INFORMATICS

&

HISTORY

III SEMESTER

CORE COURSE

B A HISTORY

(2014 Admission Onwards CU-CBCSS)

UNIVERSITY OF CALICUT

SCHOOL OF DISTANCE EDUCATION

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UNIVERSITY OF CALICUT

SCHOOL OF DISTANCE EDUCATION

STUDY MATERIAL

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INFORMATICS & HISTORY

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A list of computer related acronyms

ABM—Asynchronous Balanced Mode
AI—Artificial Intelligence
ALU—Arithmetic and Logical Unit
ARPANET—Advanced Research Projects Agency Network
ASCII—American Standard Code for Information Interchange
BIOS—Basic Input Output System
Blob—Binary large object
Blog—Web Log
BSD—Berkeley System Distribution
CAD—Computer-Aided Design
CAPTCHA—Completely Automated Public Turing Test to tell Computers and Humans Apart
CD—Compact Disc
CDMA—Code Division Multiple Access
CD-R—CD-Recordable
CD-ROM—CD Read-Only Memory
CD-RW—CD-Rewritable
COBOL—Common Business-Oriented Language
CPU—Central Processing Unit
CRT—Cathode Ray Tube
DoS—Denial of Service
DOS—Disk Operating System
DSL—Digital Subscriber Line
DSL—Domain-Specific Language
DTP—Desktop Publishing
DVD—Digital Versatile Disc
DVD-R—DVD-Recordable
DVD-ROM—DVD-Read Only Memory
DVD-RW—DVD-Rewritable
EDVAC—Electronic Discrete Variable Automatic Computer
EULA—End User License Agreement
FAQ—Frequently Asked Questions
FLOSS—Free/Libre/Open Source Software
FOSS—Free and Open Source Software
FSF—Free Software Foundation
FTP—File Transfer Protocol
GIS – Geographical Information System

GNU—GNU's Not Unix
GPL—General Public License
GPS - Global Positioning System
GSM—Global System for Mobile Communications
GUI—Graphical User Interface
HD DVD—High Definition DVD
HP—Hewlett-Packard
HTML—Hypertext Markup Language
HTTP—Hypertext Transfer Protocol
IBM—International Business Machines
IC—Integrated Circuit
ICT—Information and Communication Technology
IEEE—Institute of Electrical and Electronics Engineers
I/O—Input/output
IP—Internet Protocol
IPR -- Intellectual Property Rights
IRC—Internet Relay Chat
ISDN—Integrated Services Digital Network
ISP—Internet Service Provider
IT—Information Technology
JPEG—Joint Photographic Experts Group
JSTOR—Journal Storage
Kb—Kilobit
KB—Kilobyte
LAN—Local Area Network
LCD—Liquid Crystal Display
LED—Light-Emitting Diode
MAN—Metropolitan Area Network
Mb—Megabit
MB—Megabyte
MIT—Massachusetts Institute of Technology
MMS—Multi-Media Messaging Service
MPEG—Motion Pictures Experts Group
MS—Microsoft
OLPC—One Laptop per Child
OS—Open Source
OS—Operating System
OSI—Open Source Initiative
OSS—Open-Source Software

PAN—Personal Area Network
PC—Personal Computer
PD—Public Domain
PDA—Personal Digital Assistant
PDF—Portable Document Format
RAM—Random Access Memory
ROM—Read Only Memory
RSS—Radio Service Software
RSS—Rich Site Summary, RDF Site Summary, or Really Simple Syndication
SDSL—Symmetric DSL
SIM-- Subscriber Identity Module
TCP—Transmission Control Protocol
TCP/IP—Transmission Control Protocol/Internet Protocol
TDMA—Time Division Multiple Access
UNIVAC-- Universal Automatic Computer
UPS—Uninterruptible Power Supply
URL—Uniform Resource Locator
USB—Universal Serial Bus
VR—Virtual Reality
VRML—Virtual Reality Modeling Language
VB—Visual Basic
VBA—Visual Basic for Applications
VDSL—Very High Bit-rate Digital Subscriber Line
VLAN—Virtual Local Area Network
VoIP—Voice over Internet Protocol
VPN—Virtual Private Network
WAN—Wide Area Network
WAP—Wireless Access Point
WAP—Wireless Application Protocol
Wi Fi—Wireless Fidelity
WiMAX—Worldwide Interoperability for Microwave Access
WLAN—Wireless Local Area Network
WWW—World Wide Web
XP—Cross-Platform

A Glossary of Computer Terms

Artificial intelligence (AI)- Computer systems that attempt to imitate human processes for analyzing and solving problems.

ASCII (pronounced *as-kee*) - An acronym derived from American Standard Code for Information Interchange. ASCII is a standard 7-**bit** code that represents 128 **characters.** The use of this standard code permits **computers** made by different manufacturers to communicate with one another.

Backup- Storage of duplicate **files** on **disks, diskettes,** or some other form of magnetic medium (such as tapes) as a safety measure in case the original medium is damaged or lost.

Basic Input /Output System (BIOS)-A set of **programs** stored in read-only **memory** (ROM) on IBM or IBM-compatible **computers.** These programs control the **disk drives,** the **keyboard,** and the **display screen,** and they handle start-up operations.

Blog-A *blog* (short for Web log) is an online diary in which an individual records and publishes his or her thoughts on one or more subjects. A blog devoted to legal matters is known as a *blawg*.

Blogger- Someone who creates and maintains an online diary.

Blogosphere - The complete set of **blogs** on the Internet.

Blook-A *blook* is a **blog** that has been turned into a book or an online book that is published on a blog.

Bluetooth - A **protocol** that permits a wireless exchange of information between **computers,** cellphones, and other electronic devices within a radius of about 30 feet.

Boot (short for *bootstrap*)- To start a **computer** and load the **operating system** to prepare the computer to **execute** an **application.**

Bug-A **software** defect that causes a **program** to malfunction or cease to operate. Some writers now use *bug* to refer to **hardware** problems as well.

Bundled software- Software that is sold along with a **computer** system; several software **programs** that are packaged together (also called *software suites*).

Burn - To record information on a disc such as a **CD-R,** a **CD-RW,** a **DVD-R,** or a **DVD-RW.**

Cathode-ray tube (CRT)- Bulky Monitors previously used in computers

CD-R- Compact disc-recordable.

CD-ROM - An acronym derived from compact disc-read-only memory. A form of optical **storage.** One compact **disc** can hold up to 250,000 text pages; it can also be used to store **graphics,** sound, and video. (See also *DVD-ROM.*)

CD-RW- Compact disc-rewritable.

Cell - A box or rectangle within a table or **spreadsheet** where a **column** and a **row** intersect; an area in which information can be entered in the form of **text** or figures.

Central processing unit (CPU). The brains of an **information processing** system; the processing component that controls the interpretation and execution of instructions.

Chat - A method of communication in which people type text messages to each other, thereby holding a conversation over a **network** such as the **Internet.** (See also *Newsgroup.*)

Clipboard- A holding area in **memory** where information that has been copied or **cut** (**text, graphics,**sound, or video) can be stored until the information is inserted elsewhere. (See also *Copy; Cut; Cut and paste.*)

Column- A vertical block of **cells** in a table or **spreadsheet.** (See also *Row.*)

Command- An instruction that causes a **program** or **computer** to perform a function. A command may be given by means of a special **keystroke** (or series of keystrokes), or the command may be chosen from a **menu.**

Computer- An electronic device that is capable of (1) accepting, storing, and logically manipulating **data** or **text** that is **input** and (2) processing and producing **output** (results or decisions) on the basis of stored **Glossary of**

Cookie-A small text **file** that a Web **server** stores on a user's hard drive when the user visits certain **Web sites.** A cookie contains all the information that a user has to submit on a first visit to a particular Web site in order to gain access. When a user revisits that Web site, the cookie makes it unnecessary for the user to enter the same information all over again. The positive aspect of cookies is that they make it possible for users to take advantage of the convenient "shopping cart" feature of many Web sites. Unfortunately,

Cookies also make it possible for marketing organizations to monitor users' browsing patterns; users then find themselves the targets of custom-tailored marketing campaigns.

Copy- To reproduce information elsewhere. The original information remains in place.

Cracker- The preferred term (rather than **hacker**) used to refer to a **computer** criminal who penetrates a computer to steal information or damage the program in some way.

Crash- A malfunction in **hardware** or **software** that keeps a **computer** from functioning. (See also *Bug;Glitch.*)

Cursor- A special **character** (usually a blinking underline, dot, or vertical line) that indicates where the next typed character will appear on the **display screen.** Also known as the **mouse** pointer (arrow) or **I-beam pointer.** Microsoft Word refers to the cursor as the *insertion point.*

Cyberspace- A realistic simulation of a three-dimensional world created by a **computer** system; also referred to as *virtual reality.* Now commonly used to refer to the world of the **Internet** as a whole.

Cybrarian- The electronic equivalent of a librarian. A person who makes a career of **online** research and **data** retrieval.

Data-Information consisting of letters, numbers, symbols, sound, or images—in a form that can be processed by a **computer.**

Databas- A stored collection of information.

Database management system (DBMS)-The **software** needed to establish and maintain a **database** and manage the-stored information.

Debugging-Locating and eliminating defects in a **program.**

Default settings- The preestablished settings (for margins, **font,** type size, tab stops, and so on) that a **program** will follow unless the user changes them.

Delete - A **command** to erase information from **storage.**

Denial of service (DoS) attack- A malicious act intended to shut down a **Web site** or a **network** by flooding it with too much information. Users who attempt to visit the site will be denied access.

Desktop- The electronic work area on a **display screen.**

Desktop computer - A **microcomputer** that is bigger than a **laptop.**

Desktop publishing (DTP)- A system that processes the **text** and **graphics** and, by means of page layout **software** and a **laser printer,** produces high-quality pages suitable for printing or in-house reproduction.

Dialog box-A message box on the **screen** that supplies information to—or requests information from the user.

Directory - A list of the **files** stored on a **disk.**

Disc- A nonmagnetic **storage** medium that is used in conjunction with optical technology. (See also *CD-ROM.*)

Disk- A random-**access,** magnetically coated **storage** medium used to **store** and **retrieve** information.

Display screen - A device similar to a television screen and used on a **computer** to display **text** and **graphics.** Also called a *video display terminal (VDT)* or a *monitor.*

DNS- Domain name system.

Document- Any printed business communication—for example, a letter, memo, report, table, or form.

Domain- Typically, a three-letter element in a Web address or an **e-mail** address. The domain commonly referred to as the *zone*—indicates the type of organization that owns the **computer** being identified in the address. For example, *.com* signifies a commercial organization; *.edu* signifies an educational institution.

DOS - An acronym derived from disk operating system. The term refers to a **program** that allows the **computer** to manage the **storage** of information on **disks** and controls other aspects of a computer's operation.

Download-To transfer information to the user's **computer** from another computer.

DSL- Digital subscriber line. DSL is a high-**bandwidth** method of connecting to the **Internet** by means of telephone lines.

E-book - A small reading device that displays **downloaded** digital text.

Editing- The process of changing information by inserting, deleting, replacing, rearranging, and reformatting.Also known as *changing* or *customizing.*

E-mail (short for *electronic mail*)-The term *e-mail* refers to the transfer of messages or **documents** between users connected by an electronic **network.**

Firewall- A security system usually consisting of **hardware** and **software** that prevents unauthorized persons from accessing certain parts of a **program, database,** or **network.**

Folder - A **storage** area on a **disk** used to organize **files.**

Font - A typeface of a certain size and style. Includes all letters of the alphabet, figures, symbols, and punctuation marks.

Freenet- A local **network** that offers free (or low-cost) **access** to **host computers** located in libraries and to other public-interest groups in the community. A freenet may also offer limited access to the **Internet.**

Freeware - Copyrighted **software** that is available for use without charge.

f2f- Face to face Communication

Function keys-Keys on a **keyboard** (for example, F1) that give special **commands** to the **computer**—for example, to set margins or tabs.

Graphical user interface (GUI) - A visual computer environment that permits the user to **click** on **icons** or select options from a **menu.**

Graphics - Pictures or images presented or stored using a **computer.**

Hack-To work on an electronic project.

Hacker - A dedicated **computer** programmer. The term *hacker* is sometimes used erroneously to refer to a computer criminal who penetrates and tampers with computer **programs** or systems. The preferred term for a computer criminal is **cracker.**

Handheld computer - A portable computer smaller than a **notebook computer.** Also called a **palmtop computer.**

Hard copy - Text or **graphics** printed on paper; also called a **printout.**

Hard disk - A rigid type of magnetic medium that can store large amounts of information.

Hardware- The physical components of a **computer:** the **central processing unit,** the **display screen,** the **keyboard,** the **disk drive,** the **modem,** the **mouse,** and the **printer.**

Hit -A single request for information made by a client **computer** from a Web **server.** The popularity of a given **Web site** is often measured by the number of hits it receives. However, this number can be extremely misleading, since a particular Web page may contain a number of elements, each one of which will be counted as a hit when a visitor opens that page. Thus the number of hits recorded for a particular Web page can be significantly greater than the actual number of visitors to that page.

Home- The upper left corner of the **display screen;** the starting position of a page or **document.**

Home page- The main page for a **Web site** established by an organization or an individual; it usually serves as the entrance for a series of related pages.

Host computer- A **computer** that provides information or a service to other computers on the **Internet-** Every host computer has its own unique host name.

Hypertext markup language (HTML)- The formatting language used to establish the appearance of a Web page.

Hypertext transfer protocol (HTTP) - The **protocol** used on the **World Wide Web** that permits Web clients **(Web browsers)** to communicate with Web **servers.** This protocol allows programmers to embed **hyperlinks** in Web documents, using **hypertext markup language.**

Icon - A symbol (such as a picture of a trash can or a file folder) that represents a certain function. When the user **clicks** on the icon, the appropriate function is **executed. Information Superhighway (or I-way)-** A term used to refer the Internet**.**

Ink-jet printer - A nonimpact **printer** that forms **characters** by spraying tiny, electrically charged ink droplets on paper.

Input (n.)-Information entered into the **computer** for processing.

Input (v.)- To **enter** information into the **computer.**

Input device- A **hardware** component (such as a **mouse,** a **keyboard,** or a microphone) that lets the user **input** information.

Insert - To add information to **a file.**

Instant messaging (IM) - A **chat** program that lets people communicate over the **Internet** in real time.

Internet (or Net) - A system that links existing **computer networks** into a worldwide network. The Internet may be accessed by means of commercial online services through Internet service providers.

Internet community- A group of individuals with common interests who frequently exchange ideas on the **Internet.**

Internet protocol (IP) address - A unique set of numbers that identifies a **computer** over a **network.**

Internet service provider (ISP)- An organization that provides access to the **Internet** for a fee. Companies like America Online are more properly referred to as *commercial online services* because they offer many other services in addition to Internet access—for example, news, travel services, and financial and shopping information.

Internet telephony - Another name for **Voice over Internet Protocol (VoIP).**

Intranet - A private **network** established by an organization for the exclusive use of its employees.

Firewalls - Mechanism for preventing outsiders from gaining access to an organization's network.

Java - A programming **language** designed for **programs** used over the Internet.

JPEG _ Joint Photographic Experts Group. A format for storing complex **graphics** in compressed form.The file extension. *jpeg* or *.jpg* indicates that a particular file uses this format.

Kilobyte - A measurement of the **storage** capacity of a device. One kilobyte represents 1024 **bytes.***Kilobyte* may be abbreviated *K* or *KB;* however, *KB* is the clearer abbreviation since *K* also stands for the metric prefix *kilo* (meaning 1000).

Laptop computer - A portable **computer.** Also known as a *notebook computer.*

Laser printer - A nonimpact **printer** that produces sharper **text** and **graphics** than any other type of printer.

Linux -A type of **open source software.** When combined with other components, Linux serves as an increasingly popular **operating system** that competes with Microsoft Windows.

Liquid crystal display (LCD) - A type of **monitor** typically used on **laptop computers** or portable **computers.**

Mail merge - The process of taking information from a **database** and inserting it into a form letter or other **document** in order to customize the document for an individual recipient. For example, mail merge can be used to create the inside address and the salutation for a form letter.

Mailbomb - A deluge of **e-mail** messages from one or more sources, deliberately intended to overload the recipient's **computer** and make it **crash.** A mailbomb is typically sent to punish someone guilty of **spamming** or some other serious breach of **netiquette.**

Mainframe- A large **computer** system.

Malware - Software that disrupts normal **computer** functions or sends a user's personal **data** without the user's authorization.

Maximize - A command used in a **graphical user interface (GUI)** that enlarges a **window** so that it fills a desktop.

Megabyte - A measurement of the **storage** capacity of a device. One megabyte represents more than 1 million **bytes.** *Megabyte* may be abbreviated *M* or *MB;* however, *MB* is clearer since *M* also stands for the metric prefix *mega* (meaning 1 million). A megabyte is often referred to as a "meg."

Memory - The part of a **computer** that stores information.

Random-access memory (RAM). The temporary memory that allows information to be stored randomly and accessed quickly and directly (without the need to go through intervening data).

Read-only memory (ROM) - The permanent memory of a **computer;** a set of instructions that has been built into the computer by the manufacturer and cannot be accessed or changed by the user.

Menu - A list of choices shown on the **display screen.** For example, a **format** menu would include such options as the type style and the type size to be selected. A menu is often referred to as a *pull-down menu,* a *drop-down menu,* or a *pop-up menu* because it appears **onscreen** after the user **clicks** the **menu bar** or some other item on the screen.

Menu bar - The bar across the top of the **screen** or **window** that displays the names of available **menus.**

Merge - A command to create one **file** by combining information that is stored in two different locations. For example, a **computer** can merge the **text** in a form letter with a mailing list to produce a batch of letters with a different name, address, and salutation on each letter.

Microcomputer - A small and relatively inexpensive **computer,** commonly consisting of a **display screen,** a **keyboard,** a **central processing unit,** one or more **disk drives,** and a **printer,** with limited **storage** based upon a **microprocessor.**
Microprocessor - An **integrated circuit** on a silicon **chip** that serves as the **central processing unit** of a **computer.**
Minimize - A **command** used in a **graphical user interface (GUI)** that reduces a **window** to an **icon** or a label, usually at the bottom of a **desktop.**
MIPS - An acronym derived from millions of instructions per second. Used to measure the speed of a processor.
Modem - An acronym derived from modulator/demodulator. A device that (1) converts digital signals into tones for transmission over telephone lines and (2) converts the tones back into digital signals at the receiving end.
Monitor - The **display screen** of a **computer.**
Morph (from *metamorphosis*)- To change one image into another by means of digital technology.
Motherboard - The **computer's** main **circuit board,** which contains the **central processing unit,**the **memory,** and expansion slots for additional circuit boards called *adapters* or *cards.*
Mouse - A hand-operated electronic device used to move a **cursor** or pointer on the **display screen.** Mostly used with **microcomputers.**
Mouse elbow - A repetitive strain injury (similar to tennis elbow) that is caused by repeatedly using a **mouse.**
Mouse potato - A person who sits glued to a **computer screen** (in the same way that a couch potato sits glued to a TV screen).
Mousetrapping - Blocking someone's exit from a Web site**.**
MS-DOS - Derived from Microsoft disk operating system. An operating system used on the first IBM and IBM-compatible **microcomputers.**
Multimedia -The use of several types of media (such as **text, graphics,** animation, sound, and video) in a **document** or an **application.**
Netiquette - A set of guidelines for formatting and composing **e-mail** messages. **Netizen -** A "citizen" of the Net; an active participant in the **Internet community. Network -** A system of interconnected **computers.**
Local area networks (LAN) - connecting a number of computers within the same location or in close proximity.
Wide area networks (WAN)- use telephone lines or other **telecommunications** devices to link computers in widely separated locations.
Internet is a system that links existing networks into a worldwide network.
Notebook computer - A portable **computer.** Also known as a *laptop computer.*
Open source software - Software that makes the underlying source code available to all users at no charge. Users may make changes and improvements as long as they do not try to

sell the software commercially. **Linux** is the best example of open source software. **Operating system (OS) - Software** that manages the internal functions and controls the operations of a **computer.**

Output device - A **hardware** component (such as a **monitor,** a **printer,** or a sound speaker) that delivers the results of **computer** operations to the user.

Palmtop computer - A portable computer smaller than a **notebook** (or **laptop**) **computer** that fits on the palm of your hand. Also called a **handheld computer.**

Password- A user's secret identification code, required to **access** stored material. A procedure intended to prevent information from being accessed by unauthorized persons.

Peripheral - A device that extends the capabilities of a **computer** (for example, a **printer)**

Personal computer (PC)- A **microcomputer** for personal and office use.

Phishing - A type of computer fraud that tries to trick users into revealing their passwords and other confidential information.

Portable Document Format (PDF) - A **format** that makes it possible—with the help of Adobe Acrobat to view documents that employ different **fonts,** various types of **graphics,** and complex layouts.

Protocol- A set of standards that permit **computers** to exchange information and communicate with each other.

Save -To store a **program** or **data** on a **storage** device such as a **disk.**

Scanner - An **input** device that can copy a printed page into a **computer's memory,** thus doing away with the need to **type** the copy. A scanner can also convert artwork and photographs into a digital format and store these in memory.

Search engine - A free **program** that helps Web users locate **data** by means of a **keyword** or concept. Among the most popular search engines are Google, Yahoo, WebCrawler, and AltaVista.

Server - A computer that delivers **data** to other computers **(clients)** linked on the same **network.**

Shareware - Software that usually may be **downloaded** and used initially without charge; the author may subsequently ask for some payment.

Soft copy - Information shown on the **display screen.**

Software - The instructions that a **computer** needs to perform various functions. The term *software* means the same as **program.**

Sort - To arranges **fields, records,** or **files** in a predetermined sequence.

Spam (n.) - The electronic equivalent of junk mail; also called *unsolicited commercial e-mail*

Spam (v.) -To send an **e-mail** message to a great number of recipients without regard for their need to know. A user who spams sometimes receives a **mailbomb** in return as a form of retaliation.

Spreadsheet - A **program** that provides a worksheet with **rows** and **columns** to be used for calculations and the preparation of reports.

Spyware - Software that enables a user to track someone's **computer** activities without that person's consent.

Storage - The **memory** of a **computer.**

Toolbar - An onscreen element that offers instant **access** to commonly used **commands.** The commands are represented by **icons** on a row of buttons at the top of the **screen.** Also called a *button bar.*

Touchpad - The device on a **laptop computer** that takes the place of a **mouse.**

Touch screen technology - The technology that permits a user to perform a function simply by touching the **screen** in an appropriate spot.

Trojan horse - A type of **computer virus** that is hidden within an innocent-looking program.

Uniform resource locator (URL) - The specific **Internet** address for a resource such as an individual or an organization.

Uninterruptible power supply (UPS) -A battery-powered backup system that provides enough electricity to a **computer** during a power outage (or, in most cases, a brownout or power surge) so that the user can save **files** before shutting down the computer.

Universal Serial Bus (USB) - A common standard for connecting multiple **peripherals** to a **computer** as needed.

Upload - To transfer information from a **client computer** to a **host** computer.

Virus - A piece of **computer** code designed as a prank or malicious act to spread from one computer to another by attaching itself to other **programs.** Some viruses simply cause a humorous message to appear on the screen. Some cause minor **glitches,** but others cause serious damage to a computer's **memory** or **disks.** Some viruses flood an organization's Web site, interrupting or entirely preventing access to the organization's customers.

Voice over Internet Protocol (VoIP) - The transmission of voice communications by means of the **Internet Protocol.** VoIP is an inexpensive alternative to long-distance telephone calls.

Web browser - Software that permits a user—with a click of a **mouse**—to locate, display, and download **text,** video, audio, and **graphics** stored in a **host computer** on the Web. The most common Web browsers now in use are Internet Explorer and Mozilla Firefox.

Web site- One or more related pages created by an individual or an organization and posted on the **World Wide Web.**

Webcam - A video camera that sends live images over the **Internet** to a **Web site.**

Webcaster - An **application** that can be custom-tailored to satisfy an individual user's need for constantly updated information in specific areas. A Webcaster, when appropriately programmed, will automatically deliver the needed information to the user's **computer.**

Wi-Fi - Wireless fidelity. A process that permits high-speed wireless transmission of **data.**

Wiki - A procedure that permits a **Web site** to be continually edited or added to by those who visit the site.

Window - A frame that permits users to view messages they have received or **documents** they are working on.

Windowing- The ability of a **program** to split its **display screen** into two or more segments so that the user can view several different **documents** or performs several different functions simultaneously.

Windows- A Microsoft **operating system** used on the vast majority of **PCs.**

Wizard- An interactive feature within an **application** that helps a user through each step of a task, such as creating a customized **document** or adding **hardware.** The term *wizard* is also used to refer to the person in an organization who can quickly find and fix everyone else's **computer** problems.

Word of mouse- Gossip spread by **e-mail.**

Word processing- The electronic process of creating, formatting, **editing,** proofreading, and printing **documents.**

World Wide Web- The component of the **Internet** that combines audio, video, and **graphics** with **text.** Also called the *Web* or *WWW*

Worm- A type of **computer virus** that runs a **program** to destroy **data** on a user's **hard drive.** Worms spread by sending copies of themselves to everyone on the user's list of e-mail addresses.

MODULE -I OVERVIEW OF INFORMATION TECHNOLOGY

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MODULE - I

Overview of Information Technology

Technology and Society

"The most beautiful thing we can experience is the mysterious. It is the source of all true art and science".-Albert Einstein, *What I Believe*, 1930.

Our society is a network society; that is, a society constructed around personal and organizational networks powered by digital networks and communicated by the Internet. And because networks are global and know no boundaries, the network society is a global network society. Today, Information technology holds a significant role in almost all areas of our lives. IT is the main component in business, offices, colleges and also our homes. Almost everyone use email as an important mode of communication. Internet allows us to hold real time conversations (eg:-Skype, Google talk). Surveys and research can be conducted by using digital tools. Word processors, Power Point, Photoshop, software games, modelling and simulation, networking, digital imaging and photography, audio and video applications and electronic commerce are only a few among the extremely wide series of fields and applications of Information Technology. The growth and diversity of applications greatly increase the utility of IT, leading to its further expansion in all walks of life.

Informatics is the study, design, development, implementation, support or management of computer based information systems. It is often used synonymous with Information Technology. Information technology is "the science and activity of storing and sending out information by using computers". To be more precise, Information technology is the science and activity of moving data digitally.

In the past few decades there has been a revolution in computing and communications, and all indications are that technological progress and use of information technology will continue at a rapid pace. As a tool available to a fairly wide public, the Internet is only twenty years old, but it is already the key channel of the ever expanding and fastest technological revolution in history. Over the past two decades its effects have touched practically every citizen in the world. And it is the fastest because its large-scale adoption is quicker than that of any earlier technology. The 100-million user mark was achieved by PCs in 14 years and the Internet in 7 years. The cycles of adoption of Internet-related technologies are even shorter—Face book reached 100 million users in 2 years.

Accompanying and supporting the dramatic increases in the power and use of new information technologies has been the declining cost of communications as a result of both technological improvements and increased competition. These advances present many

significant opportunities but also pose major challenges. Today, innovations in information technology are having wide-ranging effects across numerous domains of society, and policy makers are acting on issues involving economic productivity, intellectual property rights, privacy protection, and affordability of and access to information. Choices made now will have long lasting consequences, and attention must be paid to their social and economic impacts.

It is impossible today to imagine the world without the Internet: it enables us to do things that only a few years ago would have been unthinkable, and reaches every facet of our lives. Yet what makes the Internet even more amazing is that it is such a young technology—still developing, still rapidly changing. Everything we have seen so far is just the beginning. Any iPhone today has approximately the same capacity as the largest supercomputer of the 1970s. The key difference is that a supercomputer cost 5 million dollars in 1975, occupied a very large room, was completely disconnected from other devices, and its use was restricted to very few people for very limited purposes. In contrast, an iPhone costs less than 400 dollars in today's money, we can carry it in our pocket, and we can connect it to millions of other devices for any number of purposes.

The increasing capacity of devices will continue, along with an exponential increase in the speed of data transfer. The global average data transfer speed is about 2 megabytes (MB) per second. Soon any consumer will be able to download a high-definition movie within the space of a second. In parallel to this, technologies enabling mobile wireless Internet access at speeds comparable to broadband continue to advance.

The second multiplier effect of the Internet's influence is the increasing connectivity. Internet access has moved from personal computers to mobile phones which are capable of receiving, generating, and sending information. It is estimated that by the end of 2015, there will be more than 200 billion devices connected to the Internet—four times more than in 2010. In only a few years, this will be the most complex structure ever created by humankind. There will be billions of nodes able to measure anything measurable, extracting and communicating any form of information; and this information will be used to monitor every aspect of the *real* world. In short, technology has made leaps and bounds in recent history and shows no signs of slowing down.

From Print Culture to Information Technology

Humans have been inventing since the earliest breakthroughs in understanding and application such as the first use of tools and the discovery of fire. All the human inventions were the natural outcomes of man's efforts to solve problems and find new ways for making life easier. All these inventors who had contributed decisively to make human life much more easier and comfortable may have lived centuries apart but they are united by their

common goal of turning their ideas into reality and building upon the knowledge and experiences of the previous generations. Changes in technology and the invention of new machines do not happen in isolation. All the important innovations of the world have had its impact upon society and history. The invention of the steam engine, for example, marked the beginning of the industrial revolution in Europe. Society was irrevocably changed by the revolution: class boundaries blurred, traditional women's roles almost disappeared and the shape of Europe's towns and cities changed forever. Risk and danger is a recurring theme in the history of inventions. Time after time, individual inventors faced poverty, failure and even death in order to push the levels of human understanding one step further.

Humanity has changed dramatically from the Stone Age to the Dark Ages through the Enlightenment and the Industrial Revolution. This evolution is marked by advances in technologies that appear to make people's lives better. The ability to control fire gave man the ability to warm himself and cook food. The invention of the wheel has paved the way for transportation and industry, while the ability to make energy from coal and oil has shaped entire societies. The four significant inventions of China – paper making, printing, gun powder and compass – had a deep influence on the development of Chinese civilizations and also had far reaching impact upon the world civilization in general. Printing and paper making effected revolutionary changes in literature and knowledge distribution, gun powder in warfare and Compass in navigational ventures. Gun powder, for example, spread to the Arab world in the 13thcentury and from there to Europe. Francis Bacon wrote in 'Novum Organum' that 'printing, gun powder and the compass have changed the whole face and state of things throughout the world, the first in literature, the second in warfare, the third in navigation; whence have followed innumerable changes in so much that no empire, no sect, no star seems to have exerted greater power and influence in human affairs than these discoveries'.

However, of the inventions that shaped human society from the very ancient times onwards, unparalleled was the development of means and techniques for communication. It is simply because sharing of ideas is the essential precursor of all other inventions. Here, the development of language through which humans started sharing their feelings, emotions and aspirations with their fellow beings is of supreme significance. But, the scope of oral communication in those days was definitely limited by the twin constraints of time and space. No one can communicate orally with anyone who lives outside his personal or physical reach as there were no tools and techniques for recording. So, in the very ancient times information was stored in memory and orally transmitted from region to region, culture to culture, and from generation to generation.

To overcome this lacuna man invented the art of writing. The invention of writing, first on stones, bones, terracotta, copper plates and finally on paper marked a great alteration in human affairs. Great thinkers could now write down their thoughts for those who came after them. The greatest gifts of their highly imaginative mind were no longer lost when they

died; it was handed down to others who could continue the work. Books became the treasure-houses of knowledge and great thoughts. Kings and nobles kept a few people at their courts whose only work was to make copies of famous books. Priests all over the world set apart a few of their order for the same purpose. But, making copies by hand was certainly a slow work. Only a few copies could be made in a lifetime of hard work. Books or their copies were few and costly. Scholars had to travel hundreds of kilometers before they could find the book of their choice. It is, therefore, no wonder that few people could read and write.

Invention of Printing Press

A major breakthrough in the realm of information dissemination system was undoubtedly the invention of printing. Though the invention of movable press was generally attributed to Johann Gutenberg (1337-1468), a German, later researches have proved that in China and Korea, types were used for printing even earlier. Book printing had developed in China in the 7th century itself using delicate hand carved wooden blocks to print individual pages. The 9th century Chinese work 'Diamond Sutra' is the earliest known printed document. Movable type was also used for some time, but was abandoned because of the number of characters needed. Ceramic movable type printing was developed by Bi Sheng in the 11th century, which was enhanced by the wooden movable type by Wang Zhen and in later period the bronze metal movable type was developed by Hua Sui in the 15th century.

However, as per the existing evidences, Gutenberg did not get his idea of movable types from China or Korea. He moulded each letter separately and then put these moulded letters or type together to form words, lines and pages. He made his invention in 1436 or 1437 and started a printing shop at Mainz which seems to have been his birth-place. Here was printed the first book in Europe. It was the Bible, and came to be known as the Mazarin Bible. Printing spread quickly all over Europe. The doors of knowledge were thrown open. More and more books were needed to explain all the new discoveries and to make them known everywhere. Knowledge was to be pooled for the good of all, not hoarded for the gain of the few. The invention of printing came in time to make this possible. Thousands of books were printed. They not only spread knowledge far and wide but also opened people's minds to new ideas and trends.

With the advent of colonialism, missionary activities and enlightenment the art of printing became very much popular and accessible in every nuke and corner of the world. The information generation and processing became widespread through the medium of printed materials. But there were limitations for the print format as well. The most important of the limitations of print format was the problem of retrieving a required piece of information from a large collection. Another one is the barrier of space and time which were again complicated by the linguistic and cultural dissimilarities. The third was storage space.

Lastly, the works printed on paper could not withstand the onslaught of time as it always exhibit a natural tendency to decay as an inevitable consequence of its chemical composition.

Equally important was several crucial inventions in the history of communication. It begins with the development of a signaling system in the late eighteenth century to be followed by electronic communication devices such as the telegraph in the early nineteenth century and the ground-breaking inventions of telephone, radio and television.

The digital era of Information Revolution

Computers, a strange word some fifty years ago, are now common household items and integral parts of educational systems all over the world. The ever increasing popularity of Personal Computers with its key characteristic features such as speed, accuracy, high storage capacity and diligence had dramatically transformed the pace, volume and accuracy of information processing. This qualitative and quantitative growth of information attained its unprecedented peak when in the early 1990's, Tim Bernes-Lee developed the global hypertext system - the World Wide Web - with an aim to provide a common space where information could be shared without barriers. The expansion of the Web may have surprised even its creator. In less than ten years, the online population has grown to 180 million individuals across all continents, while an estimated 250,000 sites are added to the Web each month. Rapid expansion is not unique to the Web. At the end of 1998, more than 40 percent of the households in the United States owned computers and one fourth had Internet access. Scholars, journalists and professionals reacted to the rapid development of the new information and communication technologies (ICTs) with high expectations and equally great concerns. All recognize the technology's potential to overcome geographical and cultural barriers and bring needed improvement to people's lives all over the world. The old in print format of information storage have almost completely replaced by the new digital network of globally connected knowledge repositories. The ever widening circulation of mobile computing devices which most successfully synchronizes computing with information processing and communication is another big leap towards this digital revolution. Now, two individuals who were sitting thousands of kilometers apart could easily communicate with each other and could transfer or process bulky volumes of information by using a very small and simple handheld device within fractions of seconds. So, now we are experiencing the emerging reality of massive data stores, unimaginable processing power, and super fast networks in the field of information processing. In short, the most dramatic change ensued by the internet and Information and Communication Technology (ICT) is the democratization of knowledge which is characterized by easy and effective access to rich collections of information storage to each and every individual irrespective of the barriers of caste, creed and nationality that too at a matchlessly lower coast.

In recent years there has been much debate about the future of the book in a digital world. E-books have already become a reality. This is not surprising, as the technology of the book has seen a number of transitions. Over the centuries there has been a series of changes in the way that words are presented. Clay, wax, papyrus, vellum, cloth and paper have all been used and stored as tablets, scrolls or folios or books. The digital storage of information always enjoys an advantage over the conventional mode of storing information in the following respects.

I. It facilitates the easy retrieval of a particular piece of information from the vast repository of digital resources by using effective search techniques.
II. It offers anytime and anywhere access disregarding the barriers of time and space
III. Digital media always provides high data storage capacity.
IV. It offers high speed information processing.
V. Digital storage media is less perishable than paper
VI. It always provides enough and effective chances for interaction with the authors, scholars and also the peer group.

History of Computers

Today, most of us consider computer as just an electronic device that offer a means to access the internet and World Wide Web or as an instrument to be used for word processing. But by this restricted way of thinking we are in fact overlooking the real purpose of computing for which they were originally designed. The first electronic computers were essentially large calculators. The stored- programme electronic digital computer first appeared in 1940's and from a machine designed to perform calculations, quickly evolved into an information processing and communication machine that became indispensible to business and all other spheres of human activities. The later advances in technology made computers cheaper, smaller and much more capable.

The history of computers starts out about 2000 years ago in Babylonia, at the birth of the abacus, a wooden rack holding two horizontal wires with beads strung on them. When these beads are moved around, according to **programming** rules memorized by the user, all regular arithmetic problems can be done. Another important invention around the same time was the Astrolabe, used for navigation.

In the early years of 17th century, John Napier, a Scottish mathematician made a major contribution to the history of computation by inventing logarithms. Napier's logarithm made it possible to perform multiplications easily by addition of the logarithms of the numbers, and division by subtraction. These logarithm tables are still used today. In about 1614, Napier produced a system of small rods with appropriate markings on them to be used as a mechanical aid for computation. These rods came to be called Napier's bones. The device was

consisted of a number of these rods each marked with the digits 1 to 9, with their multiples in columns underneath them.

Blaise Pascal is usually credited for building the first **digital** computer in 1642. It added numbers entered with dials and was made to help his father, a tax collector. It was an adding machine based on mechanical gears in which numbers were represented by the cogs on the wheels. This first mechanical calculator, called the Pascaline, had several disadvantages. Although it did offer a substantial improvement over manual calculations, only Pascal himself could repair the device and it cost more than the people it replaced! In addition, the first signs of technophobia emerged with mathematicians fearing the loss of their jobs due to progress.

In 1671, Gottfried Wilhelm von Leibniz (1646-1716) , a German mathematician built the first calculator to do multiplication and division.. It could add, and, after changing some things around, multiply. Leibniz used a special **stepped gear mechanism** to do calculations but it was not reliable in terms of accuracy.

The prototypes made by Pascal and Leibniz were not used in many places, and considered uncanny until a little more than a century later, when Thomas of Colmar created the first successful mechanical calculator that could add, subtract, multiply, and divide. A lot of improved desktop calculators by many inventors followed, so that by about 1890, the range of improvements included:

- Accumulation of partial results
- Storage and automatic reentry of past results (A memory function)
- Printing of the results

Each of these required manual installation. These improvements were mainly made for commercial users, and not for the needs of science.

Charles Babbage

While Thomas of Colmar was developing the desktop calculator, a series of very interesting developments in computers was started in Cambridge, England, by Charles Babbage, a mathematics professor. In 1812, Babbage realized that many long calculations, especially those needed to make mathematical tables, were really a series of predictable actions that were constantly repeated. From this he suspected that it should be possible to do these automatically. He began to design an automatic mechanical calculating machine, which he called a **difference engine**. By 1822, he had a working model to demonstrate with. With financial help from the British government, Babbage started fabrication of a difference engine in 1823. It was intended to be steam powered and fully automatic, including the printing of the resulting tables, and commanded by a fixed instruction program.

The difference engine, although having limited adaptability and applicability, was really a great advance. Babbage continued to work on it for the next 10 years, but in 1833 he lost interest because he thought he had a **better idea** -- the construction of what would now be called a general purpose, fully program-controlled, automatic mechanical digital computer. Babbage called this idea an **Analytical Engine**. The ideas of this design showed a lot of foresight, although this couldn't be appreciated until a full century later.

The plans for this engine required an identical decimal computer operating on numbers of 50 decimal digits (or words) and having a storage capacity (memory) of 1,000 such digits. The built-in operations were supposed to include everything that a modern general - purpose computer would need, even the all important **Conditional Control Transfer Capability** that would allow commands to be executed in any order, not just the order in which they were programmed.

The analytical engine was soon started using **punched cards** which would be read into the machine from several different **Reading Stations**. The machine was supposed to operate automatically, by steam power, and require only one person there.

Unfortunately, Babbage was unable to give a final shape to **Analytical Engine**- his dream project. The failure is attributed to various reasons of which the lack of precision in machining techniques seems the most pertinent. Another speculation is that Babbage was working on a solution of a problem that few people in 1840 really needed to solve. After Babbage, there was a temporary loss of interest in automatic digital computers. Madam Augusta Ada was one of few people who understood design of the engine developed by Babbage. She is considered as the first female computer programmer.

Between 1850 and 1900 great advances were made in mathematical physics, and it came to be known that *most observable dynamic phenomena can be identified by differential equations* (which meant that most events occurring in nature can be measured or described in one equation or another), so that easy means for their calculation would be helpful. Moreover, from a practical view, the availability of steam power caused manufacturing (boilers), transportation (steam engines and boats), and commerce to prosper and led to a period of a lot of engineering achievements. The designing of railroads and the making of steamships, textile mills, and bridges required **differential calculus** to determine such things as:

- center of gravity
- center of buoyancy
- moment of inertia
- stress distributions

Even the assessment of the power output of a steam engine needed mathematical integration. A strong need thus developed for a machine that could rapidly perform many repetitive calculations.

Use of Punched Cards by Hollerith

Another step towards automated computing was the development of punched cards, which were first successfully used with computers in 1890 by Herman Hollerith and James Powers, who worked for the U.S Census Bureau. They developed devices that could read the information that had been punched into the cards automatically, without human help. Because of this, reading errors were reduced dramatically, work flow increased, and, most importantly, stacks of punched cards could be used as easily accessible memory of almost unlimited size. Furthermore, different problems could be stored on different stacks of cards and accessed when needed.

These advantages were utilized by commercial companies and soon led to the development of improved punch-card using computers created by International Business Machines (IBM), Remington, Burroughs and other corporations. These computers used electromechanical devices in which electrical power provided mechanical motion -- like turning the wheels of an adding machine. Such systems included features to:

- feed in a specified number of cards automatically
- add, multiply, and sort
- feed out cards with punched results

As compared to today's machines, these computers were very slow, usually processing 50 - 220 cards per minute. However, punched cards were a huge step forward. They provided a means of input/output, and memory storage on a huge scale. For more than 50 years after their first use, punched card machines did most of the world's first business computing, and a considerable amount of the computing work in science.

Electronic Digital Computers

Alan Turing (1912-1954) was a British mathematician who made significant contributions to the early development of computing, especially to the theory of computation. In 1936, he introduced the concept of a computing machine working on the basis of statements, symbols and numbers. Turing developed an abstract theoretical model of a computer called Turing machine which is used to capture the notion of computable i.e. what problems can and what problems cannot be computed since all problems cannot be solved on a computer. However, a Turing machine is only an abstract model and not a physical computer.

The start of World War II produced a large need for computer capacity, especially for the military. New weapons were made for which **trajectory tables** and other essential data were needed. In 1942, John P. Eckert, John W. Mauchly and their associates at the Moore school of Electrical Engineering of University of Pennsylvania decided to build a high speed electronic computer to do the job. This machine became known as ENIAC (Electrical Numerical Integrator And Calculator). The size of ENIAC's numerical "word" was 10 decimal digits, and it could multiply two numbers at a rate of 300 per second, by finding the value of each product from a multiplication table stored in its memory. ENIAC was therefore about 1,000 times faster than the previous generation of relay computers. ENIAC used 18,000 vacuum tubes; about 1,800 square feet of floor space, and consumed about 180,000 watts of electrical power. It had punched card Input /Output, 1 multiplier, 1 divider/square rooter, and 20 adders and read-write register storage. The executable instructions making up a program were embodied in the separate "units" of ENIAC, which were plugged together to form a "route" for the flow of information. These connections had to be redone after each computation, together with presetting function tables and switches. Obviously, this "wire your own" technique was inconvenient and hence ENIAC could not be considered a completely programmable machine in the perfect sense of the term. It was, however, efficient in handling the particular programs for which it had been designed.

