HTTP protocol, only one of the languages spoken over the Internet, to transmit data. It uses the HTTP to allow applications to communicate in order to exchange business logic and use the Web to share information. The Web also utilizes browsers, such as Internet Explorer or Firefox, to access Web documents called Web pages that are linked to each other via hyperlinks. Web documents also contain graphics, sounds, text and video. Some people use the word- World Wide Web and Internet interchangeably, yet they are different from each other. While the internet is a vast network of computers, the Web is just one of the ways that information can be disseminated over the Internet.

6. **Shared whiteboard**: This is a touch-friendly online whiteboard application that allows the user to use his or

her tablet or smartphone to draw sketches, collaborate with others in drawing, and share them with the world. The shared whiteboard works on all modern browsers. Whiteboards are used by universities, online tutors, designers, and artists for distance learning, online tutoring and collaborative design.

7. **IM (Instant Messaging) service:** This is used for instant message exchange and real time communication. Besides textual communication and video conferencing, they allow file transfer as well. Some of the popular IM services are: WindowsLiveMessenger, Skype, and GoogleTalk.
8. **VoIP (Voice over Internet Protocol):** This is a term for technology that enables digitalization and transfer of sound (and multimedia sessions) over the Internet. Therefore, it enables sound communication much like the telephone call. In short, VoIP protocol enables audio/video communication between users.
9. **RSS (Really Simple Syndication):** This refers to a set of web formats, used by web pages that are being constantly updated, considering that by using RSS, new information, articles, etc. can be published. RSS enables us to, with use of appropriate software, read new titles and access news summaries. Users can, with appropriate software, obtain news from various portals and receive information without the need to visit all of them independently, while publishers can distribute news easily to end-users who are monitoring their RSS feeds/channel.

10. Blog (web log): This is a form of Internet media in which users can re-post or write their opinion on any topic. It can be personal (a form of Internet diary), thematic, or in the form of journals. Blogs are popular because end-users do not need to have advanced computer knowledge, or knowledge of webpage creation, in order to be present on the Internet and write about various topics, i.e. state their opinion. Blogging has greatly facilitated the exchange of interests, ideas, opinions, and contributed to realization of human right to free expression. Some use blogs to share their art, personal aesthetic, or to collect virtual clippings from websites online. Entries published on blogs are called posts, which may allow a space below for visitors to leave their comments. Besides text, it is possible to exchange multimedia files, such as photos or videos. In order to share your texts, pictures, video clips, etc., it is necessary to create a personal account on websites that offer this type of service. In case you simply wish browse the content, it is not necessary to open a personal account.

11. Social Network: This is a platform to build social networks or social relations among people who share interests, activities, backgrounds or real-life connections. Social network sites are web-based services that allow individuals to create a public profile, to create a list of users with whom to share connections, and view and cross the connections within the system. Some of the more popular social networks are: MySpace, Facebook, Whatsapp, Twitter, Google+.

12. **Forum:** This is a service that allows users to exchange opinions. It can be compared to bulletin boards on which participants leave their messages, while others leave their comments. Examples of forums are: Reddit, TED Conversations.
13. **MMO (Massive Multiplayer Online):** These are network games, played by a large number of players via the Internet. One of the sub-genres of MMO is a MMORPG (Massive Multiplayer Online Role-Playing Game), and its most popular representative is a game called 'World of Warcraft'.
14. **Chatroom:** This is a webpage or part of a webpage which allows a real-time information exchange. Unlike the instant messaging writing software, it requires computer installation, only a web browser and Internet connection.

One of the main features of the Internet is information flow. Information is valuable, and today individuals, governments, and companies are looking for ways to obtain information via the Internet. Another characteristic of the Internet is that once information is published on it, it becomes extremely difficult, if not impossible, to remove the information. For that reason it is necessary to be careful when leaving personal data on social networks. One should avoid sharing information regarding date and place of birth, home address, phone number, planned vacation, and use security settings to restrict access to your user profile. Also, be careful with the terms of use of agreement to which you agree when you open an account, because that very agreement defines how the company - owner of the some social

network, can handle the information that you released on their social networks. Also, it is also necessary to bear in mind that, when communicating with someone over the Internet, you do not know the real identity of that person. It is very easy to impersonate someone, and that fact further emphasizes the need for caution when giving any personal information.

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