

# **LIBRARY AUTOMATION AND NETWORKING**

## **Elective**

### **Paper Code:**

### **Title of the Paper: Library Automation and Networking**

#### **Unit-1: Library Automation:**

Definition - need - purpose and advantages of Library Automation - Automation Vs Mechanization - Areas of Automation - Acquisition, Cataloguing, Access to Catalogue (OPAC), Circulation and Serial Control.

#### **Unit-2: Planning for Automation Procedure:**

Steps in Automation: Developing a basic Technology Plan - Identifying goals and objectives - Describing existing library services and technology - Feasibility Study - Assessing needs and priorities - Preparing strategic Plan - Hardware and Software selection and Implementation. Barcode Technology: Meaning, need, purpose and advantages. Types of barcodes: Dumb / Generic barcode and smart barcode – their application. RFID (Radio Frequency Identification)

#### **Unit-3: Networking and Networks:**

Networking: Concept need and advantages - Basic components of network - Network Topologies – Star, Ring, Bus, Hierarchical, Tree and Complete - Wireless Networking. Types of Networks – LAN, MAN, WAN. Networks: General and Bibliographic - General ERNET – NICNET - INFONET. Library Networks: OCLC, INFLIBNET, DELNET: Their objectives, Functions, Services and Activities.

#### **Unit-4: Internet: Concept, Features, Services.**

Search Engines – Concept. Types – Search Engines and Meta Search Engines, Advantages in using Search Engines. Internet: Internet Searching. Web Browsers – Purpose, Functions - facilities available with different Browsers. Sample Search by using Internet Explorer and Netscape. Internet Security Internet Reference Sources: Identification, accessing, various sources useful for librarians in providing Reference Services with examples - Evaluation of Internet Information Sources – Need, Methods / Techniques. Protocols: Definition, Concept. Types – General - TCP / IP, OSI. Other Protocols: SMTP, Telnet, FTP, HTTP, Z39.50.

## **Unit-5: Hypertext, Hyper media.**

Markup Languages – HTML, XML – Features. Web: Concept, Usefulness - Content Development / Content Creation for Web. Web Design – Methods

### **References:**

C. Xavier, World Wide Web Design with HTML, New Delhi: TMH, 2014.

Dilip C. Naik, Internet Standards and Protocols, New Delhi: PHI, 2015.

G.G. Chowdhury and Sudatta Chowdhury. Information Sources and Searching on the World Wide Web, London: Facet Publishing, 2016.

Jesus Tramullas and Piedad Garrido (2015). Library Automation and OPAC 2.0: Information Access and Services in the 2.0 Landscape

Lakshmikant Mishra (2018) Automation and Networking of Libraries: A Manual of Library Management Software and Applications of Computer Technology in Libraries

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# **UNIT 1**

## **INTRODUCTION**

Library Automation refers to the use of computers to serve the need of library users. The operations of a library get a quantum jump with the introductions of computers. The computers help to provide fast and reliable access to the resources available in the library as well as elsewhere. The application of computers in the library operations avoids repetitive jobs and saves lot of labor, time, speeds up operations, increases use of library resources. Computers are not only used as a tool for processing the data, but also for data storage and accessing, planning for an automated system, no matter how big or small, should be part of an overall long-range plan for the library. Automation should always be used as a means to achieve overall better patron service. Careful planning for technology will assure that your automation project is “sustainable”, i.e., enhances the organization’s ability to meet its service mission without disrupting the organizational stability of the institution.

## **HISTORY AND DEVELOPMENT OF LIBRARY AUTOMATION**

A process of great change has been taking place today in libraries due the impact of information technology and application of computers in library work. We hear a lot about library automation in libraries and library automation is nothing but the application of machines viz. computers to the routine library housekeeping operations such as acquisition, serial control cataloguing and circulation.

The effects of ICT on libraries and information centers are characterized by:

- Mechanization – doing what we are already doing more efficiently.
- Innovation – experimenting with new capabilities that the ICT makes possible.
- Transformation – fundamentally altering the nature of the library operations and services through the capabilities extended by ICT.

It could be said that library automation began in 1930's when punched card equipment was implemented for use in library circulation and acquisition. The computer technology first arrived in libraries in the late 1960s in the form of locally developed software or commercial packages intended to automate library processes. The whole phase of library automation development i.e., 1960 to date may be grouped into four distinct eras:

### **First Era**

This era is characterized by computerization of library operations by utilizing either commercial automation package or software developed in the house. The development of shared copy-cataloguing system is another significant achievement of this phase that utilized computer and communication technologies for collaboration and cooperation within the library community.

### **Second Era**

This period of library automation is characterized by the rise of public access i.e., the arrival of OPAC as a replacement for the traditional card catalogue. This period also saw major developments in online access to abstracting and indexing databases, union catalogues, resource sharing networks and library consortia.

### **Third Era**

This era is characterized by the full text access to electronic documents over high-speed communication channels. The advent of Internet as global publishing platform and largest repository of information bearing objects revolutionized the ways and means of delivering library services.

### **Fourth Era**

It is known as 'network information revolution' era. This era supports a vast variety of digital contents and services that are accessible through the network at any time, from any place, can be used and reused, navigated, integrated and tailored to the needs and objectives of each user. Digital libraries, multimedia databases and virtual libraries are major achievements in the present era.

The above discussion clearly indicates that in the first era of automation, libraries were largely stand-alone; in the second era, they became reliant on campus networking strategies; in the third era, the

libraries were critically dependent on both LAN and WAN for patron access to library services. In the fourth era, libraries are not only offering their own network-based services but also becoming increasingly involved in the management and organization of external activities on the network. As a direct result of these developments, LMSs also changed considerably through four different generations.

## **DEFINITION OF LIBRARY AUTOMATION**

Modernization of library housekeeping operations mainly by computerization is known as 'Library Automation'. The term 'Library Automation' in the past was used to refer to the mechanization of the traditional library operations like acquisition, serial control, and cataloguing and circulation control. Today it is used to refer computerization of not only traditional library activities but also such related activities as information organization, information storage, retrieval, use, etc.

Although computers play very important role in the automation of libraries, application of telecommunication and reprography technology is also equally important.

International Encyclopedia of Information Technology and library science defines automation as 'the technology concerned with the design and development of process and system that minimize the necessity of human invention in their operation'.

- Library automation is use of machines in a library for various activities.
- Collection: Compact Shelving, Electronic Mapping, Conveyor Belt System, Book Lift.
- Security: Close Circuit Camera Device, Electronic Security Gate.
- Users: Photocopier, Internet, Smart Card Library Ticket, Barcode Library Card.
- Library Procedures: Computer Systems, CD Station Systems, LAN.
- Environment: Power Backup, Air Conditioning, Facilities.
- E-Resources: Book Eye Machine for Digitization, Microfilm Reader and Printer, Online E-References and DBs Access.
- Multimedia Corner: Television, Audio System, Digital Audio and Video System.

## **NEED FOR LIBRARY AUTOMATION**

The computer was invented because it was needed and it will remain, as it is needed. Its use in the library is the need of the day and its application will certainly increase the use and utility of libraries.

The need for library automation can be explained under following two headings:

- Productivity
- Accessibility

### **PRODUCTIVITY**

Automation saves the effort, time and resource involved in the manual operation of libraries. In an automated system the information can be altered and updated without the repetition involved in the manual system.

### **ACCESSIBILITY**

- ❖ To facilitate wider and deeper access to information.
- ❖ To increase the retrievability of the resources.
- ❖ To achieve a new level of library management.
- ❖ To improve the existing services and to introduce new services.
- ❖ To improve control over collection.
- ❖ To have an efficient control over the entire operation.
- ❖ To avoid the duplication of work.
- ❖ To facilitate sharing of the resources among various libraries.

Some of the factors that force the libraries to go for automating the activities are:

- ❖ Information Explosion.
- ❖ Space Saving
- ❖ Time Saving
- ❖ Availability of information in electronic form.
- ❖ Cost effectiveness.
- ❖ Data manipulation.
- ❖ Exploitation of computer readable databases.

Thus, the application of information technology and computers can exploit the computer-based database services and Internet resources.

## **PURPOSE OF LIBRARY AUTOMATION:**

The purpose of library automation can be explained in three steps:

1. Library Housing-Keeping Operation.
2. Extension Services In Library.
3. Library Automation Performances In The Context Of Internet

### **1) LIBRARY HOUSE KEEPING OPERATION**

Typical library automation helps in acquisition system as follows:

- Pre-order searching to avoid duplication.
- Creating purchase order.
  - i. Request for invoice, if necessary.
  - ii. Sending order letter.
- Receiving materials.
  - i. Complication of accession list.
  - ii. Announcement of latest documents received.
  - iii. Complication of cataloguing.
- Claims (for damaged materials) and/or cancellation notice.
- Providing information to the management on orders outstanding and sometimes on work in progress i.e., books received but not yet catalogued.
- Maintaining book fund accounts and printing book funds reports.