ENIAC is commonly accepted as the first successful high–speed electronic digital computer (EDC) and was used from 1946 to 1955. However, a controversy developed in 1971, over the patentability of ENIAC's basic digital concepts. The claim was that another physicist, John V. Atanasoff had already used basically the same ideas in a simpler vacuum - tube device he had built in the 1930's while at Iowa State College. In 1973 the courts ruled in favor of the company using the Atanasoff model.

Fascinated by the success of ENIAC, the mathematician John Von Neumann undertook, in 1945, an abstract study of computation that showed that a computer should have a **very simple, fixed physical structure**, and yet be able to execute any kind of computation by means of a **proper programmed control** without the need for any change in the unit itself. Von Neumann contributed a new awareness regarding the practicability of organizing and building high speed computers. These ideas, usually referred to as the stored - program technique, became vital for future generations of high - speed digital computers and were universally adopted. The Stored - Program technique involves many features of computer design and function. These features made very - high - speed operation attainable. As a result, computing and programming became much faster, more flexible, and more efficient with work. The all - purpose computer memory became the assembly place in which all parts of a long computation were kept, worked on piece by piece, and put together to form the final results. The computer control survived only as an "errand runner" for the

overall process. As soon as the advantage of these techniques became clear, they became a standard practice.

The first generation of modern programmed electronic computers to take advantage of these improvements was built in 1947. This group included computers using Random - Access - Memory (RAM), which is a memory designed to give almost constant access to any particular piece of information. Some of them could perform multiplications in 2 to 4 MU seconds. Physically, they were much smaller than ENIAC. Some were about the size of a grand piano and used **only 2,500** electron tubes, a lot less than required by the earlier ENIAC. The first - generation stored - program computers needed a lot of maintenance, reached probably about 70 to 80% reliability of operation and were used for 8 to 12 years. They were usually programmed in Machine Language. By the mid 1950's progress had been made in several aspects of advanced programming. This group of computers included EDVAC (Electronic Discrete Variable Automatic Computer) and UNIVAC (Universal Automatic Computer). These were the first commercially available computers.

Advances in the 1950's

Early in the 1950's two important engineering discoveries changed the image of the electronic - computer field, from one of fast but unreliable hardware to an image of relatively high reliability and even more capability. These discoveries were the **magnetic core memory** and the **Transistor – Circuit Element**. These technical discoveries quickly found their way into new models of digital computers. RAM capacities increased from 8,000 to 64,000 words in commercially available machines by the 1960's, with access times of 2 to 3 MS (Milliseconds). These machines were very expensive to purchase or even to rent and were particularly expensive to operate because of the cost of expanding programming. Such computers were mostly found in large computer centers operated by industry, government, and private laboratories - staffed with many programmers and support personnel. This situation led to modes of operation enabling the sharing of the high potential available.

One such mode is batch processing, in which problems are prepared and then held ready for computation on a relatively cheap storage medium. Magnetic drums, magnetic - disk packs, or magnetic tapes were usually used. When the computer finishes with a problem, it "dumps" the whole problem (program and results) on one of these peripheral storage units and starts on a new problem.

Another mode for fast, powerful machines is called time-sharing. In time-sharing, the computer processes many jobs in such rapid succession that each job runs as if the other jobs did not exist, thus keeping each "customer" satisfied. Such operating modes need elaborate **executable** programs to attend to the administration of the various tasks.

Advances in the 1960's

In the 1960's, efforts to design and develop the fastest possible computer with the greatest capacity reached a turning point with the LARC machine, built for the Livermore Radiation Laboratories of the University of California by the Sperry - Rand Corporation, and the Stretch computer by IBM. The LARC had a base memory of 98,000 words and multiplied in 10 Greek MU seconds. Stretch was made with several degrees of memory having slower access for the ranks of greater capacity, the fastest access time being less than 1 Greek MU Second and the total capacity in the vicinity of 100,000,000 words.

During this period, the major computer manufacturers began to offer a range of capabilities and accessories such as:

1. Consoles
2. Card Feeders
3. Page Printers
4. Cathode - ray - tube displays
5. Graphing devices

These were widely used in businesses for such things as:

- Accounting
- Payroll
- Inventory control
- Ordering Supplies
- Billing

CPU's for these uses did not have to be very fast arithmetically and were usually used to access large amounts of records on file, keeping these up to date. By far, the most number of computer systems were sold for the more simple uses, such as hospitals (keeping track of patient records, medications, and treatments given). They were also used in libraries, such as the National Medical Library retrieval system and in the Chemical Abstracts System where computer records on file now cover nearly all known chemical compounds.

Advancements after 1970

The trend during the 1970's was, to some extent, moving away from very powerful single–purpose computers to cheaper computer systems capable of performing a larger range of applications. Most **continuous process manufacturing** such as petroleum refining and electrical-power distribution systems now used computers of smaller capability for controlling and regulating their jobs.

In the 1960's, the problems in programming applications were an obstacle to the independence of medium sized on-site computers. But, gains in applications programming language technologies removed these obstacles. Applications languages were now available

for controlling a great range of manufacturing processes, for using machine tools with computers and for many other things. Moreover, a new revolution in computer hardware was under way involving shrinking of computer logic circuitry and of components, by **large-scale integration** (LSI) techniques. As early in 1950s, it was realized that "scaling down" the size of electronic digital computer circuits and parts would increase speed and efficiency and that would definitely ensure an improved performance. About 1960 **photo printing** of conductive circuit boards to eliminate wiring became more developed. Then it became possible to build resistors and capacitors into the circuitry by the same process.

In the 1970's, **vacuum deposition of transistors** became the norm and entire assemblies with adders, shifting registers, and counters, became available on tiny "chips."In the 1980's, **very large scale integration** (VLSI), in which hundreds of thousands of transistors were placed on a single chip became more and more common. In the 1970s, many companies introduced programmable **minicomputers** supplied with software packages. The "shrinking" trend continued with the introduction of personal computers (PC's), which are programmable machines small enough and inexpensive enough to be purchased and used by individuals. Many companies like Apple Computer and Radio Shack introduced very successful PC's in the 1970s. A major reason behind this newly found encouragement was a craze for computer (video) games. In the 1980s some friction occurred in the crowded PC field, with Apple and IBM keeping strong. In the manufacturing of semiconductor chips, the Intel and Motorola Corporations were very competitive into the 1980s, although Japanese firms were making strong economic advances, especially in the area of memory chips.

By the late 1980s, some personal computers were run by microprocessors capable of handling 32 bits of data at a time and could process about 4,000,000 instructions per second. Microprocessors equipped with read-only memory (ROM) which stores constantly used unchanging programs now performed an increased number of process-control, testing, monitoring, and diagnosing functions like automobile ignition systems, automobile-engine diagnosis, and production-line inspection duties.

However, progress in the area of software has not matched the great advances in hardware. Software has become the major expenditure of many systems because programming productivity has not increased very quickly. New programming techniques such as object-oriented programming have been developed to help relieve this problem. Despite difficulties with software, the **cost per calculation** of computers is rapidly lessening and their convenience and efficiency are expected to increase in the near future.

The computer field continues to experience huge growth. Computer networking, computer mail, and electronic publishing are just a few of the applications that have grown in recent years. Advances in technologies continue to produce cheaper and more powerful

computers offering the promise that in the near future, computers or terminals will reside in most, if not all homes, offices, and schools.

Different Generations of Computers

It was from the 1950's that the computer age took off in full force. The years since then have been divided into periods or generations based on the technology used during the period. The computers of different generations are marked by their steady improvements in terms of processing speed and compatibility and a decrease in size and price.

First Generation Computers (1951-58): Vacuum Tubes

These machines were used in business for accounting and payroll applications. **Valves** were unreliable components generating a lot of heat (still a problem in computers). They had very limited memory capacity. **Magnetic drums** were developed to store information and **tapes** were also developed for secondary storage. They were initially programmed in **machine language** (binary). A major breakthrough was the development of **assemblers** and **assembly language**.

Second Generation (1959-64): Transistors

The development of the **transistor** revolutionised the development of computers. Invented at Bell Labs in 1948, transistors were much smaller, more rugged, cheaper to make and far more reliable than valves. Core memory was introduced and disk storage was also used. The hardware became smaller and

more reliable, a trend that still continues. Another major feature of the second generation was the use of **high-level** programming languages such as **Fortran** and **Cobol**. These revolutionised the development of software for computers.

The computer industry experienced explosive growth.

Third Generation (1965-71): Integrated Circuits (ICs)

IC's were again smaller, cheaper, faster and more reliable than transistors. Speeds went from the microsecond to the nanosecond (billionth) to the picoseconds (trillionth) range. ICs were used for main memory despite the disadvantage of being **volatile**. Minicomputers were developed at this time. **Terminals** replaced punched cards for data entry and disk packs became popular for secondary storage. IBM introduced the idea of a **compatible** family of computers, 360 family, easing the problem of upgrading to a more powerful machine. Substantial **operating systems** were developed to manage and share the computing resources and **time sharing** operating systems were developed. These greatly improved the efficiency of computers. Computers had by now pervaded most areas of business and administration. The number of transistors that be fabricated on a chip is referred to as the **scale of integration**

(**SI**). Early chips had **SSI** (small SI) of tens to a few hundreds. Later chips were **MSI** (Medium SI): hundreds to a few thousands. Then came **LSI** chips (Large SI) in the thousands range.

Fourth Generation (1971 -): VLSI (Very Large SI)

VLSI allowed the equivalent of tens of thousands of transistors to be incorporated on a single chip. This led to the development of the **microprocessor-** a processor on a chip. Intel was the pioneer in producing microprocessors. Very soon, other companies including **Motorola**, **Texas Instruments** and **Zilog** started developing microprocessors. Personal computers were developed and IBM launched the IBM PC microprocessors. Mainframe computers have grown in power. Memory chips are in the megabit range. VLSI chips had enough transistors to build 20 ENIACs. Secondary storage has also evolved at fantastic rates with storage devices holding gigabytes (1000Mb = 1 Gb) of data. On the software side, more powerful operating systems are available such as **UNIX**. Applications software has become cheaper and **easier to use**. Software development techniques have vastly improved. Fourth generation languages (4GLs) used in these computers made the development process much easier and faster.

Fourth Generation Continued (1990s): ULSI (Ultra Large SI)

ULSI chips have millions of transistors per chip e.g. the original Pentium had over 3 million and this has more than doubled with more recent versions. This has allowed the development of far more powerful processors. **The** Developments are still continuing. Computers are becoming faster, smaller and cheaper. Storage units are increasing in capacity.

Fifth generation computers

The developments in the field of artificial intelligence explored a new path in the field of computers. The aim is to develop an autonomous intelligent system that can be controlled by human beings. The expert system in this generation can communicate with people in their natural language. The invention of magnetic bubble memories is a milestone in memory research. Robots with self-computing capacity and decision making power are the ultimate aim of the fifth generation.

Computer processor companies have increased and are offering all kinds of programs for almost anything in this world. Microsoft dominates the scene. Windows 95 raised them to a level of dominance. Now new versions of the same are available. Linux Kernel introduced by Linus Torvalds in 1991 has provided countless open source operating systems and open source software.

Computers have become more and more online oriented with the development of the World Wide Web. Popular companies like Google and Yahoo! were started because of internet. In 2008 the IBM Roadrunner was introduced as the fastest computer in the world.

Features of Modern Personal Computers

Computer is an electronic device that stores, retrieves, and processes data, and can be programmed with instructions. In other words, it is an electronic data processing machine. A computer is composed of hardware and software, and can exist in a variety of sizes and configurations. The characteristic features of modern personal computers are Speed, accuracy, high data storage capacity, diligence, versatility and reliability.

The main components of a personal computer are the monitor, keyboard and Central Processing Unit (CPU). We can classify the major components and peripheral devices of a computer into two basic categories namely input and output devices. BIOS are the abbreviation used to describe Basic Input/output System. It is the set of programs stored in read-only memory (ROM) of computers**.** These programs control the disk drives, the keyboard, and the display screen, and they handle start-up operations. Each computing device has what are called "input and output devices". An input device sends information (or stimulus) to the computer, and the output device retrieves information (or response) from the computer. There are several input and output devices. We use these to communicate with the computer so that we can get required results. Keyboard and mouse are input devices where as monitor, printer and speakers are input devices.

Monitor

Monitor is the most important output device of a computer. It is also known as Visual Display Unit (VDU). It is the device used by the computer to display information. In earlier days only monochrome monitors that could display text and images in black and white were available. But today, colour monitors are widely used. Smaller and lighter monitors that use technologies like Liquid Crystal Display (LCD) are also becoming popular.

Cathode Ray Tube (CRT) Monitor

The CRT monitor is the traditionally used computer monitors. It creates a picture out of many rows or lines of tiny coloured dots. The CRT monitor comes in 15-inch to 21-inch sizes (38-53 cm) and larger. But the actual viewing screen is about 1 inch (2.5 cm) smaller than the rated size. The specification regarding CRT monitor is 'dot pitch' which relates to the tightness or sharpness of the picture. CRT technology was widely used in the late 1990s – early 2000s. Demerits of CRT include radiation, emission, high power consumption, weight and bulkiness.

LCD (Liquid Crystal Display) Monitor

A Liquid Crystal Display is a thin, flat electronic visual display that uses the light modulating properties of liquid crystals. They are used in computer monitors, television, instrument panels, aircraft cockpit display etc. They are common in consumer devices such as video player, gaming devices, clocks and watches. Most laptops and net books use LCD screen. LCDs have displaced CRT (Cathode Ray Tube) in most applications. They are more energy efficient and offer safer disposal than CRTs. Its low electrical power consumption enables it to be used in battery powered electronic equipment. Less electricity consumption and less harm to the eye are some of its characteristic features

Central Processing Unit (CPU)

The CPU is the brain of the computer. It is sometimes referred to as the Central processor. In terms of computing power, the CPU is the most important element of a computer system. It is linked to main memory, peripheral equipment, which includes input and output devices, and the storage units. It selects instructions from the main memory in proper sequence and sends them to the instruction-decoding unit, which interprets them so as to activate functions of the system at appropriate moments. The control unit integrates computer operations.

On personal computers and small workstations, the CPU is housed in a single chip called a microprocessor. Since the 1970s the microprocessor class of CPUs has almost completely over taken all other CPU implementations. Two typical components of a CPU are the following.

The arithmetic logic unit (ALU), which performs the computer's principal logical and arithmetic operations. It adds, subtracts, multiplies, and divides, determining whether a number is positive, negative, or zero. In addition to performing arithmetic functions, an ALU must be able to determine when one quantity is greater than or less than another and when two quantities are equal. The ALU can perform logic operations on letters as well as numbers.

- **The Control Unit (CU),** which extracts instruction from memory and decodes and executes them, calling on the ALU when necessary.

Keyboard

The computer keyboard is the basic device through which you input information into the system. Though many other forms of inputting devices have come out in the market today, there is nothing equivalent to the keyboard. There are many tasks that you can accomplish using the keyboard. You can use it to type out your documents, access menus, manipulate your system and much more. The keyboard also includes shortcut keys that enable you to carry out certain tasks more easily and quickly using just the keyboard. The most common type of key board is the **QWERTY** keyboard. Usually a keyboard has between 80 and 110 keys. The difference in the keys setup is based on many factors such as board's manufacture, the operating system they are made from, whether they are part of a PC system or they are part of a laptop or hand-held device. When you press any key on the keyboard you actually turn on a switch. This sends the message to the processor that a particular key has been pressed and you see the output on your screen. If you were to hold a key down continuously for some time, it is considered to be a repetitive pressing of that key and so you see that output on the screen.

Input-Output devices

Input devices:-Any hardware device that can send data to a computer is known as an Input device. Keyboard, digital camera, joystick, barcode reader, microphone, webcam, scanner are all examples of Input devices.

Output devices:-In order to get information out of a computer, we need to use Output devices. Monitors, printers, headphones, sound cards, video cards, projectors are all examples of Output devices.

Mouse

Computers were now being controlled with a mouse as well as a keyboard. The first mouse was developed in 1981 by Xerox.Mouse is a small pointing device you can roll along a hard flat surface. Its name is derived from its shape, which looks a bit like a mouse, its connecting wire that one can imagine to be the mouse's tail, and the fact that one must make it scurry along a surface. It is a device that controls the movement of the cursor or pointer on a display screen. As you move the mouse, the pointer on the display screen moves in the same direction. Mouse contain at least one button and sometimes as many as three, which have different functions depending on what program is running Some newer mouse also include a *scroll wheel* for scrolling through long documents.

There are three basic types of mouse:

- **Mechanical:** Has a rubber or metal ball on its underside that can roll in all directions. Mechanical sensors within the mouse detect the direction the ball is rolling and move the screen pointer accordingly.
- **Optical:** Uses a laser to detect the mouse's movement. You must move the mouse along a special mat with a grid so that the optical mechanism has a frame of reference. Optical mouse have no mechanical moving parts. They respond more quickly and precisely than mechanical and opto-mechanical mice, but they are also more expensive.
- **Optomechanical:** Same as a mechanical mouse, but uses optical sensors to detect motion of the ball.

Peripheral Devices:- All the hardware devices which do not form an essential component of the computer system but helps to extend the capabilities of the computer is known as a **peripheral device** or simply the peripheral**.**(eg; printer, scanner, webcam etc.).

Ports

A port is an outlet on an equipment to which a plug or cable can be connected. Input /Output ports (***I/O ports***) are the interfaces to communicate with external devices such as printers, modems, joysticks, and terminals. Inputs are the received signals and outputs are the sent signals.

USB

A Universal Serial Bus (USB) connector allows high-speed, easy connection of peripherals to a PC. Portable computing devices such as tablets, cell phones and digital cameras that are connected to the PC as a USB peripheral benefit from having additional capability to connect to other USB devices directly. For instance, users can perform functions such as sending photos from a digital camera to a printer, cell phone, or sending music files from an MP3 player to another portable player or cell phone.

Printers

A printer is a device that accepts text and graphic output from a computer and transfers the information to paper, usually to standard size sheets of paper. Printers are usually sold with computers, but more frequently are purchased separately. Printers vary in size, speed, sophistication, and cost. In general, more expensive printers are used for higher-resolution colour printing.

Different Types of Printers

DOT MATRIX PRINTERS-They are common and cheapest. They are aptly named Dot Matrix printers because; they can only print in the form of dots.

INKJET PRINTERS: It is also known as 'BUBBLE JET PRINTERS'. They are similar to dot-matrix printers. The print head consist of ink nozzles rather than pins. Their mode of operation is such that they spray tiny inkjets on the paper in a dot matrix pattern. The quality is superior to the Dot-matrix because the head consists of many nozzles and the dots are overlapped and the ink is disposed in ink cartridge.

LASER PRINTER: It is a high speed printer, uses laser technology. Laser recreates the image on a negatively charged drum, which attacks positively charged ink to the area image.

Scanner:-A scanner is device that can capture images from photographic prints, posters, magazine paper sources for editing and display. Scanners are generally classifies into 3 types - hold in, feed in and flatbed. Very high resolution scanners are used for scanning for high-resolution printing, but lower resolution scanners are enough capturing images for computer display. Scanners usually come with software, such as Adobe Photoshop. This program lets you resize and modify a captured image.

Modem :-Modem is both an output and input device. Its full form is modulation and demodulation. It is an electronic device which helps the user to connect with the internet. The role of modem in a computer is to convert the analog signals to digital signals which a computer recognizes.

Digital Camera :-It is a battery powered electronic device which is used for recording and storing photographs in digital mode. It can be stored in a computer and later may be used to enhance or otherwise modified accordingly to the wish of the user. It stores the

photographed image electronically, rather than on film. The uses of digital cameras are mainly for capturing vivid and clearer pictures. Since it does not involve chemical and mechanical processes as in old cameras, it allows the user to take more pictures. The only drawback of digital camera is its dependence on computers to manipulate it which makes it difficult for the computer illiterate user. ***Microphones & Speakers***

They are two important devices used in computers, audio systems etc. They can record and reproduce sound signals. Microphone is an input device and speakers are output devices.

Microphones :-They are widely used in internet chatting and other communicational activities. Nowadays, microphones attached to headphones are widely being used by net savvy users. Dynamic Microphones can also be used for much advanced and specified purposes like sound mixing through computer and also for vocal recording.

Speakers:-Speakers are used as a sound output device in computers. Two channel speakers (Left/Right channel speakers) are commonly used for stereophonic sound output.

Hardware and Software

A computer consists of hardware and software components. The physical components of the computer, such as electrical, electronic and mechanical unit are known as the hardware of the computer. Thus hardware is the equipment involved in the function of a computer. It consists of the components that can be physically handled. The function of these components is typically divided into three main categories: input, output, and storage. Components in these categories connect to microprocessors, output and storage, specifically, the computer's central processing unit (CPU). The most common hardware components are ***C***entral ***P***rocessing ***U***nit (CPU), motherboard, disk drives, monitor, and keyboard.

Major hardware components of a computer can be categorized as follows:

Type	**Examples**
1. The "Box" This is the central box and contains several components, some optional	- CPU - Hard disk (storage) - RAM (random access memory) - Video card - Ethernet card
2. Input Devices	Keyboard - Mouse - Scanner - CD-ROM, DVD-R drives - Microphone - Touch screen
3. Output Devices	Monitor - Printer - Plotter

	- CD or CD/DVD "burner" - Slide or overhead projector - Speakers
4. Input / Output Devices	- Disk Drives - CD-Read/Write or DVD-R/W - Modem, Ethernet cable or Wireless card - LAN (local area network)

Software is the instructions that make the computer work. Software is a general term for organized collection of computer data and instructions. It is responsible for controlling, integrating, and managing the hardware components of a computer and to achieve specific tasks. In other words, software tells the computer what to do and how to do it. Software is held either on your computer's hard disk, CD-ROM, DVD or on a diskette (floppy disk) and is loaded (i.e. copied) from the disk into the computers RAM (Random Access Memory), as and when required Software consists all of the programs that you and the computer use to perform tasks. The software can be broadly classified into two types. They are:

a. System Software

b. Application software

An essential piece of system software on all computers is the Operating System. We may use a WINDOWS operating system for communication between the computer and the user and a variety of specialized applications software packages for word processing, data entry, management and statistical analyses.

A computer needs to be instructed to perform any task. These instructions are given in the form of computer programs, which are written in computer programming languages. A program controls the activity of the processor. The moment the hardware (processor, memory, etc.), acts as per the instructions of a program, the program is said to be in running or executing state.

A set of programs, which are specifically written to provide the user a precise functionality like solving a specific problem is termed as a software package. For example, word processing software package provides functionality to the computer so that it can be used to create text documents like letters and mailing lists. Similarly, an image processing software package assists a user in drawing and manipulating graphics.

We can equate hardware and software with human body and human intelligence, respectively. All human physical actions such as walking and eating are based on the thoughts and feelings, which is raised by the brain. If the brain does not raise thoughts and feelings, we do not perform any physical activity. Similarly, the actions and functioning of every hardware equipment is driven by software. The combination of physical equipment (hardware) and logical instructions (software) gives modern computing system their power and versatility.

Differences between Hardware and Software

HARDWARE	SOFTWARE
1. It is the physical unit of the computer	1.It is a collection of programs to bring the hardware system into operation
2. It has permanent structure and cannot be altered	2. It has no permanent structure but can be altered and reused
3. It is normally affected by agents like dust, heat, humidity, etc	3. It is not affected by these agents to some extent
4. Hardware understands only machine language, lower level language or binary language	4. It is written by a well versed programmer and generally in higher level language which is readable by human being
5. It works with binary code-the presence or absence of Pulses as 1's or 0's.	5. It is represented by the Higher Level Languages such as BASIC, COBOL etc.,

Operating System

Operating system is the system software that controls the operations of a computer. It directs the input and output of data, keeps track of files, and controls the processing of computer programs. Its roles include managing the functioning of the computer hardware, running the applications programs, serving as an interface between the computer and the user, and allocating computer resources to various functions. In short, it is a program that controls the execution of application programs and acts as an interface between the user and the computer hardware.

It is the first layer of software loaded into computer memory when it starts up. As the first software layer, all other software that gets loaded after it depends on it for various common core services. These common core services include disk access, memory management, takes scheduling, and user interfacing. In addition the operating system ensures that different programs executing at the same time do not interfere with each other. It provides a software platform on top of which other programs can run. In simple words, the operating system organizes and controls the hardware. When several jobs reside in the computer simultaneously and share resources (multitasking), the OS allocates fixed amounts of CPU time and memory in turn. Through a process called time-sharing, a large computer can handle interaction with hundreds of users simultaneously, giving each the perception of being the sole user. Modern computer operating systems are becoming increasingly machine-independent; capable of running on any hardware platform. Examples of operating systems are DOS, Windows, UNIX, and Linux. Among these, the first two (DOS and WINDOWS) are proprietary Operating Systems whereas UNIX and Linux are included in the category of Open source operating systems. In 1984 Apple introduced their MAC OS, which was the first

operating system to be completely graphical. Both MAC OS and Windows used pull down menus, icons and window to make computing more user-friendly.

The basic functions of operating systems are:

a) Process Management:-It handles the creation, deletion, suspension, resumption, and synchronization of process.

b) Memory Management:-It handles allocation and de-allocation of memory space as required by various programs.

c) File Management:-It is responsible for creation and deletion of files and directories. It also organizes, stores, retrieves, names, and protects all the files.

d) Device Management:-It manages all the devices of the computer system such as printers and modems. If any device fails, it detects the device failure and notifies the same to the user.

e) Security Management:-Protects system resources and information against destruction and unauthorized use.

f) User interface:-Provides the interface between the user and the hardware.

DOS (Disk Operating System)

In 1981, Microsoft Disk Operating System (MS-DOS) was released to run on the Intel 8086 microprocessor. Over the next few years MS-DOS became the most popular operating system in the world. MS-DOS was the widely used operating system before the introduction of the Windows operating system. Even now the MS-DOS commands are used for carrying out many jobs like copying the files, deleting the files etc. The DOS is a set of computer programs. The main functions of DOS are to manage files and to allocate system resources according to the requirement. It provides certain essential features to control hardware devices such a keyboard, screen, disk drives, printers etc. Thus, DOS is a medium through which the user and external devices attached to the system communicate the command with the system. DOS translates communication issued by the computer in the format that is understandable by the computer and instruct computer to work accordingly. It also translates the results of any wrong deeds in the form of error messages.

DOS Commands

We can type all DOS commands in either upper or lower case letters. All DOS commands must be activated by pressing the <Enter> key after typing the command.

There are two basic types of DOS commands:

a) **Internal commands:-**These commands, like COPY, DEL, and TYPE, are stored in computers memory. Many DOS commands fall into this category.

b) **External commands:-**This group of commands is stored on the disk. To use them, either insert the DOS floppy disk, or change to the directory on hard disk which contains DOS

external commands. Examples of external commands include FORMAT, DISKCOPY, and CHKDSK.

Features of DOS

- Single user system
- Machine independence
- Program control
- Peripheral management
- Operating with Directories
- Managing files
- Processing commands
- Managing input and output
- Managing memory

WINDOWS OPERATING SYSTEM

Microsoft Windows is the most popular operating system around the world. Its first version Microsoft Windows1.0 was released in 1985. Even those who are new to computers can use it with a little practice. With the help of Windows, we can operate the computer just by clicking the mouse buttons, Windows95, Windows98, Windows 2000, Windows Vista , Windows XP and finally Windows 10 (launched in July 2015)are the various versions of Windows.

Windows is the extension of the disk operating system. It requires DOS to run the application programs. The DOS should be loaded into the memory before the window is executed. After the windows is loaded into the memory the windows environment takes all the device controls. It also takes care of the memory management of the programs run by the windows software".

Features of Windows:

The important features of Windows are as follows:

(a) Graphical User Interface

Windows provides user-friendlier interface to work on. Its improved graphical user interface makes learning and using windows more natural and easier for all types of users. It is more powerful, customizable and efficient.

(b) Type of icons (Small Pictures):

There are three types of icons. They are

i) Applications icons - the minimized version of the currently running application programs. It appears at the bottom of the desktop and can be maximized.

ii) Document icons - the reduced document windows.

iii) Program icons - appear with in program manager and clicking on these icons activates the associated applications and also loads the related documents or files.

(c) Start Button

Introduction of START button by windows made life much simpler while there is a need to access multiple programs. It is the gateway of accessing most of the functionality available in the computer loaded with windows. Just Click on the start button anytime to start any programs, open or find documents, change windows settings, get Help, manage Files, maintain System, much more.

(d) Taskbar

The Task bar provides information and access to the entire task that has been currently activated by windows. Using this one can keep a track of what all programs have been activated and switched between them.

(e) Windows Explorer

Windows Explorer more or less acts as File Manager for windows, but with lots of new features. It is more efficient, faster and user friendly. Using Explorer one can easily browse through all the drives and network resources available and manage files.

(f) Right Mouse Button

Clicking on the right mouse button activates a pop-up menu in any program so as to help in completing a task efficiently.

(g) Long File Names

As the MS-DOS convention follows, none-of the file used in DOS environment should be more than 8 characters of primary name and optimal secondary name (extension) of three characters. However Windows has broken this barrier. Windows supports long file names maximum of 225 characters. It also allowed space to be used in between file name. This helps to make files and folders (directory/subdirectory) easier to organize and find.

h) Shortcuts

As the name suggests, SHORTCUTS are the shortest way to access programs, files other resources in Windows. Instead of going through the structural process of accessing a program, one can create "shortcuts" to access them. It creates links for easy access to file, programs, folders and more.

i) Multitasking

Multitasking allows the user to activate and accomplish more than one task at a time. For example, work on a document file WORD programs, which copies file from other computer available in the network. With Windows computing environment, the user can do more than one task a time.

j) Easy Internet Access

Integration of Internet Explorer 4.0 and Active Desktop, which coupled the Internet html hypertext links more tightly to the Windows user interface.

k) Software Compatibility

Windows provides complete backward compatibility. It is easily compatible with other applications developed for MS-DOS and Windows 3.x environment. It also supports latest 32-bit technology. Most of the latest software packages are now built on Windows operating environment.

l) Great Gaming Platform

Windows supports rich graphics, high quality audio and video. Software to take advantage of Intel's Multimedia Extensions (MMX) to the IA - 32 instruction set, which are designed to improve the performance of multimedia applications and games developed for windows that uses MMX technology.

m) Hardware Compatibility

Windows provides greater Hardware compatibility as compared to any other operating environment. It has flexibility of supporting hardware from different vendors.

n) Find utility

Find Utility of Windows allows the user to do searches by partial name, last modified date, or full text. In addition we can save, rename or view files from within the result pane.

(o) Help

Windows provides online help to accomplish a task. If the user is not sure how to perform a task, Windows Help will provide structured process how to accomplish the task. Simply right-click on any object in the user interface (icon) and he can get relevant description about that object.

(p) Manage more numbers of PC's

Windows 98 can manage up to eight monitors on a- single PC. The user can drag and drop resize and move desktop items such as windows, folders, icons, and applications, from one monitor to the next.

(q) Additional facilities

Windows includes additional enhancements like new backup utilities and disk defragmenter capabilities.

THE UNIX OPERATING SYSTEM

Like DOS and windows, there is another operating system called UNIX. It arrived earlier then the other two, and stayed back like enough to give us the internet. UNIX is a giant operating system and is way ahead of them in sheer power. It has practically everything an operating system should have, and several features which other operating systems never had. Its richness and elegance go beyond the commands and tolls that

constitute it, while simplicity permeates the entire system. It runs practically on every hardware and provides motivation to the open source movement.

However, UNIX also makes many demands of the user. In requires a different type of commitment to understand the subject, even when the user is an experienced computer professional. It introduces certain concepts not known to the computing community before, and user numerous symbols whose meaning is anything but clear. It achieves unusual tasks with a few keystrokes, but it takes time to devices a sequence of them for a specific task. Often, it doesn't tell you whether you are right or wrong, and doesn't warn you of the consequences of your actions. That is probably the reason why many people still prefer to stay away from UNIX.

UNIX is comprised of the following 3 basic entities:

1) **The Kernel –** The core of the UNIX system. Loaded at system start up (boot); manages the entire resources of the system. Examples of what it does are: interpreting and executing instructions from the shell, managing the machine's memory and allocating it to processes, scheduling the work done by the CPU's.

2) **The Shell –** Whenever you login to a UNIX system you are placed in a shell program. The shell is a command interpreter; it takes each command and passes it to the operating system kernel to be acted upon. It then displays the results of this operation on your screen. Several shells are usually available on any UNIX system, each with its own strengths and weaknesses. Examples are the Bourne Shell (**sh**), C Shell (**csh**), and Bourne Again Shell (**bash**).

3) **Utilities** -- UNIX provides several hundred utility programs, often referred to as commands. The commands accomplish universal functions such as printing, editing files, etc.

Features of UNIX

UNIX is an operating system, so it is has all the features an operating system is expected to have. However UNIX also looks at a few things differently and possesses features unique to it. The following section gives a clear idea of the major features of this operating system.

a) UNIX: A Multi user System

From the fundamental point of view, UNIX is a multiprogramming system; it permits multiple programs to run. This can happen in two ways;

1. Multiple users can run separate jobs
2. A single user can also run multiple jobs.

b) UNIX: A Multi tasking System Too

A single user can also run multiple tasks at the same time as UNIX is a multitasking system. It is usual for a user to edit a file, print another one on printer, send email to a friend and

browse the World Wide Web - all without leaving any of the application. This kernel is designed to handle a user's multiple needs.

c) The UNIX Toolkit

By one definition, UNIX represents the kernel, but the kernel by itself doesn't do much that can benefit the user. To properly exploit the power of UNIX, you need to use the host of applications that are shipped with every UNIX system. These applications are quite varied in scope. There are general – purpose tools, text manipulation utilities (called filters), compilers and interpreters, networked applications and system administration tools.

d) Programming Facility

The UNIX shell is also a programming language; it was designed for a programmer, not a casual end user. It has all the necessary ingredients, like control structures, loops and variables, that establish it as a powerful programming language in its own right.

f) Documentation

UNIX documentation for trouble shooting is no longer the sore point it once was. The principal online help facility available is the man command, which remains the most important reference for commands and their configuration files. Thanks to O'Reilly & Associates, one can safely say that there's no feature of UNIX on which a separate textbook is not available. Apart from the online documentation, there's a vast ocean of UNIX resources available on the internet. The FAQ (Frequently Asked Questions), a document that addresses common problems is also widely available on the Net. Then there are numerous articles published in magazines and journals and lecture notes available by universities on their Web sites.

LINUX: - The Open Source Operating System

All modern operating systems have their roots in 1969 when **Dennis Ritchie** and **Ken Thompson** developed the C language and the **UNIX** operating system at AT&T Bell Labs. They shared their source code with the rest of the world, including the hippies in Berkeley California. By 1975, when AT&T started selling UNIX commercially, about half of the source code was written by others. The hippies who always stood for free software were not happy that a commercial company sold software that they had written. The resulting legal battle ended in there being two versions of **UNIX**; the official AT&T UNIX, and the free **BSD** UNIX.

In the Eighties many companies started developing their own UNIX. IBM created AIX, Sun SunOS (later Solaris), HP released HP-UX and about a dozen other companies did the same. The result was a mess of UNIX versions and a dozen different ways to do the same thing. And here is the first real root of **Linux**, when **Richard Stallman** aimed to end this era of UNIX separation and in 1983, started the **GNU** project (GNU is Not Unix). He then founded the Free Software Foundation. His goal was to make an operating system that was

freely available to everyone and where everyone could work together (like in the Seventies). Many of the command line tools that you use today on **Linux** are GNU tools.

By the beginning of the 90's home PC's were finally powerful enough to run a full blown UNIX. Meanwhile Linus Torvalds, a young man studying computer science at the University of Helsinki, thought it would be a good idea to have some sort of freely available academic version of UNIX. In 1991, he put the source code of UNIX online and invited volunteer participation from hobbyists over the globe to collaborate with him for developing a UNIX like operating system. From the very beginning Linus' goal was to have a free system that was completely compliant with the original UNIX. That is why he asked for POSIX standards. POSIX is the standard version of UNIX then available in the market. In 1992, Torvalds decided to license Linux under GNU General Public License and subsequently all source code written to the Linux kernel by numerous contributors was under that license. Most system tools of Linux were taken from GNU project and other sources including BSD. Linux itself became the kernel of the new operating system. Linux was the first UNIX implementation targeted for microcomputers. Many people embraced the combination of this kernel with the GNU tools, and the rest is history.

Today more than 97 percent of the world's supercomputers more than 80 percent of all smart phones, many millions of desktop computers, around 70 percent of all web servers, a large chunk of tablet computers, and several appliances (DVD players, DSL modems, routers,...) run **Linux**. Linux is by far the most commonly used operating system in the world.

Linux is a free Unix-like operating system that has become popular with PC users around the world. It was originally developed by Linus Torvalds as a research project. Linux does true multitasking and includes virtual memory, shared libraries, demand loading, memory management and other features that are available with current full featured commercial operating systems. A distinguishing feature of this operating system is that it is one of the few operating systems whose source code is available as free software under the GNU General Public License (GPL). The GNU GPL is intended to safeguard and guarantee the freedom of any user of free software to share, modify and also share the modified software. This is in contrast to the licenses given for proprietary software that prohibits its users to share or modify software.

Characteristic Features of LINUX

1. **Multi-tasking**

Multi-tasking is a method by which the operating system allows multiple programs to share a computer system to give a user the illusion that the programs are running simultaneously. Multi-tasking can be done either in a preemptive or in a cooperative manner. Preemptive multi-tasking is also known as true multitasking. In preemptive multi-tasking the operating system allocates a unit of time to each process to run. This unit of time is called a time-slice or quanta (typically $1/10^{th}$ of a second). If a process uses up its time slice the

operating system arranges to run a process with the highest priority to execute its time-slice next. In a priority based preemptive multi-tasking model of execution, interacting processes are given a higher priority over processes that have recently completed their time-slice. In cooperative multi-tasking an application has to voluntarily give up use of the processor to enable another process to run. The application periodically has to inform the operating system about its willingness to give up the processor by making system calls. The problem with cooperative multi-tasking is that an application can either by mistake or by malicious intent be made to monopolize use of the processor thereby stopping all other processes from running.

2. Virtual Memory

Virtual Memory is a scheme employed by the operating system to provide means of executing programs whose codes occupy more space than the size of the on-board semiconductor memory. To achieve this, least recently used parts of a program are copied temporarily from memory into hard disk and copied back on demand.

3. Shared Libraries

Shared Libraries are used with dynamic linking to share commonly used routines. Each reference to a library routine is replaced with a stub that indicates how the appropriate routine can be located in memory. A stub initially executes and replaces itself with the address of the appropriate library routine. The next time around the same code segment is reached; the library routine is executed directly with no extra cost of locating the memory-resident portion of the library.

4. Demand Loading

Demand Loading is a method of loading only parts of the program that is currently being executed into primary memory (RAM) from secondary memory (disk). The program is logically divided into segments or pages and is loaded into primary memory on demand, hence the term demand loading.

5. Memory Management

Memory Management is a scheme by which an operating system shares the memory in a computer system among several programs or several modules of the same program.

6. TCP/IP

TCP stands for Transport Control Protocol while IP stands for Internet Protocol. These are communication protocols used for transmitting data over a computer network.

Linux - Miscellaneous Features

Graphical User Interface: Most distributions of the Linux operating system come with a windows environment called X. The X-windows environment is fully customizable and is fast. X comes with different window managers and customizable desk top features that make

it very flexible and easy to use. Some of the window managers can give a look and feel of a MS windows environment.

Java Platform: The Java platform is based on the concept that any software should run on any kind of computer, consumer gadget or any other device. This means that it is machine independent and works on any compatible device that supports the Java platform. To run Java applications efficiently, the operating system should be able to support the Java platform.

File Systems: Linux can recognize a wide range of file system formats. This means that, given for example, a system on which you have the option of running either Windows NT or Linux, we can look up files in the Windows NT partition without restarting the system, while running Linux. Some of the standard file systems that are supported are 1) A native Linux advanced extended file system 2) The MINIX file system 3) The FAT file system of MSDOS 4) The IS09660 file system used on CDROMs and 5) the VFAT file system used in Windows NT.

Linux Documents: The Linux documentation Project's (LDP) goal is to develop good reliable documentation for the Linux operating system. LDP takes care of documentation ranging from online documentation to printed manuals for installing, using and running Linux. All documentation pertaining to Linux and produced by LDP are available freely and distributed over the Internet.

Linux distributions

A Linux **distribution** is a collection of (usually open source) software on top of a Linux kernel. A distribution, abbreviated as ***distro*** can bundle server software, system management tools, documentation and many desktop applications in a **central secure software repository**. A ***distro*** aims to provide a common look and feel, secure and easy software management and often a specific operational purpose. Linux may appear different depending on the distribution, your hardware and personal taste, but the fundamentals on which all graphical and other interfaces are built, remain the same. There are hundreds of distributions of Linux, mostly licensed under GPL. The prominent among them are;

Red Hat Enterprise Linux (RHEL), Fedora, Mandriva, Ubuntu, Debian, Turbo Linux, Slack ware, SuSE etc.

Advantages of Linux

Since it is a UNIX clone, Linux is having almost all of the advantages of UNIX. But the most striking advantage is that unlike UNIX, Linux is free software. The main plus points of Linux is listed below.

1. **Linux is free:**

Linux can be downloaded in its entirety from the Internet completely for free. No registration fees, no costs per user, free updates, and freely available source code in case you want to change the system. The license commonly used is the GNU Public License (GPL). The

license says that anybody who may want to do so has the right to change Linux and eventually to redistribute a changed version, on the one condition that the code is still available after redistribution. In practice, you don't even have to pay the price of a CD.

2. Linux is portable to any hardware platform:

A vendor who wants to sell a new type of computer and who doesn't know on what kind of OS his new machine will run can take a Linux kernel and make it work on his hardware, because documentation related to this activity is freely available.

3. Linux was made to keep on running:

As with UNIX, a Linux system expects to run without rebooting all the time. That is why a lot of tasks are being executed at night or scheduled automatically for other calm moments, resulting in higher availability during busier periods and a more balanced use of the hardware. This quality is of greater use in situations where people don't have sufficient time as it provides the possibility to control their systems night and day.

4. Linux is secure and versatile:

Linux is also using UNIX idea of security, which is known to be strong and of proven quality. But, Linux is not only fit for use as a fort against enemy attacks from the Internet. It will adapt equally to other situations, utilizing the same high standards for security. Your development machine or control station will be as secure as your firewall.

5. Linux is scalable:

Linux can be used in a wide variety of systems ranging from a Palmtop with 2 MB of memory to a petabyte storage cluster with hundreds of nodes. It is possible to add or remove the appropriate packages so as to make Linux fit for different types of computers and also for doing different kinds of services.

6. The Linux OS and most Linux applications have very short debug-times:

A bug refers to the errors and problems found in computer programs and debugging is the process of rectifying these defects. Since Linux has been developed and tested by thousands of people, both errors and people to fix them are usually found rather quickly. It sometimes happens that there are only a couple of hours between discovery and fixing of a bug.

7. Linux requires very little memory to run. The more memory, the faster it will run
8. Linux does not restrict the number of clients connected at the same time
9. It provides more reliable data storage than other operating systems
10. Linux provides advanced disk management (RAID) which makes it possible to automatically duplicate stored data on several hard drives

Demerits of Linux

1. There are far too many different distributions:

There are so many different versions (distributions) of Linux available for the user. So, the Roman saying, 'the more people, the more opinions' seems very much appropriate while discussing its utility. At first glance, the amount of Linux distributions can be frightening or ridiculous depending on your point of view. But it also means that everyone will find what he or she needs. The differences are likely to be very superficial. You don't need to be an expert to find a suitable release. The best strategy is to test a couple of distributions. A quick search on Google, using the keywords "choosing your distribution" brings up tens of links to good advice.

2. **Linux is not very user friendly and confusing for beginners:**

It must be said that Linux, at least the core system, is less user friendly to use than MS Windows and certainly more difficult than MacOS. But, in light of its popularity, considerable effort has been made to make Linux even easier to use, especially for new users.

3. **Linux is a free software**

Since Linux is open source software, all the demerits and general criticism leveled against free software seems sound in the case of Linux also. The prominent among these is the lack of customer support emanating out of the fact that a thing 'belonging to all actually belongs to none'.