### **2) EXTENSION SERVICES IN LIBRARY**

Other functions of the library automation software include:

- Storage and retrieval of information regarding books, periodicals and other materials.
- Abstracting Service.
- Indexing Service.
- SDI Service.
- Preparation of Union Catalogue.
- Online Public Access Catalogue (OPAC), with search facility by author, title, publisher, subject, keyword, accession number, ISBN/ISSN, etc.
- Search browse, edit, review, delete and printing of data from database.
- Preparation of mailing list.
- Report generation in different forms, including statistical reports.
- Keeping track of stock verification.
- Exporting and importing of data.
- Bar code generation, etc.

### **3) LIBRARY AUTOMATION PERFORMANCES IN THE CONTEXT OF INTERNET**

Apart from the general functions mentioned above, the library automation also functions to incorporate the recent advances in the information technology. Some of the features are as follows:

- Access to Internet through OPAC.
- Cataloguing of Internet Website.
- Cataloguing of electronic documents like word processing file, spread sheets, databases, etc.
- Multimedia facility.
- Online ordering of documents through Internet.
- Booking of resources for specific time/period.
- Library map indication the current position of the document in the library.
- Facility for self-circulation by user.
- Presence of book wizard showing the picture of the cover, review and relative information about documents.
- Visual information or graphic information retrieval.

Hence, Library Automation has become a necessity in today's environment to perform the library activities more efficiently, effectively and quickly.

## **ADVANTAGES OF LIBRARY AUTOMATION**

Many activities of a library are routine in nature, a few are repetitive. Automation of these activities helps in managing the library's resources in a better way at the same time saving time, money and manpower. For example, once the bibliographic details like author, title, edition, publisher, price, ISBN number, etc are entered at the time of ordering, the same data can be used for accessing, cataloguing (OPAC), and circulation. Other important factors associated with automation are speed, and accuracy. One can imagine the time saved in literature researches and in preparing bibliographies. Automation also offers freedom from doing repetitive and routine works as well as enables providing efficient services properly and more efficiently cutting down time and improving productivity. Automation also facilitates generation of a number of reports for better decision making in the effective management of the library. Availability of various statistical and other usage reports and performance reports will ensure better appreciation from library users. For example, vendor performance analysis is possible. Subject-wise or project department-wise budget can be monitored. Circulation data can provide information on titles that are in great demand so that more copies can be procured if needed. Many current awareness services like current additions, contents of books and journals, etc can also be provided to users.

## **DISADVANTAGES OF LIBRARY AUTOMATION**

Disadvantages of Library Automation are as follows:

- **Employee Cut-Backs:**

With the new automation systems in public libraries, there is less funding left in the budget for employees. Also, fewer employees are needed. The automation system does the work of human employees by scanning books and more. You can check books out by yourself by simply swiping your library card and then scan your book across the book pad. Users can be taught to handle terminals and systems, but it is harder and harder to find people, especially out on the floor of public libraries, of whom you can ask your perhaps not-fully-formed question or make a general inquiry

- **Library Closings & Hour Shortages:**

Many libraries are closing their doors because of economic pressures. Library doors are either closing permanently or they are closing earlier or opening later. Partly due to the new automation system, funding can no longer be afforded to keep them all up and running. Library closings mean less library access for all patrons. Library closings mean job closings, less children's story hours, book club closings and cancelled after-school reading clubs to help keep kids off of the streets. It seems that each week brings news of libraries forced to close branches, reduce hours. Libraries without automation are simply less expensive to run. Government grants cannot cover all of the branches with rising technology costs and smaller libraries cannot always afford to pay for the automation costs on their own.

- **Book Budgets:**

A higher budget percentage being spent on automated library systems means less money is being spent on books. With bookshelves shrinking, it is less likely to find what you need during your next visit to the library. Library books have a shelf life and sometimes are only kept according to the number of times they are checked out. If academic libraries continue to cut back on their purchase of specialized scholarly books, if they begin to define worth or value in terms of the number of times someone has sought access to it one could imagine a day when every university would have its own "press." The new technology is radically changing the environment in which scholars do their work. The great danger is we will end with a system of scholarly communication which will be technically viable, but not intellectually desirable.

- **Rising Building and Maintenance Costs:**

When automated systems are added into a library, Find Articles.com states that added power consumption and the changes in heating and air conditioning needs are seldom planned for when automated systems are installed. The noise and heat of the machines combined with the noise and heat of body heat from extra people, cost more than what the library had been previously paying for the building's maintenance and power costs.



## CHALLENGES IN LIBRARY AUTOMATION

There is the challenge of optimally utilizing small fund allocation to address wide segments of the automation areas. The committee handling the project had to accommodate areas not budgeted for and yet not compromising quality job delivery. Library automation is a great enhancement for your library, but it comes with plenty of headaches. It is a time-consuming process. Libraries may struggle to have the proper technology for the automation. Staff and patrons may need a lot of training to properly operate the new system. Once the automation is completed, users will recognize many benefits.

### ❖ **Time:**

Library automation takes time. Before the automation takes place, libraries should take time to assess these elements: budget, demographics of the patrons, library environment, collection and available equipment. This analysis helps the library make the right choices during the process of selecting automation software and equipment. Weeding out is another time-consuming element of the process. According to the Colorado Department of Education, “the more titles you have to create records for, the more pricey your project is going to be.” Therefore, you should take the time to thoroughly weed through your collection before the automation. Data migration also takes time. Any existing records must be transferred to the new system. If you are upgrading from a manual system to an automated system, the circulation information must be entered into the computer. Finally, you might have to change some collection and patron bar codes during the automation process. This can involve some tedious hours of handwork to make everything work with the new automated system.

### ❖ **Technology:**

Technology is another hurdle to cross while automating your library. When selecting library automation software, you must make sure it will work with your existing equipment or be financially prepared to purchase upgraded technology. Analyse the librarians’ workstations, patron access points, network server, Internet access and building electrical system. Some libraries may require minor technological upgrades, while others will require an expensive technological overhaul.

### ❖ **Training:**

Training your staff and patrons to use a newly automated system can be challenging. According to the Colorado Department of Education, “Training is expensive and you can never pay for enough.” If your staff is unfamiliar with computerized library management software, they will need many hours of training to feel comfortable operating the system. A select number of staff will also need training to manage specialized operations, such as cataloguing or patron record management. Additionally, patrons will need assistance using the system to search for library materials. Some patrons may be reluctant to change to a new system, especially if they don’t like computers. With proper training and plenty of support, users will adjust to the new system.

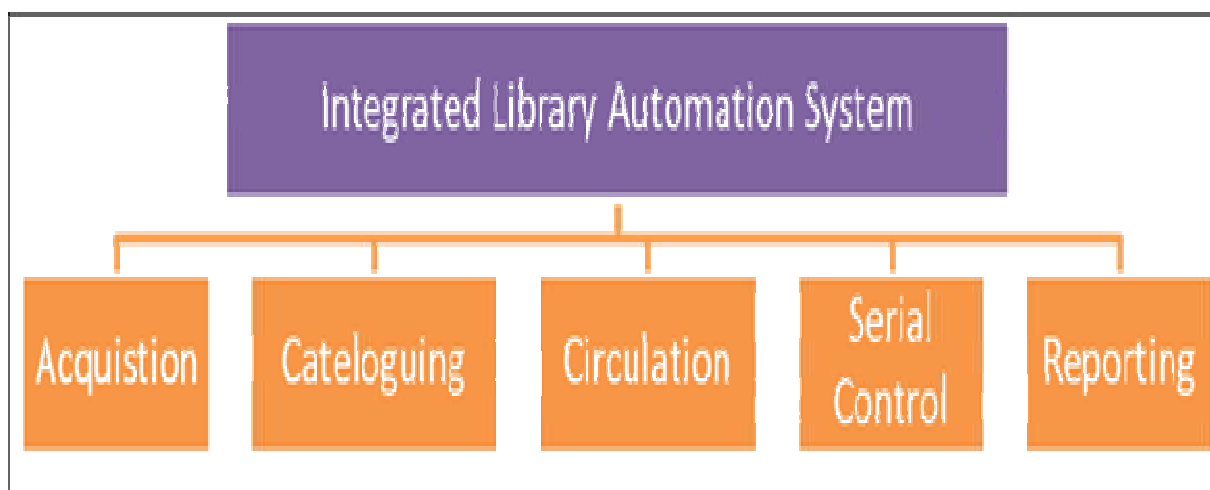
### **AUTOMATION VS MECHANIZATION**

<b>AUTOMATION</b>	<b>MECHANIZATION</b>
Saves use of human judgment	Saves human muscle
Displaces mental labor	Displaces physical labor
It replaces human being with computers and sophisticated machines.	It replaces craft work
Creates job for skilled workers at the expense of unskilled and semi-skilled workers.	Creates job for unskilled labor
Affects many industries at a time	Affects one or two industries at a time
More characteristics since 1950s	Occurred during industrial revolution

Move rapidly and create longer term job displacement	Moves slowly and the job displacement is short term
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## AREAS OF AUTOMATION

Early systems development was piecemeal, with some libraries developing cataloguing systems first, and others focusing instead on, say, circulation control systems. Current systems are integrated systems, based on relational database architecture. In such systems the files are interlinked so that, activate appropriate changes in related files.



## FUNCTIONS OF LIBRARY AUTOMATION IN ACQUISITION

A fully integrated acquisition module of any modern LMS should support:

- All traditional acquisition activities like pre-order searching, ordering, claiming, cancellation of order, receipt processing, payment, routing, fund accounting, vendor accounting, currency control, statistics and report compilation etc. Linkage between acquisitions, cataloguing and circulation module must be seamless.

- Accommodation of a variety of materials, including but not limited to monograph, series, serials, newspapers, cumulative indexes, loose leaf materials, supplements, reports and statues, musical scores, electronic resources etc.
- Processing of a variety of materials, including but not limited to print, Introduction microfilm, micro file, film, videotape, audiocassette, magnetic tape, CDROM, DVD-ROM etc.
- Recording, storing and displaying of bibliographic information, acquisition type (order, gift, approval etc.), status (ordered, received etc.) invoice and accounting information, vendor information, requestor information, subject code etc.
- Budget – based fund accounting with categorized fund allocation.
- Generation of vendor performance statistics and other reports.
- Accommodation of different order types such as firm order, prepayment, exchange, membership, gift, on approval, blanket order, standing order, subscription, continuation, deposit account etc.
- Production of various customized and predefined reports as MIS activities.

## **FUNCTIONS OF LIBRARY AUTOMATION IN CATALOGUING**

Cataloguing is an important work of the library. Cataloguing includes the job of describing, recording and displaying details of the holdings of the library. Computers are used to aid in the production, maintenance and updating of catalogues. The quality of the catalogue depends ultimately on the cataloguer. In other words, initial input data is still the cataloguer's work.

Bibliographic details are gathered from relevant sources or from the acquisitions system. Usually there is one main or master file for the holdings of the library, and a temporary file for cumulating the additional records, because printing the master file is done only once in a while.

After initial input of the records, the computer can perform simple tests on the record structure, and errors can be located and checked. Again, if a basic record structure of a package format as that of the CDS/ISIS is used, entry of data becomes a very simple process. The computer can be asked to generate added entries, if required, which can later be sorted into the main file. Separate listings for authors, subject and key points of access can be created. A postings file and an inverted index help the computer

search and display record relevant to a specific query. It has rightly been said that catalogue is the key to the library. It facilitates the search of books by various approaches like author, subject, title, etc. The other functions include,

- Printing of catalogue cards in different formats like book form, card form.
- Printing in different formats like AACR2 and CCC.
- Printing of added entry cards.
- Generation of Union Catalogue.

### **FUNCTIONS OF LIBRARY AUTOMATION IN OPAC:**

- Online Public Access Catalogue must be fully integrated with other module and accessible through web-based client.
- Online Public Access Catalogue should provide browse indexes for author, title, and series and browse index combining all four indexes.
- It should allow combined, specific and field level searching for all formats along with phrase searching, nested searching and truncated searching.
- It must enable searching by Boolean operators (OR, XOR, NOT, AND), positional operators (SAME, WITH, NEAR, ADJ) and relational operators ('greater than', 'less than', 'equal to', etc.) within and across all fields.
- It should provide facility to see processing status (fully catalogued, in process, lost, withdrawn etc.) and circulation status (in transit, reserve, recalled, on-hold etc.).
- Online Public Access Catalogue should support full, brief, standard and customized display of records including relevancy ranking of search results.
- Online Public Access Catalogue should also support bulletin board, information desk and gateway services (to access external databases) along with patron self-service options (e.g. holds, renewals etc.)
- Online Public Access Catalogue must track user's preferences and interests, organized into a list of favorites. These favorites shall be included in a user's personal online account.

### **FUNCTIONS OF LIBRARY AUTOMATION IN CIRCULATION CONTROLS**

The circulation control activities of any modern LMS must be supported with:

- Entry of borrower and item identification by scanner, RFID reader or keyboard entry at any workstation.
- A template for user's registration and automatic display of patron data.
- Automatic blocks for membership expiration, exceeding loan threshold, renewal threshold and fine threshold, placement of hold on any title or item in the database.
- Automatic calculation of loan period in hours, days, weeks or months.
- Generation of notices/reminders to users of overdue items and printing of gate pass for issued items,
- Automatic calculation of fines and other charges, recording of payment and generation of receipts.
- Generation of variety of pre-defined and user defined reports and usage statistics
- Fully operational interlibrary loan module, patron initiated transaction and mechanized inventory control (barcode, RFID, smart card etc.).

## **FUNCTIONS OF LIBRARY AUTOMATION IN SERIAL CONTROLS**

- Inputting serial data.
- Ordering new serials.
- Renewals of presently subscribed serials.
- Cancellation of presently subscribed serials, if necessary.
- Accessioning of individual issues as and when the issues are received.
- Sending reminders, if necessary.
- Claiming the issue (such as, request for replacement of a defective copy).
- Selective follow-up of missing issues.
- Preparation of various lists like:
  - i. List of periodicals received during a specified period.
  - ii. List of holding with their status on shelf, on binding, on circulation, etc. (the lists can be by subject, by country, by origin, by title, etc).
  - iii. List of periodicals cancelled during specified period.
- Keeping track of the amount spent on serials subscriptions, serials binding, etc. (subject-wise, if necessary).

- Estimation of the budget for the next academic financial year.
- Binding control.
- The module should have all the basic capabilities like ordering, check-in, claiming, routing, vouchering, fund accounting, union listing, bindery preparation and report generation.
- It should provide the ability to search for serials records by title, ISSN, publisher, vendor, purchase order, uniform title, editor, conference title, keywords etc.
- Serials control module should have provision for article indexing, online acquisition, e-journal directory service and recording of holding information.
- It should support both predictive and non-predictive modes of check-in and auto-generation of claims for non-receipted issues.
- The module should support routing of journal issues and generation of various lists and reports.

## UNIT 2

### STEPS IN LIBRARY AUTOMATION

The main steps in the process of library automation are:

#### Step 1: Preparing for Automation

Preparing for an automated library system needs system evaluation and planning before Implementation.

❖ **Appraisal of Current Status:**

Statistics regarding total number of stock, accession of materials, daily issue and return, time taken for routine activities, services given, its effectiveness, etc. were studied to find a true picture of the current status of the library and identified the problems facing by the users.

❖ **Need Assessment:**

Routine library activities such as issue and return of the books take a lion's share of the total time of the library. The librarians were not getting enough time to do added services. So, for acquiring required time for a functional library, automation was necessary. Control over the stock was not adequate. Annual stock verification and generation of monthly library statistics were not up to the standards. An automated system will make the things better. Finding a book from the stack room was time taken. There were no standard classifications or cataloguing schemes. Books were arranged unscientifically. Card catalogues were absent and the users had to go through all the collection to find the wanted one. There was no system to find whether the book was present, issued, if yes, to whom it was issued or when will it return.

❖ **Cost Evaluation:**



The cost contained in every library activity was higher in the case of a manual system. The human cost was many times greater than an automated environment. In the long run, the cost of work done by a librarian in manual system for routine activities will become less and that can be utilized in giving programmed or individualized information services.

❖ **Budget Allocation:**

Library automation needs a huge initial investment. Administrators should be informed about the urgency and usefulness of the process. The fund for the process was earmarked in the annual budget and extracted from the library allotment. Since it was a onetime investment, it will not hamper the routine book and periodical accession in coming years.

❖ **Administrative Support:**

Strong administrative backing is essential for the process.

## **Step 2: System Selection (Software and Hardware)**

Selecting the right integrated library management software package is very important. The strength of the automation is mainly depended on the quality of the system software. A number of software is available in the market. For the selection certain things should be remembered.

❖ **Selection Criteria:**

The criteria for selection must be user friendliness; portability; after service; Cost and Proper documentation.