MODULE –II

Introduction to Computer Networking

When the first computers were built during the Second World War, they were expensive and isolated. However, after about twenty years, as their prices gradually decreased, the first experiments began to connect computers together. In the early 1960s, researchers including Paul Baron, Donald Davies and Joseph Licklider independently published the first papers describing the idea of building computer networks. Given the cost of computers, sharing them over a long distance was an interesting idea. In the US, the ARPANET started in 1969 and continued until the mid 1980s. In France, Louis Pouzin developed the Cyclades network. Many other research networks were built during the 1970s. With the growth of telecommunication technology, computer industries became more and more interested in offering computer networks.

A system of interconnected computers and computerized peripherals such as printers is called computer network. This interconnection among computers facilitates information sharing among them. Computers may connect to each other by either wired or wireless media. Computer systems and peripherals are connected to form a network.

Benefits of Networking

1. **Resource sharing: -** Networks helps the sharing of both software (Files and programs) and hardware (peripherals like printers, scanners storage devices etc.) resources.
2. **Data or Information sharing/transferring:-**Data is conveniently shared from one computer to another without using CDs or other storage devices. Ideas are shared more quickly in a network which in turn will result in more informed and very quick decision making.
3. **Effective communication:-**Network always functions as an effective medium for communication. There is no need to explain the communication revolution facilitated by the advent of Internet- the global network of interconnected computer networks. It practically changed the very nature of computers from being merely a computing device to an instrument of communication through a wider, speedy and effective means for Network-based communication such as e-mail, chatting, IP phones, Video conferences, Instant messaging etc;.
4. **Cost Effectiveness:-**Networks helps to reduce the Office Equipment Costs considerably. Networking allows equipments – mainly printers and servers – to be shared with multiple users. It is always economical to purchase to ordinary computers it instead of buying a more advanced super or mainframe computer.
5. **More effective Monitoring: -** The administrator/supervisor can monitor the performance of his subordinates more effectively, if all the systems used in the office are connected in a network. He can assess personally, the actual amount of work done by each and every officer by using the administrator password.

6. **Networking brings mobility:-** Key files, data and services can be accessed from any place on the network. This will facilitate increased mobility by providing Anytime/Anywhere access to resources.

Types of Network Configuration

Broadly speaking, there are two types of network configuration.

1. Peer-to-peer networks
2. Client/server networks.

Peer-to-peer networks are more commonly implemented where less than ten computers are involved and where strict security is not necessary. All computers have the same status, hence the term 'peer', and they communicate with each other on an equal footing. Files, such as word processing or spreadsheet documents, can be shared across the network and all the computers on the network can share devices, such as printers or scanners, which are connected to any one computer.

Client/server networks are more suitable for larger networks. A central computer, or 'server', acts as the storage location for files and applications shared on the network. Usually the server is a higher than average performance computer. The server also controls the network access of the other computers which are referred to as the 'client' computers. Typically, teachers and students in a school will use the client computers for their work and only the network administrator (usually a designated staff member) will have access rights to the server.

The table given below provides a summary comparison between Peer-to-Peer and Client/Server Networks.

Peer-to-Peer Networks	Client/Server Networks
• Easy to set up • Less expensive to install · • Can be implemented on a wide range of operating systems • More time consuming to maintain the software being used (as computers must be managed individually)	• More difficult to set up • More expensive to install • A variety of operating systems can be supported on the client computers, but the server needs to run an operating system that supports networking • Less time consuming to maintain the software being used (as most of the maintenance is managed from the server)

Classification of Computer Networks

Generally, Computer networks are classified on the basis of various factors. They include:

I. Geographical span (LAN, WAN, PAN, MAN, Internet etc ;)

II. Administration (Private and Public)
III. Topology (Bus, Ring, Star, Tree, Mesh and Hybrid)
IV. Method of Connectivity (Wired and Wireless)

I. Geographical Span

Networks are usually distinguished by their geographical span. A network can be as small as distance between your mobile phone and its Bluetooth headphone and as large as the internet itself, covering the whole geographical world. Geographically a network can be seen in one of the following categories:

a) **Personal Area Network (PAN):-**A Personal Area Network (PAN) is smallest network which is very personal to a user. This may include Bluetooth enabled devices or infra-red enabled devices. PAN has connectivity range up to 10 meters. PAN may include wireless computer keyboard and mouse, Bluetooth enabled headphones, wireless printers, and TV remotes.

b) **Local Area Network (LAN):-**A computer network spanned inside a building and operated under single administrative system is generally termed as Local Area Network (LAN). Usually, LAN covers an organization offices, schools, colleges or universities. Number of systems connected in LAN may vary from at least as two to as much as millions. LAN provides a useful way of sharing the resources between end users. The resources such as printers, file servers, scanners, and internet are easily sharable among computers. LANs are composed of inexpensive networking and routing equipment. It may contain local servers serving file storage and other locally shared applications. It mostly operates on private IP addresses and does not involve heavy routing. LAN works under its own local domain and controlled centrally.

LAN uses either Ethernet or Token-ring technology. Ethernet is most widely employed LAN technology while Token-ring is rarely seen. LAN can be wired, wireless, or in both forms at once.

c) **Metropolitan Area Network (MAN):-** The Metropolitan Area Network (MAN) generally expands throughout a city such as cable TV network. It can be in the form of Ethernet, Token-ring, or Fiber Distributed Data Interface (FDDI). Metro Ethernet is a service which is provided by ISPs. This service enables its users to expand their Local Area Networks. For example, MAN can help an organization to connect all of its offices in a city.Backbone of MAN is high-capacity and high-speed fiber optics. MAN works in between Local Area Network and Wide Area Network. MAN provides uplink for LANs to WANs or internet.

d) **Wide Area Network:-** As the name suggests, the Wide Area Network (WAN) covers a wide area which may span across provinces and even a whole country. Generally, telecommunication networks are Wide Area Network. These networks provide connectivity to MANs and LANs. Since they are equipped with very high speed

backbone, WANs use very expensive network equipment. WAN may use advanced technologies such as Asynchronous Transfer Mode (ATM), Frame Relay, and Synchronous Optical Network (SONET). WAN may be managed by multiple administrations.

e) **Internetwork:-**A network of networks is called an internetwork, or simply the internet. It is the largest network in existence on this planet. The internet hugely connects all WANs and it can have connection to LANs and Home networks. Internet uses TCP/IP protocol suite and uses IP as its addressing protocol.

II. Classification of networks on the basis of Administration

From an administrator's point of view, a network can be classified as

A. **Private Network** which belongs to a single autonomous system and cannot be accessed outside its physical or logical domain. E.g.: The network of a particular Organization or office.

B. **Public Network** which could be accessed by all. E.g.; World Wide Web

III. Classification on the basis of Network Topology

In computer networking, topology refers to the layout or pattern of connected devices. Computer networks can also be classified into various types on the basis of network topologies. There are different topologies for connecting computers in a network such as bus, ring, star, tree, mesh etc. Therefore, sometimes we classify a specific network on the basis of the topology used in it. Eg; Ring Network, Star Network etc.

Network Topologies

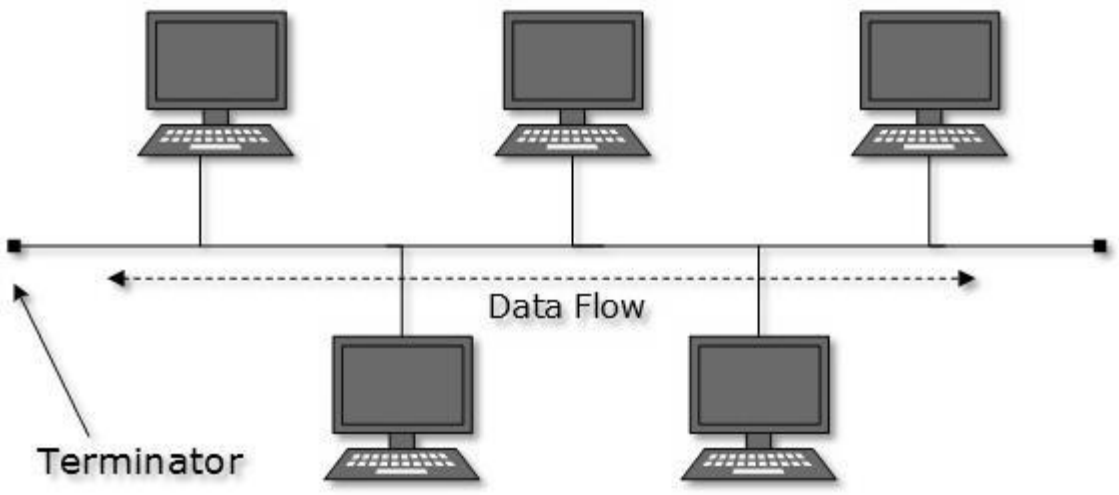
In computer networking, *topology* refers to the layout of connected devices. Topology is the network's virtual shape or structure. This shape does not necessarily correspond to the actual physical layout of the devices on the network. For example, the computers on a home LAN may be arranged in a circle in a family room, but it would be highly unlikely to find a ring topology there. There are basically two types of Topology -Physical and logical network topology. Physical Topology refers to actual layout of computer cables and other network devices. Logical Topology is the way in which the network appears to the devices that use it. In other words, logical topology is the lay out transferring information in a network. The Physical topology can again be categorized into the following basic types:

- Bus
- Ring
- Star
- Tree
- Mesh
- Hybrid

Bus Topology

Bus networks use a common backbone to connect all devices. A single cable is the backbone that functions as a shared communication medium. that devices attach or tap into with an interface connector. A device wanting to communicate with another device on the network sends a broadcast message onto the wire that all other devices see, but only the intended recipient actually accepts and processes the message.

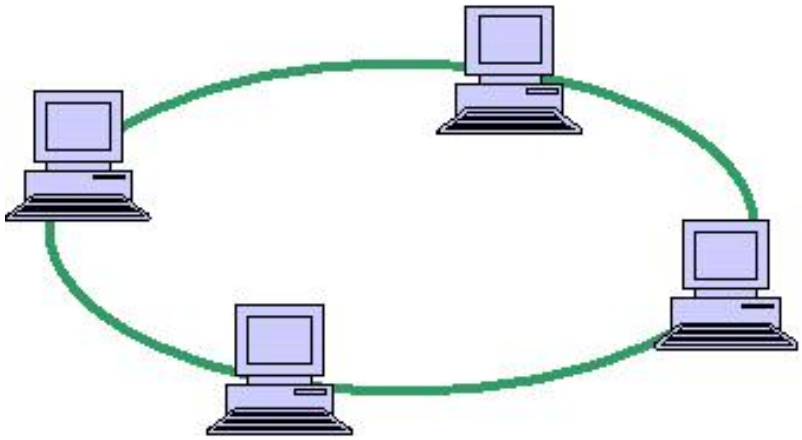
Ethernet bus topologies are relatively easy to install and don't require much cabling compared to the alternatives and hence it is less expensive. If more than a few dozen computers are added to a bus network, performance problems will likely to appear. In addition, if the backbone cable fails, the entire network becomes unusable.



Layout of a Bus Topology

Ring Topology

In ring topology, each host machine connects to exactly two other machines, creating a circular network structure. When one host tries to communicate or send message to a host which is not adjacent to it, the data travels through all intermediate hosts. To connect one more host in the existing structure, the administrator may need only one more extra cable. In a ring network, every device has exactly two neighbors for communication purposes. All messages travel through a ring in the same direction (either "clockwise" or "counter clockwise"). A failure in any cable or device breaks the loop and can break down the entire network. Thus, every connection in the ring is a point of failure. There are methods which employ one more backup ring. Ring topologies are found in some office buildings or school campuses.



Layout of Ring Topology

Star Topology

A star network features a central connection point called a "hub" that may be a hub, switch or router. Devices typically connect to the hub with Unshielded Twisted Pair (UTP) Ethernet. Compared to the bus topology, a star network generally requires more cable as all computers/devices connect to a central device called hub or switch and also each device requires a single cable to obtain point-to-point connection between the device and hub. Hub is the single point of failure but a failure in any star network cable will only take down one computer's network access and not the entire LAN. If the hub fails, however, the entire network also fails.

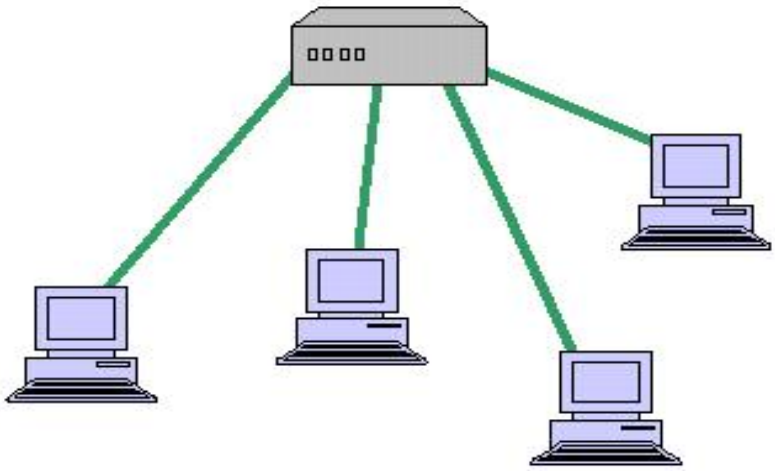


Illustration - Star Topology Diagram

The following are the major advantages of Star Topology.

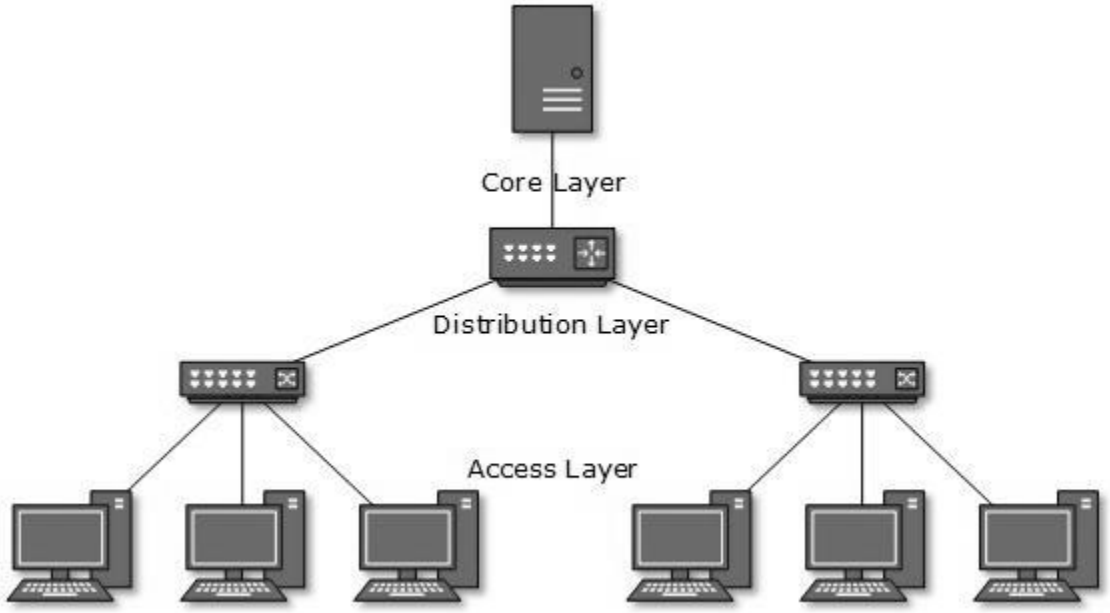
a) Easily expandable without disrupting the network
b) Cable failure affects only a single user
c) Easy to isolate and troubleshoot problems

The major disadvantages are:

a) It requires more cable and a connecting device and hence is more expensive
b) The central connecting device may become a single point of failure
c) More difficult to implement

Tree Topology

Also known as Hierarchical Topology, this is the most common form of network topology presently in use. This topology imitates as extended Star topology and inherits properties of Bus topology.



Tree Topology_ Diagram

This topology divides the network into multiple levels/layers of network. Mainly in LANs, a network is bifurcated into three types of network devices. The lowermost is **access-layer** where computers are attached. The middle layer is known as **distribution layer**, which works as mediator between upper layer and lower layer. The highest layer is known as **core layer**, and is central point of the network, i.e. root of the tree from which all nodes diverge. Tree topologies integrate multiple star topologies together onto a bus. In its simplest form, only hub devices connect directly to the tree bus and each hub functions as the "root" of a tree of devices. This bus/star hybrid approach supports future expandability of the network much better than a bus (limited in the number of devices due to the broadcast traffic it generates) or a star (limited by the number of hub connection points) alone.

Mesh Topology

In this type of topology, a host is connected to one or multiple hosts. This topology has hosts in point-to-point connection with every other host or may also have hosts which are in point-to-point connection with few hosts only. Mesh topologies involve the concept of routes.

Unlike each of the previous topologies, messages sent on a mesh network can take any of several possible paths from source to destination. (Recall that even in a ring, although two cable paths exist, messages can only travel in one direction.) Some WANs, most notably the Internet, employ mesh routing. Hosts in Mesh topology also work as relay for other hosts which do not have direct point-to-point links. Mesh technology comes into two types:

1. **Full Mesh:** All hosts have a point-to-point connection to every other host in the network. Thus for every new host n (n-1)/2 connections are required. It provides the most reliable network structure among all network topologies.

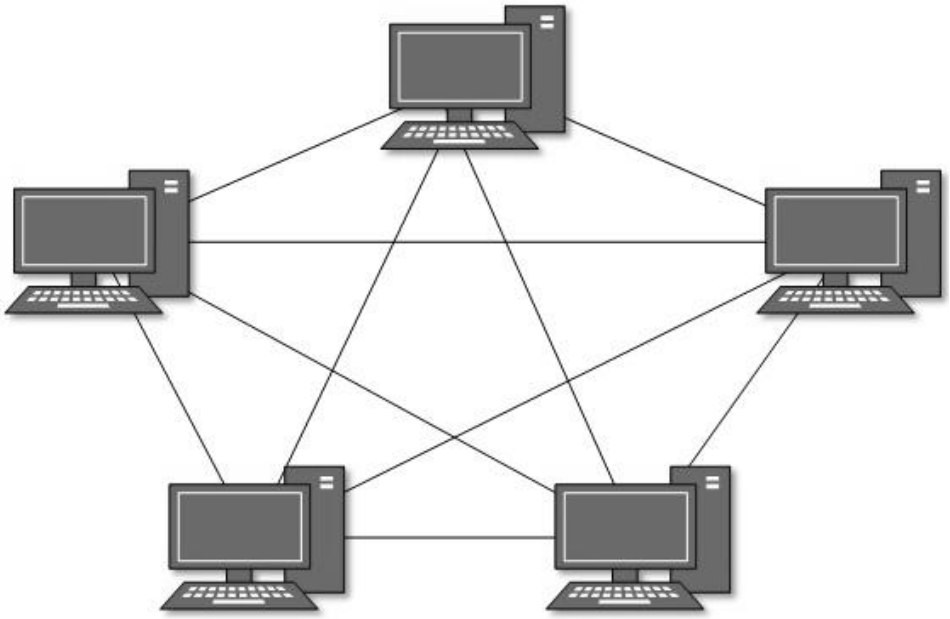


Illustration - Diagram showing a Full Mesh Topology

2. **Partial Mesh:** Not all hosts have point-to-point connection to every other host. Hosts connect to each other in some arbitrarily fashion. This topology exists where we need to provide reliability to some hosts out of all.

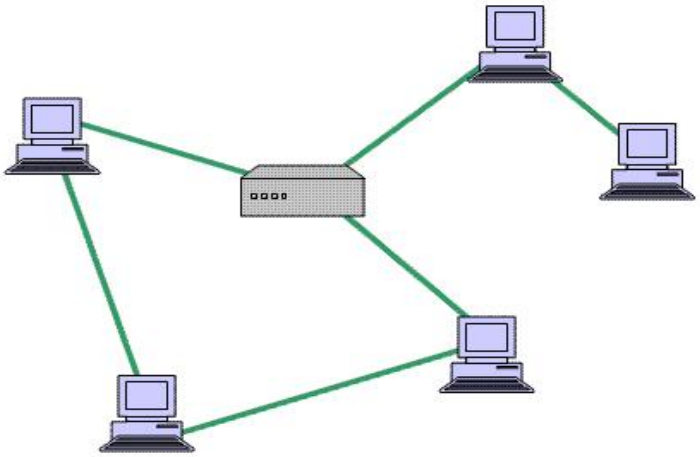


Illustration - Diagram showing a Partial Mesh Topology

Hybrid Topology

A network structure whose design contains more than one topology is said to be hybrid topology. Hybrid topology inherits merits and demerits of all the incorporating topologies.

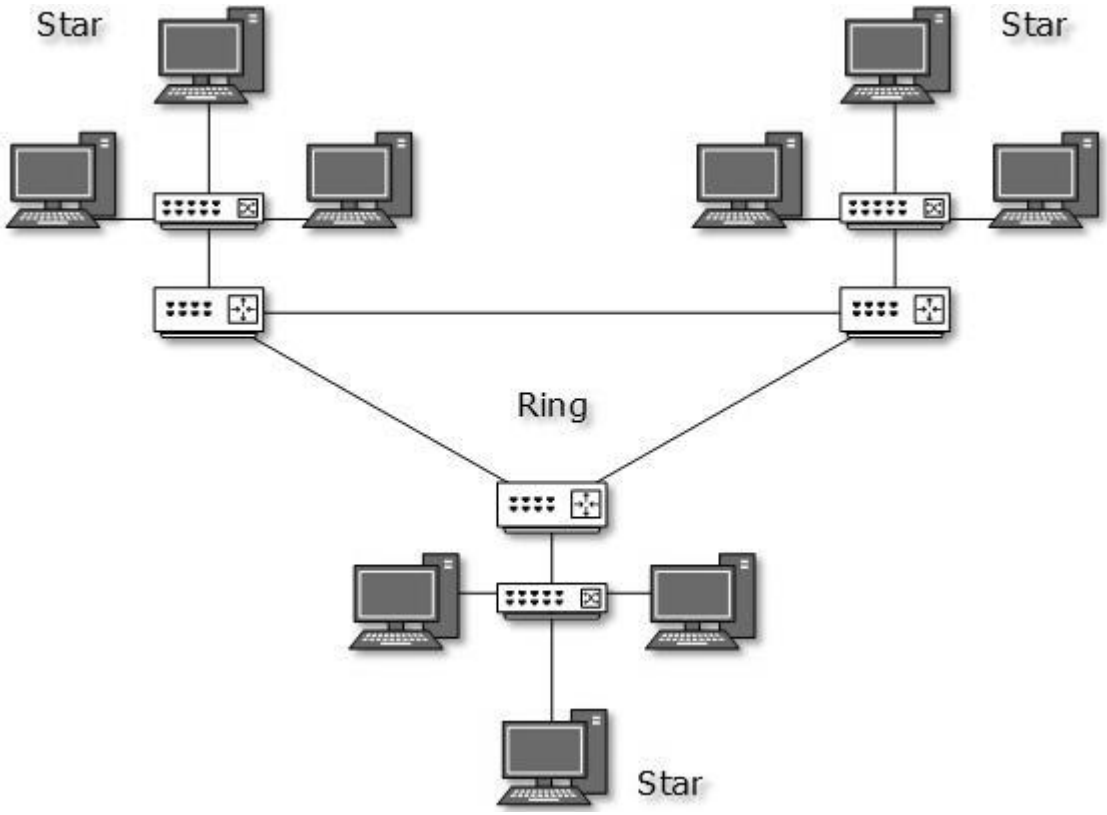


Illustration - Diagram showing a Hybrid Topology

The above picture represents a hybrid topology. The combining topologies may contain attributes of Star, Bus, and Ring topologies. Most WANs are connected by means of Dual-Ring topology and networks connected to them are mostly Star topology networks. Internet is the best example of largest Hybrid topology.

Wireless networks

The easiest and cheapest way to connect the computers in your home is to use a wireless network that uses radio waves instead of wires. The absence of physical wires makes this kind of network very flexible as you can move a laptop from room to room without fiddling with network cables and without losing your connection. The downside is that wireless connections are generally slower than wired connections and they are less secure unless you take measures to protect your network.

The term 'wireless network' refers to two or more computers communicating using standard network rules or protocols, but without the use of cabling to connect the computers together. Instead, the computers use wireless radio signals to send information from one to the other. If you want to build a wireless network, you'll need a wireless router. Signals from a wireless router extend about 100 feet (30.5 meters) in all directions, but walls can interrupt the signal. Depending on the size and shape of your home and the range of the router, you may need to purchase a range extender or repeater to get enough coverage.

You'll also need a wireless adapter in each computer you plan to connect to the network. You can add printers and other devices to the network as well. Some new models have built-in wireless communication capabilities, and you can use a wireless Ethernet bridge to add wireless capabilities to devices that don't. Any devices that use the Bluetooth standard can also connect easily to each other within a range of about 10 meters (32 feet), and most computers, printers, cell phones, home entertainment systems and other gadgets come installed with the technology.

Wireless Local Area Network (WLAN)

When the term 'wireless network' is used today, it usually refers to a wireless local area network or WLAN. A wireless local area network (WLAN) consists of two key components: an access point (also called a base station) and a wireless card. Information can be transmitted between these two components as long as they are fairly close together (up to 100 metres indoors or 350 metres outdoors). A WLAN can be installed as the sole network in a school or building. However, it can also be used to extend an existing wired network to areas where wiring would be too difficult or too expensive to implement, or to areas located away from the main network or main building. Wireless networks can be configured to provide the same network functionality as wired networks, ranging from simple peer-to-peer configurations to large scale networks accommodating hundreds of users.

A WLAN has some specific advantages:

It is easier to add or move workstations

It is easier to provide connectivity in areas where cabling is difficult or impractical

Installation can be fast and easy and can eliminate the need to pull cable through walls and ceilings

Access to the network can be from anywhere within range of an access point

Portable or semi-permanent buildings can be connected using a wireless LAN

While the initial investment required for wireless LAN hardware can be similar to the cost of wired LAN hardware, installation expenses can be significantly lower

Where a building is located on more than one site (such as on two sides of a road), it is possible with directional antennae, to avoid digging trenches under roads to connect the sites

In historic buildings where traditional cabling would compromise the facade, a wireless LAN can avoid drilling holes in walls

Increased mobility

WLANs also have some disadvantages;

As the number of computers using the network increases, the data transfer rate to each computer will decrease accordingly

As standards change, it may be necessary to replace wireless cards and/or access points

Lower wireless bandwidth means some applications such as video streaming will be more effective on a wired LAN

Security is more difficult to guarantee, and requires configuration

Devices will only operate at a limited distance from an access point, with the distance determined by the standard used and buildings and other obstacles between the access point and the user

A wired LAN is most likely to be required to provide a backbone to the wireless LAN; a wireless LAN should be a supplement to a wired LAN and not a complete solution

Internet

Internet is the global network of inter connected computer networks. More simply, it is the network of networks. This worldwide information highway is comprised of thousands of interconnected computer networks-both private and public and reaches millions of people in many different countries. The Internet was originally developed for the United States military department. This first network founded in 1969 was known as Advanced Research Project Agency Network (ARPANET). Gradually, by 1990's internet came to be used for government, academic and commercial research and communications. Now it is available to anyone with a PC, *ISP*, modem and browser.

Internet Service Provider Often abbreviated to ISP is a company which provides Internet access. Eg; BSNL. Internet enables its users to share and access enormous amount of

information worldwide. It uses WWW, FTP, email services, audio, and video streaming etc. At huge level, internet works on Client-Server model. Internet uses very high speed backbone of fiber optics. To inter-connect various continents, fibers are laid under sea known to us as submarine communication cable. Internet is widely deployed on World Wide Web services using HTML linked pages and is accessible by client software known as Web Browsers. When a user requests a page using some web browser located on some Web Server anywhere in the world, the Web Server responds with the proper HTML page. Internet functions simultaneously as a speedy and more effective medium for communication and a knowledge repository. The communication delay is very minimal in Internet. Internet is serving many proposes and is involved in many aspects of life. Some of them are:

1. Web sites
2. E-mail
3. Instant Messaging
4. Blogging
5. Social Networking
6. Marketing
7. Resource Sharing
8. Audio and Video Streaming
9. Gaming and Entertainment

World Wide Web: (WWW)

Originally developed as a resource for physicists, the web today is fast becoming the Main Street of cyberspace. The World Wide Web (abbreviated as the web or WWW) is one of the most popular services available on Internet. It is a subset of the Internet and it presents text, images, animation, video, sound and other multimedia in a single interface. This greatly enhances the experience of the Internet surfer. Although the World Wide Web is often referred to as the Internet, they are actually two different concepts. The Internet is the decentralized global network of computers that transfer information that makes all this possible whereas the web is a collection of documents or websites, that user can access using the Internet and a web browser. The web is a part of the Internet and it refers to a system of Internet servers that supports hypertext using a specific Internet protocol called HTTP on a single interface (web browsers). In addition, almost every protocol type available on the Internet is accessible on the web. This includes e-mail, FTP, Telnet, and Usenet News. Since the WWW is a subset of the Internet, it stands to reason that the web could not exist without the Internet. However, the Internet would still be the Internet without the web.

The operation of the web relies primarily on hypertext, as it is a means of information retrieval. Hypertext is a document containing words that connect to other documents. These words are called links, which the user can select. A single hypertext document can contain links to documents and resources throughout the Internet. With the ability of the web to

work with multimedia and advanced programming languages, the World Wide Web is the fastest growing and the most interesting part of the Internet.

File Transfer Protocol (FTP)

FTP or File transfer Protocol is a system of rules and a software program that enables a user to long on to another computer and transfer information between it and his/ her computer. It was the first service developed for the Internet so that government and educational institutions could easily exchange files. FTP allows the user to get access to the files stored in the directory of a remote computer that is connected to the Internet. Using FTP, one can upload and download files from the remote computer (known as FTP servers), if he/she has access permission on the remote machine.

Internet Access Methods or Types of Internet Connections

As technology grows, so does our need for bigger, better and faster Internet connections. Internet Access Methods means the ways used for getting connected to Internet. One of the critical factors determining the effectiveness of internet experience is the time spent for uploading or downloading, i.e., the speed of internet access. Internet access speed depends on which type of connection we choose for accessing Internet. There are a variety of options available to get accessed to internet- each with their own advantages and drawbacks.

These include traditional dial-up access through the analog modems and broadband options such as ISDN, DSL, Fiber Optic Cable, wireless connectivity and satellite access method.

I. Dial-up Internet Access

This method is also known as the analog internet access. In dial-up access method internet is accessed through the traditional telephone line. It is the slowest and also the cheapest internet access method. Using a modem connected to the PC, users connect to the Internet when the computer dials a phone number provided by ISP and connect to the network. Dial-up is an analog connection because data is sent over an analog public-switched telephone network. The modem converts received analog data to digital and vice versa. Because dial-up access uses normal telephone lines the quality of the connection is not always good and data rates are limited. Another drawback is that telephone line would always get a busy tone while using the internet. Typical Dial-up connection speeds range from 2400 bps to 56 Kbps. Today, analog has been widely replaced by broadband connections.

II. Broadband Connectivity

The term broadband refers to a high-speed Internet access that offers an always-on connection which is called in contrast to a dial-up connection using analog modem. Broadband connectivity is always known for its high rate of data transmission and reliability. There are different types of broadband connectivity such as;

a).ISDN - Integrated Services Digital Network: - ISDN is an international communications standard for sending voice, video, and textual data over digital telephone lines or normal telephone wires. ISDN uses fully digital signals over copper phone wire, a standard telephone line. This means there is no conversion from digital to analog and back again in the manner that an analog modem works. Most ISDN lines offered by telephone companies give users two lines at once, called B channels. The users can use one line for voice and the other for data, or they can use both lines for data. Typical ISDN speeds range from 64 Kbps to 128 Kbps.

b).DSL – Digital Subscriber Line:- DSL is another broadband service that many telephone companies and other providers offer to consumers. It is composed of several Subcategories, the most common being ADSL (Asymmetric Digital Subscriber Line), SDSL (Symmetric Digital Subscriber Line), and VDSL (Very High Digital Subscriber Line). These all work in the same general fashion. That is, DSL squeezes the maximum capacity out of a telephone line. DSL services let the user the current copper phone lines in his/her home for both data and voice communication and he/she can even use them simultaneously over the same copper pair. This means that the user can surf the Internet and talk on the phone at the same time. The DSL services do this by sending and receiving data at a different frequency than the user's voice.

(1) ADSL - Asymmetric Digital Subscriber Line:- Short for asymmetric digital subscriber line, ADSL technology is a transport that allows faster flow of information downstream (receiving data) than upstream (sending data). ADSL supports data rates from 1.5 to 9 Mbps when receiving data (known as the downstream rate) and from 16 to 640 Kbps when sending data (known as the upstream rate). ADSL requires a special ADSL modem.

(2) SDSL - Symmetric Digital Subscriber Line: - Short for symmetric digital subscriber line, SDSL is a technology that allows more data to be sent over existing copper telephone lines (POTS). SDSL supports data rates up to 3 Mbps. SDSL works by sending digital pulses in the high-frequency area of telephone wires and cannot operate simultaneously with voice connections over the same wires. SDSL requires a special SDSL modem. SDSL is called symmetric because it supports the same data rates for upstream and downstream traffic.

(3) VDSL - Very High DSL: - Very High DSL (VDSL) is a DSL technology that offers fast data rates over relatively short distances — the shorter the distance, the faster the connection rate.

FiOS or Fibre Optic Service

Fibre-Optic Service is another option for broadband internet access. It is the method of accessing internet. Whereas ISDN and DSL have become popular by taking advantage of copper telephone lines, cable is another broadband option which takes advantage of the infrastructure installed by cable TV operators. A cable modem uses the cable TV provider's hybrid Fiber/Co-axial infrastructure as a shared data network. Since Cable TV systems are originally designed to deliver large amounts of bandwidth (TV pictures and audio) from the head end (central distribution point) to the user (TV sets), these networks are capable of carrying large amounts of computer data in the downstream direction. Theoretically, cable access can operate at speeds of up to 50 Mbps for downloading and 10 Mbps for uploading. But practically, these can deliver 1 Mbps to 10 Mbps for downloading and 200 Kbps to 2Mbps for uploading. One problem is variability of speed. If many users are using the network simultaneously, the connection speed will decrease, because cable network users share a semi-LAN connection to the internet with other members of their neighborhood. So it is basically impossible to precisely predict connection speeds.

Wireless Fidelity (Wi-Fi)

There are several wireless options available for accessing Internet. In wireless internet connectivity, instead of using telephone or cable networks for your Internet connection, you use radio frequency bands. Wireless Internet provides an always-on connection which can be accessed from anywhere — as long as you are geographically within a network coverage area.

Wi-Fi or Wireless Fidelity standard for data transmission, known as 802.11 standards was established by the Institute of Electrical and Electronic Engineers (IEEE). Computers, smart phones and other digital devices can be connected to the internet by using this method. There may be one or many access points which cover a range of distance. The wireless clients are connected to the existing wired networks through a wireless router or Wireless Access Point (WAP). The wireless client receives signals from the WAP through a DSL modem.

Satellite Internet Access

This technology is a method by which Internet content is downloaded to a satellite dish and then transmitted directly from the dish to the user's PC. Download speeds are typically about 600 kbps. But , during peak Internet usage times, speeds could drop down to around 150 kbps. This option may be particularly appealing to those in remote areas like islands and forest regions where extensive cabling is not feasible. Unlike its cable and

telephone counterparts, satellite technology is not faced with the problem of pulling wire through the desert and over mountains. But this method is comparatively more costly and also there are more chances for interrupted signals especially during rainy season.

Modem

The word 'modem' is derived from the terms modulation and demodulation. This is a small boxlike electronic device that is used for connecting computers to internet by sending communications via the telephone lines. The role of modem in a computer is to convert the analog signals to digital signals which a computer recognizes. The modem modulates the digital data of computers into analogue signals to send over the telephone lines, then demodulates back into digital signals to be read by the computer on the other end; thus the name "modem" for modulator/demodulator. Modems are used for sending and receiving email and surfing the Internet. Modems also support a variety of other functions such as transmission error control, automatic dialing and faxing. Modem is both an output and input device. The transmission speed of a modem is expressed in baud rate. Baud refers to the speed at which modems transfer data. One baud is roughly equal to one bit per second. It takes eight bits to make up one letter or character. The standard for a good, high-speed modem is 56K and hence a standard modem is known as 56 K modem.

Web Browsers

Web Browser is software used for accessing the Internet. It is a client program that allows users to read hypertext documents on the World Wide Web (a vast interconnected group of files stored on and accessed by computers around the world) and navigate between them. Examples are Microsoft Internet Explorer, Mozilla Firefox, Google Chrome, Opera etc. The key to the Web is its interwoven connections- the hyperlinks you work with to access specific files on your screen. When a user requests a page using some web browser located on some Web Server anywhere in the world, the Web Server responds with the proper HTML page. The communication delay is very low. When we use a Web Browser it is actually using Hyper Text Transfer Protocol (HTTP) to interact with the network. The flexibility of the web combined with the simplicity of the browser software has greatly extended the ways in which individuals can communicate. They support text, voice and multimedia formats and can provide immediate access to shared information.

Search Engine

The Internet has become the largest source of information. Today, millions of Websites exist and this number continuous to grow. The end user uses the Internet heavily in accessing information in their day to day needs since the Internet is the biggest repository of knowledge in the history of mankind. Thus the Internet has become the world's widely accessed information source and Websites are added, updated, and obsolete daily. Therefore, "Finding the right information at the right time" is the challenge in the Internet age. Hence

there is a need for a more effective way of retrieving information on the Internet. The best way of finding information on the Internet is by using a search engine.

Search engine is a program on the Internet that allows users to search for files and information. A search engine is a searchable database which collects information on web pages from the Internet, and indexes the information and then stores the result in a huge database where it can be quickly searched. The search engine then provides an interface to search the database. Examples: Google, Alta Vista, Yahoo, Bing etc. You can search Google by typing a search word into the box which appears on screen.

A Search engine has three parts.

a. **Spider:** Deploys a robot program called a spider or robot designed to track down web pages. It follows the links these pages contain, and add information to search engines' database. Example: **Googlebot** (Google's robot program)
b. **Index:** Database containing a copy of each Web page gathered by the spider.
c. **Search engine software:** Technology that enables users to query the index and that returns results in a schematic order.

If you are looking for Web pages containing specific words or phrases, search engines such as Google, provide a fast and efficient means of locating those pages. For a broader view of the information on the Internet, or when you are unfamiliar with a topic, you can use subject directories, such as the World Wide Web Virtual Library, to acquaint yourself with the field and select the most appropriate information resources.

In broad sense, search engines can be divided into two categories.

1. Individual search engines:-An individual search engine uses a spider to collect its information regarding websites for own searchable index. There are two types of individual search engines.

i . General Search Engines. Examples: Google, AltaVista, HotBot, etc.

ii. Subject specific search engines. Examples: MetaPhys, ReligionExplorer,

2. Meta search engines: - A Meta search engine searches multiple individual engines simultaneously. It does not have its own index, but uses the indexes collected by the spiders of other search engines. Example: met crawler.

Search engine is searchable database which allows locating the information on the Internet by submitting the keywords. It is a very useful tool for quickly and easily searching the information Online. It is important to formulate the search statement using advanced searching techniques to filter the most relevant information out of search engines huge database more efficiently and effectively. For a more effective web search, you can also make use of the net searching techniques such as Boolean Operators and Wild Cards.

Electronic Mail (e-mail)

Electronic mail, or e-mail, is a fast, easy, and inexpensive way to communicate with other Internet users around the world. It is one of the basic and earliest services of the

Internet and the most used application on the Internet too. E-mail overcomes most of the problems and delays of getting a physical document from one person to another. Rather, it has the dual advantage of not only being faster but cheaper to sue as well. For using emails facility both the sender and the recipient should have pre-registered email ID's. For getting an email ID which is unique by all respects, one should have to register their names and other information with email service providers like Gmail, Yahoo, and hotmail. This process is known as signing up.

The basic concepts behind email parallel those of regular mail. You send mail to people at their particular addresses. In turn, they write to you at your email address. You can subscribe to the electronic equivalent of magazines and newspapers. If you have email you will almost certainly get electronic junk mail (or spam) as well.

Email has two distinct advantages over regular mail. The most obvious is speed. Instead of several days, your message can reach the other side of the world in hours, minutes or even seconds. The other advantage is that once you master the basics, you'll be able to use email to access databases and file libraries as well as transfer files and programs.

Email also has advantages over the telephone. You send your message when it's convenient for you. Your recipients respond at their convenience. No more frustration whilst you phone someone who's out, then they phones you back whilst you're out. And while a phone call across the country or around the world can quickly result in huge phone bills, email lets you exchange vast amounts of mail for a meager amount – even if the other person is on the other side of the earth. Other advantage of email over regular mail is that the mails you once sent and received are kept intact in separate folders (inbox and sent folder respectively) for future reference. Another advantage is that you can attach larger files with text and graphics along with the mails you compose without any extra cost.

Chatting

Chatting is a method of communication in which people type text messages to each other, thereby holding a conversation over Internet. Chat programs allow users on the Internet to communicate with each other by typing in real time. They are sometimes included as a feature of a website, where users can log into chat rooms to exchange comments and information about the topics addressed on the site. All day, every day it is possible to chat on the Web - meeting in virtual rooms and carrying on conversations through your keyboard and the screen. Using your Internet connection and your Web browser, or a special chat program, you can explore the world of online chat and meet people from all over the globe. **Newsgroup** (also called a *forum)* is an electronic discussion group maintained over the Internet or tied into a bulletin board system. Each newsgroup is typically organized around a specific interest or matter of concern. At present, there is more interesting and effective ways of chatting with online friends such as voice chat and video chat. An online chat room is very similar to our drawing rooms in which people sit together to discuss matters of their concern.

Internet Relay Chat (IRC):- IRC or Internet Relay Chat is a service on the Internet that allows people to communicate in real time and carry on conversations via the computer with one or more people. It provides the user with the facility to engage in simultaneous (synchronous) online "conversation" with other user form anywhere in the world.

Mobile Phone Technology

Mobile or cellular phone is a portable electronic communication device connected to a wireless network that allows users to make voice calls, send text messages and also to run applications. It is an electronic device with a rechargeable battery that facilitates two-way duplex radio telecommunication over a cellular network of base stations known as cell sites. It is called a mobile phone since it provides maximum mobility as it functions in wireless mode.

In all mobile phone systems, a geographic region is divided up into a cell. That is why the devices are also called cell phones. The cellular network utilizes radio waves spread around these cells. To serve these cells there will also be a fixed location (transceiver) base station. The Cell Base Station is the physical location of some of the equipment needed to operate the wireless network, such as antennas, GPS timing systems, cell towers etc.

Cellular Technology enables mobile communication because they use of a complex two-way radio system between the mobile unit and the wireless network. It uses radio frequencies over and over again with minimal interference, to enable a large number of simultaneous conversations. This concept is the central tenet to cellular design and is called frequency reuse. The cell phone may have a **Subscriber Identity Module** known as **SIM card.** It is a small plastic card inserted into a mobile device on which phone numbers, contact information, and other data are stored.

Mobile phones conduct simultaneous two-way transmissions. This is known as Full Duplex. One channel is used for transmitting and one channel is used to receive. Depending on the technology, the frequency may be the same or they may be different. The Cell Base Station is the physical location of some of the equipments needed to operate the wireless network, such as antennas, GPS, timing systems, cell towers etc. The size of the base station is dependent upon its location and system needs.

History of Mobile phones

Wireless communication networks have become much more pervasive than anyone could have imagined when the cellular concept was first developed in the 1960's and 1970's. In the 1970s, after the first experiments with ALOHA Net, interest in wireless networks grew. Many experiments were done on and outside the ARPA Net. In 1973, Martin Cooper, an engineer associated with Motorola, successfully demonstrated first mobile phone. This experimental mobile phone was the starting point for the first generation analog mobile phones. Given the growing demand for mobile phones, it was clear that the analog mobile phone technology was not sufficient to support a large number of users. To support more

users and new services, researchers in several countries worked on the development of digital mobile telephones.