❖ **Advantages of Local Software:**

The main advantage of using local software is the promptness in service. Most of the libraries (school, college and research institutions) have been using the software for years. The pricing was reasonable. It was easy to use. Simple user interface and searching facilities are helpful for students.

❖ **Hardware:**

One computer system is used as the server and one as OPAC for the users. A laser printer have been using for printing of labels. The retrospective conversion work needed two computers.

Barcode reader (PSC Quick scan 6500) was selected as input device for reading books and identity cards. Other materials such as self-adhesive labels and cello tapes were also procured.

### **Step 3: Preparing the Collection for the Automating System**

To start the technical processing (retrospective conversion), the materials (books, multimedia and periodicals) for the process had to be selected and prepared.

❖ **Periodicals:**

All the periodicals were included in the selection.

❖ **Multimedia:**

Subject and encyclopedic multimedia CD-ROMs were selected for the process.

### **Step 4: Implementing the Automated System**

The implementation phase consists of retrospective conversion, database of members, operations, statistics generation and training for staff and users.

#### **Retrospective Conversion:**

The process of converting the bibliographic or documentary details of the existing stock into the machine-readable form is known as retrospective conversion. This technical processing consists of Bibliographical data entry and physical processing. The steps in Bibliographical data entry are:

1. **Classification:**

In library classification, materials are classified according to the subject of their content. The classification system used and being followed is Dewey Decimal Classification, Edition 21 (the most favoured scheme around the world). Here, the subjects are primarily classified into ten main divisions (First summary). Each division is again classified into ten subdivisions and again into ten, according to the depth of the subjects (Second and Third summaries).

2. **Cataloguing:**

Although the software has the facility of printing card catalogues, there not raised any need of that, since we are using the Online Public Access Catalogue (OPAC).

**3. Indexing:**

In the case of books all the entry fields are indexed and searchable where as in the case of periodicals indexing terms were feed into the database.

**4. Bar coding:**

In an automated environment every document should be unique and searchable. It is done through bar coding. Bar coding facilitates the searching, circulation and systematic shelving of the concerned document. After entering all the details regarding the documents into the database, barcodes are printed on adhesive labels according to the accession number of the document. For this process we used one barcode software and laser printer.

**5. Labeling:**

The barcode label was pasted on the lower bottom of the title page of the book. This has been read by the barcode reader during circulation and stock verification. The second label that pasted on the lower bottom side of the spine of the book is called spine label. It contains Call number (class number and book number), Accession number and library code. After pasting, these labels were covered with cello tapes for more protection.

**6. Shelf arrangement:**

The processed books were arranged on the shelves in the stack room according to their call numbers. If more than one books are present with the same call numbers, they were arranged based on the alphabetical order within the call number.

**Database of Users:**

The preparation of the user's database using the library management software was critical. Just like a book which has its unique accession number, a member should also have his/her unique identification. Since, the only unique number for the student was the Admission Number, it was selected.

**Student's/Staff Identity Cards:**

The school identity cards have been also used as the library membership cards. One side of the card contains the bar coded admission number of the student along with instructions. On staff identity cards, the serial number of the staff has been bar-coded, along with his/her personal particulars.

### **Circulation Control:**

The user has to bring the identity cards to the library at the time of issue, return, renewal and reservation.

#### **1. Issue/Return of Books:**

When a user comes to the circulation counter along with the selected book from the shelf, the barcode reader reads his/her identity card. Then the system will show the details of the member such as name, class & div., category, books previously issued or to be returned along with the dates. Then the book's details are automatically entered by the barcode reader by reading the barcode label on the title page of the book. The process of issue is completed by stamping the due date on the due date slip. When the book is returned, its barcode label is read by the barcode reader and details such as due date, fine details etc. are appeared. The librarian can now 'return' the book by selecting the required graphic options.

#### **2. Renewal and Reservation:**

Giving the membership/accession number at the circulation section, users can do renewal of the books for an extended period. Books can be reserved by submitting the Identity cards.

#### **3. Fine:**

The 'loan period' should be fixed at the beginning of the operation (e.g. one/two weeks). Then the system will automatically give the overdue details, when the member returns the book.

### **Serials Control:**

The details of the periodicals subscribed by the library were entered into the database such as title, periodicity, subject, imprint, and vol./issue numbers, date of publication and date of receipt. It is searchable by OPAC. The system will automatically generate the missing issues, so that the librarian can send reminders.

### **Multimedia:**

The collection details of CDs, ACDs, VCDs, DVDs, etc. are feeded into the database. Title, producer, imprint, subject, language, format and duration of the media are entered. Barcode labels (accession number) are pasted on the CD-ROMs so that, they can be circulated.

### **Library Statistics:**

Periodical library statistics shows the functional effectiveness of the stock and services. The main statistics that can be generated from the systems are:

- a. Monthly stock details (subject-wise, format-wise)
- b. Member information (students and staff)
- c. Weekly/Monthly circulation details (class-wise, member-wise)
- d. Renew/reservation details
- e. Overdue and fine details
- f. List of new additions
- g. Details of written off and condemned documents

### **Stock Verification:**

Annual stock verification can be done with ease by reading the barcodes of the books and comparing it with the basic database.

### **Step 5: Networking**

The main system where the software has loaded and the data entry has been taking place was kept as server. It has been protected with passwords. The remaining systems in the library including OPACs and the computer system were networked locally. Proper monitoring and maintenance of the network is necessary. Updating of the database should be done when new documents are added.

### **Step 6: OPAC (Online Public Access Catalogue)**

The Online Public Access Catalogue, popularly known as OPAC is the user interface of the automated system. The user gets all information regarding the holdings of the library here.

**Searching OPAC:**

Searching the OPAC is very easy. First the user selects the document, which may be a book or a journal or multimedia from the “Document” field. Book is the default document.

**Finding the Book-work Flow:**

The user noted down the Call No. of the required book from the database. Then he/she goes to the stack room where books are shelved according to their call numbers. Shelf guides are there to help to find the concerned shelf number. From the shelf the user picks the book and brings it to the circulation counter for issue.

**Back-up:**

The backup has been taken in fixed intervals. The database is copied on CD-ROMs as to avoid unexpected system crashes and data losses.

**Step 7: Staff Training and User Education**

The librarian should be well trained in the overall management and maintenance of the automated system. He will get initial training from the software vendor and has to continuously update it according to the changing user needs and technology. In this case the librarians got training from the company. Training sessions on the automated library system (mainly, OPAC search, finding the book, circulation, etc.) are conducted for the users. These skill development programmes can be organized during the library periods. For staff members special time slots should be planned.

**Step 8: Evaluation**

The system must be evaluated for its currency and effectiveness periodically. User studies can be conducted to assess the effectiveness of services. Real time oral interviews with the users and observation techniques can be used. The shortcomings should be identified and clearing measures be taken. A suggestion book may be kept in the library to express user’s views.

**Step 9: Planning for the Future**

Library is a growing organism. As the technology changes in the field of information storage and retrieval, the user needs are also changing. There should be planned Library programmes which will incorporate the future needs.

## **BARCODE TECHNOLOGY**

In recent time, libraries and knowledge centers are facing lots of changes due to the rapid growth of modern technologies. Modern technologies have replaced the out-of-date methods applied in libraries and knowledge centers for storing and disseminating of information. In the world of information technology and computerization, automation of libraries and growing demand for improved facilities to users. Library materials are also changing quickly to the various digital formats from the traditional print formats. In this scenario, Barcode technology plays an important role in automating the functions of the library, especially the circulation process. Application of Barcode increases the speed and accuracy in operations. Barcode technology provides a simple and inexpensive method of encoding text information that is easily read by inexpensive electronic readers. Bar coding also allows data to be collected rapidly and with extreme accuracy. Bar coding is a computer-aided process of generating codified information, which is subsequently printed on predefined stationery, invariably on a self-adhesive label for several later applications. A Barcode is a combination of a series of parallel, adjacent bars and spaces. Predefined bar and space patterns or "symbologies" are used to convert small strings of character data into a printed symbol. A Barcode reader interprets a Barcode by scanning a light source across the Barcode and calculating the intensity of light replicated back by the white spaces. The pattern of replicated light is identified with a photodiode which produces an electronic signal that exactly matches the printed Barcode pattern. This signal is then construed back to the original data by inexpensive electronic circuits.

## **MEANING OF BARCODE**

A barcode, consisting of bars and spaces, is a machine-readable representation of numerals and characters. Today, stripes as shown below on packages of products sold at supermarkets, convenience stores and other stores are ubiquitous. These are barcodes. A barcode consists of bars and spaces of varying width that can be read with an optical barcode scanner.



### **Basic requirements for Barcode applications in the library**

Implementing Barcodes in library applications following hardware and software are required:

- Personal computers, (PCs);
- Barcode Printing software;
- Barcode printer
- Barcode Scanner;
- Decoder;
- Library management software; and
- Membership database;
- Bibliographic database of library users.

### **NEED OF BARCODE TECHNOLOGY IN THE LIBRARY**

- Accessioning when a library obtains a new book it has to be given a serial number which is called accession number. Information about the book such as title, author, subject, keywords etc. has



been recorded after assigning an accession number. After assigning accession number, Barcode usually matching with the accession number is created. Afterwards, Barcode labels are printed and pasted at the specified place on the books. Entered bibliographic data helps in identification of book through Barcode. In almost all library automation software, two options are available viz. system-generated Barcode or user-defined.

- Membership identification: With the help of Barcode technology, library staff can identify the membership status of a user. For that Barcode is to be printed on the library membership card, the Barcode will be scanned by the Barcode scanner and the data will be transformed through library management software. In the library management software, details of the user will be displayed.
- Circulation Barcode is mostly useful for circulation; the main motive of using the Barcode in the library is for circulation of library materials. The accession numbers of the book or study material are to be converted into Barcode and have to be pasted inside the book or study material. Library staff in the circulation section than can easily scan the Barcode and can issue/return the book to the users in a quick time, most importantly the transaction is error-free.
- Library attendance system: Barcode can also be used to monitor the entry and exit time in the library. One Barcode scanner has to be set up in the entrance of the library. Every time when the user comes to the library, they need to scan the Barcode available in their library membership card, which will automatically take the attendance, which can later be downloaded in the excel file.
- Issue of “no due” certificates: No dues certificate is issued when any member leaves the organization and his/her membership is cancelled then the library issues no dues certificate. This process is time consuming and error-prone in a manual system. In a computerized system using Barcode technology, the member surrenders his/her identity card and the counter staff can scan it. The automation package will search the database for any document issued in his/her name. If nothing is due, no dues certificate will be printed.
- Inventory and periodical control: For the periodicals control system, the primary task is to develop a database of periodicals holdings and assign code numbers for each periodical. Each

periodicals record may contain information such as title, volume number, year of publication, frequency, publisher, price etc. The database may be updated periodically. For each periodical, Barcode is created, based on the code number and pasted on the lower card maintained for each periodical in the Kardex system. When a particular issue is received, its respective Barcode is scanned for months and issue numbers.

- Stock verification: The manual system of stock verification is very unwieldy but with the help of Barcode, the library professional can easily check the stock of the library. Library professional carrying the handheld scanner attached with Barcode reader checks the available books on the stack and this data can be transferred on the server and can be downloaded. By further dispensation, library staff may know about books issued, books sent to the bindery etc. Subsequently, the software will generate a list of missing books. In this way, the valuable time of library staff can be saved in the lengthy and tedious work related to stock verification.

## **TYPES OF BARCODE**

In order to establish a library barcode system, a unique item number must be assigned to each circulation item, and a corresponding barcode must be placed somewhere on each item's surface or interior. The barcode is essentially a visual representation of the item number, which can be read electronically by a scanner. Furthermore, each item number (and, by extension, each barcode) is linked to a unique item record stored on a computer database.

With thousands and possibly hundreds of thousands of books, movies, magazines etc. in one collection, it can be difficult to make sure everything is properly linked. The challenge is to place the correct barcode on the correct item and to link both of them to the correct entry in the computer database. There are two approaches to doing so and two different types of barcodes to help you achieve your goal.

### **DUMB BARCODE**

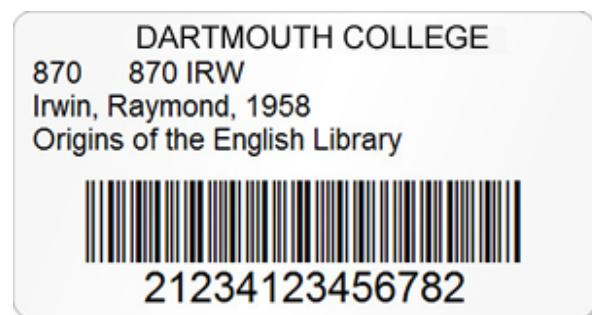
Dumb barcodes are less expensive to produce than smart barcodes and can be applied at random to the items in your collection. Dumb barcodes are barcodes that have not been linked to specific item records in your database. As a result, once they have been applied, your library staff will have to link the

barcode on each book to the appropriate entry in your database. This will entail locating each book's item record in the database, and either manually typing in the barcode number or using a scanner to scan it in.



### **SMART BARCODE**

Unlike dumb barcodes, each smart barcode is pre-assigned to an item records before it is printed. This is useful because it avoids the tedious work of linking each books and barcode to the correct item record in the database. Smart barcodes are usually produced by sending a full list of books and other inventory items to a vendor who then generates barcodes for each item and prints them out. For libraries with a comprehensive call-number system it is easy to apply smart barcodes, because they are usually printed according to shelf order. Since shelf arrangement is critical to the process, a preliminary self reading campaign should be considered to make sure everything is in order.



## **DIFFERENCE BETWEEN “SMART” AND “DUMB” BARCODES**

A “dumb” barcode just contains the library name, the barcode, and the barcode number beneath the barcode. A smart barcode contains extra information and is designed specifically for libraries that need to replace their barcodes. Whether rebar coding libraries will use dumb or smart barcodes will depend on several factors, including the current ILS, the ability to close the library, and a few other factors. To make sure everything works properly, the decision about which barcode to use should be made in conjunction with the Cooperative’s Sitka staff.

## **ADVANTAGES OF BARCODE TECHNOLOGY IN THE LIBRARY**

- Barcodes eliminate the possibility of human error in the circulation section of the library
- Barcodes are inexpensive to design and print. Generally, they cost mere pennies, regardless of their purpose, or where they will be affixed.
- Barcodes are extremely versatile. They can be used for any kind of necessary data collection in the library.
- Library material control improves. Because Barcodes make it possible to track library materials so precisely.
- Data obtained through Barcodes are available rapidly. Since the information is scanned directly into the server, it is ready almost instantaneously.
- Barcodes promote better decision making. Because data is obtained rapidly and accurately, it is possible to make more informed decisions. Better decision making ultimately saves both time and money.

## **DISADVANTAGES OF BARCODE TECHNOLOGY IN THE LIBRARY**

- They are very labour intensive; as they must be scanned individually.
- Barcodes are more easily damaged; as the line of sight is needed to scan, the printed Barcode has to be exposed on the outside of the library materials.
- If a Barcode is ripped or damaged there is no way to scan the library materials.
- Restricted traceability.
- Susceptible to environmental damage.
- Prone to Human Error

## **RFID (RADIO FREQUENCY IDENTIFICATION)**

RFID is a combination of radio-frequency based technology and microchip technology and the information contained on microchips in the tags affixed to library materials is read using radio frequency technology. This technology is slowly merging the Library Automation Activities and services as an urge on the part of library managers to improve the effectiveness of the library keeping in mind of the user's consciousness towards information access and use. As this technology is new to the field of librarianship, author attempts to provide conceptual framework of relevance of RFID technology and its functioning, also it highlights the prospects of this technology.

### **CONCEPT OF RFID**

The concept of RFID systems originated in the 1940s as a means of distinguishing friendly aircraft from Enemy aircraft in WWII. Large powered RFID tags, or transponders, were placed on friendly aircraft in Order to be correctly identified by radar signals. This IFF (Identify: Friend or Foe) system was the first use of RFID and its concepts continue to be used in present day aviation traffic control. This invention of the microchip and subsequent technological advances led to the design and use of passive RFID tags. This was primarily used to track objects in industrial environments where barcodes. Today the RFID technology has become integral part of many businesses industries, software companies and information industries in the world. Although the technology is still considered young and emerging, it is based on electronics, and therefore, major breakthroughs are not only natural, but are expected. During the last several years, "smart labels" are the "buzz" in RFID (Garfinkel and Rosenberg, 2005). According to Chachra (2003) Radio Frequency Identification (RFID) is the technology that is slated to replace barcodes in library applications. It is a form of identification that is contact-less and does not require line of sight. The technology, though new to libraries has been in use in other sectors for more than 20 years. The RFID tags are placed in books and generally covered with a property sticker. Antennas of different sizes, based on application, are used to read the tags and manage the various library functions.

### **COMPONENTS OF RFID SYSTEM**

A comprehensive RFID system has three components.

### **RFID Tags:**

The tags are electronically programmed with unique information. The tag is paper thin, flexible and approximately 2”\*2” in size which allows it to be placed inconspicuously on the inside cover of each book in a library’s collection. It consists of an etched antenna and a tiny chip which stores vital bibliographic data including a unique ID number to identify each item. This contrasts with a barcode label, which does not store any information, but merely points to a database.