The first commercially automated cellular network was launched in Japan by NTT (Nippon Telegraph and Telephone) in 1979, initially in the metropolitan area of Tokyo. Within five years, the NTT network had been expanded to cover the whole population of Japan and became the first nationwide 1G network. In 1981, this was followed by the simultaneous launch of the Nordic Mobile Telephone (NMT) system in Denmark, Finland, Norway and Sweden. NMT was the first mobile phone network featuring international roaming. The first 1G network launched in the USA was Chicago based Ameritech in 1983 using the Motorola Dyna TAC mobile phone. Several countries then followed in the early-to-mid 1980s including the UK, Mexico and Canada. The wide spread adaptation of wireless communication was accelerated in the mid 1990's, when governments throughout the world provided increased competition and new radio spectrum licenses for personal communication services (PCS) in the 1800-2000MHz frequency band.

Different Generations of Mobile Phones

Mobile phones were first introduced commercially in the early 1980s. In the succeeding years, the underlying technology has gone through four distinct phases of its development known as generations. They are

1. 1G Analog voice.
2. 2G Digital voice.
3. 3G Digital voice and data (Internet, e-mail, etc.).
4. 4G High-speed broadband internet access and visual- centric information

1. The first generation (1G)

The first generation (1G) phon**es** used analogue communication techniques: they were bulky and expensive, and were regarded as luxury items. **F**irst-generation mobile phones had only voice facility. The introduction of 1G cellular phones 1G (or 1-G) refers to the first-generation of mobile telecommunications. These are the analog telecommunications standards that were introduced in the 1980s and continued until being replaced by 2G digital telecommunications.

2. The Second generation (2G) phones

The Second generation 2G cellular telecom networks were commercially launched on the GSM standard in 1991. Three primary benefits of 2G networks over their predecessors were

a) Phone conversations were digitally encrypted;
b) 2G systems were significantly more efficient on the spectrum allowing for far greater mobile phone access levels; and
c) 2G introduced data services for mobile, starting with SMS text messages.

In 1987, several European countries decided to develop the standards for a common cellular telephone system across Europe- the Global System for Mobile Communications (GSM). Since then, the standards have evolved and more than three billion users are connected to GSM networks today. While most of the frequency ranges of the radio spectrum are reserved for specific applications and require a special license, there are a few exceptions. These exceptions are known as the Industrial, Scientific and Medical (ISM) radio bands. These bands can be used for industrial, scientific and medical applications without requiring a license from the regulator. For example, some radio-controlled models use the 27 MHz ISM band and some cordless telephones operate in the 915 MHz ISM. In 1985, the 2.400-2.500 GHz band was added to the list of ISM bands. This frequency range corresponds to the frequencies that are emitted by microwave ovens. Sharing this band with licensed applications would have likely caused interferences, given the large number of microwave ovens that are used.

After 2G was launched, the previous mobile telephone systems were retrospectively dubbed 1G. While radio signals on 1G networks are analog, radio signals on 2G networks are digital. Mobile phones became widely used only from the mid 1990s, with the introduction of second generation (2G) technology characterised by the Global System for Mobile Communications (GSM). This is more powerful digital communication techniques which have which have resulted in a dramatic reduction in the cost to mobile communication. It also allowed a wider range of services than before. Examples include text messaging, fax, data, and basic access to the Internet.

The **main difference** between two succeeding mobile telephone systems- 1G and 2G, is that the radio signals that 1G networks use are analog, while 2G networks are digital. Although both systems use digital signaling to connect the radio towers (which listen to the handsets) to the rest of the telephone system, the voice itself during a call is encoded to digital signals in 2G whereas 1G is only modulated to higher frequency, typically 150 MHz and up.

3. Third Generation (3G) phones

3G, short for 3rd Generation, is a term used to represent the 3rd generation of mobile telecommunications technology. This is a set of standards used for mobile devices and mobile telecommunication services and networks that comply with the International Mobile Telecommunications. Third generation (3G) phones still use digital communications, but they send and receive their signals in a very different way from their predecessors. This allows them to support much higher data rates than before and hence to provide more demanding services such as video calls and high speed Internet access. The most popular third generation mobile phone technology is called Universal Mobile Telecommunication System (UMTS).The third-generation (3G) technology has added multimedia facilities to 2G phones.

3G technology is the result of ground-breaking research and development work carried out by the International Telecommunication Union (ITU) in the early 1980s. 3G specifications and standards were developed after fifteen years of persistence and hard work. The technical specifications were made available to the public under the name IMT-2000. The communication spectrum between 400 MHz to 3 GHz was allocated for 3G. Both the government and communication companies unanimously approved the 3G standard. The first pre-commercial 3G network was launched by NTT DoCoMo in Japan in 1998, branded as FOMA. It was first available in May 2001 as a pre-release (test) of W-CDMA technology. The first commercial launch of 3G was also by NTT DoCoMo in Japan on 1 October 2001. It was initially somewhat limited in scope and broader availability of the system was delayed by apparent concerns over its reliability.

3G finds application in wireless voice telephony, mobile Internet access, fixed wireless Internet access, video calls and mobile TV. Several telecommunications companies market wireless mobile Internet services as *3G*, indicating that the advertised service is provided over a 3G wireless network. Services advertised as 3G are required to meet IMT-2000 technical standards including standards for reliability and speed (data transfer rates). To meet the IMT-2000 standards, a system is required to provide peak data rates of at least 200 kb/seconds (about 0.2 Mb/seconds). However, many services advertised as 3G provide higher speed than the minimum technical requirements for a 3G service. Recent 3G releases often denoted 3.5G and 3.75G, also provide mobile broadband access of several Mb /s to smart phones and mobile modems in laptop computers.

3G cellular services, known as Universal Mobile Telecommunications System (UMTS) or IMT-2000, will sustain higher data rates and open the door to many Internet style applications. The main characteristics of IMT-2000 3G systems are:

Mobile TV
Video on demand
Video Conferencing
Location-based services
Global Positioning System (GPS)

4. Fourth Generation

The 4G (fourth generation) of mobile phone mobile communications is a successor of the third generation (3G) standards. The declared objective of 4th generation mobile technology was to achieve "high-speed broadband internet access for data- and visual-centric information and to transmit data at 100mbps while moving and 1Gbs while standing still.

The 4G system provides mobile ultra-broadband Internet access to laptops with USB wireless modems, smart phones and to other mobile devices. Possible applications include amended mobile web access, IP telephony, gaming services, high-definition mobile TV, video conferencing and 3D television. Recently, Android and Windows-enabled cellular devices

have fallen in the 4G category. One base advantage of 4G is that it can at any point of travelling time provide an internet data transfer rate higher than any existing cellular services excluding broadband and Wi-Fi connections. Some of the features of 4G systems include high bandwidth, ubiquity (connectivity everywhere), seamless integration with wired networks and especially IP, adaptive resource and spectrum management, software radios, and high quality of service for multimedia. Now, several mobile communication companies throughout the world are claiming to have launched 4G standards commercially. Two major technological standards used in 4th Generation devices are

1. Mobile WiMAX (Worldwide Interoperability for Microwave Access) standard, launched in South Korea in 2006 and
2. Long Term Evolution (LTE) standard launched in Scandinavia since 2009.

Different varieties of mobile phones

Wireless telephones come in two basic varieties: cordless phones and mobile phones (also called **cell phones**). **Cordless phones** are devices consisting of a base station and a handset sold as a set for use within a small geographical area like a home or office. These are never used for networking. On the other hand, mobile systems could be used for wider area voice and data communication. The communication technology used in mobile phones may vary from CDMA (Code Division Multiple Access) to GSM (Global system for mobile Communication)

GSM:- Global System for Mobile Communication (GSM) is the most widely used cell phone technology worldwide. GSM uses a variation of Time Division Multiple Access (TDMA) which is one among the three digital wireless telephony technologies; the other two being GSM and CDMA. GSM compliant phones may have removable SIM cards that enable the transferring of mobile subscription account, contacts and other data from one GSM phone to another. The GSM was developed as a uniform standard for mobile communication applicable to the whole of Europe.

CDMA:-CDMA or Code Division Multiple Access refers to any of the several protocols used in second and third generation wireless communication. As the term implies, it is form of multiplexing that allows numerous signals to occupy a single transmission channel, optimizing the use of available bandwidth. It is a transmission scheme that allows multiple users to share the same RF range of frequencies.

Mobile phones can be categorized as follows, on the basis of features and services incorporated in it.

1. **Basic phone:** Device with basic phone functionality (e.g., SMS and voice), very limited computing power, few connectivity options and a basic user interface and numeric keypad.

2. **Feature phone:** Midrange mobile device with a graphical user interface, basic apps and more numerous connectivity options than a basic phone, but without a smart phone's computing power and QWERTY keyboard.
3. **Smartphone:** A smart phone is a mobile device that offers more advanced computing ability and connectivity than a contemporary basic feature phone. It is a high-end, full-featured mobile device with touch screen graphical user interface, on-screen or hard-button QWERTY keypad, advanced computing power, downloadable apps, ("App"is the short form of application. It is a small, specialized piece of software that can be downloaded onto a mobile device), GPS receiver and multiple connectivity options. A smart phone allows the user to install and run more advanced applications based on a specific platform. The smart phones run complete OS software providing a platform for application developer. It can be considered as a personal pocket computer (PPC) with mobile phone functions, although quite smaller than a desktop computer.
4. **Android:** Android is the popular operating system developed by Google that is used on many smart phones and tablets. Smart phones with Android operating system are known as **Android Phone**.
5. **iPhone** is a series of smart phones designed and marketed by Apple Incorporated. They run on Apple's iOS Operating System.

Mobile Computing

Recent estimations of the number of hosts attached to the Internet show a continuing growth since last 25 years. However, it is quite obvious that a major share of internet users prefers their mobile phones over personal computers for accessing internet. The most dramatic factor which facilitated the unprecedented information/communication revolution of 1990's was undoubtedly the launching of 3G mobiles that combined the basic features of mobile phones with that of a personal computer.

Advances in wireless networking have prompted a new concept of computing, called mobile computing in which users carrying portable devices have access to a shared infrastructure, independent of their physical location. This provides flexible communication between people and (ideally) continuous access to networked services. Mobile computing is revolutionizing the way computers are used and in the coming years this will become even more perceptible although many of the devices themselves will become smaller or even invisible (such as sensors) to users. It offers anytime, anywhere access to information and network resources without restricting them to the fixed network infrastructure. Mobile computing is becoming increasingly important also because of the rise in the number of portable computers and the desire to have continuous network connectivity to the Internet irrespective of the physical location of the node.

The need for mobile computing is originating from the basic fact that people are mobile by their very nature. People wanted to move from one place to another simply for his survival. He is used to keep himself moving either toward resources or away from scarcity.

So, the technological devices are also to be mobile as all these devices have been designed to fulfill human needs.

The mobile computing is a computing system in which a computer and all necessary accessories like files and software are taken out to the field. It is a system of computing through which it is being able to use a computing device even when someone being mobile and therefore changing location. It is invisible, ubiquitous, pervasive and wearable computing. The portability is one of the important aspects of mobile computing. Dr. G. H. Heilmeier defines mobile computing as a system in which ***"people and their machines should be able to access information and communicate with each other easily and securely, in any medium or combination of media – voice, data, image, video, or multimedia – anytime, anywhere, in a timely, cost-effective way."*** Mobile computing is a form of human–computer interaction by which a computer is expected to be transported during normal usage. Mobile computing is made possible by portable computer hardware, software, and communications systems that interact with a non-mobile organizational information system while away from the normal, fixed workplace. Mobile computing has three aspects: mobile communication, mobile hardware, and mobile software. The first aspect addresses communication issues in ad-hoc and infrastructure networks as well as communication properties, protocols, data formats and concrete technologies. The second aspect is on the hardware, e.g., mobile devices or device components. The third aspect deals with the characteristics and requirements of mobile applications.

Ranging from wireless laptops to cellular phones and Wi-Fi/Bluetooth enabled PDA's (Personal Digital Assistant) to wireless sensor networks; mobile computing has become ubiquitous in its impact on our daily lives. Mobile computing is a versatile and potentially strategic technology that improves information quality and accessibility, increases operational efficiency, and enhances management effectiveness. Since the start of this millennium, a standard mobile device has grown from being simple device used for two-way conversation to being a fully fledged communication device. It now occupies the image of a much smarter device with GPS navigation, an embedded web browser and instant messaging client, and a handheld game console, all bundled together in a single unit. Many experts argue that the future of computer technology rests in mobile computing with wireless networking. Mobile computing by way of mobile phones and tablet computers is becoming more and more popular day by day and in many western countries smart phones and iPhones with advanced computing standards is virtually began to replace personal computers.

Different types of Mobile Computing Systems

The following are the different types of mobile computing systems.

I. Traditional Distributed System

Traditional distributed systems consist of a collection of fixed hosts that are themselves attached to a network– if hosts are disconnected from the network this is considered to be abnormal whereas in a mobile system this is quite the norm. These hosts are *fixed* and are usually very powerful machines with fast processors and large amount of memory. The bandwidth in traditional systems is very high too. Furthermore, the execution context is said to be *static* as opposed to a *dynamic* context whereby host join and leave the network frequently. In a traditional system, location changes rarely and hosts are much less likely to be added or deleted from the network.

II. Nomadic Distributed System

This kind of system is composed of a set of mobile devices and a core infrastructure with fixed and wired nodes. Mobile devices move from location to location, while maintaining a connection to the fixed network. There are problems that arise from such shifts in location. The mobile host has a home IP address and thus any packets sent to the mobile host will be delivered to the home network and not the foreign network where the mobile host is currently located. Such problem can be solved by forwarding packets to the foreign network with the help of Mobile IP. Nevertheless, Mobile IP also suffers from efficiency, security and wireless access problems. These systems are susceptible to the uncertainty of location, a repeated lack of connections and the migration into different physical and logical environments while operating. However, compared to ad-hoc networks, nomadic systems still have comparatively reliable connections and services since most of these are actually supported by the fixed infrastructure ("backbone") of the network.

III. **Ad-Hoc Mobile Distributed System:-**Ad-hoc Mode is a wireless networking mode, also referred to as peer-to-peer mode or peer-to-peer networking, in which wireless enabled devices communicate with each other directly, without using an access point as a communication hub.

Ad-hoc distributed systems are possibly the type of network that comes close to mobile networks in the sense that every node is literally mobile. It is these networks that are very much seen as the systems of the future, whereby hosts are connected to the network through high-variable quality links (e.g.: from GPS to broadband connection) and executed in an extremely dynamic environment. Ad-hoc systems do not have any fixed infrastructure which differs them both from traditional and nomadic distributed systems. In fact, ad-hoc networks may come together as needed, not necessarily with any assistance from the existing (e.g.: Internet) infrastructure.

When nodes are detached from the fixed/mobile network they may evolve independently and groups of hosts opportunistically form "clusters" of mini-networks. The speed and ease of deployment make ad-hoc networks highly desirable. These kinds of systems are extremely useful in conditions where the infrastructure is absent, impractical to establish or even expensive to build (e.g.: military applications, high terrain uses, and emergency relief operations).

Advantages of Mobile Computing

According to a report published by World Bank there were more than six billion mobile phone subscribers in 2012. Again, according to International Telecommunication Union, 75% of the world has access to mobile phones. The ubiquity of mobile phones is well illustrated in a 2013 quote from the United Nations News Centre. "Of the Worlds 7 billion people, 6 billion have mobile phones. However, only 4.5 billion have access to toilets or latrines". All these figures are simply showing the possibilities of this hand held device as an effective and efficient tool for computing.

Some of the applications of mobile computing are education and research, healthcare sector, pollution monitoring, tourism industries, airlines and railway industries, transportation industry, manufacturing and mining industries, banking and financial institutions, insurance and financial planning, hospitality industry etc. The internet can be accessible from anywhere at any time. Social networking has also taken off with applications such as Face book, Twitter and so on. Now, almost all the internet oriented activities became much more easily accessible through a variety of specifically designed Apps (Small programs or Applications) to be downloaded and used in portable devices such as cell phones and tablets.

As an important evolving technology, Mobile Computing offers significant benefits for organizations that choose to integrate it with their fixed organizational information system. It enables mobile personnel to effectively communicate and interact with the fixed organizational information system while remaining unconstrained by physical location. Mobile computing is a versatile and potentially strategic technology that improves information quality and accessibility, increases operational efficiency, and enhances management effectiveness. Mobile computing may be implemented using many combinations of hardware, software, and communications technologies. The mobile phones are being used to gather scientific data from remote and isolated places that could not be possible to retrieve by other means. The scientists are initiating to use mobile devices and web-based applications to systematically explore interesting scientific aspects of their surroundings, ranging from climate change, environmental pollution to earthquake monitoring. This mobile revolution enables new ideas and innovations to spread out more quickly and efficiently.

Disadvantages

The mobile computing is also having certain disadvantages like comparatively higher and sometimes unaffordable initial costs of setup and maintenance, access restrictions, interruptions in power supply, limited file storage capacity and relatively higher security risks. But, many of these limitations can be bypassed through careful planning and effective monitoring.

SMS

One of the first messaging systems to have been introduced in mobile networks is the Short Message Service (SMS). In its simplest form, SMS is a basic service for exchanging short text messages (with a maximum of 160 simple characters). Despite its limitations, SMS is widely used today and accounts for a significant part of mobile operator revenues. SMS was first introduced as a basic service of GSM and has been the subject of many extensions. In its most recent form, SMS allows short text messages to be joined together to form larger messages and several application-level extensions have also been designed. One of the significant evolutions of SMS is an application-level extension called the Enhanced Messaging Service (EMS). EMS allows subscribers to exchange long messages containing text, melodies, pictures, animations, and various other objects.

MMS

MMS is the acronym of multimedia messages. Since 1998, standardization bodies have concentrated on the development of a new messaging service called the Multimedia Messaging Service (MMS). MMS is a sophisticated multimedia messaging service. MMS integrates multimedia features, allowing message contents to be choreographed on the screen of the receiving device. MMS phones typically allow the composition of messages in the form of slideshow presentations composed of sounds, pictures, text, and video clips. Telenor from Norway was the first operator to launch MMS in Europe in March 2002. This initiative was followed by Italia Mobile (May 2002), Orange UK (May 2002), Swiscom (June 2002), Orange, France (August 2002), and others.

Wireless Applications

Wireless technology came into existence in 1901 when Marconi successfully transmitted radio signals across Atlantic Ocean. The consequences and prospects of Marconi's attempt were simply overwhelming. Above all, it highlighted the possibility of replacing telegraph and telephone communications with transmission of waves in the near future. Nevertheless, while two-way wireless communication did materialize in military applications, wireless transmissions in daily life remained limited to one-way radio and television broadcasting by large and expensive stations. Ordinary two-way phone conversation would still go over wires for several decades.

Wireless communication networks have become much more pervasive than anyone could have imagined when the cellular concept was first developed in the 1960's and 1970's. In the 1970s, after the first experiments with ALOHANET, (first network based on packet radio developed at University of Hawaii in 1971) interest in wireless networks began to grew rapidly. By mid 1980's ARPANET, designed exclusively for meeting the needs of U.S Department of Defense, reached the peak of its development. But it fell far short of its expectations in terms of both speed and performances. It was actually after the cellular revolution of 1990's wireless technologies came into the forefront of communication

revolution. By far, the most successful application of wireless networking has been the cellular telephone system.

Like every access medium or technology, wireless has its pros and cons. The pros include;

- It is much less expensive to deploy than trenching for cabling.
- It is much quicker to deploy—a link can be up in a couple of hours.
- Wireless can go where cables can't, such as mountainous or inaccessible terrain.
- Less red tape is involved for deployment, if roof rights or elevation access is available.
- It involves an inherent high degree of security, and additional security layers can be added.
- Wireless provides broadband mobility and portability that wired access doesn't provide.

Disadvantages Wireless Technology

- Higher loss-rates due to external interference like lightning and bad weather
- Cost of installation is relatively higher
- Restrictive regulations of frequencies
- Low data transmission rates
- a higher degree of security threats

Advances in wireless technology are producing a host of portable communication, information, and control devices that connect without wires to local as well as wider networks. These mobile wireless devices support a wide range of applications ranging from voice and data communication, remote monitoring and position finding. Two most popular applications of wireless technology are Bluetooth and Global Positioning Systems (GPS). Currently, almost all the portable communication devices available in the market would regularly have these two wireless applications incorporated in it.

Bluetooth:

Bluetooth is a standard wireless technology permitting wireless connection between Personal computers, Printers, Mobile phones, Hands free headsets, LCD projectors, Modems, Notebooks, PDAs etc. It is a wireless PAN technology used for voice and data links with a typical range of 10 meters. This technology is useful when transferring information between two or more devices that are near each other. Bluetooth delivers a standard data rate of 720 kbps. The Bluetooth standard is based on a tiny microchip incorporating a radio transceiver usually built into the digital device. This wireless application is named after Harold I Bluetooth who ruled Denmark in 10th century A.D. Harold is known in history for unifying Denmark and Norway. Since, Bluetooth technology proposes to unite devices via radio connection, it is named after this historical figure.

Today, almost all the digital communication devices available in the market invariably have inbuilt Bluetooth facility incorporated in it. We are getting familiar with Bluetooth because of mobile phones which is now become an inevitable part of our life. By using Bluetooth facility, it is very much easy to transfer audio and video files in offline mode. The main drawbacks of Bluetooth connectivity is its shorter range and comparatively higher security vulnerabilities.

The Global Positioning System (GPS)

GPS is a technology for determining global positions on Earth. The device determines its location by analyzing signals broadcast from a group of satellites. The location information is usually expressed in terms of longitude, latitude and sometimes altitude. A GPS receiver coupled to a handset, either as built-in equipment or as an accessory can provide the location of a person or equipment. This location information can be formatted in a short message and sent to a remote server via SMS. The server interprets locations received from several handsets and displays them on associated geographical maps. GPS application is now seen largely used in a variety of fields such as aviation, rail and road transport, logistics, scientific research, archaeological excavations etc.

MODULE - III

SOCIAL INFORMATICS

"Civilization advances by extending the number of important operations which we can perform without thinking about them".

Alfred North Whitehead-*An Introduction to Mathematics*, 1911

Computers have led to a third revolution for civilization with the information revolution taking its place alongside the agricultural and the industrial revolutions. In the past thirty years humanity has moved into a digital era where billions of people are connected via an ever advancing technology boom. In these few decades there has been a revolution in computing and communications and all indications are that technological progress and use of information technology will continue at a rapid pace. The resulting multiplication of mankind's intellectual strength and achievements naturally has affected our everyday lives profoundly and also changed the ways in which the search for new knowledge is carried out.

Accompanying and supporting the dramatic increases in the power and use of new information technologies has been the declining cost of communications as a combined result of both technological improvements and increased competition. According to Moore's law the processing power of microchips is doubling every 18 months. Each time the cost of computing improves by another factor of 10 and the opportunities for computers multiply. The end result is that applications that were economically infeasible yesterday suddenly become practical. This sudden and ubiquitous growth and development of information technology (IT) is resulting in larger dependence of the society on the individual knowledge and competence of a person in the IT area.

Information Technology

Information technology (IT) is a technology which uses computers (here, computer is used as a generic term to denote all the digital devices used for computing and communication irrespective of their size, nature and generation)to gather, process, store, protect, and transfer information. Today, it is common to use the term Information and communications technology (ICT) because it is unimaginable to work on a computer which is not connected to network. **Information technology** (IT) or **Information and Communication Technology** (ICT) is a broad subject which deals with technology and other aspects of managing and processing information, especially in large organizations. IT particularly deals with the use of electronic computers and computer software to convert, store, protect process, transmit, and retrieve information. It is all about accessing, storing and distributing information. As such "Information technology (I.T) is the science and activity of storing and sending out information by using computers". B.H. Boar considers that "the information technologies permit preparing, collecting, transporting, finding, memorizing, accessing,

presenting and transforming the information in any form"(graphic, text, voice, video and image). These actions can take place between people, between people and equipments and/or between equipments. As a matter of fact "information" is a subjective term and hence it is better to replace it with the neutral term "data". Again, as there are different varieties of computing equipments, the more appropriate word to denote computerization is digitalization. So we can simplify the definition of Information technology as "the science and activity of moving data digitally".

Scope of Information Technology

The last half of the 1900s has been characterized by the increasing importance of information and communication technologies (ICTs) in personal, professional and social life. Computers, both on the desktop and embedded in automobiles, appliances, cellular phones, and satellite dishes have become an integral part of our social lives. In three decades, the Internet has grown from a network connecting four American universities and research labs to a global communications network. The increasing importance of the World Wide Web (WWW), electronic commerce, digital libraries and computer-mediated distance education are all examples of a phenomenon particularly termed as digital revolution.

Information technology is revolutionizing the way we live, work, learn, play and do business. The digital revolution has given mankind the ability to treat information in a systematic way, to transmit it with a very high accuracy and to manipulate it at will. Computers and communications are becoming an integral part of our lives and the advent of internet has changed our routine life dramatically. Now, the physical barriers for interacting with people and also the community at large, like time and space (more precisely, the geographical boundaries of nations) has already turned outdated and irrelevant. To survive in this information world one must keep pace with these changes. This ever growing need for digitalization provides the basic scope for information technology. Now, we need technology to communicate with our fellow beings, to process information, and above all, to make our lives easier and effective.

The knowledge and skills acquired in Information Technology enable learners to use information and communication technology (specifically computers) in social and economic applications, systems analysis, problem solving (using either applications or a current object-oriented programming language), logical thinking, information management and communication. It is envisaged that the fundamental knowledge and skills developed will not be restricted only to Information Technology but also relate to applications in other subjects in Further Education and Training and beyond.

The core focus areas of Information Technology include:

- History of computing
- Computer hardware Software;
- Data structures and types;
- Database development;

■ Electronic communications and;
■ Human-computer interaction.

As a subject of study, Information Technology always demand an interdisciplinary treatment as it involves scientific, technological, social, philosophical, physiological and psychological aspects. The subject Information Technology will enable learners to understand the principles of computing through the use of current programming language, hardware and software, and how these apply to their daily lives, to the world of work and to their communities.

Social Informatics

The advancements in technology present many significant opportunities but also pose major challenges. Since the appearance of technology, human beings have neglected each other and themselves. Technology, together with commerce, has slowly robbed humans of their innate abilities and amputated them of their capacities. Today, too many of us find ourselves in poor health, depressed, isolated, alienated, alcoholics, drug addicts, overweight, stressed out, overworked, and exhausted. We are spending less and less time together in living face to face conversation and interaction with our families, friends, neighbours, and colleagues and more and more time working, consuming, eating, drinking, driving our cars, watching TV, being online on the computer, sending emails and text messages.

A sour dependence on I.T grows on daily basis, the problems that are affecting our society are also in the increase. These newly generated problems include creating gaps and distancing people from the main stream, reason and motivation for advancement and larger concerns regarding the misuse of technological improvements. Today, innovations in information technology are having wide-ranging effects across numerous domains of society, and policy makers are acting on issues involving economic productivity, intellectual property rights, privacy protection, and affordability of and access to information. Choices made now will have long-lasting consequences and attention must be paid to their social and economic impacts.

At present, being a computer illiterate person means to be a person who is unable to participate in modern society or more simply, a person without opportunity. In spite of acknowledged necessity and benefits of inclusive computer literacy by international agencies like European Commission and UNESCO there are still groups of people with hindered access to basic computer education. This deprived sections are comprising of persons with disabilities, persons with learning difficulties, migrant workers, unemployed, persons lives in remote (rural) areas where IT education is not accessible etc.

Apart from bringing a vast array of opportunities, the ongoing information and communication revolution is also puts some serious questions regarding our personal as well as professional lives. These questions- many of them seem rather difficult to answer in

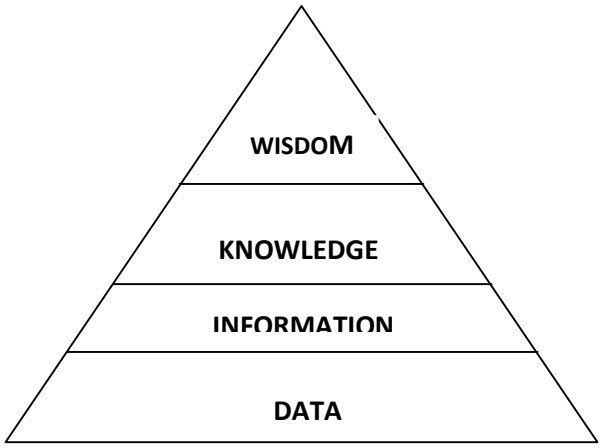
unambiguous terms- includes; how are ICTs changing the ways in which we live, work and play? What are the effects of the ever increasing computerization in modern societies? What are the practical, conceptual and ethical issues and implications of this widespread and pervasive phenomenon and many more. The answers to these irresistible questions or at least, the ways to find them, forms the base of social informatics.

We have given up so much in exchange for the glory and never-ending development of science, technology, and commerce; but we have little or no time for a few kind words with a neighbour or a friend or simply another human being whose path we cross during our busy days. We have allowed this situation to evolve and have not yet been able to find the strength to resist it. Our digital society badly needs a deepest sense of attention and wisdom in order to find solutions for more harmony, wellness, and health for human beings everywhere, and also to set a balance between our use of technology and the time we spend in conversation and social interaction with others. This growing need for balancing man with machine is the subject matter of social informatics.

Social informatics refers to the interdisciplinary study of the design, uses and consequences of information and communication technologies (ICTs) that takes into account their interactions with institutional and cultural contexts. Social Informatics is actually application and integration of tools, techniques and technologies for better information processing and dissemination. The key areas to be covered under the broad title of Social Informatics includes the question of accessing tools and techniques of I.T, the greater concerns of digital divide, privacy, cyber security, cyber crimes, cyber ethics, managing digital resource, social networking and so on.

Data, Information, Knowledge and Wisdom.

The most widely accepted working definition of computer is that it is a data processing machine. It is all about processing or refining data so as to reach the higher concepts of information and knowledge. Sometimes, knowledge can again be processed, refined or synthesized to form wisdom, an even higher level of understanding. From the body of knowledge thus created, it is possible to generate some new sets of data again and the process continues unabated. This never ending cyclical process forms the starting point of Information Science. This cycle is known as information life cycle or DIKW (short for data, information knowledge, and wisdom) cycle. Since all these different levels of information are graded hierarchically from data to wisdom, information scientists also call it knowledge hierarchy or Knowledge Pyramid. As the hierarchy is consisting of Data, Information, Knowledge and Wisdom it is also known as DIKW hierarchy. To reach a better understanding of the subject matter of information technology, it is essential to have a basic awareness regarding these four key concepts.



Knowledge Pyramid or DIKW Hierarchy

Data: - Data means any collection of raw figures or facts. Data can be considered as the raw material of information. Data refers to an elementary description of things, events, activities, and transactions that are recorded, classified, and stored, but not organized to convey any specific meaning. The data may be numerical such as payroll, employee Number, etc. or non-numerical like Student names, Product names, etc. Data can be defined as a representation of facts, concepts or instructions in a formalized manner which should be suitable for communication, interpretation, or processing by human or electronic machine. Data is represented with the help of characters like alphabets (A-Z,a-z), digits (0-9) or special characters (+,-,/,*,<,>,= etc.).

Types of Data

Data can be categorized as;

1. Qualitative data: It denotes the characteristics of things such as Average, Fair etc.

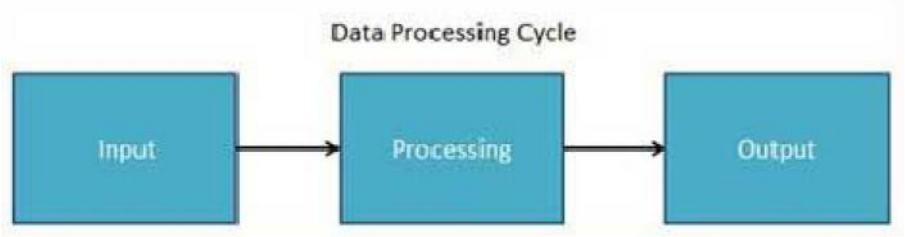
2. Quantitative data: It is expressed in terms of measurable quantities such as 10 KG, 40 degree Celsius etc.

3. Numeric Types: The data types may also be an integer (+, -) without any fractional part or real number which includes integers and fractions.

Besides the above, the data types include alphabetic data and alphanumeric data.

Data Processing: - As data is in its raw form it cannot solve any problem. The data needs some processing to make it useful. Data processing is the conversion of data into a more useful form. The transmission of data into meaningful information is called data processing. Data Processing is viewed as a system that accepts data as input, processes it into information as output. The result obtained by data processing is called information. It is the processed data. However, information produced in one data processing step may be used as

data in the next data processing step. This can be explained with the help of the following diagram.



Data processing is the re-structuring or re-ordering of data by people or machine to increase their usefulness and add values for particular purpose. Data processing consists of three basic steps, namely input, processing and output. These three steps constitute the data processing cycle.

Objectives of Data Processing

After the industrial revolution, the needs of the mankind increased. Man had to deal with large volume of data. He had to cope up with more and more information. The information collected is to be sorted out, stored and retrieved at short intervals. This necessitated the concept of data processing. As the complexities of business increased, the number of functions to be performed also increased. The data processing system must be responsible to supply the information when it is needed, so as to make the performance of the organization optimum. Let us have a look at the general objectives of Data Processing.

1. Handle huge volume of Data: The basic objective of data processing is to handle huge data in order to enable the organization to function efficiently.

2. Qualitative and quantitative information: The next important want of data processing is to provide qualitative and quantitative information.

3. Proper and Timely Information: Different kinds of information are needed in almost all organizations. Data processing provides correct and timely information.

4. Storage and retrieval of data: Through data processing, information can be stored and retrieved as and when necessary.

5. Helps in Decision-making: In every organization various decisions are taken at different levels. Such decisions can be more accurate if effective data processing system is used

6. Improves Productivity: To improve productivity, various measures are to be identified and implemented. It is possible through the properly designed data processing system.

7. Maintaining Performance at Optimum Level: To maintain the performance of the organization at best possible level various functions at different levels of the organization are to be coordinated. There should be a smooth flow of information among various functional departments. This can be easily achieved through data processing system.

8. Efficient Office Management: In office management also data processing plays a very important role, through which office automation can be done.

Kinds of Data processing

The important kinds of data processing are as follows:

1. **Manual Data Processing**: Data is processed without the help of mechanical devices. Here the data is processed using manual things such as abacus, slide rule, Napier bones etc.
2. **Mechanical Data Processing**: In Mechanical Data Processing, mechanical devices like calculators, tabulators, etc, are used for processing.
3. **Electronic Data Processing**: In Electronic Data Processing, the data is processed by either analog or digital computer.

Information

Information is organized or classified data which has some meaningful values for the recipient. Information is the processed data on which decisions and actions are based. A common and precise definition of information is that it is the interpreted data. The central idea is that data become information by a process of interpretation. In other words, information is quite simply an understanding of the relationship between pieces of data. Data needs to be combined in some manner to make information. The letters in this sentence is combined in a specific way to make words. The words are in a way just data in a more structured form. The meaning of the sentence is not inherent in its words or letters; it will need to be put in context to make sense. An equation familiar among information scientists says that I = i (D, S, t) where I represent the information we can get through the interpretation process 'i ' which is operating on data ' D', together with our pre-knowledge 'S ', during a certain point of time 't'. The sentence 1 Litre Diesel costs Rs.60/-can be cited as an example of information since contains a collection of data organized together so as to be meaningful.

DATA V/s INFORMATION

Data	**Information**
Raw records	Completed one
Unordered	Ordered
Unrefined	Refined
What prevails	What is necessary

Knowledge

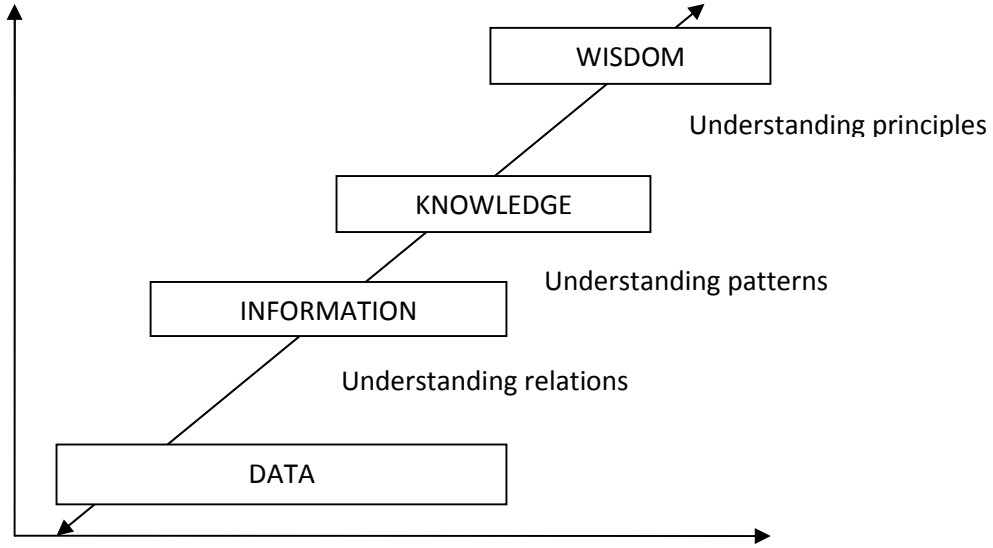
Oxford dictionary defines knowledge as expertise and skills acquired by a person through experience or education. It refers to the theoretical or practical understanding of a subject. Knowledge is the data or information that have been organized and processed to

convey understanding, experience, accumulated learning and expertise. Individuals and organizations could attain knowledge by interpreting and analyzing the existing or stored in pieces of information. Thus, knowledge is what we learn from information. It is created when information is transformed through human social interactions. Information becomes knowledge only when one is able to realise and understand the patterns and their implications. Information is not to be equated with knowledge. Just like data must be interpreted in order to become information, so must information be interpreted and analysed in order to obtain knowledge. Information is never the knowledge itself, the knowledge is within the knower. In order to understand information, people must have pre-knowledge. In other words, data that catches our interest transforms to a consciousness of something. This signifies that turning data into information is done through a mental process and during that process the data changes form and will ultimately lead to knowledge. Once we have selected, paid attention to or created some data, or turned it into a consciousness, we relate it to other things or put it in a context. We attribute meaning to it and by this we once again convert it, this time to information. This can be done individually or collectively and this process - selection and conversion of data into meaningful information can lead to larger structures of related information, or what we call knowledge. Knowledge is usually built by learning, thinking and proper understanding of the problem area. The following statement can be cited as an example for a piece of knowledge. "If there is a 2% hike in the price of one barrel crude oil, the bus charges will be enhanced up to 20 paise/km and the price of 1 KG tomato will be Rs.30/-."

In this statement we can see the organization and processing of several bits of information and the author is trying to find or establish a reasonable relationship between various aspects of a single phenomenon, i.e.; the hike in crude oil price. The more interesting part is that this very sentence underlines the author's comparatively higher level of understanding and expertise of the interdependence of market forces.

Wisdom

Wisdom refers to the ability of an individual to judge between right and wrong or good and bad. Oxford Advanced Learner's dictionary defines wisdom as "the ability to make sensible decisions and give good advice because of the experience and knowledge that you have". It is an understanding and realizing of people, things, events or situations resulting in most appropriate actions. It usually arises from multiple rounds of the DIK cycle. Wisdom requires synthesis or bringing together of a wide range of knowledge created from a huge amount of information refined from tremendous mounds of data. Wisdom is usually regarded as the highest segment of knowledge hierarchy as it contain the higher idea of a 'common good' and tries to achieve the standards of philosophy. The diagram given below will help you to realize the synthesis of wisdom.



DIKW Hierarchy showing synthesis of wisdom

Although it is by processing data we could reach the higher standards of information and knowledge, the case is not always the same. All these are interrelated terms. Something which is approached by someone as data may be a processed piece of information for someone else and vice versa. As Neil Fleming rightly put it; "collection of data is not information; collection of information is not knowledge; collection of knowledge is not wisdom; collection of wisdom is not truth". The underlying idea is that information, knowledge and wisdom are more than simply collections. Rather, the whole represents more than the sum of its parts and has synergy of its own.

Information Technology and Society

Humanity has changed dramatically from the Stone Age to the digital age through the Enlightenment and the Industrial Revolution. This evolution is marked by advances in technologies that appear to make people's lives better. The ability to control fire gave man the ability to warm himself and cook food. The invention of the wheel has paved the way for transportation and industry, while the ability to make energy from coal and oil has shaped

entire societies. Now however, we are in the midst of a new digital era, where cell phones, Face book, and twitter dominate. Technology has made leaps and bounds in recent history and shows no signs of slowing down. With this exponential evolution occurring at a rapid pace, the fundamental questions arise: What are the real implications of this new technological revolution in our society and how will it shape the future?

Concern about the impact of technology on people, organizations, and society is not new. As early as the 1830s, English intellectuals expressed philosophical arguments about the effects of technologies that had given rise to the Industrial Revolution some 60 to 70 years earlier. Samuel Butler, in his 1872 book *Erehwon* (an anagram for *nowhere*), summarized the anxiety about the disruptive influences of technology on the lives of people. The book described a society that made a conscious decision to reject machines and new technology; in it, people have "frozen" technology at a predetermined level and outlawed all further technological development. While there are many philosophical, technological, social, and cultural differences between society at the start of the Industrial Revolution and the society of the middle of the Information Age in which we now live, there are, nevertheless, people who continue to believe that humankind is threatened by the evolution of technology. The major positive impact of I.T in our society includes;

IT Is Eliminating the Barriers of Time, Space, and Distance

One of the most noticeable developments precipitated by information technology is the elimination of numerous barriers that traditionally separated individuals, organizations, and societies at different geographic locations. In essence, information technology is redefining the entire concept of time, space, and distance. Proliferation of high-speed data communication networks that span the globe enables companies to integrate geographically distant manufacturing and research facilities, link international financial markets, and even provide customer service from halfway around the world. Broadband Internet access, secure virtual private networks, and mobile computing technologies are making it possible for many professionals to telecommute, or work from outside the office. Since 2000, telecommuting has continued to increase. Globalization and telecommutings are transforming the ways in which people work and organizations operate. Now, work can be performed at any time, and from any part of the globe, which tends to make organizations more efficient. Organizational structure, job content, and the nature of management and supervision are altered significantly by this trend.

Internet- The Most Powerful Agent of Change

Internet is the single most powerful agent of change in recent history. In the words of Arthur C. Clarke, internet "is indistinguishable from magic." The rapid pace of the changes shaped by the Internet indeed have a touch of magic about them. As a tool available to a fairly wide public, the Internet is only thirty years old, but it is already the key catalyst of the most extensive and fastest technological revolution in history. It is the most extensive

knowledge repository the world has ever seen. It is most extensive because over the past two decades its effects have touched practically every field and every citizen in the world. And it is the fastest because its large-scale adoption is quicker than that of any earlier technology. The 100-million user mark was achieved by Personal Computers in 14 years and the Internet in 7 years. The cycles of adoption of Internet-related technologies are even shorter—Facebook reached 100 million users in 2 years.

I.T Revolutionized the way we communicate

Another leading feature of I.T is the changes occurred in the way in which we communicate with one another. Human communication has remained fairly constant, and limited, for the vast majority of our time on earth. Face to face and interpersonal communication had been the status quo for thousands of years. Charisma and oratorical skills as well as social signs and eye contact have been keystones in our abilities to interact, get what we want, and make progress as a society. However, all this is changing. It has become routine to send an email instead of writing a letter, a text message instead of calling, and adding someone on Face book instead of inviting them to coffee.

I.T is Ubiquitous

In our digital or information society I.T has attained a ubiquitous status. It is impossible to point out a single field of our personal or professional lives that is not affected, regulated or sometimes dominated by I.T. Today, each and every individual starting from primary school children find out about the impact of computer in their lives. Now, we are governed by the tools and techniques of E-governance, we are purchasing things online, watching movies in the internet, we are frequently using the larger knowledge resources available in the net to expand the horizons of our knowledge base, we are using the E-banking and telemedicine facilities and so on. We are busy reading news papers and magazines in digital format while travelling in bus or train. In short, we manage to do all the routine activities of our life simply sitting idle in our homes.

Undesirable Impacts of I.T

The IT revolution may result in many changes in structure, authority, power, and job content, as well as personnel and human resources management. Information technology significantly impacts individuals, organizations and societies. Any kind of technology is likely to affect multiple entities in ways that may be both positive and negative.