### **Readers or Sensors**

These components are available in various shapes and sizes to suit respective applications within the library, and are often integrated into one enclosure for that specific purpose, i.e. patron self-check-out.

Machines and inventory readers: The reader powers the antenna to generate an RF field. When a tag passes through this RF fields, the information stored on the chip is decoded by the reader, and sent to the computer systems or Central Server which in turn, communicates to the Library Information System.

### **Server/Docking Station**

The server is the heart of some comprehensive RFID systems. It is the communications gateway among the various components. It receives the information from one or more of the readers and exchanges information with the circulation database. Its software includes the APIs- Applications Programming Interface, necessary to interface it with the automated library system.

## **RFID IMPLEMENTATION IN LIBRARIES**

Phase-wise Planning for deployment of complete solution. Overview: Estimated timeline for tagging 4 lakhs (four lac) items procurement of:

### **Hardware**

Sourcing of RFID hardware, i.e. Readers, Tags and Antenna needs to be done before starting anything else. Once the hardware specification and respective products are finalized specific read regions can be decided and implantation can be done.

### **Tagging Books**

Each and every book needs to be tagged. The process needs 2-3 people continuously sticking tags to specific are of the book as decided earlier from the findings during the pilot test.

### **Integrating Middleware**

Integrating Middleware with the present library software systems and testing the results for improvements and errors.

### **Performing Test Cases**

Predefined set of test cases will be performed in scenario-based. Format to check-out unit level and system level performance for accuracy and greater throughput.

### **Training Staff**

This part of the implementation will include training staff on various aspects of RFID Technology and the new system in place. There will a demo which will include all the process in the system.

### **Process Improvement**

The errors and improvements found out from the test cases will be revisited to make system perform in better way.

## **ADVANTAGES OF RFID IN LIBRARY**

### **Check – out**

RFID technology's ability to read ID tags regardless of position or orientation, as well as detect signals through physical materials, is particularly advantageous for library circulation processes.

Since several items can be read at once, check-out procedures can be accomplished much more rapidly than with barcode technology, which requires that each item be handled individually. For these reasons, patrons can accomplish self-check-out much more efficiently, as well.

Implementation of RFID in libraries generally leads to greatly-reduced queues at the check-out counter, user service, and less respective strain injuries for library staff, repetitive motions, associated with circulation such as lifting, reaching and grasping as a result of its RFID implementation.

### **Check-in**

RFID can be equally advantageous for check-in processes. In addition to being able to check-in multiple items simultaneously, RFID readers can be affixed to book return slots, effectively checking in items as they pass through the slot. RFID can further streamline check-in when used in conjunction with an automated materials handling (AMH) system. A conveyor carries items past an RFID reader, which checks them in and then sorts them by category into bins or onto carts, eliminating the need for staff to handle items until the fine-sorting step of the process.

The time saving potential of an RFID implementation can be substantial; an Australian library reported an 80% reduction in time spent on circulation procedures by staff after RFID was implemented.

### **Inventory**

RFID also has had a significant impact on inventory processes in libraries. With a fully-tagged collection, inventory can be taken with a portable, hand-held wand which is passed alongside the books on the shelves; the reader picks up the individual signals from each item's tag, without needing to remove or even tip the books outward from the shelves. As a result, says Karen Coyle, with RFID "not only does the cost of doing an inventory in the library go down, the odd of actually completing regular inventories goes up". RFID has enabled the library at California State University, Long Beach to inventory 5,000 books per hour, and the Vatican Library in Rome estimates the ability to inventory 120,000 tagged items in its collection in half a day, as opposed to the full month it took to do so before implementing RFID.

Inventory with RFID has also proven to be extremely useful and cost-effective in terms of locating lost or misshelved items. The library at Cal State-Long Beach reported finding 300 items that had been recorded as lost or missing upon its first RFID-enabled inventory. The library at the University



of Nevada at Las Vegas found 500 such items after tagging its 600,000 plus collection and estimated saving \$40,000 in potential replacement costs as a result.

## **Security**

Item security is another area in which RFID technology can benefit a library. RFID tags can be enabled with a theft-detection bit that is deactivated upon proper check-out, allowing the materials to which they have been affixed to pass freely through an RFID powered security gate. As the items pass an RFID reader upon being checked back in the security bits are reactivated.

## **DISADVANTAGES OF RFID SYSTEM**

- **High cost:**

The major disadvantages of RFID technology is its cost.

- **Vulnerability to compromise:**

It is possible to compromise RFID system by wrapping the household foil to block the radio signal. It is also possible to compromise and RFID System by placing two items against one another so that one tag overlays another. That may cancel out the signals. This requires knowledge of the technology and careful alignment.

- **Removal of exposed tags:**

The RFID tags cannot be concealed in either spine or gutter of the books and are exposed for removal. If a library wishes, it can insert the RFID tags in the spines of all except thin books, however, not at all, RFID tags are flexible enough. A library can also imprint the RFID tags with its logo and make them appear to be bookplates, or it can put a printed cover label over each tag.

- **Evaluation RFID from Different Vendors:**

It is potentially overwhelming to evaluate competitive offering of a new technology; hence the following guide lists some of the characteristics to be considered.

- **Security Features:**

The same RFID tag used to manage inventory can also be used to protect it from theft. Current offerings provide the choice between a purely RFID solution, or RFID with an EM (electro-magnetic) add-on for theft.

- **Tag Memory Capacity:**

More memory is not necessarily better than less – it often correlates with price, and data transmission speed. As a first step, consider what information you need to program into each tag, and then discuss with vendors.

- **Tag Functionally:**

Some vendors offer tags which can only be “written to” once. That is, once the tag is programmed, the information stored in the memory of read/write tags can be updated as required.

- **Anti-Collision:**

All RFID Vendors in the Library market offer a product with anti-collision (the ability to read several tags simultaneously). However, the speed at which this can be performed, and the total number of tags that can be read, will vary. This relates specifically to inventory management with a hand-held reader, and check-in process.

- **EAS (Electronic Article Surveillance):**

Mechanism As mentioned above, RFID can be used to prevent theft in the library. This approach varies from vendor to vendor – the security mechanism may be integrated into the clip itself, or security gates may be linked to a separate server, which interrogates the database to conclude whether an alarm needs to be triggered.

- **Standards:**

The emerging standard for library RFID solution is to employ a frequency of 13.56 MHZ. However, no formal standards are currently in place.

## **UNIT 3**

### **NETWORKING**

A particular digital library can provide a link to any other resources of other digital libraries very easily; thus a seamlessly integrated resource sharing can be achieved.

### **NEED OF NETWORKING**

#### **To share computer files**

Networks enable users to share files with others. For example, in a company, one file is to be shared by multiple branches. When we locate this file on the network system, all the branches can use this file.

#### **To share computer equipment**

Laser printers and large hard-disk drives can be expensive. Networks enable users to share such equipment by networking microcomputers or workstations together.

#### **To enable unlike computer equipment to communicate**

A company with computers of multiple uses using several operating systems, including MS-DOS, UNIX, WINDOWS 95, and Apple DOS, cannot share files from one computer to another unless arranged using a Networking operating system including Network 4.1 or Windows NT 4.0.

#### **To improve communication speed and accuracy**

Sending messages through networks is virtually instantaneous, and there is also less chance of a message being lost.

#### **To reduce the cost of data transfer**

The cost of transfers of files using computers associated with networks is less expensive than other traditional means like telegrams.

## **Verify Data Transfer**

Fluctuations of costs in foreign exchange and shares can be broadcasted promptly using the channel of computer communications. The transmission can be increased and checked at any occurrence of time.

## **High Reliability**

All files can be recreated on a few machines, and therefore if one of them is unavailable (because of hardware failure), the different copies can be used.

## **COMPONENTS OF NETWORK**

A network has 5 basic components viz. clients, servers, channels, interface devices and operating systems. A brief intro:

### **1. Servers:**

Servers or Host computers are powerful computers that store data or applications and connect to resources that are shared by the users of a network.

### **2. Clients:**

Client is the computer used by the users of the network to access the servers and shared resources (such as hard disks and printers). So, a personal computer is a client.

### **3. Channels:**

The technical name of channels is network circuit. It is the pathway over which information travels between the different computers (clients and servers) that comprise the network.

### **4. Interface devices:**

The devices that connect clients and servers (and sometimes other networks) to the channel are called interface devices. The common examples are modems and network interface cards.

### **5. Operating systems:**

This is the Network Software. It serves purpose that the operating system serves in a stand-alone computer.