The major negative impacts of information revolution includes the digital divide or the uneven access to information technology, information overload, the fear that machines and information systems can displace humans from their jobs etc. Robotics, decision support systems, and other manifestations of information technology are improving the quality of human lives by relieving people from some of their tedious and hazardous tasks. At the same time, increased interaction with computers considerably reduced the conventional forms of

face-to-face interaction among people. All these changes ultimately caused an adverse impact upon the interpersonal relationships and other aspects of quality of human life.

Information technology challenges traditional value systems and raises certain previously neglected issues such as security and privacy, freedom of speech and protection against inappropriate content, as well as respect for intellectual property and fair use. Many people feel a loss of identity or dehumanization because of computerization; they feel like "just another number" because computers reduce or eliminate the human element that was present in the non-computerized systems.

Another possible psychological impact relates to distance learning. Some advanced European countries have legalized educating children at home through IT. Since distance learning system would deny all the possibilities of socialization, educational experts is arguing that such systems would not foster the social, moral, and cognitive development of school-age children who spend long periods of time working alone on the computer. Next is the problem of **Information Anxiety.** This is a state of mental unrest that can take several forms such as frustration with our inability to keep up with the amount of data present in our lives. Information anxiety can take other forms as well. One is frustration with the quality of the information available on the Web, which frequently is not up-to-date or incomplete. Another is frustration or guilt associated with not being better informed, or being informed too late A third form of information anxiety stems from information overload because of the existence of too many online sources.

Another negative aspect is one involving **Health and Safety.** Computers and information systems are a part of the environment that may adversely affect individuals' health and safety. The major problems of this category are job stress and repeated strain injuries. An increase in workload and/or responsibilities can trigger job stress. Although computerization has benefited organizations by increasing productivity, it has also created an ever-increasing workload for some employees. Some workers, especially those who are not proficient with computers, but who must work with them, feel overwhelmed and start feeling anxious about their jobs and their job performance. **Repetitive Strain Injuries,** the other potential health and safety hazards are repetitive strain injuries such as backaches and muscle tension in the wrists and fingers caused by spending a long time in front of computers very often in an unhealthy working environment. Carpal tunnel syndrome is a painful form of repetitive strain injury that affects he wrists and hands. It has been associated with the long-term use of keyboards.

Technological determinism argues that technology is the principal driving force of society determining its mode of operation, development, course of history, structure and values in a decisive manner. Modern information scientists explicitly reject technological determinism because it tries to explain technological development only in terms of logic of science, without considering the social, psychological philosophical and emotional aspects of technology. However, we could not ignore the basic role being played by Information

Technology in shaping the course of our society. The fact that frequency and variety of human–computer interactions as well as computer-assisted interactions between humans have increased over the past few decades is well established. What may not be entirely clear is the effect that information technology has on sociability and the quality of interpersonal relations. Does information technology isolate people from society by capturing the time that humans used to spend with one another? Or does it improve sociability by offering humans better connectivity and more free time? In the past few years, a number of researchers conducted empirical studies to find the answers to these questions. Most of these studies focused somewhat more narrowly on the impact of Internet use on sociability. Surprisingly, these studies arrived at diametrically opposite conclusions on this issue. Some studies found that Internet use reduces sociability, since time spent on the Internet is, in part; replacing time previously spent interacting with family and friends, as well as socializing outside the home. Other studies argue that Internet users become more socially engaged and improve their relationships with families and friends thanks to the substantial enhancements to interpersonal connectivity that e-mail and the Internet have to offer.

E-governance

E-Governance (short for electronic governance, also known as digital governance, online governance, or connected governance) can be defined as the use of ICTs as a tool to achieve better governance. Good governance is most important factor in promoting any business and development. E-Governance basically provides better services to citizens by effective use of information and technology by improving the system of government. Basically e-governance is an application of ICT for delivering government's services, exchange of information communication transactions, integration of various stand-alone systems and services. Its aim was to create a comfortable, transparent, and cheap interaction between government and citizens (G2C – government to citizens), government and business enterprises (G2B –government to business enterprises) and relationship between governments (G2G – interagency relationship). There are four domains of **E-government** namely, governance, information and communication technology (ICT), business process re-engineering (BPR) and e-citizen. However, we should distinguish e-governance from e-government. E-governance is beyond the scope of e-government. While e-government is defined as a mere delivery of government services and information to the public using electronic means, e-governance allows direct participation of constituents in government activities. As Blake Harris summarized E-governance is not just about government web site and e-mail. It is not just about service delivery over the Internet. It is not just about digital access to government information or electronic payments. It will change how citizens relate to governments as much as it changes how citizens relate to each other. It will bring forth new concepts of citizenship, both in terms of needs and responsibilities.

E-Governance is the process of changing the way government works. Government uses ICT to deliver the services at the location convenient to the citizens. Greater accessibility and full service availability i.e. 24 hours a day and seven days a week without visiting government offices is provided through e governance. E-Governance basically provides citizens the facilities for accessing government services and information by electronics means. Through e-Governance, government services are made available to the citizens in a convenient, efficient and transparent manner.

Three notable aspects to e-governance are

(a) Automation of government routine functions

(b) Web-enabling government functions for access of the citizens

(c) Achievement of openness, accountability, effectiveness and efficiency through improvement of government processes.

E-governance promotes efficiency, reduces time delays, enforces accountability and brings transparency in the working of the governmental system. As a result, it has become an integral part of democracy. All important government policies, acts, rules, regulations, notifications that are useful to the general public including land records, examination results, crime records, vehicle registration, birth and death registration, training and education, employment information, policies and legislation, telephone directory, etc. are made available on the Internet and can be accessed by the public free of cost. It is beneficial to the citizens as they can enjoy faster, effective and timely government services and also to the government as it can become more integrated into the community and can focus its resources where they are needed the most.

E-governance that involves technology, policies, infrastructure, training and funds is becoming popular around the world including India and other European and Western countries. E-Governance is not just about government web sites and e-mails. Neither is it just about service delivery over the Internet or digital access to government information or electronic payments. E-governance aims at changing how citizens relate to governments as well as how citizens relate to each other. It brings forth new concepts of citizenship, both in terms of needs and responsibilities. Usually, e-governance is described as a form of SMART governance. But the term SMART is seen used variedly to denote **S**imple, **M**easurable, **A**ccountable, **R**ealistic &**T**ime-related projects aiming better governance or as an acronym for **S**peed, **M**oral, **A**ccountable/**A**ccurate, **R**esponsive and **T**ransparent Governance.

In its most ideal sense, e-governance is a practical concept meant to achieve all aspects of citizen-oriented governance; bringing the citizenry closer to the government and decision making process. Commitment to e-governance tends to transform how public servants work, relate to each other, do business, and engage citizens and others. E-government is a process that requires a sustained commitment of political will, resources and engagement among the government, private and public sectors.

Evolution of E-Governance

Global shifts towards increased deployment of IT by governments emerged in the nineties; with the advent of the World Wide Web (WWW).The technology as well as e-governance initiatives have come a long way since then. With the increase in Internet and mobile connections, the citizens are learning to exploit their new mode of access in wide ranging ways. They have started expecting more and more information and services online form governments and corporate organizations to further their civic, professional and personal lives, thus creating abundant evidences that the new citizenship' is taking hold.

The concept of e-Governance has its origins in India during the seventies with a focus on development of in-house government applications in the areas of defence, economic monitoring, planning and the deployment of IT to manage data intensive functions related to elections, census, tax administration etc. At that time automation and interconnection among some government office was main focus. The First serious step taken towards ushering India into e-governance is setting of National Informatics Centre in 1977.In 1980's National informatics centre (NIC) established a network that connected all the district headquarters of India. It is a significant achievement at that time. From the early nineties, IT technologies were supplemented by ICT technologies to extend its use for wider sectoral applications with policy-emphasis on reaching out to the rural areas and taking in greater inputs from NGO's and private sector as well. With the advent of World Wide Web in 90's there is increment in deployment of IT by government. With the increase in mobile and internet connection people are expecting more and more services online form government. In mid to late 1990's, for conducting operations and to deliver services government agencies began using web sites. Then national e-governance plan was launched in 2006 which led to drastic change in e-governance strategy and program for India. This plan launched core infrastructure and policies for development of e-governance. For the development of e-governance laws and technologies in developing countries like India, there has been increasing involvement of international donor agencies under the framework of e-governance.

While the emphasis has been primarily on automation and computerization, state governments have also endeavored to use ICT tools into connectivity, networking, and setting up systems for processing information and delivering services. This has ranged from IT automation in individual departments, electronic file handling and work flow systems, access to entitlements, public grievance systems, service delivery for high volume routine transactions such as payments of bills, tax dues to meeting poverty, alleviation goals through the promotion of entrepreneurial models and provisions of market information.

Every state government has taken the initiatives to form an IT task force to outline IT policy document for the state and the citizen charters have started appearing on government websites. For governments, the more obvious motivation to shift from manual processes to IT-enabled processes may increase efficiency in administration and service delivery, but this

shift can be conceived as a worthwhile investment with potential for returns. FRIENDS (Fast, Reliable, Instant, Efficient Network for the Disbursement of Services) is the most well-known e-governance initiative of the Government of Kerala.

Benefits

Introduction of e-governance leads to many benefits like saving of time and money due to provision for services through single window; simplification of procedures; better office and record management; reduction in corruption due to fastness and transparency; and improved attitude, behaviour and work handling capacity of the employee. It increases the effectiveness and efficiency to do the right work at right time.

E-governance will allow citizens to communicate with government, participate in the governments' policy-making. It also helps the citizens to communicate each other. The e-governance will truly allow citizens to participate in the government's decision-making process and to reflect their true needs and welfare by utilizing e-government as a tool.

Disadvantages

The main disadvantages of e-government includes the lack of equality in public access to the internet (digital divide), reliability of information on the web, vulnerability to cyber-attacks and hidden agendas of government groups that could influence and bias public opinions.

Inaccessibility: - An e-government site that provides web access and support often does not offer the potential to reach many users especially those who live in remote areas, having low literacy levels, existing on poverty line incomes etc.

Cost: -The cost for providing infrastructure for e-governance is very high. Although a larger amount of money has been spent on the development and implementation of e-government, it has yielded only a mediocre product so far. The outcomes and effects of Internet-based governments are often unsatisfactory especially in under-developed and developing nations with poor infrastructure, frequent power failure and lack of awareness among citizens.

Hyper- surveillance:- Increased contact between government and its citizens goes both ways. Once e-government begins to develop and become more sophisticated, citizens will be forced to interact electronically with the government on a larger scale. This could potentially lead to a lack of privacy for civilians as their government obtains more and more information on them. When the government has easy access to countless information on its citizens, personal privacy is lost.

False sense of transparency and accountability:-Opponents of e-government argue that online governmental transparency is dubious because it is maintained by the governments themselves. Information can be added or removed from the public eye for promoting vested interests.

Information Revolution: New issues and Concerns

As we have mentioned already, the ongoing Information Revolution has changed our lives upside down. A vast array of tools and techniques of I.C.T together with the advent of Internet and the ever growing possibilities of mobile or ubiquitous computing has ushered an era of both qualitative and quantitative alterations in our lives. But, apart from bringing several advantages aimed to better our standards of living, level of understanding and communication strategies, digital revolution is also raising some serious issues, concerns and threats having far complicated implication in our personal as well as social lives. This new issues may be vary from the concerns of individual privacy and security to a wider spectrum of problems affecting the entire community such as digital divide, decreasing social interactions, information overload, cyber-crimes, the need for ethical computing etc.

Since the industrial revolution the notion of technology has invoked mixed reactions. There is a formidable group of thinkers and technocrats who considers technology as an omnipotent solution to social problems. On the other hand, some others regard it as a diabolic invention destined to alienate humans from themselves and nature. The basic question of 'whether technology is good or bad' has not changed since the Luddite movements in the early 19th century through the romantic spirit of a 'return to nature', the futurists' love for technology at the beginning of the 20th century culminating in today's radical environmentalist movements.

The most obvious feature of information society is the ever-growing number, variety and complexity of technological instruments and their constant change at an unprecedented scale and at a barely manageable pace. This unprecedented influx of instruments and information is really causing greater problems to humanity. The need for adapting this rapidly changing technology in more and more areas of our everyday lives often ends up in frustration and shock for individuals and in moral panic for society as a whole. When the real negative effects of technological change surface, it is primarily 'machines' (PCs, mobile phones, the Internet, etc.) that come to be seen as scapegoats by the public and the mass media alike exaggerating their contribution to the problem and forgetting their positive effects. The fact is that technology is neither good nor bad; it is neutral by all means. The good and bad are determined by the mindset or value system governing the person who uses it.

Digital Divide

Digital Divide is the most serious social issue aggravated by Information Revolution. It refers to the existing social gap between those with better access to information and communication technology and those underprivileged having no or little access to technology. It is a fact that technologies enabling access to information are not distributed evenly among various groups of people. For some people, information continues to be a scarce resource, which puts them at a comparative economic and social disadvantage. The gap in computer technology in general and Web technology in particular, between those who

have such technology and those who do not is referred to as the **digital divide.** Digital Divide will lead to increasing inequality between different industries and geographic regions, with some proving capable of taking advantage of the Internet's potential while others are left behind. Just as the Industrial Revolution divided the world into two large blocks- wealthy industrialized countries and the deprived colonies, the ICT revolution also divided social groups and nation states in terms of access to technology.

The following statistical figures would convincingly explain the real gravity of this social menace.

In 1998, 88 percent of all Internet users lived in industrialized countries that accommodate only 15 percent of the world's population, while South Asia, with one-fifth of the world's population, had less than one percent of the users. The United Kingdom alone had 10.5 million Internet users, compared to one million in the whole African continent. In 1994, when the Web started to spread through the world, the average telephone density in industrialized countries was 52.3 per 100 habitants, compared to 5.2 in developing countries.

Digital divide exists not only between nations, but also within individual countries. A recent study on the telecommunications and information technology gap in the United States shows that computer ownership and Internet access are strongly correlated with income and education. Households with annual incomes of $75,000 and higher are about nine times more likely to have a computer at home and twenty times more likely to have access to the Internet than households at the lowest income levels. Although access to electronic resources has been steadily increasing all over the world, digital divide still remains as a problem to be tackled.

The most common factors leading to this unequal access to digital tools and techniques are;

1. Socio-economic: - This refers to the disparity between rich and poor. The rich people all over the world may have better access to ICT than the poor people. It is the most common factor causing digital divide, because being poor in our times simply means a person who is deprived of education and training. This will attain alarming preposition in I.T field where accessing digital tools and techniques are more costly.
2. Geographical or Location: - This division is pointing towards the gap between highly advanced western and not so advanced Afro-Asian and Latin American nations as well as the urban/rural divide. Regardless of income, families living in rural areas are less likely to have Internet access when compared to families living in urban areas.
3. Racial: - This is referring to the existence of majority and minority communities and also the marginalized or underprivileged tribal and ethnic groups. E.g.: studies proved that Afro-Americans in U.S.A are far behind their White compatriots in accessing digital devices and techniques.
4. Generational: - This is the gap existing in terms of generations or age groups. The younger segment of the society would always exhibit a greater enthusiasm for

accessing digital means to information processing in quite contrast to older generation who are usually more reluctant to embrace technology.

Digital divide is not anyone particular "gap" between rich and poor or between local and global, but rather includes a variety of gaps caused by inequitable distribution of resources. There is a comparative lack of meaningful access to information and communication technologies (ICTs), which can be viewed in terms of several kinds of "gaps": (1) a gap in access to the ICTs themselves; (2) a gap in having the skills needed to use these technologies; (3) a gap between rich and poor in their ability to access information needed to compete in a global economy; and (4) a gap in education that translates into a "gap in abilities to process and absorb information."

The moral importance of the digital divide as a problem that needs to be addressed is linked to "inequalities between the rich and the poor— especially between wealthy nations and nations in absolute poverty."Digital divides are one of the most pertinent ethical issues arising from the globalization of economic activity and ICT. Again, there is little agreement on what constitutes a digital divide, why it is bad, or how it can be addressed. One of the reasons why digital divides are perceived as an issue is that it is an obvious case of discrimination leading to exploitation. It is visible form of injustice because it increase and perpetuate the economic inequality within and between nations. A core issue is that some people have an advantage that is linked to their ability to use ICT. Only this privileged few will have access to information whereas others do not. In most cases such digital divides are closely linked to social divides, and those who have few resources off-line are unable to improve their situation because they have even fewer resources online.

Bridging the Gap of Digital Divide

Recently various governments and international agencies like U.N.O are realizing the need for reducing the gap of digital divide and are implementing a variety of programmes and initiatives to bridge the existing gap in terms of technology. These purposeful actions from the part of U.N and other international donor organizations like USAID, World Bank etc. are usually seen concentrated on propagating e-literacy, providing digital tools at an affordable price and encouraging e-governance. The U.N Project **One Laptop per Child** (OLPC) targeting the school going children of developing nations is a worth mentioning initiative in this direction. Regionalization of computing language by replacing English is another notable step. However, the world is now gradually begun to accomplish certain significant achievements towards reducing the gap of digital divide primarily because of the widespread acceptance of mobile computing. Innate quality of digital information and communication tools to reduce their size and price in all the succeeding generations, coupled with the larger possibilities of wireless and cellular technology has proved instrumental in ushering the era of mobile or ubiquitous computing. Now, the previous notion of digital tools as bulky and expensive gave way to the newly emerged concept of handy and

affordable devices. The end result of this trend is the ever-growing increase in the number of mobile phone subscribers. With 3G Revolution, most of these mobile phone users are invariably getting connected to Internet. Besides these key factors, the increasing competition between cell phone producers, Internet and Cellular phone Service providers, Free and Open Source Initiatives, and the launching of more advanced and net friendly smart phones and I Phones all have contributed greatly to bridge the gap of digital divide.

Cyber Ethics: Applying Old Values to a New Medium

Ethics is the set of beliefs about right and wrong behavior. It is applicable to virtually all fields of human life. An old adage tells us "Character is what you do when no one is watching." So is it with the Internet. The term 'ethics' carries wider connotations in the cyber world as it opens new opportunities as well as new threats. It offers its users, an opportunity to remain invisible while leading a normal life in public. In the 1940s and early 1950s, the field of study called "computer ethics" was given a solid foundation by Professor Norbert Wiener of MIT. Sadly, Professor Wiener's works in computer ethics were essentially ignored for decades by other thinkers. In the 1970s and 1980s computer ethics was recreated and redefined by thinkers.

Walter Maner defined this field of study as one that examines "ethical problems aggravated, transformed or created by computer technology." Some old ethical problems, he said, were made worse by computers, while others came into existence because of computer technology. He suggested that we should use traditional ethical theories of philosophers, such as the utilitarian ethics of the English philosophers Jeremy Bentham and John Stuart Mill, or the rationalist ethics of the German philosopher Immanuel Kant.

In her book, Computer Ethics (1985), Deborah Johnson says that computer ethics studies the way in which computers "pose new versions of standard moral problems and moral dilemmas, exacerbating the old problems, and forcing us to apply ordinary moral norms in uncharted realms." In his influential article "What Is Computer Ethics?" (1985), James Moor provided a definition of computer ethics that is much broader and more wide-ranging than those of Maner or Johnson. It is independent of any specific philosopher's theory; and it is compatible with a wide variety of approaches to ethical problem-solving. Since 1985, Moor's definition has been the most influential one. He defined computer ethics as a field concerned with "policy vacuums" and "conceptual muddles" regarding the social and ethical use of information technology.

To be more precise, Cyber ethics is the study of ethics pertaining to computer networks. It tries to analyse and explain various aspects of our digital society such as the user behaviour and what networked computers are programmed to do, and how this affects individuals and society. Examples of cyber ethical questions include "Is it OK to display personal information about others on the Internet? Should users be protected from false

information? Who owns digital data (such as music, movies, books, web pages, etc.)? Is technology dehumanizing us? Is ICT has affected our socialization process? etc.

Ten Commandments of Computer Ethics: - The ethical values of computing were defined in 1992 by the Computer Ethics Institute; a non-profit organization whose mission is to advance technology by ethical means. These general norms of ethical computing are popularly known as the ten commandments of Computer Ethics. They are;

1. Thou shall not use a computer to harm other people.
2. Thou shall not interfere with other people's computer work.
3. Thou shall not snoop around in other people's computer files.
4. Thou shall not use a computer to steal.
5. Thou shall not use a computer to bear false witness.
6. Thou shall not copy or use proprietary software for which you have not paid.
7. Thou shall not use other people's computer resources without authorization or proper compensation.
8. Thou shall not appropriate other people's intellectual output.
9. Thou shall think about the social consequences of the program you are writing or the system you are designing.
10. Thou shall always use a computer in ways that ensure consideration and respect for your fellow humans (Computer Ethics Institute, 1992).

Computer Crime/ Cyber Crime

Computer crime refers to any crime that involves a computer and a network. The term is used broadly to describe criminal activity in which computers or computer networks are a tool, a target, or a place of criminal activity and include everything from electronic cracking to denial of service attacks. It is also used to include traditional crimes in which computers or networks are used to enable the illicit activity. The computer may have been used in conducting a crime, either as a target or as a tool. Though there is no technical definition by any statutory body for Cybercrime, it is broadly defined by the Computer Crime Research Center as - "Crimes committed on the internet using the computer either as a tool or a targeted victim." Cybercrime could include anything as simple as downloading illegal music files to stealing millions of rupees from online bank accounts. Cybercrime could also include non-monetary offenses, such as creating and distributing small or large programs written by programmers called viruses on other computers or posting confidential business information on the Internet.**Net-crime** refers to criminal exploitation of the Internet. Cybercrimes are defined more comprehensively as, "offences that are committed against individuals or groups of individuals with a criminal motive to intentionally harm the reputation of the victim or cause physical or mental harm to the victim directly or indirectly, using modern

telecommunication networks such as Internet (Chat rooms, emails, Etc;) and mobile phones (SMS/MMS)". Such crimes may sometimes threaten a nation's security and financial health. Issues surrounding these types of crime have become disturbing, particularly those surrounding cracking, copyright infringement, child pornography, etc. There are also problems of privacy when confidential information is lost or intercepted, lawfully or otherwise.

We can categorize computer crimes in two ways:

1. Criminal activities in which computer is the target - attacking the computers of others (spreading viruses is an example).
2. Crimes in which computers are used as a tool, accessory or medium - using a computer to commit "traditional crime" that we see in the physical world (such as fraud or illegal gambling).

The first recorded cyber-crime dates back to 1820, when, in France, the employees of a textile mill owned by Joseph-Marie Jacquard sabotaged the new technological device attached to the loom that allowed the repetition of a series of steps involved in the weaving of special fabrics. This criminal act was aimed to prevent Jacquard from further use of technology because the employees feared that their traditional employment and livelihood were being threatened by that newly invented device. At present, computer crime mainly consists of unauthorized access to computer systems data alteration, data destruction, theft of intellectual properly. Now, Cyber-crimes have been reported continuously across the world and potential risks associated it have risen dramatically. The potential harm of such a crime to humanity can hardly be explained. Cyber-harassment is a distinct Cyber-crime. Various kinds of harassment can and do occur in cyberspace, or through the use of cyberspace. Different types of harassment can be sexual, racial, religious, or other. Persons perpetuating such harassment are also guilty of cyber-crimes. Cyber harassment as a crime also brings us to another related area of violation of privacy of citizens. Violation of privacy of online citizens is a Cyber-crime of a grave nature. No one likes any other person invading the invaluable and extremely touchy area of his or her own privacy which the medium of internet grants to the citizen. Unlike in traditional crimes, here, the Information Technology infrastructure is not only used to commit the crime but very often is itself the target of the crime. Pornography, threatening email, assuming someone's identity, sexual harassment, defamation, SPAM and Phishing are some examples where computers are used to commit crime, whereas viruses, worms and industrial espionage, software piracy and hacking are examples where computers become target of crime.

Different Types of Cyber Crimes

There are a good number of cyber-crime variants.

Cyber stalking

Cyber stalking is the use of Internet or other electronic means to stalk or follow someone. This term is used interchangeably with online harassment and online abuse. Stalking generally involves harassing or threatening behaviour that an individual engages in repeatedly, such as following a person, appearing at a person's home or place of business, making harassing phone calls, leaving written messages or objects, or vandalizing a person's property. Very often, women are being targeted in this particular form of criminal activity.

Hacking

Going by literal meaning, hackers are not disturbing, as the term is originally used to refer a person who is well versed in using computers. But, now the term hacking is seen used increasingly to describe a computer crime in which the offender penetrates into a computer or network to steal information or damage the program in some way."Hacking" is a crime, which entails cracking systems and gaining unauthorized access to the data stored in them. It means unauthorized control/access over computer system. The act of hacking completely destroys the whole data as well as computer programs. This criminal act of breaking into your computer systems without your knowledge and consent in order to tamper the precious confidential data and information actually amounts cracking and hence the perpetrators of such crimes are also referred to as crackers. The hackers are classified into different groups on the basis of the real motive behind their intrusion.

a) **White Hat Hackers:** - This group is comparatively harmless. They are joy riders who use their technical expertise only to show the world that they are capable of penetrating into computer systems or networks.
b) **Black Hat Hackers:** - This group constitutes the potentially dangerous hackers. They are the real crackers capable of manipulating your data with malicious intentions. They always wanted to make monitory benefits from the act of cracking.
c) **Grey Hat Hackers:** - This particular group of hackers always targets networks for unauthorized access.

Identity Theft

An important form of cyber-crime is **identity theft**, in which criminals use the Internet to steal personal information from other users. Identity theft occurs when someone appropriates another's personal information without his or her knowledge to commit theft or fraud. Identity theft is a vehicle for perpetrating other types of fraud schemes. Typically, the victim is led to believe they are revealing sensitive personal information to a legitimate business sometimes as a response from the bank or business firm. Various types of communication platforms and social networking sites are also used for this purpose to find the identity of interested peoples. The most common means usually employed for identity theft are phishing, vishing and spoofing. These methods lure victimized users to fake websites, where they are asked to enter personal information. This includes login information, such as usernames and

passwords, phone numbers, addresses, credit card numbers, bank account numbers, and other information.

Phishing

Phishing is just one of the many frauds on the Internet, trying to fool people into parting with their money. It is the criminal act of eliciting vital information like user name, password and account number by impersonation. The usual mode of phishing starts with the receipt of unsolicited emails by customers of financial institutions, requesting them to enter their username, password or other personal information to access their account for some reason. Customers are directed to a fraudulent replica of the original institution's website when they click on the links on the email to enter their information, and so they remain unaware that the fraud has occurred. The fraudster then has access to the customer's online bank account and to the funds contained in that account.

Vishing

Vishing is the criminal practice of using social engineering and Voice over IP (VoIP) to gain access to private, personal and financial information from the public like credit card numbers or other information used in identity theft schemes from individuals for the purpose of financial reward. The term is a combination of "voice" and phishing. Vishing exploits the public's trust in landline telephone services.

Spoofing

Spoofing literally means fooling. In Cyber terminology, Spoofing refers to a peculiar kind of cyber-crime in which the perpetrator make intentional use of bogus email ID's, IP address, Cell phone numbers etc; to spoof or fool the recipient of mails and messages. It also comes under the category of identity theft. This is typically done by hiding ones identity or faking the identity of another user on the internet. Such fake IDs, usually forged by imitating the already existing one, especially of financial institutions, are seen used increasingly for staging fraudulent activities. Unaware of the fact that the message was sent from a fake ID, the victim takes all the messages received from such fake ID's as genuine and starts acting accordingly, only to realize his folly at a later stage. Spoofing can take place on the internet in several different ways. One common method is through email. Email spoofing involves sending messages from a bogus email address or faking the email address of another user. A spoofed e-mail may be said to be one, which misrepresents its origin. It shows its origin to be different from which actually it originates. Another one is **SMS Spoofing.** Here an offender steals identity of another person in the form of mobile phone number and sending SMS via internet and receiver gets the SMS from the mobile phone number of the victim. It is very serious cyber-crime against any individual. Fortunately, most of the email service providers nowadays are employing more effective security measures against this sort of deception and fraudulences.

Spamming

Spamming refers to sending of unsolicited mails containing usually, bulky marketing information. Such lengthy unwanted messages may cause considerable harm for the recipient as it would always be a matter of nuisance and require a huge storage space. Mail-bomb is another term associated with spamming. It is the term used to denote a deluge of e-mail messages from one or more sources, deliberately intended to overload the recipient's computer and make it crash. A mail-bomb is typically sent to punish someone guilty of spamming or some other serious breach of netiquette. A Cancelbot (short for cancel robot) isa program that detects spamming in newsgroups and automatically issues a cancel command. At present all the E-mail service Providers are equipped with inbuilt spam filters to curb this menace.

Denial of Service Attacks (DoS)

A denial of service attack is a targeted effort to disrupt a legitimate user of a service from having access to that service. This may be accomplished through a number of methods. Offenders can limit or prevent access to services by overloading the available resources, changing the configuration of the service's data, or physically destroying the available connections to the information. This involves flooding a computer resource with more requests than it can handle, causing the resource (e.g. a web server) to crash thereby denying authorized users the service offered by the resource. Another variation to a typical denial of service attack is known as a Distributed Denial of Service (DDoS) attack wherein the perpetrators are many and are geographically widespread. It is very difficult to control such attacks and is often used in acts of civil disobedience.

Violation of Intellectual Property Rights:-

Intellectual property consists of a bunch of rights aimed to protect the ideas and innovations that are products of human mind and intelligence. Any unlawful act by which the owner is deprived of his rights is a crime. The most common types of IPR violation are software piracy, infringement of copyright, trademark, patents, designs and service mark violation, theft of computer source code, etc. Piracy, etymologically denoting sea robbers is the commonly used term to refer copy rights infringements today. Some hackers and hobbyists like the exponents of the Free Software Movement are trying to confer an ethical perception to the illegitimate reproduction of software, literature, music, films etc; as they are driven by the motto 'knowledge should be free'. However, when judged from the legal perspective this type of unauthorized copying definitely amounts to a criminal activity especially when financial motives are involved.

Publishing Obscene Materials, Defaming and Pornography

There are certain cyber offences which affect the personality of individuals. The most common form is defaming an individual by publishing obscene materials in social networking sites such as Face-book, Twitter, Whats App etc. Some offenders also used to send emails with obscene content to harass others. At present, harassment aiming defamation

has become very common as usage of social networking sites is increasing day by day. Defamation also involves hacking a person's mail account and sending vulgar mails from it, only to lower down the dignity of the victim. Pornography refers to taking and publishing nude pictures which is also used to defame others especially women.

Cyber Squatting

Cyber squatting is the act of registering a famous domain name (Website Address) and then selling it for a much higher price. It involves two persons claiming for the same Domain Name. It can be done in two different ways; either by registering a domain name first (prior to the registration by the person or firm who really wants that name) foreseeing its future possibilities or by registering a domain name very similar to a famous domain name.

Cyber Terrorism

Cyber terrorism can be defined as an act of terrorism committed through the use of cyberspace or computer resources. As such, a simple propaganda in the Internet, that there will be bomb attacks during the holidays can be considered cyber terrorism. As well there are also hacking activities directed towards individuals, families, organized by groups within networks, tending to cause fear among people, demonstrate power, collecting information relevant for ruining peoples' lives, robberies, blackmailing etc. **Cyber extortion** is a form of cyber terrorism in which a website, e-mail server, or computer system is subjected to repeated denial of service or other attacks by malicious hackers, who demand money in return for promising to stop the attacks.

In addition to the above, there are also other varieties of cyber-crimes like **Physical Loss** (Stealing or theft of Computer Hardware and peripherals), **Cyber Vandalism (**destroying, damaging and disrupting the data or information stored in computers or networks), **Web Jacking**(taking control of a website forcefully through hacking)**Internet Time Theft**(use by an unauthorized person, of the Internet hours paid for by another person)**Cyber Trafficking (**trafficking of drugs, human beings, arms weapons etc by using cyber tools), **Salami Attacks** (a financial fraud, involving meagre amount in individual cases, based on the idea that an insignificant alteration will go unnoticed) **Online Gambling** etc.**.**

Malicious Programs (Viruses, Worms, Trojan Horses etc.)

In addition to traditional crimes occurring on the electronic resources, there are crimes that exist explicitly due to the availability of technology. These crimes, which include malicious programs like viruses that are designed to disrupt and negatively impact entities in both the digital and real world. In these types of offences it is the computer system or the network that forms the direct target of attack. Viruses and malicious programs intended to cause electronic resources to function abnormally can potentially crash a massive amount of individuals and resources. These programs, generally known as the **malware** (Software or program with a malicious intent and content) can also endanger a legitimate user's access to computer resources.

Viruses are programs that attach themselves to a computer or a file and then circulate themselves to other files and to other computers on a network. They usually affect the data on a computer, either by altering or deleting it. Now, so many anti-virus programs are available in the market to curb this menace. Eg. Norton Anti-virus, Avast, Avira, Kaspersky and AVG.

A **worm** is a malware that attempts to travel between systems through network connections to spread infections. Unlike viruses, worms do not need a host program to attach themselves to. They merely make functional copies of themselves and do this repeatedly till they eat up all the available space on a computer's memory.

A **Trojan horse** is a computer program that appears to be something beneficial, interesting or desirable such as a game or screen saver, but causes something malicious in the background. It hides its real identity and thereby concealing what it is actually doing. The term is derived from the ancient Greek story of wooden horses in which the Greeks were said to have concealed themselves in order to enter Troy. Unlike viruses a Trojan horse do not replicate itself. But it is more harmful since its mode of operation is very much akin to guerilla warfare.

Spyware

Spyware is software that covertly transfers information about an unsuspecting user to a corporate site where such details can be manipulated for marketing or can be sold for a profit. Spyware often enters a system in the form of freeware or shareware. Spyware is an unwanted program that downloads itself with the software that is installed from Internet and then runs in the background of the system. Once downloaded in the computer, the spyware would transmit vital information regarding the user such as his internet searching habits, to the sender of the spyware program so that the information can be used for marketing purpose. This threat is more dangerous than the adware and is usually not detected by ordinary anti-virus software. However, certain anti-spyware programs such as Ad-Aware and eTrust can effectively quell this malware.

Adware

Adware is the software used for communicating advertisement of business products. It is downloaded automatically when other programs like a free software or a game is installed from the Internet. Once installed unintentionally, this software will display advertisements in pop-up windows while we are busy surfing the net. Although it is not as dangerous as a spyware, it can create considerable nuisance for the user. However, there is one plus-point in this, as it is very often used as a source of income for the developers of free software.

Cyber Security

In the present day world, India has witnessed an unprecedented index of Cyber-crimes whether they pertain to Trojan attacks, salami attacks, e-mail bombing, DOS attacks, information theft, or the most common offence of hacking. Despite technological measures being adopted by corporate organizations and individuals, we have witnessed that the frequency of cyber-crimes has increased over the last decade. Since users of computer system and internet are increasing worldwide, in large number day by day, it is easy to access any information within a few seconds through internet. Certain precautionary measures should be taken by all of us while using the internet which will assist in challenging this major threat Cyber Crime. These measures such as encrypting, use of anti-virus programs, assigning password protection, promotion of ethical computing standards, and enactment of cyber laws are known collectively as cyber security measures.

Cyber security may be defined as "the body of technologies, processes and practices designed to protect networks, computers, programs and data from attack, damage or unauthorized access". In a computing context, the term *security* implies cyber security. Organization and user's assets include connected computing devices, personnel, infrastructure, applications, services, telecommunications systems, and the totality of transmitted and/or stored in information in the cyber environment. Cyber security strives to ensure the attainment and maintenance of the security properties of the organization and user's assets against relevant security risks in the cyber environment. The general security objectives comprise the following:

- Integrity, which means that information cannot be changed during transmission
- Authentication, which occurs when an identity is established between two users
- Confidentiality and non-repudiation, meaning that it is important to be able to prove that a message has been sent.

There are many ways to have a secure communication in computer networks today. However, one should be aware of the basic fact that, as tools and techniques of ICT is going on expanding and improving day by day, so does its vulnerabilities too. Therefore, we should always give proper attention and vigil against the possible threats involved in ICT and should struggle constantly for achieving higher standards of cyber security. This could be done by opening three different war fronts. They are;

1. By using tools and techniques of technology like antivirus programs, firewalls, encrypting etc.
2. Through the enactment and effective implementation of a comprehensive body of cyber laws aiming the prevention or reducing of cyber offences
3. By promoting and propagating the norms and standards for ethical or judicious computing.

However, prevention is always better than cure. It is always better to take certain precautions while working on the net. One should make them a part of his cyber life. Sailesh

Kumar Zarkar, technical advisor and network security consultant to the Mumbai Police Cyber-crime Cell, advocates the 5P mantra for online security: Precaution, Prevention, Protection, Preservation and Perseverance. To achieve the wanted security there are privacy-enhancing technologies called PET's designed to protect the personal privacy of the user. Eg; Cryptography.

Information security is becoming one of the most important conditions for ensuring national and international security, as well as the personal security of each individual. An analytical study of 600 incidents of security breaches over a five-year period conducted in USA reveals that 87 percent of such cases could have been avoided if reasonable security controls had been implemented. Cybercrime prevention can be achieved fairly quickly and in a cost-effective manner. When armed with a little technical advice and common sense, many cybercrime attacks can be avoided. Some of the techniques to be used for enhancing cyber/information security are;

a. **Encrypting: -** Encrypting is the process of encoding messages or information. It is the conversion of electronic Data/Information in to another form called a cipher text in order to prevent an authorized user from accessing it. The message that is going to be encrypted is known as the plaintext and the output of the encryption is called cipher text and it is the cipher text that later on is transmitted between users. It is one of the oldest and most effective Privacy Enhancing Technique used for protecting the content of the messages transmitted between two communicating users on the Internet. The underlying principle of cryptography is that a cipher text cannot be understood by anyone except the authorized one.
b. **Installing and updating antivirus software:—**Antivirus software is designed to prevent malicious software programs from embedding on your computer. Antivirus software monitors all online activity with the intent to protect the system from viruses, other malicious programs, and can be upgraded to protect against spyware and adware. If it detects malicious code, like a virus or a worm, it works to disarm or remove it. Viruses can infect computers without the users' knowledge. Most types of antivirus software can be set up to update automatically. Most of the computers sold today come with some form of antivirus software. Failure to keep this software current is where a majority of the issues arise. To be safe on the Internet, the antivirus software should be configured to update itself every time the system connects to the Internet.
c. **Firewalls: -** A firewall helps to protect your computer from hackers who might try to gain access to crash it, delete information, or steal passwords and other sensitive information. There are both hardware and software firewalls available in the market. Software firewallsare widely recommended for single computers. The software is prepackaged on some operating systems or can be purchased for individual computers. For multiple networked computers, hardware routers typically provide

firewall protection. The firewall monitors all data flowing in and out of the computer to the Internet, often blocking attacks from reaching the system.

d. **Choosing a strong password and protecting it:—**Usernames, passwords, and personal identification numbers (PIN) are used for almost every online transaction today. A strong password should be at least eight characters in length with a mixture of letters and numbers. Using the same password for various sites or systems increases the risk of discovery and possible exploitation. It is never a good practice to write a password down and leave it near the system it is intended to be used on. Changing a password every 90days is a good practice to limit the amount of time it can be used to access sensitive information.

e. **Keep the computer system up to date:—**Cyber criminals will use software flaws to attack computer systems frequently and anonymously. Most Windows based systems can be configured to download software patches and updates automatically. By doing this, we can upset cyber criminals who exploit flaws in software packages. This will also deter a number of automated and simple attacks criminals use to break into your system.

f. **Protect your personal information:—**using many of the online services today involves haring basic personal information to include name, home address, phone number, and email address. Using common sense is the best way to protect against and prevent cybercrime. One should avoid disclosing any personal information to strangers, the person whom they don't know, via e-mail or while chatting or any social networking site. Do not respond to email messages asking to disclose information such as Credit and Debit Card numbers, PIN etc. When in doubt about responding to an email, consider a telephone call to the organization to verify authenticity. Type the address for the website in the browser instead of clicking on a link.

Cyber Law

By the close of the preceding millennium, the new boon brought by information technology and the resultant changes in the business environment has brought its scar in the form of cybercrime and I.T sector began to experience an ever-growing need for new regulations, legal endorsements and legal remedies for curbing certain newly emerged threats precipitated by Information Revolution. To address this issue the United Nation through its core agency, United Nations Commission on International Trade Law (UNCITRAL) had formulated model legislation on electronic commerce in 1996.Consequently, **THE INFORMATION TECHNOLOGY ACT, 2000**is enacted on 9thJune, 2000. It owns a special recognition as a prime legislation of international standard dealing with cybercrime, ecommerce, Cyber Terrorism, Data Protection and privacy. India was the 12th nation of the world to adopt a comprehensive cyber law. With the adoption of this law, India

has entered the coveted world of the few countries that have separate law to deal with information technology issues.

The Information Technology Act 2000 is applicable to the whole of India, including any offense committed outside India, if such contravention involves a computer, computer system or computer network located in India. The adoption of information technology law has facilitated the growth of ecommerce and trade and provided the law enforcing agency the iron hand to deal with cyber offenses effectively so as to transform the country technologically vibrant.

The Act initially contained 94 sections divided into 13 chapters and 4 schedules. The Act is applicable to the whole of India and to the offenses or contravention committed outside the territory of India by any person irrespective of his nationality. The Act provides legal recognition to electronic records and facilitates electronic filing of documents with Government agencies. The core object of the Information Technology Act 2000 was,

a. To provide legal recognition of e-records.
b. To provide legal recognition of digital signature.
c. To provide legal recognition to electronic governance.
d. To provide punishment for cyber offenses as the Indian Penal code 1860 was inadequate to deal with the growing menace of cyber offenses.
e. To establish the Cyber Appellate Tribunal.
f. To amend the certain provisions of Indian Penal Code, the Indian Evidence Act, 1872,he Banker's Book Evidence Act, 1891 and the Reserve Bank of India Act, 1934 for technological compliant.

THE INFORMATION TECHNOLOGY (AMENDMENT) ACT, 2008

With the passage of time, as technology developed further and new methods of committing crime using Internet & computers surfaced, the need was felt to amend the IT Act, 2000 to insert new kinds of cyber offences and plug in other loopholes that posed hurdles in the effective enforcement of the IT Act, 2000. This led to the passage of the Information Technology (Amendment) Act, 2008 which was made effective from October 2009. The following are important changes adopted in the amendment Act of 2008.

a) The definition of communication device is provided under the new amendment and it includes cell phones, personal digital assistants or any other device used to communicate, send or transmit any text, video, audio or image. Thus mobile phones/smart phones came under the purview of Information Technology Act, 2000.
b) The concept of electronic signature has been introduced. Electronic signature means authentication of any electronic record by a subscriber by means of the electronic technique specified in the second schedule of the Act and it includes digital signature. After this amendment information technology Act is now amenable to modern technological development in the field of authentication of electronic records. The

Government can now prescribe new methods of authentication of e-record and is not restricted only to digital signature.

c) Protection of privacy through data protection is one of the key amendments of Technology Amendment Act 2008 where it imposes liability on corporate body possessing, dealing and handling personal sensitive data. It shall be its responsibility to implement and maintain reasonable security practices and procedures and can be held liable for damages in case of negligence. It also prescribes punishment for breach of confidentiality and privacy by disclosure of information without consent.
d) It provides for audit of documents, records or information processed and maintained in electronic format.
e) The new amendment validates contracts formed through electronic means.

The IT (Amendment) Act, 2008 has brought marked changes in the IT Act, 2000 on several counts. The declared objective of this amendment was to fill the gaps existed in the Act of 2000.It was a step in the right direction. However, there are still certain lacunae in the Act, which will surface while the amendments are tested on the anvil of time and advancing technologies.

Free and Open Source Software (FOSS)

The late 1970s and early 1980s experienced the extensive expansion of proprietary software as a result of the competition among manufacturers. As its name implies, proprietary software is software that is owned as private property by a company or by an individual software developer. These proprietary rights are protected by various intellectual property laws and regimes and by the licenses required for its use. In order to prevent their software from being used on their competitors' computers, manufacturers copyrighted their software and stopped distributing source code. Simply, source code is the key to open the software so as to understand its working and modifying it).By this, they limited or prohibited the copying, redistribution and modification of software. Free Software initiative or the social movement advocating the need for free and open source software emerged during the mid 80's has to be viewed as a reaction against the excessive expansion of proprietary software which restricts the access of users to the source code, limits and prohibits copying and redistributing software.

Free and Open Source Software (FOSS) has become an international phenomenon over last three decades. In the words of David Wheeler, Free softwares "are programs whose licenses give users the freedom to run the program for any purpose, to study and modify the program, and to redistribute copies of either the original or modified program (without having to pay royalties to previous developers)".As per GNU manifesto, Free software means "software that respects users' freedom and community. Roughly, it means that **the users have the freedom to run, copy, distribute, study, change and improve the software"**. Thus, "free software" is a matter of liberty, not price. As such, the term 'free' in free software does not always mean free of cost. Although, some of the free software is available absolutely

free under a general public license, most of them are not. So, here the term free may be interpreted as in free speech implying the concept of freedom. Free software is a broad concept that accommodates at least two important streams; the free software and Open Source software or the software with an openly accessible source code. That is why the movement has been generally known by different names such as Free Software movement and Free and Open Source Software (FOSS) movement. Another term used to denote the concept of free software is *Software Libre* that owes its origin to the French word *libre* meaning liberty or freedom. Whatever may be the name used and notwithstanding the slight variations existing in conceptualization, the basic idea behind this movement having sociological, philosophical and technological foundation is the concept of democratization of knowledge. The ideal, "knowledge should be free" is the primary motto behind all these developments. The concept of free software offers many opportunities for governmental, industrial, and educational institutions. Organizations, as well as developing nations, that take advantage of FOSS and implement them appropriately stand to gain much, while those that fail to take advantage of this opportunity may find their ICT development lagging behind. However, there is still a lack of understanding about what really constitutes FOSS and the implications of this new concept. For a better understanding of this phenomenon, it is highly essential to examine the philosophy and development methods behind FOSS.

The FOSS philosophy

There are two major philosophies in the FOSS world: the Free Software Foundation (FSF) philosophy and the Open Source Initiative (OSI) philosophy. We can start from FSF philosophy, due to its historical precedence and pioneering position in the movement.

According to the FSF, free software is about protecting four user freedoms:

- Freedom 0: The freedom to run the program, for any purpose.
- Freedom 1: The freedom to study how the program works, and adapt it to your needs. (Access to the source code is a precondition for this).
- Freedom 2: The freedom to redistribute copies so you can help your neighbor.
- Freedom 3: The freedom to improve the program, and release your improvements to the public, so that the whole community benefits. (Access to the source code is a precondition for this).

At the heart of FSF is the freedom to cooperate. Because non-free (free as in freedom, not in terms of price) software restricts the freedom to cooperate, FSF considers non-free software unethical. FSF is also opposed to software patents and additional restrictions to existing copyright laws. All of these restrict the four user freedoms listed above. Free software is one that can be easily run and distributed on a computer without much time-consuming installation process. Free software can also be copied, changed and improved upon.

Philosophy of Open Source Initiative

The Open Source Initiative was started by Eric S. Raymond in 1998.He urged people to rename "Free Software" into "Open Source". The basic idea behind open source is very simple. When programmers can read, redistribute, and modify the source code of a piece of software, new software evolves. People improve it, people adapt it, and people fix bugs. And this can happen at a rapid speed in quite contrast to the slow pace of conventional software development. The OSI is focused on the technical values of making powerful, reliable software, and is more business-friendly than the FSF. It is less focused on the ethical or moral issues of Free Software and more on the practical advantages of the FOSS distributed development method.

While the fundamental philosophy of the two movements are different, both FSF and OSI share the same space and cooperate on practical grounds like software development, efforts against proprietary software, software patents, and the like. As Richard Stallman says, the Free Software Movement and the Open Source Movement are two political parties in the same community.

Today, the number of people who are not computer users is declining all the time, as technology seep around the globe. It takes knowledge to make this technology work. People, who accumulate this knowledge, are punishing and threatening others who try to obtain and share it. They are not doing so in order to preserve it, despite what they may claim. Instead, they are preserving power for themselves at the expense of others' freedom. Recognizing this, millions of people around the world—including governments and organizations—have made the commitment to use only free software on their computers. Now, so many people are willing to make and stand by this decision in the midst of stiff opposition from Microsoft, Apple and other proprietary software companies.

History of Free Software Movement

The free software movement was started in 1984 by Richard M. Stallman. In January1984 Stallman quit his job at MIT to develop his new initiative announced as GNU operating system – a complete operating system that is free software, modeled after UNIX. Stallman actually wanted to establish a community of cooperating hackers. The term GNU stands for "GNU' is Not UNIX". In October 1985 he started the Free Software Foundation, a nonprofit organization, with the mission of promoting, advocating and educating the concept of free software. By pioneering the Free Software Movement, Richard Stallman claimed proprietary software as being unfair, "building walls to divide people" and "making the world a worse place."

Meanwhile in 1991, Linus Torvalds, a young man studying computer science at the University of Helsinki, prepared a UNIX like Operating System named Linux and decided to license it under General Public License originally conceived by Stallman. Thus, Linux became the first free and open source operating system. Many people embraced the combination of

this kernel with the GNU tools, and Linux with its varying distributions, soon became extremely popular throughout the computing world. Another notable development was the launching of Open Source Initiative in 1998 by Eric Steven Raymond and Bruce Perens. OSI is more concerned with the technological aspects of the concept of free software rather than its moral or ethical values. They argues that "free" in "frees software" was ambiguous and philosophically focused which may be comprehensible to the community of hackers but would be a problem for motivating companies to adopt the whole concept.

General Public License and Copy left

Because the copyright laws covering software are often used to take away our freedoms, Stallman and the FSF developed a specific legal document called the GNU General Public License (GPL) to protect them. Instead of restricting what we can do with software the GPL encourages us to learn and share, so it is called a "copy left" license. The GPL, discovered to prevent the GNU software from being turned into proprietary software, was based on the principle of Copy left in total contrast to copy right. "A Copy left license such as the GPL means that code must be shared with others and does not allow any user to distribute the code and its modifications, enhancements, and additions as part of a proprietary scheme. In addition, the GPL requires that the enhancements be licensed on the same terms as the code which the developer initially received and used". In other words, GPL licensed software is free to copy, distribute and modify and in return, the derivative works of that software must also be GPL licensed. Its main purpose is to keep the continuity of the freedom of software, ensure and reinforce the sharing of the programs' source code. Thousands of people and businesses—from hobbyists to big companies like IBM- are now authoring and distributing free software using the GPL.

Different Categories of Free Software

Public domain software: It is the software of which the author has relinquished all rights and anyone can do what they like with it. For example, they could improve the software and then keep the improvements to themselves, perhaps to make money. In other words, it is the software whose copyright has been expired, or is not copyrighted, or the author has released it onto the public domain (in countries where this is possible). Since public-domain software lacks copyright protection, it may be freely incorporated into any work, whether proprietary or free.

- **Permissive licenses**:- These licenses are also known as copy free as they have no restrictions on distribution. The author retains copyright solely to disclaim warranty and require proper attribution of modified works, and permits any modification and redistribution, even with a closed source code. This type of a free software are also

called BSD-style (Berkley System Distributions) because they are applied to much of the software distributed with the BSD operating systems.

- **Copy left licenses**: - GNU General Public License is the most prominent in this category. Here, the author retains copyright and permits redistribution under the restriction that all such redistribution is also to be licensed under the same license. Additions and modifications by others must also be licensed under the same "copy left" license whenever they are distributed with part of the original licensed product. This is also known as a viral license.
- **Freeware: -** Freeware refers to software that anyone can download from the Internet and use for free. The term freeware was first used by Andrew Fugleman in 1982.User license or EULA (End User License Agreement) is an important part of freeware. Copyright laws are also applicable to Freeware. All the features are free.Freeware programs can be distributed free of cost. Eg; Adobe PDF, Google Talk, yahoo messenger, MSN messenger etc.
- **Shareware: -** Shareware is not actually free software in the genuine sense of that term. It is a type of proprietary software which is provided (initially) free of charge to users, who are allowed and encouraged to make and share copies of the program, which helps to distribute it. The word "shareware" is a created by combining the words "share" and "software". Sharewares give users a chance to try the software before buying it. Shareware is software that is distributed on a trial basis with the understanding by the users of the software that there may be a small charge by the author to continue to use it. Most shareware is delivered free of charge by downloading it from the Internet either from the author's website or from a software download site. By registering the software and paying the fee, you become registered with the author and can receive technical support and software updates when they become available. You can copy shareware and pass it along to friends and colleagues, as long as it is the trial version of the software and not the registered version. They are also expected to pay a registration fee if they intend on using the software regularly beyond the trial period. Eg; WinZip.

Advantages of Free and Open Source Software

The open source software is a collaborative effort by the group or a team of developers with the use of internet. The free and Open Source software offers many advantages to its users. The fundamental advantage is the higher degree of user freedom it offers. This is because of the availability of source code that makes the user capable of reading, modifying and redistributing the program. Another key advantage is that many of this software are available free of cost or at a lower or nominal license fee. The major advantages of Free and Open Source software can be summarized as follows:

a) ***Availability of Source Code and Right to Modify:-***Open Source Software are always available with its source code in binary or executable format and users or programmers has to modify that source code according there requirements. It enables the improvement of a software product. It also makes it possible to port the code to new hardware, to adapt it to changing conditions, and to reach a detailed understanding of how the system works. One can easily isolate bugs and fix them. Some experts are reaching to the conclusion that the availability of source code extends the lifetime of an application.

b) ***Right to Redistribute Modifications***:-The right to redistribute modifications and improvements to the code, and to reuse other open source code, permits all the advantages due to the modifiability of the software to be shared by large communities. Usually it is the point that differentiates the open source software license from free software. In fact, the redistribution rights are universal and they cannot be revoked that attract developers to work around open source projects.

c) ***Right to Use Software in Anyway***:-There is no one with the power to restrict in a unilateral way how the software is used. This to improve the quality and functionality of the product. When a proprietary software vendor decides not to upgrade some software product for some old platform, customers can only stick to the old version of the software, or switch to another product. If open source software is used, customers can also found some development for the desired platform, or look for other vendors to provide the upgrades (of the very same product).

d) ***Lesser Software Co****st:*-Most of the open source software projects are available with no or little cost. From a business perspective the purchase cost of software is only one factor; total cost of ownership (TCO) is what really matters. Other things being equal, the solution with lowest TCO is usually the most desirable one. The Open source software always offers a low TCO because of the factors such as Possibility of zero purchase price, a small or nominal license fee, no restriction on copying, near-zero vulnerability to viruses eliminating need for virus checking, data loss and lower vulnerability to security breaches and hack attacks.

e) ***Lesser Hardware Cost:-***Open source solutions are easily portable and compressed; it takes lesser hardware power to carry out the same tasks when compared to the hardware power it takes on servers, such as Windows or workstations. With this less hardware power advantage, you can even use cheaper or older hardware and still get the desired results.

f) ***No Vendor Lock-in:-***IT managers in organizations face constant frustration when dealing with vendor lock-ins'. Lack of portability, expensive license fees and inability to customize software are some of the other disadvantages. Using open source software gives you more freedom and you can effectively address all these disadvantages.

g) ***Simple License Management:-***Open Source Software is licensed under various open source licenses like GNU General Public License and Barkeley's License etc. These licenses provide us ability to install it several times and also use it from any location. We shall be free from monitoring, tracking or counting license compliance.

h) ***Constantly developed by thousands of developers:***-The international development community for the larger open source software brands has become vast indeed. This system of multi-contributors means there is any requirement and problem that comes up has already been through by someone, somewhere and a solution is available.

i) ***Abundant Support:***-We will get ample support when you use open source software. Open source support is mostly freely available and can be easily accessed through online communities. There are also many software companies that provide free online help and also varied levels of paid support. Most organization that creates open source software solutions also provides maintenance and support.

j) ***Reliability:-***Reliability means the absence of errors or bugs which cause incorrect operation, data loss or sudden failures. If an error occurs in proprietary software, a defect report needs to be filed and then there will be a delay before the vendor determine when or whether to issue an updated release. If an error occurs in open source software, it could be fixed within hours, using a process that is undoubtedly assisted by the availability of source code. Developers discover error and fix it and also report to maintainers as well as release an updated version of the software on their own authority.

III. Demerits

The main reason to the use of open source software is that it is cheaper and availability of source code for further modifications and reuse. So before stating using open source software we should be aware of its various limitations also. However, we should also remember that there do exist some remedial measures also to overcome many of these limitations. Various demerits of open source software are described below:

a) ***Not So User Friendly:*** -The main disadvantage of open-source software is not being straightforward to use. Open-source operating systems like Linux cannot be learned in a day. They require effort and possibly training from our side before we are able to master them. We may need to hire a trained person to make things easier, but this will incur additional costs.

b) ***Less no of applications: -***There is a shortage of applications that run both on open source and proprietary software; therefore, switching to an open-source platform involves a compatibility analysis of all the other software used that run on proprietary platforms. In addition, there are many ongoing parallel developments on open source software. This creates confusion on what functionalities are present in which versions.

c) ***Hardware Incompatibility: -***Many of the latest hardware are incompatible to the open source platform, so it is also a big limitation of the use of open source software.

d) ***Most OSS are not reliable: -***Most of the developers and promoters of open source software believe in an obscure, idealistic world where software companies do not sell commercial software. Although big multinational companies like IBM and Sun Microsystems are backing the open source software movement there are no great financial stakes involved and the motivation mostly originates from a prevalent anti-Microsoft feeling. So there is no clear-cut discipline in this field and everything is emotion driven. Hence most of the applications are not reliable and you cannot run critical business operations on them.

e) ***Less User Support: -***Once we decide to use open source software we are on our own. We agree that there is a lot of help is available on the Internet and many self-motivated forums that can help us install and run open source software; but there is no qualified support available. We have to figure out on our own efforts that how to install and use applications without sabotaging our data and hardware. For instance, many have lost their rich and valuable data trying to shift from Windows to Linux. No help documents and manuals are made available since the software is being changed every second week. The saying "a thing that belongs to everyone belongs to none" seems absolutely true in the case of Free and Open Source software.

f) ***No guaranty of updates:*** -There is no guaranty of updating of Open Source Software. Since we are not paying for the open source software nobody is bound to give us regular updates. We can get stuck with the same old version for years without ever getting an update.

g) ***Difficult to know the current state of software: -***Open source software is come with its full source code. The availability of source code is the advantage of OSS and also disadvantage. Every person who has a little knowledge about the software can upgrade and change the software according to their requirements with its source code. Sometimes there are so many changes in software that it is difficult to know about the present state of the software. There is also not much advertising for open source software, so it is difficult to know about the existence of the project and if exist, its current status. For the general public, some more education is still needed before the regular user can approach these services and get a solution to her software problems in terms of open source software.

h) ***Involvement of Significant problems connected to intellectual property:-*** Open source software, would invite many significant problems connected to intellectual property as almost all the nations are accepting software patents. Further, because of the availability of source code Open Source Software is disclosing how the software works. This includes disclosure of algorithms and how a device with a unique design might function. Revealing this information to others may cause duplication and loss of financial advantage.

Intellectual Property Rights (IPR)

Intellectual property means the legal rights which result from intellectual activity in the industrial, scientific, literary and artistic fields. It usually relates to products of mind and intelligence that are intangible and cannot be measured physically or accurately. Countries have laws to protect intellectual property for two main reasons. One is to give statutory expression to the moral and economic rights of creators in their creations and the rights of the public in access to those creations. The second is to promote creativity and the dissemination and application of its results and to encourage fair trading which would contribute to economic and social development. Generally, intellectual property law aims at safeguarding creators and other producers of intellectual goods and services by granting them certain time-limited rights to control the use made out of those productions. Intellectual Property Rights can be defined as the "rights that pertain to creations of the human mind". Individuals, corporations, or other entities may claim them. IPRs typically give the owner of the IP the exclusive right to control use of the creation for a certain period of time. Laws governing IPRs are intended to stimulate innovation and creativity, ensure fair competition, and protect consumers. Because intellectual property shares many of the characteristics of real and personal property, associated rights permit intellectual property to be treated as an asset that can be bought, sold, licensed, or even given away at no cost. IP laws enable owners, inventors, and creators to protect their property from unauthorized uses.

Intellectual Property is traditionally divided into two branches, "industrial property" and "copyright." The Convention Establishing the World Intellectual Property Organization (WIPO), concluded in Stockholm on July 14, 1967, provides that intellectual property shall include rights relating to:

- Literary, artistic and scientific works,
- Performances of performing artists, phonograms and broadcasts,
- Inventions in all fields of human endeavor,
- Scientific discoveries,
- Industrial designs,
- Trademarks, service marks and commercial names and designations,
- Protection against unfair competition, and
- All other rights resulting from intellectual activity in the industrial, scientific, literary or artistic fields.

The key forms of intellectual property are copyrights, patents, trademarks, and trade secrets.

Copyright

Copyright is a legal term describing the economic rights given to creators of literary and artistic works, including the right to reproduce the work, to make copies, and to perform or display the work publicly. Copyrights offer essentially the only protection for music, films,

novels, poems and other works of cultural value. As artists and creators have developed new forms of expression, these categories have expanded to include them. Computer programs and sound recordings are also been protected through the institution of copyright. Copyright protection arises automatically on creation of the work, provided it is original. The term of copyright depends on the type of work that is protected, when it was made and whether it was published. Generally, protection lasts for 70 years after the death of the creator.

Patents

A patent is a grant from the government conferring the rights to exclude others from making, selling, or using an invention for the term of the patent. It is a title providing the ***inventor*** and/or the ***applicant*** with the **exclusive right** to prevent others from possessing, using, selling, manufacturing and importing the patented invention or offering to do any of these things within a definite geographical area. Patent is generally applicable for inventions, processes, machines, improvements, and composition of matter. However, one could not obtain patent for scientific principles, methods of doing business or most naturally occurring articles. Even though, Software algorithms can often be patented, typically software is protected under copyright. To file an application for obtaining patent, the product should possess the following three basic qualities.

1. Novelty- it should be a new innovation having some kind of uniqueness.
2. Utility –the product must be useful in some way or the other.
3. Non-obvious to one skilled in the art- the method of making or the technology behind the product to be patented should not be understandable easily or visible apparently to someone skilled in that field.

Patent protection provides the right to exclude others from making, using, and selling the claimed invention during the patent term. In most of the countries ,patents for products are ordinarily been given for a term of 20 years from the date of filing application. But Industrial Designs are usually patented for a period of 14 years. Ever since its first granting in 1474, by the Republic of Venice, patent protection has greatly encouraged the development and distribution of new technologies.

Trademarks

A company's trademarks are very often its most important assets. The names, designs and emblems used by internationally renowned producers such as Nike, Coca-Cola, Nestle and Apple Computersare the well-known examples of trade marks.A trademark is a word, phrase, symbol or design-- or a combination of any of these--that serves to identify and distinguish a specific product or service from others in the marketplace. The term "**service mark**" rather than "trademark" is sometimes used when referring to a mark used in connection with a service rather than a product. For example, the particular font-style and the

logo used by Life Insurance Corporation of India would distinguish it from other companies who are also offering insurance service in India.

Trademarks normally perform four main functions:

- Distinguishing the products or services of one enterprise from those of other enterprises
- Referring to a particular enterprise which offers the products or services on the market
- Referring to a particular quality of the product or service for which it is used
- Promoting the marketing and sale of products and the marketing and rendering of services.

Geographical Indications (GI)

Geographical indications are treated as a subset of trademarks. GIs identify a good or service as originating in a place, region, or locality where a given quality, reputation, or other characteristic of the good is essentially attributable to its geographic origin. They serve the same functions as trademarks because, like trademarks, they are source identifiers and guarantees of quality, and they represent valuable business interests .GIs increasingly are being recognized as valuable marketing tools in the global economy. Examples of GIs are Banaras and Kanchipuram saris in India and Florida oranges in United States. Recently, the Aranmula Mirror of our own Kerala has also been accorded the status of GI.

Trade Secrets

A trade secret is any formula, pattern, physical device, idea, processor other information that provides the owner of the information with a competitive advantage in the market place. Trade secrets encompass an almost infinite spectrum of information, such as Customer lists, Supplier lists, financial data, Product formulas, manufacturing processes, Marketing strategies, Software source code, Pricing information and similar types of proprietary information. In general, a trade secret is confidential information that has commercial value. Under international agreements, trade secrets are defined to include information that is secret, having commercial value and are to be subjected to reasonable procedures designed to maintain its secrecy. Trade secrets may be protected indefinitely so long as the information remains secret. If the secret is revealed, trade secret protection ceases. One of the most famous trade secrets in the world is the formula for Coca-Cola which is kept in a heavily guarded vault and is known to only a few people within the company.

International Conferences, Treaties and Agreements Relating to IPR

In the wake of increasing pace of globalization, protection of Intellectual Property Rights (IPR) worldwide is vital to the economic growth and development of all countries. Because they create common rules and regulations, international IPR treaties, in turn, are essential for achieving the forceful intellectual property protection that spurs global economic expansion and the growth of new technologies. The World Intellectual Property Organization (WIPO) functioning under United Nations Organizations is the apex body specialized in the protection of IPR. The WIPO was established at Stockholm Convention of 1967 and entered into force in 1970. However, the real origins of WIPO go back to the convening of Paris

Convention for Protection of Industrial Property in1883. It was the oldest major International Treaty concerning the protection of Intellectual Property. This treaty was revised several times during the period between 1900 and 1967 and the treaty was also amended in 1979. Each of these revision conferences starting with the Brussels Conference of 1900 ended with the adoption of a revised Act of Paris Convention. Other major agreements relating to IP are the Madrid Agreement Concerning the International Registration of Marks (1891) and the Protocol Relating to that Agreement (1989), Hague Agreement Concerning the International Registration of Industrial Designs (1925), Nice Agreement Concerning the International Classification of Goods and Services for the Purposes of the Registration of Marks (1957)Berne Convention for the Protection of Literary and Artistic Works (1971) etc.

However, the international community did not have a single source for intellectual property obligations and norms until the formation of World Trade Organization (WTO). The WTO was organized in 1994 as the culmination of Uruguay Round talks of the General Agreement on Tariffs and Trade abbreviated as GATT.

TRIPS Agreement

The Agreement on Trade-Related Aspects of Intellectual Property Rights generally known as the TRIPS agreement is a major step towards formulating a universally applicable standard for Intellectual Property Rights .Significance of the TRIPS Agreement is three-fold: 1) It is the first single, truly international agreement that establishes minimum standards of protection for several forms of intellectual property; 2) It is the first international intellectual property agreement that mandates detailed civil, criminal, and border enforcement provisions; and 3) It is the first international intellectual property agreement that is subject to binding, enforceable dispute settlement.

The Trade Related Aspects of Intellectual Property Rights Agreement (TRIPS) culminated at the end of seven years of negotiations from 1986 to 1993, as part of the Uruguay Round of Multilateral Trade Negotiations of the GATT. The TRIPS Agreement came into force on the 1st of January 1995, with the establishment of the World Trade Organization. TRIPS is drastically different from all previous IPR accords because membership in the WTO is a 'package deal' meaning that WTO members are not free to pick and choose among agreements. TRIPS apply basic international trade principles to member states regarding intellectual property, including national treatment and most favored nation treatment. TRIPS establish minimum standards for the availability, scope, and use of the trade related aspects of the seven basic categories of intellectual property rights such as Copyrights and Related Rights, Trademarks, Geographical Indications, Industrial Designs, Patents, Layout Designs of Integrated Circuits and the protection of Undisclosed Information.

Blogging

A blog is a frequently updated online personal journal or diary. It is almost like a mini website. It is a medium to express your thoughts, views and ideas. It is also an easy-to-use personal web site that you can access from the Internet. Wikipedia defines blog as a type of website, usually maintained by an individual with regular entries of commentary, descriptions of events, or other material such as graphics or video. Entries are commonly displayed in reverse-chronological order. A blog can also be a shared online journal where people can post daily entries about their personal experiences and hobbies.

Blogging is one of the easiest and simplest ways of reaching out to your audience. Blog is a short form for the word weblog and the two words are often used interchangeably. One who participates in the activities of maintaining a blog is known as a blogger and the activity of keeping a blog is known as blogging. The word 'blog' can be used both as a noun and a verb. So we could say that the blogger blogs in his blog.

Anyone can write a blog. Several web sites are offering blogging services. They will let you post your thoughts on your own blog on their web site using their software. Usually this service is free, but you have to register in order to use the site. The four well-known free blogging providers are Blogger (http://www.blogger.com),WordPress (http://wordpress.com), Type Pad (http://www.typepad.com) and Xanga (http://www.xanga.com).Blogging happens to be a very effective medium for building your reputation, for interacting with your customers, for building relationships as well as for business purposes. Blogging entails not only talking about yourself, your ideas, views and opinions, but more importantly to listening to the community as well.

Any content **-** word, picture, sentence, paragraph or essay, with links and names and current news- uploaded in the blog is called a post. A blog usually contain the date, and title of the Post. It would also contain the name or username of the person who writes the post (author) and the feedback from the part of viewers in the form of comments. The examples of popular blog categories are:

- **Personal:** This is the broadest category and includes blogs about topics of personal interest. The topic of a personal blog may vary from yoga to Nano technology in accordance with the personal interest of the blogger.

- **Corporate Blogs: -** All of the Corporate Companies in the world today have engaged themselves in building and interacting with customers across the globe through their Corporate Blogs. Each of these blogs is created and maintained with the vision and goal of promoting their business interest. In the technology field, you can find the best blog sites maintained by Corporates like IBM, Dell, Samsung etc. The subjects that are discussed may vary from discussions on product, installations, service, applications,

problem solving to new developments and several technology related issues, besides customer service.

- **Other Types of Blogs: -** Besides the Personal and Corporate Blogs, one other type of blogs that you would want to check out would be the blogs that are built around a particular topic or genre such as political blogs, travel blogs, blogs floated by Scientist community, Educationists and other such specialist blogs. TED Blog is an ideal example of a blog of think tank community where in the best of thinkers put forward their thoughts and the discussions build around the progressive ideas.

Advantages of Blogs

1. A Blog can be developed very easily
2. A blog post goes public, in other words, it can be accessed and read by almost everyone who have an access to internet.
3. The usage of blogs are very convenient, hence people tend to use them more frequently.
4. Students tend to improve their writing skills as blog articles should be reasonably good enough and free from grammatical mistakes.
5. Blog sites used as online class forums enabling the students to interact with various personalities including teachers, scholars and experts.
6. Individuals learn to express their opinions and exchange their views on topics of common interest, which not only keeps them updated but also contribute generating new ideas.
7. It is place for students and individuals to share their articles and opinions with people outside their community.

Disadvantages of Blogs

1. It involves a lot of time to update and post an entry on the blog site
2. Regular writing may give rise to slangs and sloppy way of writing spoiling the quality of proper usage of language.
3. Blogging cannot be forced upon students who are hardly interested in reading and replying to the post.
4. There is no confidentiality as it is a public forum.
5. It can no way be related to conversation, as there is always a time gap in the replies received.
6. It is not suited for issues requiring immediate solution.
7. There may be possibilities of misusing the blog posts for publishing obscene and offensive content and also a tool for defamation.

Social Media

All of us would agree to the point that the advent of Internet drastically changed the entire mode of human communications and interactions. Now, there are several web based services designed to function as an effective platform for socialization. These web based services are collectively known as Social Networking sites or more simply, the Social Media. Social networking services can be broadly defined as internet- or mobile-based social spaces designed to facilitate communication, collaboration, and content sharing across networks of contacts. They allow users to manage, build and represent their social networks online. Social networking sites are web-sites where users can create a profile and connect that profile to others to form an explicit personal network. They are web-based services that allow individuals to

a. Construct a public or semi-public profile within a bounded system
b. Articulate a list of other users with whom they share a connection and
c. View and traverse their list of connections and those made by others within the system. The nature and nomenclature of these connections may vary from site to site.

Permissions are a very important feature of most social networking services. They allow members and groups to control who gets access to their profiles, information, connections and spaces, as well as degrees of access.

Social Media is a term used to describe a variety of Web-based platforms, applications and technologies that enable people to socially interact with one another online. Some examples of social media sites and applications include Facebook, YouTube, Twitter, blogs and WhatsApp. Social media refers to all online communications channels dedicated to community-based input, interaction, content-sharing and collaboration. Websites and applications dedicated to forums,microblogging, social networking , social bookmarking, and wikis are among the different types of social media.

Some prominent examples of social media:

- **Facebook** is a popular free social networking website that allows registered users to create profiles, upload photos and video, send messages and keep in touch with friends, family and colleagues. According to statistics from the Nielsen Group, Internet users within the United States spend more time on Facebook than any other website.
- **Twitter** is a free micro blogging service that allows registered members to broadcast short posts called tweets. Twitter members can broadcast tweets and follow other users' tweets by using multiple platforms and devices.

- **Google+** is Google's social networking project, designed to replicate the way people interact offline more closely than is the case in other social networking services. The project's slogan is "Real-life sharing rethought for the web."
- **Wikipedia** is a free, open content online encyclopedia created through the collaborative effort of a community of users known as Wikipedians. Anyone registered on the site can create an article for publication; registration is not required to edit articles. Wikipedia was founded in January 2001.
- **LinkedIn** is a social networking site designed specifically for the business community. The goal of the site is to allow registered members to establish and document networks of people they know and trust professionally.
- **Whats App Messenger** is a cross-platform mobile messaging app which allows you to exchange messages without having to pay for SMS. Whats App Messenger is workable in all varieties of smart phones and I Phones. Since, Whats App Messenger uses the same internet data plan that you use for email and web browsing, there is no cost to message and stay in touch with your friends. In addition to basic messaging Whats App users can create groups, send each other unlimited images, video and audio media messages.

Advantages:

- Facilitates open communication, leading to enhanced information discovery and delivery.
- Allows us to discuss ideas, post news, ask questions and share links.
- It helps to generate a higher sense of social responsibilities by promoting social criticism and online activism
- Provides an opportunity to widen business contacts.
- Targets a wide audience, making it a useful and effective tool for business, education and entertainment.
- Expands market research, implements marketing campaigns, delivers communications and directs interested people to specific web sites.

Disadvantages:

- Opens up the possibility for hackers to commit fraud and launch spam and virus attacks.
- Increases the risk of people falling prey to online scams that seem genuine, resulting in data or identity theft.

- More chances for misuse/abuse by misguided elements for viewing and forwarding objectionable, illicit, porn or offensive material and also for defaming and harassing others.
- Potentially results in lost productivity, especially if employees and students are busy updating profiles, etc.

Online Activism

Activism consists of efforts to promote, block, or direct social, political, economic, or environmental change, or continuity. Various forms of activism range from writing letters to newspapers or politicians, political campaigning, economic activism such as boycotts, rallies, street marches, strikes, sit-ins, and hunger strikes. The term activism refers to the principle or practice that emphasizes direct vigorous action especially in support of or opposition to one side of a controversial issue. Traditionally, activism is defined as "the principle or practice of rigorous action or involvement as a means of achieving political or other goal, sometimes by demonstrations protests, etc.

Now, the world is witnessing the increasing role of social media as a platform to facilitate civic engagement and collective action. Our digital world is experiencing the unbound potentialities of Social media in the form of online activism. The new media has already acquired the stature of an all-powerful political weapon across the globe. The Jasmine Revolution of the Arab world and the almost unexpected rise of the Aam Admi Party (AAP) in Delhi demonstrated the role of social media in fostering political mobilizations. The new tools of social media have reinvented social activism.

Online activism is the use of electronic communication technologies such as social media, especially Twitter, Facebook, YouTube, e-mail, and podcasts for various forms of activism to enable faster communication by citizen movements and the delivery of information to a large audience. Online activism "is the process of using Internet-based socializing and communication techniques to create, operate and manage activism of any type". It allows any individual or organization to utilize social networks and other online technologies to reach and gather followers, broadcast messages and progress a cause or movement. Online activism is also known as Internet activism, cyber activism, digital activism, online organizing, electronic advocacy, e-campaigning and e-activism.

Online activism's basic working principle is similar to standard physical activism: to initiate a citizen-based movement toward a specific goal, cause or objective. Cyber-activism uses social networking tools and platforms to share and broadcast mottos and messages, and to interact with netizens. These platforms include Twitter, Facebook, LinkedIn, YouTube and other popular social networks, along with email, instant messaging (IM) and other online collaboration tools.

Depending on the cause or need of the e-activist, cyber activism can be used for various purposes, such as awareness creation, gathering and organizing followers and initiating

reactions. For example, e-activists use e-petitions digitally signed by a number of followers before they are sent to government and legislative authorities. Very often, virtual media platforms are consistently been utilized, even by conventional political parties for mobilizing people in order to ensure a high degree of peoples participation in their political programmes and activities.

There are different categories of online activism such as;

Hash-tag activism is a term coined by media outlets which refers to the use of Twitter's hash-tags for internet activism. It is the act of fighting for or supporting a cause that people are advocating through social media like Facebook, Twitter, Google+ and other networking websites. This is the kind of activism that does not require any action from the person other than sharing or "liking" a post or "retweeting" tweets on Twitter. The term gets its name from the liberal use of hash-tags (#) that are often used to spread the word about a cause over Twitter.

Slacktivism is a term that combines the words "slacker" and "activism" to refer to simple measures used to support an issue or social cause involving virtually no effort on the part of participants. Slacktivism is most commonly associated with actions like signing online petitions, copying social network statuses or joining cause-related social networking groups. Slacktivism critics contend these actions are merely for participant gratification because they lack engagement and commitment and fail to produce any tangible effect, in terms of promoting a cause.

Hacktivism is the combination of the words hacking and activism. It refers to the act of hacking a website or computer network in an effort to convey a social or political message. The person who carries out the act of hacktivism is known as a hacktivist. In contrast to a malicious hacker who hacks a computer with the intent to steal private information or cause others harm, hacktivists engage in similar forms of disruptive activities to highlight political or social causes. For the hacktivist, hacktivism is an Internet-enabled strategy to exercise civil disobedience. Acts of hacktivism may include website defacement, denial-of-service attacks (DoS), redirects, website parodies, information theft, virtual sabotage and virtual sit-ins.

Advantages

Online activism does have a distinct advantage in the sense that it allows people to act much more quickly than in the real world and it helps a group to keep a centralized narrative. Furthermore, although offline activists can create stronger connections by meeting in person, social media groups allow individuals to find like-minded people they otherwise would have never known. Another merit is that it can be used as an effective tool to galvanize offline action. Even though the number of people inspired to act may be less, there should definitely be a considerably larger number of people to support the cause. Online activism also provides activists a sense of safety and security often allowing them to express

radical ideas. This feature is particularly important in the context of autocratic or totalitarian regimes that do not care for individual liberty and freedom of expression. Another advantage is that social media offers instant visibility and information sharing in a cost effective way especially when targeting the younger generation who usually prefers the new media over the conventional one to keep a watch on happenings around them. The success of the Arab Spring of 2011 has categorically proved that the social media activism would foster internal organization, external collaboration and stronger relationships. The advantages of online activism also include the Boosting of fundraising capability and accountability.

Criticism or Disadvantages of Online Activism

While it is true that online activism offers many significant advantages over its conventional counterpart we should not be blind to the limitations that accompany these new technological opportunities. The most prominent criticism leveled against cyber activism is one related to unequal Internet access, referred to as digital divide. This point is particularly relevant when dealing with the language problem concerning internet. As English still holds the status of *linguafranka* of internet, many from third world countries find it extremely difficult to cope with online activism. Other major shortcomings are directly linked to the very nature of more popular forms of online activism such as hash-tag activism and slacktivism. Some critics will argue that it is only a kind of pseudo activism as it very often generates a false sense of social commitment. By simply clicking an online link designed for expressing solidarity to a social cause, even the idlest among us who leads a life totally detached from their social environment would feel that they are actively championing a great social cause. It is this easiest and nothing to lose kind of 'activism' that has earned the nickname 'clicktivism' for online activism. But, here we should also remember the fact that there do exist more active and vibrant forms of activism in the cyber world. Another criticism is that the new media seem to lose their newness quickly which, in turn, will affect the creation of stable ties between activists that are necessary for sustained collective action. According to several scholars the Internet is unable to create the necessary trust and strong ties that are necessary to build a sustainable network of activists. In addition to above, all the general demerits of digital media such as the problems of accessibility, network and power failures, security vulnerabilities and identity theft may also be enumerated as the negative aspects of online activism.

MODULE- IV

Digital Resources for Learning and Research

"The Internet isn't just a powerful tool for communication. It's arguably the most potent force for learning and innovation since the printing press".

Jeb Bush, "Internet Brings Historic Shift in Learning", 2013.

Information Communications Technologies (ICT) is a generic term used to refer technologies that enable society to create, collect, consolidate, communicate, manage and process information in multimedia and various digital formats for different purposes. The most popular types ICT gadgets include computers, TV, Radio, cellular phones, Projectors, CD-ROM and the Internet. ICTs are making dynamic changes in society. They are influencing all aspects of our life including education. ICT is revolutionizing the education sector as it provides both students and teachers with more opportunities in adapting learning and teaching to individual needs. The potentials of ICTs in increasing access and improving relevance and quality of education in developing countries need no explanation. ICTs greatly facilitate the acquisition and absorption of knowledge, offering unprecedented opportunities to enhance educational systems.

The use of ICT in teaching-learning is very important for it provides opportunities for teachers and students to operate, store, manipulate, and retrieve information, encourage independent and active learning, and self-responsibility for learning such as distance learning, motivate teachers and students to continue using learning outside school hours, plan and prepare lessons and design materials such as course content delivery and facilitate sharing of resources, expertise and advice. This versatile instrument has the capability not only of engaging students in instructional activities to increase their learning, but of helping them to solve complex problems to enhance their cognitive skills.

ICT enabled education is a broader concept covering a wide variety of tools, techniques, strategies and methods aiming the speedy and effective acquisition and dissemination of knowledge, both in and outside classroom. It may vary from comparatively simple way of employing certain digital tools such as computers and projectors aimed to make the conventional class room teaching much more effective, to conducting highly complex scientific experiments in virtual laboratories. It could be used in both formal and non formal streams of education. ICT could invariably be applied in the conventional chalk and talk mode of teaching as well as in several kinds of web based self learning modules that are functioning without the presence of a teacher or facilitator. This variedness indispensably demands the labeling of ICT enabled learning into the following three major categories.

1. **E-learning**

E-learning or electronic learning encompasses learning at all levels, both formal and non-formal, that uses an information network—the Internet, an intranet (LAN) or extranet (WAN)—whether wholly or in part, for course delivery, interaction and/or facilitation. Some prefers to call it online learning. Web-based learning is a subset of e-learning. Generally speaking, e-learning is more suited for higher and advanced learning in a teacherless environment. There are so many online learning resources available in the web.

2. **Blended Learning**

Blended learning refers to learning models that combine traditional classroom practice with ICT solutions. For example, a teacher can make use of certain digital tools like laptops and projectors to supplement his lecture. In another, a little more advanced case the students in a traditional class can be assigned both print and online materials, have online mentoring sessions with their teacher through chat and are subscribed to a class email list. In yet another instances, a Web-based training course can be enhanced by periodic face-to-face instruction. "Blending" was prompted by the recognition that not all learning is best achieved in an electronically-mediated environment, particularly one that dispenses with a live instructor altogether. Instead, consideration must be given to the subject matter, the learning objectives and outcomes, the characteristics of the learners, and the learning context in order to arrive at theoptimum mix of instructional and delivery methods.

3. **Open and Distance Learning**

Open and distance learning is defined by the Commonwealth of Learning as "a way of providing learning opportunities that is characterized by the separation of teacher and learner in time or place, or both time and place; learning that is certified in some way by an institution or agency; the use of a variety of media, including print and electronic; two-way communications that allow learners and tutors to interact; the possibility of occasional face-to-face meetings; and a specialized division of labour in the production and delivery of courses."Open and distance learning is an ideal way of learning designed to meet the educational needs of those underprivileged lots such as the dropouts and individuals from marginalized groups and is functioning with the motto learning while earning.

Advantages of ICT Supported Learning

ICTs greatly facilitate the acquisition and absorption of knowledge, offering unprecedented opportunities to enhance educational systems, improve policy formulation and execution, and widen the range of opportunities for business and the poor. One of the greatest hardships endured by the poor, and by many others, who live in the poorest countries, is their sense of isolation. The new communications technologies promise to reduce that sense of isolation, and to open access to knowledge in ways unimaginable not long ago. Thus, we can summarize the principal advantages of imparting ICT in the field of education as follows;

I. Expanding access

ICTs are a potentially powerful tool for extending educational opportunities, both formal and non-formal ,to previously underserved constituencies. Expanding access means integrating populations that had been traditionally excluded from education for cultural and social reasons. This may consists of scattered and rural populations, ethnic minorities, girls and women, persons with disabilities, and the elderly, as well as all others who for reasons of cost or because of time constraints are unable to enroll on campus. This increased accessibility could be attained in two distinct ways;

a). Anytime, anywhere access: - One defining feature of ICTs is their ability to transcend time and space. Online course materials maybe accessed 24 hours a day, 7 days a week. ICT-based educational delivery (e.g., educational programming broadcast over radio or television) also dispenses with the need for all learners and the instructor to be in one physical location. Additionally, certain types of ICTs, such as teleconferencing technologies, enable instruction to be received simultaneously by multiple, geographically dispersed learners.

b). Access to remote learning resources: - Teachers and learners no longer have to rely solely on printed books and other materials in physical media housed in libraries for their educational needs. With the Internet and the World Wide Web, a wealth of learning materials in almost every subject and in a variety of media can now be accessed from anywhere at any time of the day and by an unlimited number of people. This is particularly significant for many schools in developing countries that have limited and outdated library resources. ICTs also facilitate access to resource persons—mentors, experts, researchers, professionals, and peers—all over the world.

II. Helps to create a Learner- centered learning environment

Learner centered learning environment is one that pays attention to knowledge, skills, attitudes, and beliefs that learners bring with them to the learning process where its impetus is derived from a paradigm of learning called constructivism. As ICT enabled learning always demands learners' active personal involvement in learning task, the whole process of education becomes very much interesting and hence so effective in contrast to the monotonous one way process normally seen in traditional classrooms.

III. Motivating to Learn

An effective teaching/learning process must stimulate intellectual curiosity and offer a sense of enjoyment that will move the students from the passive role of recipients of information to the active role of builders of knowledge. Yet, engaging the learner in this process can be the most challenging task for teachers. ICTs are effective instructional aides to motivate and engage students in the learning process. Videos, television, and computer multimedia software provide information that can be authentic and challenging inaddition to stimulating students' sensorial apparatus through images, color, sound, and movement.

IV. Fostering Inquiry and a sense of Exploration

Although basic skills and information are essential components of the teaching/learning process, learning is more than information transfer. Learning requires the

ability to analyze and synthesize information, use it in diverse circumstances, and propose new lines of inquiry that foster knowledge. Inquiry and exploration are essential strategies to attain those abilities. As astronomer Carl Sagan said, all children start out as scientists, full of curiosity and questions about the world, but schools eventually destroy their curiosity. ICTs have the potential to restore curiosity to education. ICTs can take students on exciting journeys through time and space. Movies, videos, audio technology, and computer animations bring sound and movement to static textbook lessons and make the classes lively and attractive and in turn will helps to stimulate a sense of inquiry and exploration.

V. ICT makes education easy and less expensive

ICT, with its high storage capacity, significantly effortless reprographic techniques and a rich variety of software programmes and applications designed to meet various educational needs, makes the teaching learning process an easy affair. Spreadsheets can store and analyze large amounts of data necessary for complex mathematics and science studies. Computer simulations transform risky and expensive experiments into safe and cost-effective virtual laboratories. There is several software packages designed to simplify the otherwise tiresome task of data analysis used in social science research. In our digital age, it is very much easy to access the rich volumes of digital data preserved in digital format in archives and libraries without bothering the constraints of time and space. All these would help considerably to reduce the effort to be taken and time and money to be spend for acquiring knowledge.

VI. ICT Promotes Collaborative Learning

ICT-supported learning encourages interaction and cooperation among students, teachers, and experts regardless of their physical location. Apart from modeling real world interactions ,ICT-supported learning provides opportunity to work with students from different cultures, thereby helping to enhance learners teaming and communication skills as well as their global awareness. This type of collaborative spirit would invariably leads to the creation of a sense of global citizenship and a broader outlook.