## **ADVANTAGES OF NETWORKING**

A network is very useful for connection and communication purposes. Not just that, it also has many other advantages. Below are some of the prominent ones:

### **1. Ease of accessibility**

Modern computer networks are easy to explore. So, even if you are a kid or a person new to technology, you'll find it easy to connect.

### **2. Flexibility**

Here, flexibility means that different people will be able to explore different things as per their requirements. For this purpose, computer networks provide you a wide array of choices to share a particular piece of information. For example, e-mail or messaging apps like Whatsapp. So, there is flexibility for different users.

### **3. Convenient resource sharing**

The main aim of a computer network is to enable sharing of resources among its users. You can use resources such as printers, scanners and photocopy machines that can be shared across multiple users. This resource sharing is important for big companies as they can use one single common network for connecting with their employees.

### **4. Connectivity**

Computer Networks improve connectivity irrespective of a person's location. In these testing times, we can see live examples as we use video call apps or Google documents to connect with our friends and colleagues.

### **5. Security**

Computer networks provide security through authorization. Authorization is done via user id and password. So, it ensures that when we log in, we are only able to do it when there is a perfect match between our details and the details stored in the database.

### **6. Great storage capacity**

Organizations have an abundance of data that needs to be stored. For that purpose, they are required to store them in a central server. A central server is a remote server that is accessible to each and every employee. So, if in case one loses the data, others have it.

## **7. Reduced cost**

Cost is one of the crucial factors that one needs to consider while evaluating the pros and cons of a particular technology. In networking, a central server is used that enables companies to store files in one place and thus reducing file storage expenses.

## **DISADVANTAGES OF NETWORKING**

Various disadvantages include:

- Lack of robustness
- Spread of computer virus
- Implementation issues
- Lack of productivity
- Health issues

### **1. Lack of robustness**

Computer networks rely on the main server called the central server. If the central server malfunctions or there is an issue in the central server, then the entire network would stop functioning. So, this is a major disadvantage due to dependency on a single server.

### **2. Spread of computer virus**

As computers in a network are interconnected, there is a high probability that if one of the computers is affected by the virus, others too can get affected. This spread can actually damage the entire system. Also, if the central server gets corrupted, then it's quite dangerous as the network depends on the central server.

### **3. Independence issues**

The entire networking system is based on a centralized server, so it lacks independence. So, individual users lack the freedom to use the computer as per their wish.

#### **4. Lack of productivity**

Since a network has a lot of advantages and applications, it is certain that it results in simultaneous use of many services that cause distraction. Thus, due to employees focusing on a myriad of tasks, productivity issues are quite common.

#### **5. Health issues**

Computer network provides access to a gamut of services including entertainment, gaming, and movies. These result in making you addicted to the content and thus results in overuse of these services. This excessive screen time makes you feel lethargic, causes eye strain and body pain.

### **NETWORK TOPOLOGY**

A network topology is the physical and logical arrangement of nodes and connections in a network. Nodes usually include devices such as switches, routers and software with switch and router features. Network topologies are often represented as a graph.

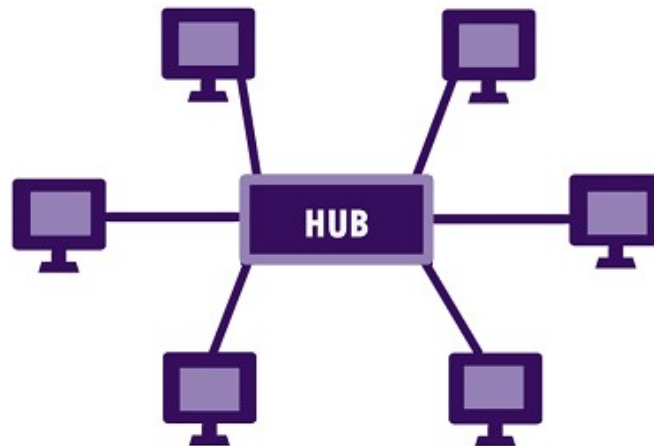
Network topologies describe the arrangement of networks and the relative location of traffic flows. Administrators can use network topology diagrams to determine the best placements for each node and the optimal path for traffic flow. With a well-defined and planned-out network topology, an organization can more easily locate faults and fix issues, improving its data transfer efficiency.

Network geometry can be defined as the physical topology and the logical topology. Network topology diagrams are shown with devices depicted as network nodes and the connections between them as lines. The type of network topology differs depending on how the network needs to be arranged.

### **TYPES OF TOPOLOGY**

#### **STAR TOPOLOGY**

Access and control of star networks typically is maintained by a polling system. Polling means that the central computer or communications controller “polls” or asks each device in the network for it has a message to send and then allows each in turn to transmit data.



### **Star Network**

The star network is frequently used to connect one or more small computers or peripheral devices to a large host computer or CPU. Many organizations use the star network or a variation of it in a time-sharing system, in which several users are able to share a central processor.

In a time-sharing setup, each terminal receives a fixed amount of the CPU's time, called a time slice. Actually, because the CPU operates so much faster than terminals, one may not probably even notice that the CPU is away.

By establishing time-sharing, many people in a large organization can use a centralized computing facility. Time-sharing can also be purchased from an outside service, which is an economical way to operate for a small company that cannot afford its own large computer.

Star network is frequently used in a LAN to connect several microcomputers to a central unit that works as a communications controller. If the user of one microcomputer wants to send a document or message is routed through the central communications controller.

Another common use of the star network is as a LAN to connect several microcomputers to a mainframe computer that allows access to an organization database.



### **Advantages of Star Topology**

- It is very reliable – if one cable or device fails then all the others will still work
- It is high-performing as no data collisions can occur
- Less expensive because each device only need one I/O port and wishes to be connected with hub with one link.
- Easier to put in
- Robust in nature
- Easy fault detection because the link are often easily identified.
- No disruptions to the network when connecting or removing devices.
- Each device requires just one port i.e. to attach to the hub.
- If N devices are connected to every other in star, then the amount of cables required to attach them is N. So, it's easy to line up.

### **Disadvantages of Star Topology**

- Requires more cable than a linear bus.
- If the connecting network device (network switch) fails, nodes attached are disabled and can't participate in network communication.
- More expensive than linear bus topology due to the value of the connecting devices (network switches)
- If hub goes down everything goes down, none of the devices can work without hub.
- Hub requires more resources and regular maintenance because it's the central system of star.
- Extra hardware is required (hubs or switches) which adds to cost
- Performance is predicated on the one concentrator i.e. hub.

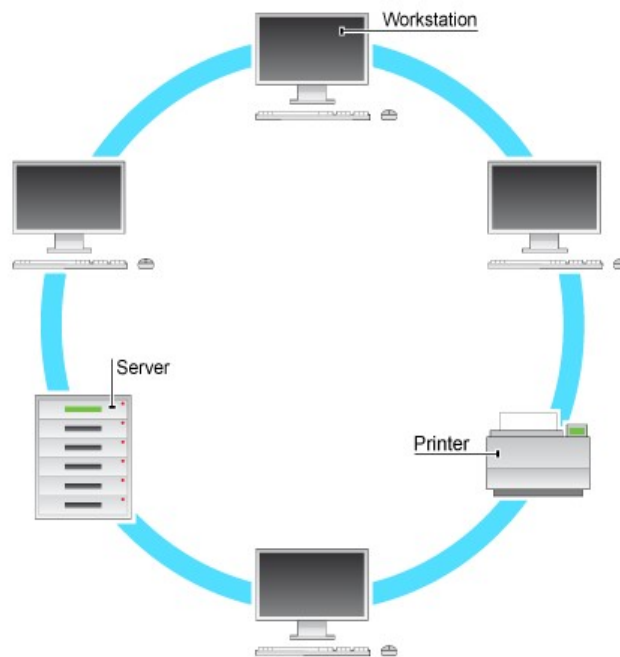
## **RING TOPOLOGY**

The ring network is a local-area network (LAN) whose topology is a ring. It can be as simple as a circle or point-to-point connections of computers at dispersed locations. There may not be a central host computer or communications controller. That is, all of the nodes are connected in a closed loop.

Messages travel around the ring, with each node reading those messages addressed to it. One of the advantages of ring networks is that they can span larger distances than other types of networks, such as bus networks, because each node regenerates messages as they pass through it.

Access and control of ring networks are typically maintained by a “token-passing” system. IBM’s Token-Ring network is thought by observers to be a watershed event comparable to the development of the IBM PC itself.

Token-Ring network is designed to link all types of computers together, including not only personal computers but also possibly minicomputers and mainframes. A Token-Ring network resembles a merry-go-round. To deliver a message, you would hand your addresses note to a rider (the token) on the



merry-go-round, who would drop it off at the appropriate place.