Limitations of ICT use in Education

ICT as a modern technology that simplifies and facilitates human activities is not only advantageous in many respects, but also has many limitations. Many people from inside and outside the education system, think of ICT as panacea or the most important solution to all problems related to education. However, there also several limitations of ICT use in education. These limitations can be categorized as teacher related, student related, and technology related. All of them potentially limit the benefits of ICT enabled education. However, we should also remember the basic fact that many of these limitations could be circumvent easily by employing certain precautious and remedial measures.

a**). Teacher Related Limitations of ICT Use.**

Teachers' attitude plays an important role in the teaching-learning process that utilizes computers and internet connections. Although teachers' attitude towards use of these technologies is vital, many observations reveal that teachers do not have clarity about how far technology can be beneficial for the facilitation and enhancement of learning. Of course, some teachers may have positive attitudes to technology, but refrain from using it in teaching due to low level of self-confidence. Many senior teachers very often consider themselves as not qualified to teach with technology. Moreover, attitude, motivation, computer anxiety, and computer self-efficacy are factors affecting teachers' use of computers in their lessons. Teacher resistance and lack of enthusiasm to use ICT in education may also be another limitation. Furthermore, many teachers may not have the required IT skills and feel uncomfortable, nor do they have trainings needed to use the technology in their teaching. Unless teachers develop som ebasic skills and willingness to experiment with students, ICT use in education will not yield any desirable impact.

b). **Student Related Limitations of ICT Use**

On the other hand, there are also another set of limitations of ICT use in education that are directly related to student behaviour. It is true that appropriate use of computer and the internet by students have significant positive effects on students' attitude and their achievement. Nonetheless, it is very common to observe limitations related to student behaviour. Students tend to misuse the technology for leisure-time activities and have less time to learn and study. Online gaming, use of facebook, chat rooms, and other communication channels are the perceived drawbacks of ICT use in education. Students easily switch to these sites at the expense of their study. Internet access at home, for instance, may be a distraction because of chat rooms and online games, reducing the time spent in doing assignments and learning. Therefore, the impact of availability of ICT on student learning strongly depends on its specific uses. If ICT is not properly used, the disadvantage will overweight the advantage. For example, while students use the internet, it may confuse them by the multiplicity of information to choose from. As a result, the teacher spends much time to control students from websites unrelated to the learning content. Then, there are also certain other limitations of ICT use in education as related to student behaviour. Computers limit students' imaginations. Over-reliance on ICT limits students' critical thinking and analytical skills. Students often have only a superficial understanding of the information they download. Computer-based learning has negative physical side-effects such as vision problem, musculoskeletal problems and cyber addiction. Students may be easily distracted from their learning and may visit unwanted sites. They tend to neglect learning resources other than the computer and internet and get focused only on superficial presentations and copying from the internet. Excessive reliance upon ICT adversely affects the oral skills and hand writing capacity of students. Further use of ICT may be difficult for weaker students, because they may have problems with working independently and may need more support from the teacher.

c). Technology Related Limitations of ICT Use

The other limitation of ICT use in education is technology related. The high cost of purchase, installation and maintenance of technological devices, high cost of accessories and probable vulnerabilities to virus and other forms of cyber attacks, interruptions of internet connections, and poor supply of electric power are among the technology related limitations of ICT use in education. Further, there are also the problem of digital divide referring to the unequal access to ICT devices and the language problem resulting out of the still continuing predominance of English in the cyber world. Besides, there are certain highly relevant moral, ethical and philosophical issues which are also to be taken into account. These ethical concerns include the problem of plagiarism, information overload, the problem related to authenticity and accuracy of information, privacy and security threats, software piracy and so on. Even more disturbing is the question, "is technology could substitute a teacher"? This almost unanswerable question, raising some doubts over the very existence of teacher as a person and teaching as a profession is evolved gradually in the context of ever increasing pace of dehumanization caused by digital revolution. The fear of technology replacing teacher seems particularly relevant in the ongoing scenario of decreasing socialization and increasing isolation experienced by students across the globe.

Use of ICT in History Classrooms

Until recently, there is a misconception that the tools and techniques of ICT are of no use in history classes and many would suggest pure lecturing as the best suitable method for narrating historical incidents. These advocates of traditional chalk and talk method were perhaps driven by the overwhelming influence previously enjoyed by political history that depends more upon the oratory skill of the teacher to provide a detailed narration of events and happenings of the past. Moreover, many senior teachers might have thought that the modern tools of ICT are not only unnecessary but also unfit for explaining the events relating to a remote past. But all these things changed dramatically in accordance with the changing perception of history as a discipline and also because of the unprecedented advancements in the field of technology. Now, the study of history is more analytical rather than rendering a detailed narration of events and happenings of the past. Analytical history gives too much importance to the concept of causality in the study of history. This involves the generation and testing of hypotheses, somewhat akin to what one does in science and in other fields of inquiry. This changing approach towards the subject definitely provides more room for using the tools and techniques of ICT in teaching learning process.

We all know that learning history includes learning some facts (names, dates, places, etc.) Students find it very difficult to remember all these names and dates. Traditionally, history teachers used to make extensive use of blackboards and paper charts to explain these names and dates effectively. Very often, time charts were also prepared manually to impart a sense of chronology. To create a sense of location and space in students' minds, history

teachers used to depend on drawing maps. But, all this would require a high level of artistry, expertness and hard work from the part of teachers stealing considerable time and money. As not all teachers could manage these difficult tasks and many of them simply resort to the uninteresting and monotonous way of lecturing. But, today a history teacher can make the maximum use of ICT for displaying the names, events, chronological charts and maps. Attractive power point presentations containing facts, dates, timeline, charts and maps could be prepared in a few simple steps either by scanning from a text books or downloading from the net, so as to facilitate its displaying by using a projector. Going by the paradigm 'seeing is believing', displaying the larger and clearer pictures of microliths and Mughal monuments by using LCD Projector is apt and more effective rather than spending two or three hours in explaining the peculiarities, features and dimensions of these objects. Moreover ,displaying pictures and graphs in appropriate places and in a judicious manner is the best possible tactic to escape from the dullness of long lectures and to increase the effectiveness of teaching by stimulating the inquisitiveness among students.

A teacher having a through awareness about the possibilities of ICT in teaching history could make the effective use of audio and video clippings so as to make his classes much more attractive, interesting and effective. For instance, in classroom sessions dealing with India's heroic struggle for independence, the teacher can make effective use of audio clippings of the speeches made by national leaders such as Mahatma Gandhi, Jawaharlal Nehru, Patel, and Subhash Chandra Bose.This would make the students really interested in the topic and also helps to stimulate their enthusiasm for learning. Similarly, in learning sessions on our great national leaders, the teacher can make maximum use of feature films and documentaries based on their lives and activities like Richard Attenborough's *Gandhi* and ShyamBenegal's*The Making of Mahatma.* Using films and documentaries could offer an added impetus in classroom sessions dealing with almost all aspects of modern and contemporary history like the world wars, cold war, national movements occurred in different nations, social and environmental movements, etc.

Even more important is the fact that ICT will always encourage self-learning. Conventional method of teaching like lecturing, generally promotes passive learning characterized by the overemphasis given to memmorising and retention capabilities. On the other hand, ICT enabled learning especially online learning motivates students to pose historical problems, develop hypotheses, find evidence and develop logical arguments to support these hypotheses, and so on. Effective use of ICT would always help to generate a sense of inquiry and enthusiasm for learning. This in turn will ensure self-learning by students through different methods such as project method, brain storming and problem solving.

The more advanced form of ICT supported history learning is the adaptation of virtual reality environment. *Virtual reality* is an artificial environment that is created by using certain

software and presented to the user in such a way that the user began to accept it as a real environment. *Virtual reality* is primarily experienced on a computer through two of the five senses; sight and sound. It is the computer-generated recreation of a three-dimensional image or environment. The user (learner) starts interacting with this simulated environment in a seemingly real or physical way with the help some specifically designed electronic equipment, such as a helmet with a screen inside or gloves fitted with sensors. This virtual reality environment is particularly effective for teaching ancient history as it helps to create a feeling in the minds of the students that they are walking through the streets of Ancient Greece or sitting in front of a pyramid in Egypt.

Another instance of using ICT in history classroom is the employing of mapping and location services such as Google Maps and Google Earth. This would definitely help a lot in providing a more accurate and effective sense of space and location in classes related to history, geography and environmental studies. In addition to this the teacher can also make use of presentations and talks by renowned historians and scholars and documentaries such as BBC India and Travels of IbnBatuta, readily available in social networking sites like YouTube and Ted.com. Further, teachers can motivate their students to make the maximum use of worldwide class rooms, online discussion groups online course materials and information databases like Geographic Information Systems (GIS)so as to ensure the active involvement of learners in teaching learning process.

Apart from the aforesaid tactics to be incorporated in class room teaching, ICT is also offering a major advantage as it provides anytime anywhere access to rich volumes of knowledge repositories stored in digital format. The traditional textbooks available to students studying history are severely limited in their usefulness in generating and disseminating knowledge. The conventional libraries in schools and colleges should face the constraints of lack of storage space and restricted access. It is not possible for an educational institution, to maintain a library with all the books catering to the needs of each and every students studying in different classes or courses. In contrast, the rapidly growing collection of digital resources- CD ROMs and a host of online resources ranging from Wikipedia to online libraries and e-books is actually revolutionizing the teaching and learning of history. Now, both primary and secondary sources that could be utilized for reconstituting the past are readily available in the net in digital format. The Web is now a global library that contains a large number of primary source documents in the form of archives and e-books. Thus, students can now obtain information from primary sources rather than relying upon information filtered through the minds of their textbook authors.

Digital Resources

Digital information resource is a generic term used to denote all the knowledge repositories which are available in digital formator as soft copies. The digital world gives everyone an opportunity to find his or her own expert, not necessarily in the classroom. The Internet and other digital resources provide

students and teachers the means to extract the most interesting and highly useful information. A digital resource is a file stored in digital media. The most common example of a digital resource is a Word document saved in a personal computer or attached to a mail ID. It could be anything, like a video file or an audio file or even a text file such as a pdf file or a PowerPoint Presentation.

Generally, digital resources can be classified into two; born digital and digitized materials. The born digital materials includes; e-books, e-journal, e-news paper, e-magazine, thesis, dissertations, reports, website, www-resources and other related materials which is created or uploaded in digital format. On the other hand, digitized materials mean sthose converted from other formats to digital format. The best known example is the scanning of printed books or archival records to form its e-versions. A digital resource is available in the form of CD ROMs or can be accessed from libraries, database or from the world-wide-web.

Merits and Demerits of Digital Resources

The benefits of digital resources for student learning are many. Digital content can easily be kept updated and relevant to students' lives without the cost of reprinting or redistributing as in the case of print materials. It can be made available anytime and anywhere, both online and offline, accessible when the student, researcher or teacher needs it, whether from home, school, or from any other location. Digital content can be far richer and attractive, including not only text, but also high-definition graphics, video clips, animations, simulations, interactive lessons, virtual labs and online assessments. Digital resources could be utilized to facilitate and supplement all the existing streams of education such as formal, informal and non-formal and also in its different levels like primary, secondary and higher. Digital resources are available in various forms such as e-books, e-journals, webpage, blogs, wikis, databases etc.

The major demerits of digital learning resources as pointed out by its critics is centering on the concept of dehumanization. The critics argue that the increased exposure of humans to machines, more specifically the digital media devices would inevitably leads to a high degree of dehumanization with the end result of treating humans just as a number or another machine. If education is viewed as merely an exercise for imparting knowledge, we can unhesitatingly go ahead with digital resources. But, when judging from the point of view of socialization, most of the e-learning systems seem virtually inadequate as these systems lacks sufficient room for inter-personal relationships among students and also between the student and teachers. Another thing is the problem of digital divide and comparatively higher expenses needed for providing infrastructure. Other major demerits of digital resources are the problem of information overload, chances for getting wrong and misleading information, the issue of plagiarism and network problems affecting the accessibility of digital content.

Educational Websites

These are basically individually designed websites that are tailored to a particular audience, often on a particular subject. They are much like an interactive text book, including audio, video and 3D graphics. Some also contain activities and quizzes etc to aid learning. They can make learning more interesting and have can help students to visualize situations and objects in a realistic way that they would not otherwise have the opportunity to see. They are often based on a particular resource such as a digital library or collection. These sites can also contain the discussion board and can give students to ask questions to experts via email.

Some educational websites also contain an area for teachers, giving advice on how to use the resources for particular age groups and curricula. These sites allow distance-learning students to maintain a better sense of community. These sites can also serve to promote the work of the organisation and are not so much aimed at a select group of students but are available to academics and members of the public alike. Two popular educational websites are the site on Ancient India [offered by British Museum] and BBC Learning.

Database

A database is a structured collection of data. A database is organized in such a way that it can easily be retrieved, managed, and updated. Databases can be classified according to types of content: bibliographic, full-text, numeric, and images .In computing, databases are sometimes classified according to their organizational approach. A distributed database is one that can be dispersed or replicated among different points in a network. **Geographic Information System (GIS),** the system designed to capture, store, manipulate, analyze, manage, and present all types of spatial or geographical data can be cited as an example of database.

Open Educational Resources (OER) Movement

The concept of 'Openness' is based on the idea that knowledge should be disseminated and shared freely through the Internet for the benefit of society as a whole. The most important aspect of openness are free availability and the use of resource without any kind of technical, legal or price barriers. Openness exists in different forms and in different fields. The term Open Educational Resources (OER) was first introduced at a conference hosted by UNESCO in 2000 and was promoted in the context of providing free access to educational resources on a global scale. The most often used definition of OER is, "digitized materials offered freely and openly for educators, students and self-learners to use and reuse for teaching, learning and research".The principal developments that caused the popularization of open educational resources are;

Open Source Initiative:- During February 1998, Eric Raymond and Bruce Perens founded OSI, the Open Source Initiative, with the purpose of "managing and promoting the Open Source Definition for the good of the community, specifically through the OSI Certified Open

Source Software certification mark and program". It is dedicated to promoting open source software for which the source code is published. This allows anyone to copy, modify and redistribute the code and its modifications without paying royalties or fees.

Open Content Initiative: - Inspired by the success of Open Sources Initiative (OSI), David Wiley founded "Open Content Project" in 1998to popularize the principle of OSI for creating and reusing learning objectives and content. The first content-specific license was created for educational materials and a key fundamental of Wiley's original license is that any object is freely available for modification, use and redistribution with certain restrictions.

Open Access Initiatives: - The idea of Open Access is that scholarly work should be freely and openly available online with no unnecessary licensing, copyright, or subscription restrictions.

Creative Commons: - - These are licenses designed to help both the creators and the users of intellectual property. The non-profit organization Creative Commons (CC) provides an easy to use mechanism for choosing and attaching to a creative work one of six standardised CC licenses. The set of Creative Commons licenses allows authors and institutions who wish to provide the content they created as open while retaining some copyrights, in an internationally standardized way. As against the slogan 'all rights reserved' raised by the advocates of copyright the creative commons stands for 'some rights reserved'. In other words, creative commons envisages a middle path between the exorbitant exploitation of the copy-rightists and the vision of anarchy preached by the exponents of unrestricted openness. By using a creative commons license, the authors could make their creative works available to the public without losing their copyright. These products of mind are licensed as free for certain uses and on certain conditions. It is dedicated to realizing the full potential of the Internet to support open learning and to reduce barriers to sharing, remixing and reusing educational resources.

Wiki Resources

A wiki is a web site that is generally editable by anyone with a computer, a web browser, and an internet connection. Wikis use a quick and easy syntax to allow users to apply formatting to text and create links between pages. This simple formatting syntax means that authors no longer need to learn the complexities of HTML to create content on the web. The term 'wiki' is derived from the Hawaiian phrase, wiki-wiki, which means quick. A wiki is a collaborative web site whose content can be edited by visitors to the site, allowing users to easily create and edit web pages collaboratively. The name Wiki was chosen by Ward Cunningham, the creator of world's first Wiki. The main strength of a wiki is that it gives people the ability to work collaboratively on the same document. The only software you need is an Internet browser. Consequently, wikis are used for a variety of purposes. If you make a mistake, it's easy to revert back to an earlier version of the document.

Wikipedia

The largest and most talked about Wiki on the Internet is **Wikipedia**. It is an online encyclopedia providing and updating information virtually about anything and everything. Wikipedia is editable by anyone in the world with a computer and an internet connection. *Wikipedia* has become astonishingly widely read and cited. More than a million people a day visit the *Wikipedia* site. *Wikipedia* contains 3 million articles of which 1 million is in English. There are also more than 250,000 articles in German, French, Polish, and Japanese; and more than 100,000 articles in Spanish, Italian, Dutch, Portuguese, Russian, Swedish, and Chinese. The goal of Wikipedia is to create an encyclopedia that can be shared and copied freely while encouraging people to easily change and improve the content. Each and every article has an "Edit this page" button, allowing anyone, even anonymous passersby, to add or delete any content on any page. What would surely seem to create chaos has actually produced increasingly respected content which has been evaluated and revised by the thousands of visitors to the site over time. Wikis are quickly becoming the actual technology for collaborative group work online.

Wikipedia is entirely free. That freedom includes, not just the ability of anyone to read it, but also their freedom to use it. You can take *Wikipedia*'s entries and put it on your own Web site. You can hand out its copies to students, and you can publish it in a book—all with only one restriction; you may not impose any more restrictions on subsequent readers and users than have been imposed on you. And it has no authors in any conventional sense. Tens of thousands of people—who have not even got the glory of affixing their names to it—have written it collaboratively. The entry on former US President, Roosevelt, for example has emerged over four years as five hundred authors made about one thousand edits. This extraordinary freedom and cooperation make *Wikipedia* an Internet-based, volunteer-contributed encyclopedia that has become a popular online reference in a very short period. It has thousands of international contributors and is the largest current example of an *open content* wiki.

The following wikis represents a range of different applications of wiki technology:
WikiWikiWeb- the first ever wiki appeared in 1995.
Wikitravel- a project to create a free, complete, up- to- date, and reliable world wide travel guide.
Scholarpedia- a wiki project based on a system of peer review.

Other well-known Wiki resources are Wikinews, Wikimedia Commons, Wikiversity, Wikiquote, Wiktionary and Wikibooks.

E-learning

Internet has been long used for educational purpose and a number of prominent models of Internet-based education have been emerged over the past 20 years. Perhaps the most established of these are various forms of what has come to be known as *e-learning*—ranging from online courses to virtual classrooms and even virtual schools. Many early forms of e-learning involved the predominantly one-way delivery of learning content, thereby

replicating traditional correspondence forms of distance education. These programs which continue to the present day tend to rely on online content management systems, although supported by some form of interactivity in the form of e-mail, bulletin boards, and other communications systems. Alongside these forms of content delivery is the continued development of so-called virtual classrooms—usually spatial representations of classrooms or lecture theaters that can be attended by learners and teachers. Often these virtual spaces are designed to support synchronous forms of live instruction and feedback, with learners able to listen to lectures and view videos and visual presentations while also interacting with other learners via text and voice. Other asynchronous forms of virtual classroom exist in the form of digital spaces where resources can be accessed and shared—such as audio recordings and text transcripts of lectures, supplementary readings, and discussion forums. These forms of e-learning have continued to be developed since the 1990s. With the establishment of a large number of cyber schools and online universities, e-learning now became the rapidly growing and increasingly popular segment of educational systems around the world.

While the examples of e-learning tend to replicate the basic structures and procedures of conventional schools and universities, a variety of other models of Internet-supported education have emerged over the past twenty years. One of the most familiar forms of Internet-based education is the collective open creation of information and knowledge, as exemplified by the online encyclopedia named Wikipedia. Despite ongoing debates over its accuracy and coverage, the educational significance of Wikipedia is considerable.

These characteristics of wiki tools correspond with the wider *Open Educational Resource* movement which is concerned with making professionally developed educational materials available online for no cost. In this manner, it is reckoned that content from almost 80 percent of courses at the Massachusetts Institute of Technology are available on this freetouse basis. Similar commitments can be found in institutions ranging from world-class universities such as Yale and Oxford to ordinary colleges. In all these cases, course materials such as seminar notes, pod casts, and videos of lectures are shared online with a worldwide population of learners, most of who could otherwise not attend. Crucially, the emphasis of Open Educational Resources is not merely permitting individuals to use provided materials, but encouraging the alteration and amendment of these resources as required. For example, the UK Open University's extensive Open Learn project provides free online access to all of the institution's curriculum materials with an invitation for individual users to adapt these resources as they wish.

Other forms of online content sharing involve the open distribution of educational content that has been created by individuals as well as institutions. For example, the YouTube EDU service offers access to millions of educational videos produced by individual educators and learners. Similarly, Apple Computers' collection of educational media known as ***iTunesU***is designed to allow learners to circumvent traditional educational lectures and classes in favor of on-demand free mobile learning. Describing itself as "possibly the world's

greatest collection of free educational media available to students, teachers, and lifelong learners," iTunes U offers free access to hundreds of thousands of educational audio and video podcast files. Another model of online learning is the so called flipped classroom in which learners are allowed to engage with instructional elements of learning before entering a formal classroom. Face-to-face classroom time can then be devoted to the practical application of the already acquired knowledge through problem solving, discovery work, project-based learning, and experiments.

Another notable *open* example of Internet-based education has been the development of *MOOCs* (Massively Open Online Courses) over the past five years or so. Now, MOOCs involve the online delivery of courses on a free-at-the-point-of-contact basis to mass audiences. At its heart, the MOOC model is based on the idea of individuals being encouraged to learn through their own choice of online tools—what has been termed ***personal learning networks***—the collective results of which can be aggregated by the course coordinators and shared with other learners. This focus on individually directed discovery learning has proved especially appropriate to college-level education. Now it is possible for individuals of all ages to participate in mass online courses run by professors from the likes of Stanford, MIT, and Harvard universities in subjects ranging from Roman architecture to fundamentals of neuroscience.

Another radical application of the Internet to support self-directed, non-institutional learning is initiatives such as the *hole-in-the-wall* and *School in the Cloud* initiatives. These programs are built around an ethos of *minimally invasive education* where children and young people can access digital technology at any time, and teach themselves how to use computers and the Internet on an individually paced basis. This approach is seen to be especially applicable to locations such as slum communities in India where Internet access is otherwise lacking. The recent elaboration of the initiative into the School in the Cloud marks an attempt to use online communication tools to allow older community members in high-income countries to act as mentors and *friendly but knowledgeable* mediators to young autonomous learners in lower income communities. The provision of such access and support is to be viewed as an attempt to build self-organized learning environments and to encourage self-activated learning as an ideal alternative for those who were denied formal schooling, especially in low-income countries.

These programs, projects, and initiatives are indicative of the variety of ways in which education and the Internet have combined over the past 20years. Yet perhaps the most significant forms of Internet-based education are the completely *informal* instances of learning that occur in the course of everyday Internet use. In this sense the Internet's implicit support of various forms of *informal learning* could be seen as its most substantial educational impact.

Advantages of e- learning

Apart from the usual benefits attributed to I.T devices, such as the anytime and anywhere access and high storage capacity and the like, there are five main advantages of online learning:

1. **It offers Greater Opportunities: -** Distance learning affords educational opportunities to individuals unable to attend conventional classroom settings. Such individuals include the disabled, those living in rural communities where travelling daily to university or college would prove difficult or even impossible, and finally those with various time restrictions that prevent them from attending pre-scheduled classes. A large number of today's students wishing to enter into Higher Education have work and family responsibilities. Online learning provides them the greater opportunity to continue their studies without compromising their job and household tasks.

2. **Learner-determined location for learning –** whereby students are able to choose their own place of study;

3. **Learner-determined time of learning –** students are able to organize their own individual learning schedule, rather than having to study on a specific day at as pecific time, and finally;

4.**Learner-determined pace of study –** students are able to set their own individual pace of study without being held up by slower students or vice-versa.

5. Shy students may gain more confidence and perform better in an online environment rather than being intimidated in the conventional classroom.

Disadvantages.

1. **Risk of Isolation**

The arguments against online learning are centered largely on the concerns for the loss of traditional classroom face-to-face interaction, and the potential feelings of isolation this can create. Researches suggest that the majority of online courses still adopt an asynchronous approach to learning that limits the amount and depth of interaction amongst both students and instructors. Whereas a synchronous approach to online learning would provide students and instructors, a more interactive environment.

2. **Reduced social and cultural interaction**

Reduced social and cultural interaction is a major drawback in online education. Students miss out on certain communication mechanisms that are often taken for granted in the conventional classroom, such as body language and peer-to-peer learning. Most of the online learning materials are designed to work in an impersonal environment. This would definitely cause some hardships for the students in acquiring and developing certain skills and techniques needed for effective communication and interpersonal relationships. Students who constantly interact via technology can find difficulty in confronting interpersonal interactions and the skills needed to negotiate with all kinds of people, and handle personality conflicts. Ultimately, life is something more valuable than the ability to click through a series of menu bars.

3. **Online learning offers more chances for distraction and deviation.**
   When students are sitting alone in front of a computer they are more prone to distraction, and unless the online course material is interesting or providing sufficient amounts of interaction, the learner will become distracted and may even drop out. Even though, we can't ignore the significance of Internet as an ever-growing knowledge repository, we should also be aware of the fact that the web contains so many unwanted things also. So, there are more chances of students, especially the adolescents among them becoming an easy prey of porn sites and similar unwanted things. Some students who finds themselves disappointed with their online lessons, spends more time on social networking, chatting and very soon gets attracted by the dirty side of the Internet.

Educational software

Educational software is computer software the primary purpose of which is teaching or self-learning. It is the software, or computer applications developed for the purpose of teaching and learning. Educational software encompasses a variety of forms and purposes. Mainly there are two categories of Educational Software.
a) Software designed to facilitate and support formal education/learning/training
b) Software designed as self-learning or training Kits

Educational software or programs are used mostly in pre-primary education. These programs help kids to learn alphabets, sounds and grammar in English as well as other languages. It appears very much interesting for kids and promotes the play-way method of learning. Some educational software are available in the form of attractive games that helps to stimulate the inquisitive spirit in kids' minds and make them capable of understanding patterns, relationships and similarities and also helps to enrich their vocabulary. Such program which combines education with entertainment is sometimes known as edutainment. The most known examples of children's learning software are Click'n KIDS, Disney Interactive learning titles based on characters such as Winnie-the-Pooh, Aladdin, The Jungle Book and Mickey Mouse.

There are also some other programs used for introducing mathematical concepts for all grades, or are aimed at helping to develop good writing skills. Some programs, such as flight simulators, teach professionals the details of their jobs. Still other programs, called Learning Management Systems (LMSs), are designed for use by certain grades for teaching or evaluation purposes. A learning management system is a software application for the administration, documentation, tracking, and reporting of training programs, classroom and online events, e-learning programs, and training content.
At the college and university level, LMSs are powerful application management systems that

offer courses via the Internet for non-formal students. These tools allow institutions to design entire online courses.

Courseware

Courseware is educational material intended as kits for teachers or trainers or as tutorials for students, usually packaged for use with a computer. It is the study material or course content made available in digital format. Courseware can encompass any knowledge area. Educational institutions like MIT have made available virtually all the study materials pertaining to almost all the courses offered by them. Eg; MIT Open Course Ware (ocw.mit.edu).Courseware is frequently used for delivering education about Information Technology, personal computer and its most popular business applications, such as word processing and spreadsheet programs. Courseware can include:

- Material for instructor-led classes
- Material for self-directed computer-based training (CBT)
- Web sites that offer interactive tutorials
- Material that is coordinated with distance learning, such as live classes conducted over the Internet
- Videos for use individually or as part of classes

EBook

An eBook is the electronic version of a traditional print book that can be read by using a personal computer or by using an eBook reader. E-book reader is available either as a software application (eg. Microsoft's *free Reader* application), or as a book-sized computer that is used solely as a reading device. Many reference materials like dictionaries and encyclopedias which are now available in CD ROMs can be cited as the best examples of eBooks. Users can purchase an eBook on diskette or CD, but the most popular method of getting an eBook is to purchase a downloadable file of the eBook from a Web site. Most of the book publishers are now offering their products in digital format too. There are also certain free e-book sites that facilitate free and unrestricted downloading of e-books. The main advantages of e-books over the conventional books include its smaller size, larger storage, easy and less expensive accessing and easy navigation.

Electronic Journals

An electronic journal or e-journal is a periodical publication which is published in electronic format, usually on the Internet. These are scholarly journals or intellectual magazines that can be accessed via electronic transmission. They are a providing material for academic research and learning. They are formatted more or less like journal articles in traditional printed journals. Many e-journals are the electronic versions of already existing

print journals. For example, Economic and Political Weekly (EPW), the most famous research journal in Social Science is now available both in print and electronic media. An increasing number of e-journals are available as open access journals, requiring no subscription and offering free full-text articles and reviews to all. Most electronic journals are published in HTML and PDF formats, but some are available in only one of the two format. Electronic journals have several advantages over traditional printed journals such as;

1. It provides anywhere and anytime access at a comparatively lesser expense.
2. Helps searching the contents pages and/or the full text of journals to find articles on a certain subject.
3. You can e-mail articles to yourself or download them for printing.
4. Hypertext links allow you to move to different sections within individual journals or articles and can link you to related resources on the Internet.
5. E-Journals can include more images and audio-visual material.
6. E-Journals are more interactive - you can e-mail the author or editor with your comments.

Open Access Publishing

Open Access (OA) stands for unrestricted access and unrestricted reuse. Most publishers own the rights to the articles in their journals. Anyone who wants to read the articles must pay to access them. Those who want to use the articles in any way must obtain permission from the publisher and is often required to pay an additional fee. Most of the researchers are accessing these costly journals via their institution that pays for it. Paying for access to content makes sense in the world of print publishing where providing content to each new reader requires an extra expenditure as it involves the production of an additional copy. But free and unrestricted accessing of these researches articles seems sensible in the online world as it is possible to provide access to all readers anywhere in the globe without the burden of any additional expenditure. Open Access Publishing refers to the existence of online academic journals which facilitates publishing and accessing of research and scholarly articles from any part of the globe without having paid for it. Open Access journals are available online to the reader without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. It is a significant initiative aiming the production and dissemination of knowledge. Authors can choose to publish their research articles in a growing number of journals that meet the full definition of Open Access. Articles are free to all interested readers, and the publishers place no financial or copyright barriers between the readers and the article. The publisher of an open access journal is known as an "open access publisher", and the process, as "open access publishing". Open Access publishing is the fastest growing segment of the scholarly publishing market, and journal

options are now available for nearly every area of research. Authors can make use of Open Access facility in any of the following ways.

(1) **'Green' open access**: -Self-archiving their journal articles in an open access repository, also known as, or

(2) **'Gold' open access**: - Publishing in an open access journal

Benefits of Open Access

- **Accelerated discovery.** With open access, researchers can read and build on the findings of others without restriction.
- **Public enrichment**. Much scientific and medical research is paid for with public funds. Open Access allows taxpayers to see the results of their investment.
- **Improved education**. Open Access means that teachers and their students have access to the latest research findings throughout the world.

Edusat- India's First Exclusive Educational Satellite

EDUSAT, launched on September 20, 2004, is the first Indian satellite built exclusively for serving the educational sector. It is mainly intended to meet the demand for an interactive satellite based distance education system for the country. It strongly reflects India's commitment to use space technology for national development, especially for educating the population in remote and rural locations. The 1950 kg EDUSAT was launched from Satish Dhawan Space Centre (SDSC) Sriharikota, into a Geosynchronous Transfer Orbit (GTO) by ISRO's Geosynchronous Satellite Launch Vehicle (GSLV-F01).

The extension of quality education to remote and rural regions becomes a herculean task for a large country like India with multi-lingual and multi-cultural population separated by vast geographical distances. Since independence, India has seen substantial increase in the number of educational institutions at primary, secondary and higher levels as well as the student enrolment. But the lack of adequate rural educational infrastructure and non-availability of good teachers in sufficient numbers adversely affect the efforts made in education. Satellites can establish the connectivity between urban educational institutions with adequate infrastructure imparting quality education and the large number of rural and semi-urban educational institutions that lack the necessary infrastructure. Besides supporting formal education, a satellite system can facilitate the dissemination of knowledge to the rural and remote population about important aspects like health, hygiene and personality development and allow professionals to update their knowledgebase as well. Thus, in spite of limited trained and skilled teachers, the aspirations of the growing student population at all levels can be met through the concept of tele-education.

With the success of INSAT based educational services, a need was felt to launch a satellite dedicated for educational service and ISRO conceived EDUSAT Project in October 2002. EDUSAT is the first exclusive satellite for serving the educational sector. It is specially configured for audio-visual medium, employing digital interactive classroom and

multimedia multicentre system. It is primarily meant for providing connectivity to schools, colleges and other centres of higher education and also to support non-formal education. The scope of EDUSAT programme was planned to be realized in three phases.

In the first phase of pilot projects, service utilities of the previously launched satellite INSAT-3B, was used. In this phase, Visveswaraiah Technological University (VTU) in Karnataka, Y B Chavan State Open University in Maharashtra and Rajiv Gandhi Technical University in Madhya Pradesh were covered. In the second phase, EDUSAT is being used in a semi-operational mode and at least one uplink in each of the five spot beams will be commissioned. About 100-200 classrooms will be connected in each beam. Coverage will be extended to the whole of India through spot beams. The commencement of fully fledged EDUSAT services on March 7, 2005 marks the third phase. EDUSAT became fully equipped with the launching of EDUSAT based Primary Education Project in Chamaraja nagar District under taken jointly by ISRO and Karnataka State

EDUSAT is operating from a central and 5 regional hubs or beams. The Hub for National Beam has been established at Ahmadabad. The National Beam is planned to be used for nationally reputed institutions like Indira Gandhi National Open University, National Council for Educational Research and Training, Indian Institutes of Technology at Kharagpur and Chennai, etc. The five regional beams -- Southern Beam, Western Beam, Northern Beam, Eastern Beam, and North-Eastern Beam are specifically designed to meet the educational needs of respective regions.

While ISRO provides the space segment for EDUSAT System and demonstrate the efficacy of the satellite system for interactive distance education, content generation is the responsibility of the user agencies. The quantity and quality of the content would ultimately decide the success of EDUSAT System. This involves an enormous effort by the user agencies. To help in this, ISRO, in cooperation with the user agencies, organized five conferences at the regional level, one at the national level and one conference of vice-chancellors of Indian universities to create awareness about EDUSAT and itscapabilities. The successful launch of EDUSAT and its commissioning has provided a great impetus to countrywide distance education.

VICTERS

ViCTERS (Virtual Classroom Technology on EDUSAT for Rural Schools) is the cable TV channel designed exclusively for promoting education. It is India's first broadband network on EDUSAT for schools. It was inaugurated by A P J Abdul Kalam, the then president of India on 28th July, 2005 at Thiruvananthapuram. Through, ViCTERS, which is functioning on interactive IP based technology, Kerala has demonstrated how EDUSAT could be used to successfully empower teachers. The scheme which is being executed by

IT@School Project of Government of Kerala, is mainly intended to meet the demand for an Interactive Satellite based Distance Education system for the country. It strongly reflects India's commitment to use space technology for national development, especially for the development of the population in remote and rural locations. ViCTERS offers interactive virtual classrooms that enable the school students as well as the teachers to directly communicate with the subject experts and educationists. It also ensures the dissemination of high quality education to the students and teachers from the original source.

ViCTERS has two modes of operation - the interactive mode and non-interactive mode. **Interactive mode** of ViCTERS is used for video conferencing and other such educational training purposes. Being India's first interactive broadband network for school, this mode is equipped with 116 Satellite Interactive Terminals (SITs). The main users of the facility under Thiruvananthapuram Hub are IT@School Project, Directorate of Collegiate Education, Directorate of Technical Education, CDAC, SSA, Directorate of IT Lakshadweep etc.

The non-interactive mode of ViCTERS is the complete educational channel, first of its kind in the country, which was officially inaugurated on 3rd August 2006 by Sri. V.S Achuthananthan, the then Chief Minister of Kerala. The channel which is telecast for 17 hours a day from 6 a.m. to 11 p.m. is unique in the sense that it caters to students & teachers on a need based manner, and programs are aired on demand, sensitive to school curriculum and even timetable. The channel reaches out to as many as 12,500 schools and about 50 lakhs children and covers almost entire households in the State. ViCTERS is the only complete educational channel of the State which telecast programmes of educational value, general awareness programmes and content on general interest and is fast becoming the most sought after channel by students, parents, teachers and general public. ViCTERS telecast specific curriculum based programmes, regional, national and international programmes on education especially on Science and Technology. The channel is now available throughout the State through local cable, receive only terminals and also via live through internet at www.victers.itschool.gov.in, enabling the students, teachers and general public to watch the channel live through internet from any part of the world.

Various programmes telecast through ViCTERS are as follows;

- Padanakauthukam and Shastrakauthukam educational programmes
- Examination oriented programme for SSLC and Plus 2 level
- Shasthramuthukal (Science programmes).
- Vazhikaatti (produced by State Institute of Educational Technology)
- Ormayile Malayalam (Specific date-wise regional programme)
- Kerala Sree (Produced by Department of Information & Public Relations, Kerala

- Pusthakangalkkoppam (Introducing various Books)
- HarithaVidhyalayam (Educational reality show for schools)
- Kadhaparayum Neram (Story telling time)
- Mozhimuthukal (Detailing famous quotes)
- Drishyapaadam (produced by State Open School)
- Naadavismayam (Introducing Musical instruments and symphonies)
- Innalekalile Innu (Yesterday - Today)
- Samrakshithasmaarakangal (Protected monuments)
- Gaanamayooram (Familiarisng patriotic songs)
- Great Teachers (Familiarising famous and renowned teachers)
- Career After 12th
- Kalothsavam (State School Youth Festival)
- IT for All (Technology outlook programme for students and public)
- Inspire (career guidance programme)
- Chithrashala (film based programme)
- MAT (talent time Special)
- Educational News
- Anukalikam (Weekly cultural news programme)
- Sasthralokam (Weekly science based programme)
- Shasthranaadakam (Weekly science based programme)
- BBC TIME (BBC Programme)
- NFDC film (Classic films produced by National Film Development Corporation)
- Weekend (Weekly global news)
- Vibgyor (subject related programme)
- AdhithiyodothuAlpaneram (Interaction with a renowned personality)
- Beyond the text (text based programme)
- Magic fingers (tricks and plays on magic), ...and many more.

Digital Library

A digital library is a library in which collections are stored in digital format (as opposed to the conventional paper and print media) and accessible through the medium of computers or similar digital devices. The digital content may be stored locally in a physical library, or accessed remotely via computer networks. A digital library is a type of information retrieval system. The widely accepted definition of digital library perceives it as "a potentially virtual organization, that comprehensively collects, manages and preserves for the long depth of time, rich digital content, and offers to its targeted user communities specialised functionality on that content, of defined quality and according to comprehensive codified policies." Even though, there is a tendency to use the terms digital library and online library interchangeably, there does exist a distinction between the two. A digital library is one available in digital format irrespective of the fact that it is available online or could be

read offline. A digital library can function online with the collection of digital books available in mediums like CD ROMs. On the other hand, an online library is one existing in the virtual world and accessible remotely through the internet. More simply, all digital libraries are not necessarily online libraries; but all online libraries are digital libraries.

Advantages

1. **It is Cost Effective**: - The advantages of digital libraries as a means for easily and rapidly accessing books, archives and images of various types are now widely recognized. In contrast to traditional libraries which are limited by storage space; digital libraries have the potential to store much more information, simply because digital information requires very little physical space to contain it. As such, the cost of maintaining a digital library is much lower than that of a traditional library. A traditional library must spend large sums of money paying for staff, book maintenance, rent, and additional books. Digital libraries may reduce or, in some instances, do away with these fees.
2. **No barriers of physical boundary**: - The user of a digital library need not to go to the library physically; people from all over the world can gain access to the same information, as long as an Internet connection is available.
3. **Round the clock availability: -** A major advantage of digital libraries is that people can gain access 24/7 to the information.
4. **Multiple accesses**: - The same resources can be used simultaneously by a number of institutions and persons. A conventional library may have a license for "lending out" only one copy at a time.
5. **Easy Information Retrieval**: - In traditional libraries, searching for a particular book is a tedious task, even to a reader who is well versed in cataloguing techniques. In contrast, in a digital library, user is able to apply any search term (word, phrase, title, name, and subject) to search the entire collection. Digital libraries can provide very user-friendly interfaces, giving clickable access to its resources.
6. **Digital content is less vulnerable to decay**: - Digital content is comparatively less perishable than conventional books printed in paper. Preservation and conservation of digital resources too is much easier than the traditional library materials. There are also easier reprographic techniques by which we can take additional copies of the rare and damaged materials.
7. **Added value**: - Certain characteristics of digital media help to improve the quality of reading materials in contrast to the dullness and monotony of conventional books. A digital library could accommodate more interesting and interactive things such as audio and video books and could ensure the quality and clarity of images and text. Digitization can enhance legibility and remove visible flaws such as stains and discoloration.

The major criticism against digital libraries is centering on its limitations such as the high initial expenses required for providing infrastructure, certain technology related issues such as connection failure or network problems, risk of security vulnerabilities involved and comparatively higher chances of plagiarism. Some critics are also trying to examine e-reading in terms of man-machine interface. They feels that physical books cannot be replaced by digital books as reading the former requires the total mental and physical involvement of the reader, where as reading books in digital format very often leads to an increased volume of mechanization. Lastly, there is also some serious health issues such as vision problems and muscular- skeletal diseases caused from excessive e-reading.

INFLIBNET

Information and Library Network (INFLIBNET) is an autonomous inter-university Centre (IUC) of University Grants Commission, Government of India. It is involved in creating infrastructure for sharing of library and information resources and services among Academic and Research Institutions. INFLIBNET works collaboratively with Indian university libraries to shape the future of the academic libraries in the evolving information environment. This major National Programme was initiated by UGC in 1991 with its Head Quarters at Gujarat University Campus, Ahmadabad. It became an independent Inter-University Centre in 1996.N-list is the major utility service of INFLIBNET aiming to provide instant access to a rich and diverse collection of electronic academic journals to its users. INFLIBNET is involved in modernizing university libraries in India and connecting them as well as information centres in the country through a nation-wide high speed data network using the technologies for the optimum utilization of information. INFLIBNET is set out to be a major player in promoting scholarly communication among academicians and researchers in India

NICENET:-A free Web-based virtual classroom

NICENET is a non-profit organization of internet professionals who donate their time to provide services for the Internet community. Everything in NICENET is offered free for public use. It was founded in 1995 with the primary objective of bringing communication tools and resources previously available only to those with large sums of money or substantial technical expertise to the education community across the globe. NICENET provides one of the most popular 'Learning Management System' of the world. NICENET offers a computer mediated conferencing system that acts as a place for interaction where the members of a group can share information, ask questions and get extra help. It is just like a classroom accessible only through the site www.NICENET.org.NICENET is conferencing software that resides on the Net. It is free and currently in use by many educators in the

world. You need not even download the software. You simply bookmark NICENET in your browser and go there when you are online to read and send messages.

Major Advantages and special features of NICENET

1**. Internet Classroom Assistant (ICA)**: - It is a sophisticated communication tool that brings powerful World-Wide-Web based conferencing, personal messaging, document sharing, scheduling , linking and sharing of resources to a variety of learning environments.

2. Anyone can set up a class in minutes and allow others to join. After login, users are presented with a 'heads-up' display of class resources.

3. **Conferencing**: Create your own private, threaded conferencing on topics you make for the class or opt to allow students to create their own topics.

4. **Schedulin**g: Put the class schedule on-line. With a seven day advance view on your class homepage, students will have a heads-up display of upcoming assignments and class events.

5. **Document sharing**: Students and teachers have the ability to publish their documents on the NICENET website by using certain simple web-based techniques.

6. **Personal Messa**ging: Similar to traditional email but fully integrated with document sharing and conferencing, personal messaging is a great way to communicate with and between individuals in your class, comment privately on conferencing postings or give private feedback on papers or documents published.

7. **Link Sharing**: Share links to relevant Internet resources sorted by topics that you create.

Bio-Resource Network (BRNet)

Bio-Resource Network (BRNet) is a prototype portal site for biological information. An initiative of Japan Science and Technology (JST) Corporation, BRNET is basically meant to bring together biological information resources scattered over different networks, so as to ensure its optimum utilization. BRNET categorizes the information resources in such a manner that the end user can easily search the desired information. Furthermore, it also allows the users to create their own bio resources database. The National Bio-resource Project (NBRP) is a Japanese project that aims to establish a system for collecting, preserving and providing bio-resources for use as experimental materials for life science research. It is promoted by 27 core resource facilities, each concerned with a particular group of organisms, and by one information center. The NBRP database is a product of this project. Thirty databases and an integrated database-retrieval system known as the Bio-Resource World (BRW) have been created and made available through the NBRP home page. The 30 independent databases have individual features which directly reflect the data maintained by each resource facility. The BRW is designed for users who need to search across several resources without moving from one database to another. BRW provides access to a collection of 4.5-million records on bio-resources including wild species, inbred lines, mutants, genetically engineered lines, DNA clones and so on.

In our country, Indian Bio-resource Information Network (IBIN) is being developed as a distributed national infrastructure to serve relevant information on diverse range of issues of bio-resources of the country to a range of end users. It is a project funded by the Department of Biotechnology (DBT), Government of India. Its major goal is to network and promote an open ended, co-evolutionary growth among all the digital databases related to biological resources of the country and to add value to the databases by integration. Indian Bio-resource Information Network (IBIN) is designed to serve relevant information on bio-resources of the country to the professionals involved in bio-prospecting, marketing, protecting bio-piracy and the conservation of bio-resources. IBIN is proposed to be uniquely placed as a single portal data provider on India's bio-resources like plants, animals, marine, spatial distribution and microbial resources.

The immensely rich collection of data stored in databases known as Bio-resource networks is usually being used for various purposes especially in learning and researching life science and its auxiliaries such as biomedical engineering, biotechnology, biochemistry, microbiology and the like.

I.T in Historical Studies

We have already discussed the impact of using tools and techniques of ICT in history classrooms and concluded that ICT could function as an ideal means for renovating the way we teach history at all levels. This could be done by employing a broad spectrum of tools that may vary from simple power point presentations to adopting a little more complex virtual reality environment. Similarly, the tools and techniques of I.T could also be incorporated in a much higher level of historical studies, more precisely, in the area of historical research. Today, modern tools of I.T have definitely simplified the processing of all the major stages involved in historical research such as identifying the research problem, formation of hypothesis, collection of data, interpretation of data and the presentation or publication of research findings. The I.T tools used in the field of historical research may vary from the simplest personal or laptop computers used for data storage to highly advanced Global Positioning System (GPS) and remote sensing techniques employed by archaeologists. In addition to this, there are also certain specifically designed software programs used for quantification and analysis of data such as SPSS and MATLAB. Some educational websites like WebQuests offers a popular way of providing structure to historical research on the Internet. Typically, WebQuests have an introduction, a process, guidance, a task, a list of resources, a conclusion and an evaluation. The motive behind such research sites is familiarizing students with certain key aspects of research in a particular topic.The following section would attempt a review of major tools and techniques of I.T utilized in various stages involved in historical research such as identifying the topic, collection of data, interpretation of the collected data and finally, the presentation of their findings or the result of the research.

a.) Identifying the Research Problem or the Topic:-

The starting point of any research is the identification of the research problem. The topic of research should be taken with utmost care and concern by considering various aspects such as the relevance, scope, capability of the researcher and the availability of sources. More importantly, before, finalizing the topic of research, the researcher should also satisfy himself with respect to the genuineness or novelty of the proposed research work. For ensuring all these factors one should have a clear idea about previous research works conducted on the subject and also in related fields. Here, one can make the maximum use of the immensely rich web resources or databases. At present, most of the standard universities and other research centres across the globe used to publish online, the list of research works undertaken by them. Some institutions make the full text of thesis available in their websites. Besides, there are also a large number of online or open access journals providing anytime and anywhere access to rich volumes of research works done in different parts of the world. By referring these online sources, the researcher can carefully choose his topic of research so as to avoid the possible chances of duplication and likely allegations of plagiarism.

b.) Data Collection

The second major step involved in historical research is the collection of data based on which the researcher has to formulate his own research findings. The collection of data is a hazardous task involving the utilization of considerable time, money and effort from the part of the researcher. Here also, the tools and techniques of Information Technology could act as the most trusted companion of the researcher. The digital libraries and digital archives provides an easy, anytime anywhere access to rich volumes of both primary and secondary sources stored in digital repositories all over the world. The web contains the richest collection of digital resources virtually on almost all areas coming under the discipline of history. It is possible to do some good research works exclusively on the basis of Wiki resources since over 60% of Wikis' content is on topics related to history. Some of the digital data could be accessed on open access terms and some others are available upon paying a nominal or reasonable registration fee. The researcher who is searching for useful data can also make use of the most sought after databases like Geographical Information System (GIS) and Bio-resource Networks (BRNet). However, one must take maximum care while dealing with the online resources as validity of the material on the Internet is always questionable. The researcher should evaluate these sources critically by giving an extra emphasis to matters such as the authorship, authenticity and accuracy.

All the data so collected could be stored intact in digital storage devices such as Laptops, PCs palm-top computers and also in secondary storage devices like CDs, DVDs and memory chips so as to facilitate future manipulation, analysis and interpretation. The digital storage of data always offers an edge over the conventional media both in terms of high storage capacity and easy retrieval. Scanners and cameras of varying sizes and types may be

utilized for reproducing the exact and clearer images of data stored in conventional format so as to digitalise them. Researching art history became much easier now, as the digital revolution offers certain highly advanced and handy reprographic techniques to get easy and real-like copies of the original pieces of artistic objects. The improved imaging technology in turn would facilitate a detailed observation and analysis of the object from different angles helping a more accurate measuring, assessment and a reasonable evaluation.

c.) Analysis or Interpretation of Collected Data

The next major step involved in historical research is the analysis and interpretation of data. This means the rearranging of all the scattered data to form a meaningful outcome or a reasonable conclusion. This could be attained through scrutinizing, reorganizing, investigating and collating the stored in data. All these data manipulations would be much easier if it is stored in digital format. If all the materials collected by the researcher is stored in the form of a database it could easily be analyzed and restructured by using database management techniques. There are also certain software packages like Statistical Package for Social Sciences (SPSS) specifically designed for quantification and analysis of data.

d.) Presentation of Research Findings

The final stage of the entire process of research is attained by publishing the research findings in the form of a thesis or an article. It is through publication that the researcher publicly reveals his findings before the academic community. As we are aware, the developments in the field of Information Technology have totally revolutionized the field of Publishing. Preparing a presentation, making a hard copy of the thesis and publishing a research paper online, all would require a basic understanding of the tools and techniques of ICT such as word processing, PowerPoint Presentation and Desk Top Publishing (DTP). The most easy and cost effective way to publicize the research findings is by resorting to Open Access Publishing, a comparatively recent phenomenon that has revolutionized the world of academic publishing. All these digital mediums adopted by researchers to express themselves, offers a greater possibility of effective communication that too in a cost effective manner. This is primarily because of the fact that digital media always offer better opportunities for drawing graphs, charts and diagrams and reproducing images so as to enable a convincing illustration of the research findings.

I.T and Archaeological Research

As per dictionary definition, archaeology is the study of human antiquities, especially of the prehistoric period and usually by excavation. Webster's International Dictionary sees archaeology as the scientific study of extinct peoples or of past phases of the culture of historic peoples through skeletal remains and objects of human workmanship found in the earth. Archaeology involves three crucial elements; the past, material remains, and

excavation. Archaeologists are therefore dealing with the remains of past peoples, societies and cultures. Remains have a tendency to be lost, buried and forgotten, so archaeology has developed a range of methods to recover partial remains. Ordinary people always exhibit a tendency to view archaeology as excavation or the process of digging. This underlines the significance of excavation in archaeology. Archaeological excavations conducted at places of historical significance have contributed the coining of the term Field Archaeology. Field archaeology is what archaeologists do in the field. Since its very inception, archaeology is regarded as a discipline having close connections or association with technology. It is more like physical science, though it is used to expand our horizons of knowledge in social sciences like history, sociology and cultural studies.

The first element of field archaeology is therefore, the creation of a research design. The actual content of each research design is naturally going to be very different; there are, however, certain elements that should be common to all. The basic stages involved in any type of archaeological excavation are identifying the site, designing the project, surveying, excavation, recording of the artifacts unearthed from excavations, interpreting the findings and publishing the report. In our digital age, archaeology incorporates a wide spectrum of digital tools and techniques in almost all the steps involved in an archaeological excavation. The increasing interaction between archaeology and digital tools and techniques gave currency to a new term, digital archaeology. This particular term has attained considerable acceptance recently, both in and outside academics. In simpler terms, digital archaeology refers to the use of digital information and communication devices and practices in the field of archaeology. *Digital Archaeology* explores the basic relationships that archaeologists have with Information and Communication Technology (ICT) and digital technology to assess the impact that such innovations have had on the very basic ways that archaeology is performed and considered.

The major digital tools and techniques being used by archaeologists are;

a.) Image Capturing

The capture and analysis of image data is an integral part of the archaeological process and digital applications and techniques have revolutionized methods of data gathering. Image capturing is the basic prerequisite for taking the exact measurement of micro sized artifacts. Image capturing also helps the rearrangement or conservation of broken artifacts through a process known as photocomposing. A variety of digital image capturing tools and techniques ranging from digital cameras to the high definition satellite photography are now being used for image capturing. Software applications have enabled new processing and analysis techniques for these types of images. The most popular among such software program is the Bonn Archaeological Software Package (BASP), a collaboratively developed suite of tools started developing since 1973. It also includes functions like clustering, correspondence analysis, and mapping. Airphoto19 is another low cost programme used for capturing images. It allows the user to correct a distorted aerial view and represent terrain as

a relief model, combining the geometric accuracy of a map with the detail of a photograph. The use of multiple photographs to determine accurate measurements and to produce digital terrain models (DTM's) is a high standard technical process known as photo grammetry, for which a range of software is also available.

b.) Google Earth

Google Earth, one of the most popular utility services from Google acts as an easily accessible and cost effective means for locating and surveying sites of excavation. In one of his papers titled *Computer Applications and Quantitative Methods for Archaeology,* Scott Madry, an archaeologist from the University of North Carolina, states that to find potential excavation sites in the Burgundy region of France, Google Earth provided him with more meaningful results in a matter of hours than he had gathered in years of carrying out aerial photography and land-based surveys. Google Earth's interoperability with GIS data makes it a potentially useful tool for modern archaeologists. The benefits of using this system are however enticing and begin to offer the user some quite sophisticated geospatial referencing functionality. In conventional GIS (Geographical Information Systems), the overlaying of one map onto another, or one layer of information over a related image, is carried out by a process of geo-referencing where point data on both source files are matched up sequentially, ultimately allowing the images to be accurately superimposed. In conjunction with a GIS data import function, distance measurement tools, and the ability to find, mark, map and export data to other applications, Google Earth has the potential to provide serious benefits to archaeologists, in terms of time that it takes to achieve certain tasks in comparison with using standard GIS packages and dedicated aerial or satellite imagery.

c.) Remote Sensing

Generally, Remote Sensing refers to the activities of observing/recording/perceiving (sensing) objects or events at far away (remote) places. In remote sensing, sensors are not in direct contact with the objects or events being observed. The term is used for referring the technique of gathering images using equipment that is at some degree removed from the subject matter and therefore covers a very wide range of techniques for analyzing the environment. The electromagnetic radiation is normally used as an information carrier in remote sensing. This technology is particularly useful in excavations involving the unearthing of delicate or breakable objects and also in marine or underwater archaeology.

Ground Penetrating Radar (GPR) was also used by archaeologists to equip them with a better understanding of sites to be excavated, especially in cases involving the unearthing of buried archaeological features or the deepest layers of ancient settlements. In addition to seismic surveys where the reflection of sound waves are measured to identify sub-surface features (usually applied in maritime archaeology), archaeologists also uses a range of airborne techniques such as multi-spectral photography and airborne thematic mapping. Another development in remote sensing was seen manifested in more recent initiatives such as LIDAR (Light Detection and Ranging; or Laser Imaging Detection and Ranging).

d.) GIS (Geographic Information System)

It has been proposed that rather than being classified as a 'tool', GIS might more accurately be labeled a sub-discipline in its own right, complete with its own competing methodologies and camps endorsing one approach over another in relation to the vast amount of functionality that GIS encompasses. There are at least, five categories of activity that GIS systems can address. They are;

- Data acquisition
- Spatial data management
- Database management
- Spatial data visualization
- Spatial data analysis

It is apparent that the aggregation of all of the above activities represents a significant proportion of the ICT related activities that archaeology is likely to provoke.

GIS is designed to allows users to describe some form of entity (situated in a landscape) in terms of its geospatial coordinates and to then make connections between that very explicit instance of data and any other information that might be pertinent to the description or analysis of that entity. This related information can take the form of text, images, statistics, graphs, multi-media; or anything that can be stored or referenced by a database. This enables GIS to act as both a visualization tool (displaying the database information spatially) and an analysis tool (displaying the spatial information quantitatively).

e.) CAD

Originally developed for architectural and engineering purposes, CAD (Computer-Aided Design) software is now used in a multitude of disciplines and integrates seamlessly with the archaeological data that may be acquired from a variety of sources including Total Station surveys and GPS (Global Positioning System) readings. CAD packages enable the user to create 2D and 3D vector-based drawings and work with a coordinate referencing system, x and y for position and z for height. Drawings can consist of layers of information which can be edited and manipulated either separately or together adding functionality to the pre-digital technique of pin-bar drafting.

f.) Virtual Reality Environment

Another field of interaction between archaeology and digital technology is the interesting world of virtual reality. It is the Virtual Reality techniques that shape a layman's understanding of the past as they tend to reconstruct the past realities in an artificially simulated environment. This side of archaeology is developing into one of the main and most important interfaces between archaeologists and the rest of the world – connecting archaeology into the mainstream world of multimedia and the internet, presenting information in ways that can easily grasp the imagination, attention and interest of the non-professional public.

g.) **Archaeology and Digital Publishing Tools**

The most significant impact of the digital revolution upon archaeology is in terms of dissemination of information. The digital revolution facilitated the speedy publishing and easy accessing of the entire volume of information of archaeological excavations conducted worldwide. The digital publishing tools used to publicize the findings of archaeological excavations may vary from simple power point presentations targeting a limited audience to resorting to Open Access Publishing mode. Today, archaeologist invariably uses audio and video devices and the social media platforms to make their presentations attractive and appealing. The incorporation of digital publishing tools in the field of archaeology has proved instrumental in assigning it the reputable status of a truly inclusive discipline, increasing the possibilities for people to present and access the past regardless of their relationships to it.

Quantification

Q**uantification** is the act of counting and measuring that maps human observations and experiences into members of some set of numbers. Quantification is the approximation of a subjective aspect (like attributes or characteristics) of a thing or phenomenon into numbers through an arbitrary scale. Every aspect of nature could be quantified, even though many of them are not measurable. Quantitative data is the data that can be quantified and verified, and is amenable to statistical manipulation. Quantitative data defines whereas qualitative data describes. Quantification in this sense is fundamental to the scientific method. In the social sciences, quantification is an integral part of economics and psychology. More recently, the technique of quantification is gaining popularity among historians too, owing to the fast changing perception of history as a discipline and the analyses of historical data had already acquired a special name, historiometry.

Quantitative history is the term for an array of skills and techniques used to apply the methods of statistical data analysis to the study of history. Sometimes also called cliometrics by economic historians, the term was popularized in the 1950s and 1960s as social, political and economic historians called for the development of a 'social history. They were attracted by certain methods or strategies of social sciences, and started applying them in the treatment of historical problems. These historians also called for social scientists to historicize their research and consciously examine the temporal nature of the social phenomena they explored. For both types of questions, historians found that they needed to develop new technical skills and data sources. That effort led to an array of activities to promote quantitative history.

Classical historical research methodology relies upon textual records, archival research and the narrative as a form of historical writing. The historian describes and explains particular phenomena and events, be they large epic analyses of the rise and fall of empires and nations, or the intimate biographical detail of an individual life. Quantitative history is animated by similar goals but takes as its subject the aggregate historical patterns of multiple

events or phenomena. Such a standpoint creates a different set of issues for analysis. A classic historical analysis, for example, may treat a general election as a single event. Quantitative historians consider a particular general election as one element in the universe of all general elections and are interested in patterns which characterize the universe or several units within it. The life-course patterns of one household or family may be conceived as one element in the aggregate patterns of family history for a nation, region, social class or ethnic group. Repeated phenomena from the past that leave written records, which read one at a time would be insignificant, are particularly useful if they can be aggregated, organized, converted to an electronic database and analyzed for statistical patterns. Thus records such as census schedules, vote tallies, vital (e.g., birth, death and marriage) records; or the ledgers of business sales, ship crossings, or slave sales; or crime reports permit the historian to retrieve the pattern of social, political, and economic activity in the past and reveal the aggregate context and structures of history. The standpoint of quantitative history also required a new set of skills and techniques for historians. Most importantly, they had to incorporate the concept of the data set and data matrix into their practice.

In short, to make effective use of quantitative evidence and statistical techniques for historical analysis, practitioners had to integrate the rapidly developing skills of the social sciences, including sampling, statistical data analysis and data archiving into their historical work. That task led to the development of new training programs in quantitative methods for historians, to the creation of new academic journals and textbooks, and to the creation of data archives to support the research.

EARLY EFFORTS

Historians had made use of quantitative evidence prior to the 1950s, particularly in the fields of economic and social history. The *Annales* School in France pointed the way in the pre-World War II period. The rapid growth and expansion of the United States had long required American historians to consider quantitative issues in their study of the growth of the American economy, population and mass democracy. Thus, for example, Frederick Jackson Turner's classic 1893 essay on 'The Significance of the Frontier in American History' was largely based on a reading and interpretation of the results of the 1890 population census. But true 'data analysis' in the current sense had to await the growth of the social and statistical sciences in the first half of the twentieth century, and the diffusion to universities in the 1950s of the capacity for machine tabulation of numerical records, and then of mainframe computing in the 1960s. One can see the emerging field exemplified in seminal studies in the late 1950s and early 1960s.In 1959, for example, Merle Curti and his colleagues at the University of Wisconsin published *The Making of an American Community: A Case Study of Democracy in a Frontier County*. This work explored Turner's thesis with an in depth look at the mid-nineteenth century history of Wisconsin, including its records of newspapers, diaries, private papers and county histories.

In 1984, Noboru Karashima has attempted a quantitative analysis of Vijayanagara inscriptions as part of the joint research project on "Socio –economic development in South India from the 13th century through the 18thcentury. This study was supported by the Institute for the Study of Languages and Cultures of Asia and Africa, Tokyo. It was conducted both in India and Japan under the aegis of the Mitsubishi Foundation and the Indian Council of Historical Research. The Indian part of the work was carried out by Y. Subbarayalu, and Dr. P. Shanmugham. The Vijayanagar Inscriptions in South India brought out by NoboruKarashima in 2002 is a remarkable example for computer assisted research in Indian history. Karashima used statistical tools to examine 568 Tamil Inscriptions, ranging from15th to 17th century, dealing with various grants, revenue transactions and irrigation works.

Data analysis

Data analysis is the process of evaluating datausing analytical and logical reasoning to examine each component of the data provided. This form of analysis is just one of the many steps that must be completed when conducting a researchexperiment. Data from various sources is gathered, reviewed and then analyzed to form some sort of finding or conclusion. There are a variety of specific data analysis method, some of which include data mining, text analytics, business intelligence, and data visualizations. Quantitative historians have borrowed heavily from sociology, political science, demography and economics, and made use of the classic linear regression model and its variants for more complex analysis. Statistical packages, such as SPSS, SAS, STATA and the like support the analysis of quantitative historical work, as they do for the social sciences. SPSS is the most popular software package used for data analysis. **SPSS** is the acronym of Statistical Package for the Social Science. It can perform highly complex data manipulation and analysis with simple instructions. It is designed for both interactive and non-interactive uses.

Attempts at Deciphering the Indus Script

The Indus script is an undeciphered script of the ancient world. In spite of numerous attempts over several decades, the script has defied universally acceptable decipherment. Although the attempts for deciphering the Indus script was started even before John Marshal's official declaration of the discovery of Harappan culture, the matter is still shrouded in mystery without any definite success in providing a generally acceptable pattern for its decipherment. Sir Alexander Cunningham who reported the first known Indus seal from Harappa in1875 had assumed that this unique find was a foreign import. A few years later he supposed that the seal might bear signs of the Brahmi script from its unknown early phase. After Cunningham, many scholars like G. R. Hunter, S. R. Rao have attempted the decipherment and concluded that the Harappan Script is the proto-type of the Brahmi script. Immediately after the discovery of the Indus Civilization became known in 1924, the British linguists A. H. Sayce, C. J. Gadd and Sidney Smith pointed to its resemblance to the Elamite

and Mesopotamian civilizations and compared the Indus signs with the pictograms of the Proto-Elamite and archaic Sumerian scripts. In 1974, the British scholar James Kinnier Wilson tried to revive th ehypothesis that the Indus language is related to Sumerian in his book *Indo-Sumerian*. Sir John Marshall thought that the language of the Indus script most likely belonged to the Dravidian family, which is still represented in the Indus Valley and Baluchistan by the Brahui language.

All the scholars worked on the subject came forward with their own hypothesis regarding language affinity and certain schemes for its decipherment. But, none of them were able to provide a digestible key for its decipherment. However, the most serious attempts towards the decipherment of Indus script were started outside India in 1964. The two teams of computer-assisted scholars started working on the Indus script independently of each other, one in Russia, and other one in Finland. What makes these two attempts really remarkable is the fact that both these methods were carried out in a quantitative or statistical way by using computer technology. Both teams came to the conclusion that the language was Dravidian. The Russian team was led by Yurij Knorozov, who initiated the decipherment of the Mayan script, and included a Dravidian specialist, Nikita Gurov. The Russians initially proposed only few interpretations, but in their final report from 1979, meanings are assigned to all the Indus signs. Their use of the computer seems to be limited to a comparison of samples of the Indus and Egyptian scripts. The Russians never published a text corpus or any computer analysis of Indus sign sequences.

The Finnish team is consisting of AskoParpola, his brother SimoParpola and SeppoKoskenniemi, the computer specialist. They were inspired by the decipherment of the Mycenaean script without the help of bilinguals in the 1950s. They started by preparing a machine readable text corpus, and published an automated method to classify characters of unknown ancient scripts in 1970 and the first computer concordance of the Indus texts in 1973. There is no doubt that the most important publication in this field in recent years is the magnificent *Corpus of Indus Seals and Inscriptions* (Vol. I: 1987. Vol. II: 1991) by AskoParpola and others. These superbly printed volumes illustrate the Indus seals and other inscribed objects in the collections in India and Pakistan. A noteworthy feature is that each seal is reproduced in the original as well as from the impression. The non-availability of the original publications and the inherent limitations of the hand-drawn or computer-made concordances need no longer stand in the way of would-be decipherers from looking at the inscriptions as they are. The world of Indus scholarship is deeply indebted to AskoParpola and his co-editors for this landmark publication.onin Indus script was rendered by Tamil Scholar IravathamMahadevan. Mahadevan, who has done remarkable work in the field of Old Tamil epigraphy, started working on the Indus material in Indian museums in 1971.In 1977, Mahadevan brought out his very useful computer-corpus and concordance with the assistance of KimmoKoskenniemi. Then Mahadevan went on to publish several papers proposing Dravidian readings for Indus signs. Then, he initiated the project of publishing a

comprehensive photographic *Corpus of Indus Seals and Inscriptions* in international collaboration under the auspices of the UNESCO.

Digitizing Archives

The word 'archives' is derived from Greek word '*archion*' which means a place in which public records are kept. The same word is also used to denote 'a historical record or document so preserved'. When we go back to trace the antiquity of archives, we can trace back the history of archival institutions to the great civilizations. According to the historians, it was the Sumerian people who developed a system of maintaining the records. In the modern world, the system of archival keeping was originated in post-revolutionary France. In India, the system was initiated by the British, though its roots may be traced back to the times of Harshavardhana and imperial Cholas. The rich corpus of records or documents kept in an archival repository is of extremely significant because of its historical, administrative and cultural value. To a professional historian, it constitutes the most vital primary source material for reconstructing the past. In ancient periods all the official documents are written in materials such as palm leafs, papyrus and parchments. Later, paper became the commonly accepted medium for recording. All these organic materials used for writing would always have a natural tendency to perish or decay. It is because of this decaying tendency that archival repositories give too much importance to the process of preservation of records. It is only through employing proper scientific methods of preservation, the longevity of these documents could be increased. So, scientific method of preservation enjoys a prominent place in archival system. One of the most widely accepted procedure for preservation is the reprographic technique which is the art and science of taking copies out of the original, either by digital or mechanical means. In the beginning, converting the documents into microfilms is the commonly accepted means of preservation. With, the ongoing digital revolution, digitizing became extremely popular in archival circles as the more effective and affordable way of preserving archival documents as it offers the added advantage of expanding access of such digitized materials.

We live in an increasingly digital world. Hundreds of libraries, museums and archives have recently launched projects designed to digitize their collections and place them on the web. The potential of digital projects to present information in new and important ways seems limitless. Digitization is the process of transferring records or information into electronic form. Digitization converts materials from formats that can be read by people (analog) to a format that can be read only by machines (digital). Tools and techniques of I.T enable the conversion of records stored in paper or other conventional media to electronic or machine-readable form. Flatbed scanning, digital cameras, planetary cameras, and a number of other devices can be used to digitize archival materials. Digitization would lead to storing and viewing the information electronically, saving space and increasing accessibility. New scanning and imaging technologies makes the reproduction of exact images of traditional

records and archives a comparatively easy affair. There are many types of scanners and equipment for viewing and reproducing scanned images. Digitization is an increasingly popular activity in archival institutions in many countries. National Archives of India, United Kingdom and USA have achieved greater success in their digitization projects.

Advantages of digitization

Digital imaging projects offer unique advantages. The main advantages of digitizing are enhanced access and improved preservation. By digitizing their collections, archives can make information accessible from anywhere at any time that was previously only available to a select group of researchers. Digital projects allow users to search collections rapidly and comprehensively from anywhere at any time. Image quality can be quite good, and is often enhanced, with continuously improving capabilities. There is an added advantage with the possibility of full-text searching, cross-collection indexing and newly designed user interfaces that allow for new uses of the material and content. Flexibility of the digital material is another advantage. Since the data is not "fixed", as with paper or printed text, it is easy to reformat, edit and print.

Another advantage of creating digital archives is that it helps the preservation of documents. This is done in two ways. Firstly, the digital media is comparatively less vulnerable to decay or it is durable than those recorded in paper. Secondly, the use of the digital substitute reduces handling of original material which may be old or fragile, hopefully extending its longevity.

Disadvantages of digitization

A major disadvantage of digitizing process is its extremely higher financial costs. Required staff expertise and additional resources are often the greatest costs in digitization projects. The digitization projects not only needs large budget allocations but also a considerably longer time span. Further, digital conversion projects would always require an added workload. These requirements pull staff away from their regular workloads. Costs for digitization continue even after a project's conclusion, as all digital files require maintenance to ensure that they will readable in the future.

Digital conversion is not yet a form of preservation that is proved absolutely successful. Certain digital storage devices may be affected with fungi and online archives may become targets of cyber attacks. Moreover, in the rapidly changing technological environment, there may be future incompatibility of many of these digital storage devices. Hence, it is generally said that the only accepted long-term preservation media are durable acid-free paper or preservation in the form of microfilm.

Another disadvantage of creating digital archives is that users are completely reliant on computers and stable Internet connections to view and retrieve the digital information. Depending on users' hardware and software capabilities access may be frustrating because of the large variety of computer models, platforms, software, and hardware around the world.

Virtual Tour to Historical Sites

The term **virtual** is used to denote something that is not real. The term is popular among computer scientists and is used in a wide variety of situations. **Virtual reality** is a computer generated artificial environment. It is presented to the user in such a way that it appears and feels like a real environment. To "enter" a virtual reality, a user dons special gloves, earphones, and goggles, all of which receive their input from the computer system. Recently, virtual reality techniques are seen widely used in educational sector. There are two ways of using virtual reality in the classroom. The first one is involving a traditional desktop setup in which the student explores a virtual environment using the computer, keyboard and mouse. The second set up is fully immersive and requires the student to wear a head mounted display (HMD) and data glove – for interaction – within a virtual environment. This environment may take the form of a series of large screens or a complete CAVE virtual reality system. Through the Virtual Reality Modeling Language (VRML), teachers and students can have a direct access to 3D learning environments. VRML gives teachers the opportunity to enhance their students' knowledge, while simulated spaces can help students visualize information in new and realistic ways, give abstract concepts a realistic flavour and encourage cross-cultural, global communities.

The most popular way of applying virtual learning environment in teaching and learning history is by conducting virtual tours to sites of historical significance such as ancient caves or historical monuments. A **virtual tour** is a simulation of an existing location, usually composed of a sequence of videos or still images. It may also use other multimedia elements such as sound effects, music, narration, and text. The phrase "virtual tour" is often used to describe a variety of videos and photographic-based media. In virtual tour, still and moving pictures are presented to offer a panoramic view. The term panorama indicates an unbroken or sequential view designed to unfurl different phases of a single story or aspect. A panorama can be either a series of photographs or panning video footage. However, the phrases "panoramic tour" and "virtual tour" have mostly been associated with virtual tours created using still cameras. Such virtual tours are made up of a number of shots taken from a single vantage point.

The origin of the term 'virtual tour' dates to 1994. The first example of a virtual tour was a museum visitor interpretive tour, consisting of 'walk-through' of a 3D reconstruction of Dudley Castle in England as it was in 1550. This consisted of a computer controlled laserdisc

based system designed by British-based engineer Colin Johnson. Virtual tours are usually presented in 3D mode allowing the user to move easily between different rooms or places and obtain an overall picture of the location. Hotspots guide the visitor through the doors into other rooms, down different streets or around the corners. Furthermore, virtual reality panoramas will let you navigate in a 360 degree circle, viewing everything that is visible from one spot. Interactive video virtual tour offers a virtual representation of some location, which allows audience to be fully immersed into presented environment. Virtual Tours can be staged both online and offline.

Virtual Tour to Spanish Caves

Virtual Reality tours are widely seen adapted in different nations of Europe like Spain and France. In both the countries, the technique is largely used to organize virtual tours to ancient caves that houses rich and vivid collections of palaeolithic cave paintings. Nearly 340 caves have now been discovered in France and Spain that contain art from prehistoric times. The reindeer depicted in the Spanish cave of Cueva de Las Monedas; attributed to the last Ice Age provides some clue as regards the antiquity of these caves. Many of these caves attract thousands of visitors every year because of its historical significance as well as artistic elegance. This overcrowding of people, always invites certain alarming worries and concern over the safety and conservation of such sites. This phenomenon could well be illustrated by the story of the palaeolithic cave at Lascaux in France. The cave was discovered accidentally in 1940, while, four boys were playing in a nearby meadow. When their dog fell into a hole in the ground, the boys climbed down the hole to rescue and what they found inside was a rich array of prehistoric cave paintings! Over the years, many people visited the cave and the carbon dioxide from their breath began to destroy the paintings. As a result, the caves were closed to visitors in 1963.Very soon many of such caves in France and Spain were closed down citing the security risks and damage vulnerabilities involved. But, the closing down could not be accepted as an ideal solution for the problem, as in effect, it is the shutting down of the gates of rich treasures of human knowledge. It is totally unwise to shut down the gates of such historical monuments when viewed from the perspective of those who are interested in it either because of historical or aesthetic reasons. In this situation, virtual reality tours are generally began to be viewed as an ideal substitute for accessing such places of historical significance without compromising the need for preservation and conservation. So, most of these prehistoric caves are now accessible on virtual reality mode. Virtual tours provide an ideal opportunity to have a clear inside vision of such caves without having any form of physical contact so as to avoid any sort of worries regarding the possibilities of damaging the site. Some of the virtual tours are onsite and some others are offsite. There is also a third category of online virtual tours which is accessible through a website specifically designed for the purpose. The second and third categories (off-site and online) have an added

advantage of providing easy access to prehistoric sites situated at remote locations, without bothering the constraints of time, space and money.

Spain that houses a large number of prehistoric caves is greatly successful in transferring virtual tours as an ideal alternative to physical tours. The most famous Spanish caves are**:**

- Ardales cave in southern Spain famous for Paleolithic paintings
- Cuevas DelDrach, on Majorca, containing one of the largest subterranean lakes in the world.
- Cave of Altamira, in Cantabria, northern Spain famous for its Upper Paleolithic paintings.

Virtual Tour to Ardales cave in Spain

One of the famous sites of virtual tour in Spain is in Ardales. Ardales cave in southern Spain is well known for a series of Paleolithic paintings and engravings it houses. It was always been a major attraction of tourists causing serious reservations as regards to its safety and conservation. To conserve and promote this rich treasure of antique knowledge, the local government there in developed a Virtual Tour operating from nearby Interpretation Centre outside the cave.

The virtual visit developed by Virtual-ware displays the three-dimensional environment of the cave which is shown on a projection system in the Interpretation Centre. The guides who are in charge of the projections can stop the visit at any of the virtual information points found throughout the cave to find out more about the engravings and paintings dating from the Upper Paleolithic age. To carry out this project, it was necessary to perform a laser scan of the entire cave. The resulting data was used to model the more complex geometrical elements of the cave in a 3D environment. Along with the laser scanning, more than 300 digital high resolution photographs were used to assist in developing the virtual surface, giving the resulting model a highly realistic result. To add another element of interactivity to the installation, visitors can also navigate through the virtual cave themselves on large screens using videogame controllers.

The 3D Virtual Tour of the Ardales cave became a clear example of how technology could be used for the conservation and diffusion of the archaeological heritage of the region. Visitors of all ages can enjoy a safe virtual journey through the cave and learn a great deal about this unique geological and archaeological treasure through the engaging installation.

Google Earth and Google Maps

These are two technologies powered by Google. Both of them provide almost the same features but in different ways. While Google Maps is available through the window of your browser, Google Earth is a downloadable application which can be installed on your

computer in order to view the satellite imagery straight from your desktop. However, the super giant Google updates the two products every once in a while so they have almost the same functions. Anyway, is there any difference between the two products? Google says yes because Google Earth can provide better photos bundled with improved functionality.

While both Google Earth and Google Maps use satellite imagery to share geographical information, such as the location of a building or driving directions, Google Earth provides a more powerful, interactive user experience and offers more tools for learning about a location. The Google Earth experience is one of fast, fluid flight -- zooming and rotating and tilting imagery to view the geographic data you're interested in. You can wind along hairpin turns, view buildings in 3D, and fly to your favorite shopping destinations.

Google Earth also allows you to easily measure distances and areas, draw lines and shapes, and even import your own data. However, both applications received quite revolutionary functions that lured a considerable number of consumers. While Google Maps received Street View, the innovative feature which shows street-level panoramas Google Earth was updated with Flight Simulator and Sky, two abilities which provide a different perspective over the satellite imagery included in the downloadable tool.

JSTORE

JSTOR is the short form for Journal Storage. It is a digital library founded by William G. Bowen in 1995. Originally containing digitized back issues of academic journals, it now also includes books and primary sources, and current issues of journals. It provides full text searches of almost 2,000 journals. More than 8,000 institutions in more than 160 countries have access to JSTOR. Most of the journals are available on subscription basis. But, some older public domain content is freely available to anyone. JSTOR is a service of ITHAKA (ithaka.org), a not-for-profit organization that helps the academic community use digital technologies to preserve the scholarly record and to advance research and teaching in sustainable ways.

By digitizing many journal titles, JSTOR allowed libraries to outsource the storage of journals with the confidence that they would remain available long-term. Journals, books, and pamphlets on JSTOR are all full-text. All the materials on JSTOR are scholarly and academic. Almost all journals are peer-reviewed. However, some journal issues pre-date today's standard peer-review process, and some are literary/ primary materials – these would not have gone through a peer review process.

Online access and full-text search ability improved access dramatically. In addition to the main site, the JSTOR labs group operates an open service that allows access to the contents of the archives for the purposes of data analysis at its *Data for Research* service. This site offers a search facility with graphical indication of the article coverage and loose integration into the main JSTOR site. JSTOR Plant Science which is available in addition to

the main site provides access to content such as plant type specimens, taxonomic structures, scientific literature, and related materials and aimed at those researching, teaching, or studying botany, biology, ecology, environmental, and conservation studies. JSTOR launched its Books at JSTOR program in November 2012, adding 15,000 current and backlist books to its site. The books are linked with reviews and from citations in journal articles.

Archaeological Survey of India (ASI)

Archaeological Survey of India functioning under the Ministry of Culture, Government of India is the premier organization for the archaeological researches and protection of the cultural heritage of the nation. Maintenance of ancient monuments and archaeological sites and remains of national importance is the prime concern of the ASI. Besides, it regulates all archaeological activities in the country as per the provisions of the Ancient Monuments and Archaeological Sites and Remains Act, 1958. It also regulates Antiquities and Art Treasure Act, 1972.

The Archaeological Survey of India (ASI) is headed by the Director General. The major activities of the Archaeological Survey of India are:

a) Survey of archaeological remains and excavations;
b) Maintenance and conservation of centrally protected monuments, sites and remains and improvements of their surroundings through horticultural operations;
c) Chemical preservation of monuments and antiquarian remains;
d) Architectural survey of monuments;
e) Development of epigraphical research and numismatic studies;
f) Setting up and re-organization of site museums;
g) Expedition abroad;
h) Training in Archaeology;
i) Publication of technical report and research works.

ASI was established in the year 1861 during the viceroyalty of Lord Canning, with the appointment of Alexander Cunningham, a Second Lieutenant of the Bengal Engineers as the first Archaeological Surveyor of India from December 1861. Later, Cunningham came to be known as the father of Indian Archaeology. However, archaeological and historical pursuits in India started much before Cunningham with the efforts of Sir William Jones, who put together a group of antiquarians to form the Asiatic Society on 15th January 1784 in Calcutta. Other individuals who contributed enormously for the cause of Indian Archaeology, included James Fergusson, Markham Kittoe, Edward Thomas and Sir John Marshal.

The Archaeological Survey was revived as a distinct department of the government and Cunningham was appointed as Director General who assumed his charge in February 1871. The department was entrusted with the task of doing - 'a complete search over the

whole country, and a systematic record and description of all architectural and other remains that are either remarkable for their antiquity, or their beauty or their historical interest'. Cunningham was also entrusted 'to direct his attention to the preparation of a brief summary of the labours of former enquirers and of the results which had already been obtained and to the formulation of a general scheme of systematic enquiry for the guidance of a staff of assistance in present and future researches'.

The surveys of Cunningham led to several discoveries such as monolithic capitals and other remains of Asoka, specimens of architecture of Gupta and post-Gupta period; great stupa of Bharhut; identification of ancient cities namely: Sankisa, Sravasti and Kausambi. He also brought to prominence the Gupta temples at Tigawa, Bilsar, Bhitargaon, Kuthra, Deogarh and Guptain scription sat Eran, Udayagirietc. However, the most significant achievement of ASI so far is the discovery of Harappan culture during the early decades of the preceding century. The founding of the journal Indian Antiquary in 1872 by James Burgess enabled publication of important inscriptions and their decipherment by scholars like Buhler and Fleet, Eggeling and Rice, Bhandarkar and Indraji. Cunningham also brought a new volume known as *Corpus Inscriptionum Indicarum* which was aimed at publishing inscriptions of connected epigraphical material in a compact and handy volume.

To ensure the maintenance of ancient monuments, archaeological sites and the remains of national importance the entire country is divided into 24 Circles under ASI. The organization has a large work force of trained archaeologists, conservators, epigraphist, architects and scientists for conducting archaeological research projects through its Circles, Museums, Excavation Branches, Prehistory Branch, Epigraphy Branches, Science Branch, Horticulture Branch, Building Survey Project, Temple Survey Projects and Underwater Archaeology Wing.

A remarkable achievement of ASI is its exceptionally designed website that stands as an excellent example for academic website. Anyone can access this site by simply googling the web address www.asi.nic.in. The website provides a comprehensive account of all the archaeological excavations conducted by ASI with the assistance of maps, pictures and charts. The vast array of useful information available in the site is categorized in different links such as monuments, excavations, museums, publications etc each leading to different sub links. The website also provides for the online booking of gate passes to visit historical monuments like Tajmahal. Another, major feature is the online digital library providing anytime and anywhere access to a large number of scanned in versions of rich collections of primary and secondary sources of history ranging from manuscripts to inscriptions.

Kerala Council for Historical Research [KCHR]

Kerala Council for Historical Research [KCHR] is an autonomous institution committed to scientific research in history and social sciences. Funded by the Ministry of Higher Education, Government of Kerala, KCHR is a recognized research centre of the University of Kerala. KCHR is located at Thiruvananthapuram, in the multi-purpose cultural complex VyloppillySamskrithiBhavan, at Nalanda. It is housed in the blocks dedicated to the inspiring memory of the two pioneering researchers of Kerala history, K.P. Padmanabha Menon and Elamkulam KunjanPillai.

KCHR offers doctoral, post-doctoral and internship programmes and short term courses in social theory, research methods, epigraphy, palaeography and numismatics. Research, publication, documentation, training and co-ordination are the other major activities carried out by Kerala Council for Historical Research. KCHR has a well-equipped library and research resource centre with a fairly large collection of books on Kerala history and society. KCHR publications include twenty-seven volumes on Kerala society that is widely acclaimed as works of vital research significance. The multi-disciplinary and multi-seasonal archaeological research at Pattanam near north Paravur in Ernakulam district undertakenfrom2007 by the Kerala Council for Historical Research is a pioneering initiative in the history of Kerala Archaeology.

Another major project of KCHR is the 'Digitizing Kerala's Past'. It is an inter-disciplinary initiative to survey, store and study the historical, cultural and intellectual legacies of the people of Kerala. The 'Digitizing Kerala's past' project envisages the collection and creation of a digital repository of various sources related to archaeology, anthropology and history, lying scattered across the state and outside it as texts, images, monuments, artifacts, oral traditions, myths, experiences and memories.

KCHR has a three tier organizational set up with a Patrons Council, Advisory Council and Executive Council. The Chairman of KCHR is Prof. K.N.Panikkar, a renowned historian of modern Kerala. The Director is Prof. P.J. Cherian, former State Editor, Gazetteers Department. The Patrons Council headed by Governor of Kerala [Chief Patron] is consisting of Chief Minister, Minister of Cultural Affairs, Speaker, Kerala Legislative Assembly, leader of Opposition, Kerala Legislative Assembly and Chief Secretary, Government of Kerala. The Executive Council of KCHR has nine distinguished social scientists along with the Principal Secretaries of the Departments of Culture and Finance, Government of Kerala and the Directors of the State Archaeology and Archives Departments. It also includes the chairman and the director of the council.

Aims and Objectives of KCHR

- To form a forum of professional historians to promote research and exchange of ideas on history;
- To create a comprehensive worldwide database of research on Kerala History;
- To publish source materials and studies to further historical research;
- To set up a library and resource centre with the latest facilities;
- To identify important research areas and initiate and encourage research in those areas;
- To organize and sponsor seminars, workshops and conferences for the promotion and dissemination of historical knowledge;
- To institute and administer fellowships, scholarships and sponsorships on historical research;
- To provide professional advice and direction for the proper conservation of archival materials and archaeological artifacts as a nodal agency of the State Archives Department and the Archaeology Department;
- To facilitate exchange programmes for teachers and scholars of history to provide exposure to advanced scholarly practices;
- To attempt to historicise areas like science, technology, industry, music, media etc. conventionally held to be beyond the range of historical analysis;
- To assist and aid the Education Department in restructuring history curricula and syllabi, so as to impart the critical component in teaching and learning practices;
- To restore local history to its rightful position and help set up local museums and archives;
- To develop popular and non-reductive modes of historical writing;
- To undertake the publication of a research journal on Kerala History;
- To optimally utilize the electronic media and information technology in the dissemination of historical knowledge worldwide;
- To undertake projects entrusted by the Government.

www.Keralahistory.ac.in is the official website of KCHR. It could be treated as a good example for academic website. The website provides an overview of major projects and initiative of KCHR. It also accommodates a rich collection of digital resources for historical studies in different forms such as archives and research articles. The website contains links to certain highly useful digital resources of archival sources like local history archive and family history archive. The website also hosts user friendly online platform for publishing articles and uploading manuscripts. There is also an online discussion group under the title, KCHR Friends Forum. The KCHR website is updated regularly so as to incorporate the latest findings at Pattanam excavation, one of its major project.