### **Advantages of Ring Topology**

- In this data flows in one direction which reduces the chance of packet collisions.
- In this topology additional workstations can be added after without impacting performance of the network.
- Equal access to the resources.
- There is no need of server to control the connectivity among the nodes in the topology.
- It is cheap to install and expand.
- Minimum collision.

- Speed to transfer the data is very high in this type of topology.
- Due to the presence of token passing the performance of ring topology becomes better than bus topology under heavy traffic.
- Easy to manage.
- Ring network is extremely orderly organized where every device has access to the token and therefore the opportunity to transmit.

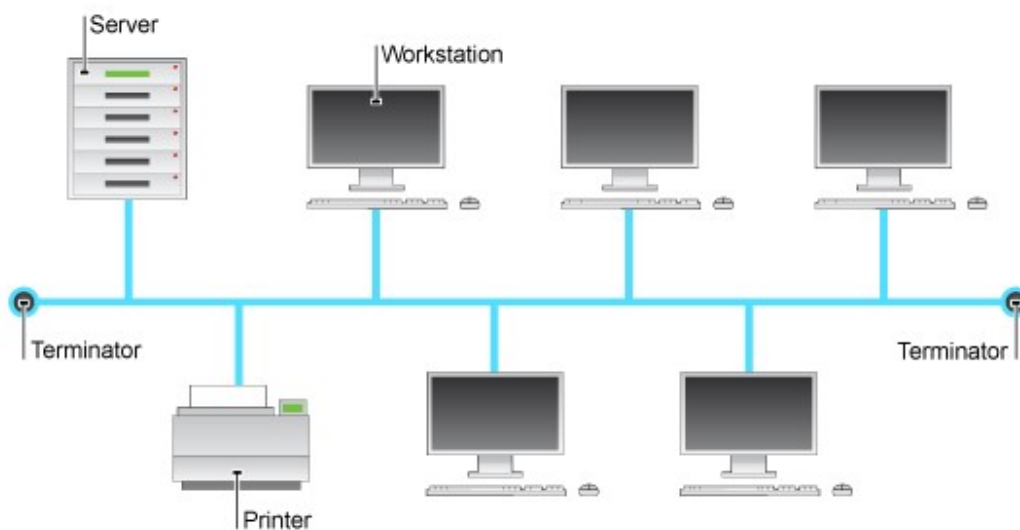
### **Disadvantages of Ring topology**

- Due to the Uni-directional Ring, a data packet (token) must have to pass through all the nodes.
- If one workstation shuts down, it affects whole network or if a node goes down entire network goes down.
- It is slower in performance as compared to the bus topology
- It is Expensive.
- Addition and removal of any node during a network is difficult and may cause issue in network activity.
- Difficult to troubleshoot the ring.
- In order for all the computer to communicate with each other, all computer must be turned on.
- Total dependence in on one cable.
- They were not Scalable.

### **BUS TOPOLOGY**

Alternatively mentioned as line topology, bus topology could even be a specific quiet topology during which each computer and network device is connected to a minimum of one cable or backbone. In general, the term refers to how various devices are acknowledged during a network. counting on sort of network card, coax or an RJ-45 network cable is employed to attach them.

Bus topology carries transmitted data through the cable, because data reaches each node, the node checks the destination address (MAC/IP address) to work out if it matches their address. If the address does not match with the node, the node does nothing more. But if the addresses of nodes match to address contained within data then they process on knowledge. In the bus, communication between nodes is done through a foremost network cable.



### **Advantages of Bus Topology**

- It is the easiest network topology for connecting peripherals or computers in a linear fashion.
- It works very efficiently well when there is a small network.
- The length of cable required is less than a star topology.
- It is easy to connect or remove devices in this network without affecting any other device.
- Very cost-effective as compared to other network topology i.e. mesh and star
- It is easy to understand topology.
- Easy to expand by joining the two cables together.

### **Disadvantages of Bus Topology**

- Bus topology is not great for large networks.
- Identification of problems becomes difficult if the whole network goes down.
- Troubleshooting individual device issues is very hard.

- Need terminators are required at both ends of the main cable.
- Additional devices slow the network down.
- If the main cable is damaged, the whole network fails or splits into two.
- Packet loss is high.
- This network topology is very slow as compared to other topologies.

## **HIERARCHICAL TOPOLOGY**

Hierarchical networks offer a wide range of benefits, such as enhanced performance, reliability and scalability, better security, easier management and design, and improved cost-efficiency.

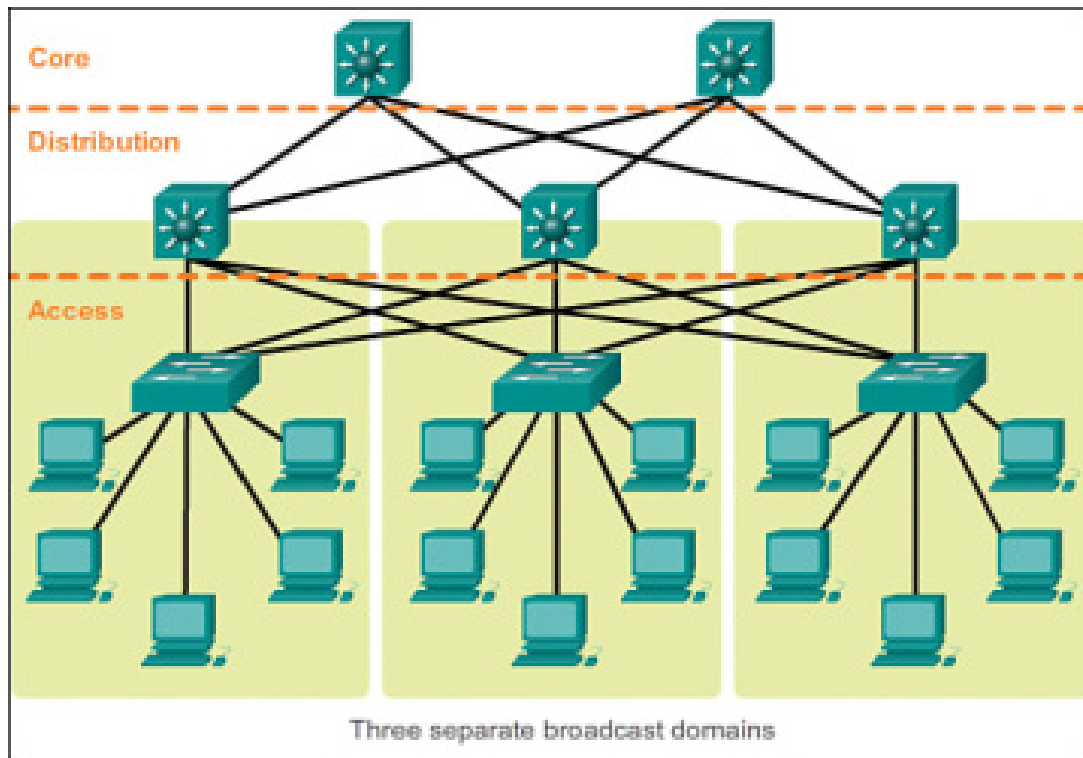
Hierarchical models are used where there is a single source for data and the data has to be distributed among collaborations worldwide.

### **Hierarchical network**

Hierarchical network models are iterative algorithms for creating networks which are able to reproduce the unique properties of the scale-free topology and the high clustering of the nodes at the same time. These characteristics are widely observed in nature, from biology to language to some social networks.

The development of hierarchical network models was mainly motivated by the failure of the other scale-free models in incorporating the scale-free topology and high clustering into one single model. Since several real-life networks (metabolic networks, the protein interaction network, the World Wide Web or some social networks) exhibit such properties, different hierarchical topologies were introduced in order to account for these various characteristics.

The hierarchical network model is part of the scale-free model family sharing their main property of having proportionally more hubs among the nodes than by random generation; however, it significantly differs from the other similar models in the distribution of the nodes' clustering coefficients: as other models would predict a constant clustering coefficient as the function of the degree of the node, in hierarchical models nodes with more links are expected to have a lower clustering coefficient. Moreover, while the Barabasi-Albert model predicts a decreasing average clustering coefficient as the number of nodes increases, in the case of the hierarchical models there is no relationship between the size of the network and its average clustering coefficient.



### Advantages of hierarchical topology

- The hierarchical topology is generally supported by most hardware and software.
- In the hierarchical topology, data is received by all the nodes efficiently because of point-to-point link.

### Disadvantages of hierarchical topology

- In the hierarchical topology, when the root node fails, the whole network crashes.
- The hierarchical topology is difficult to configure.

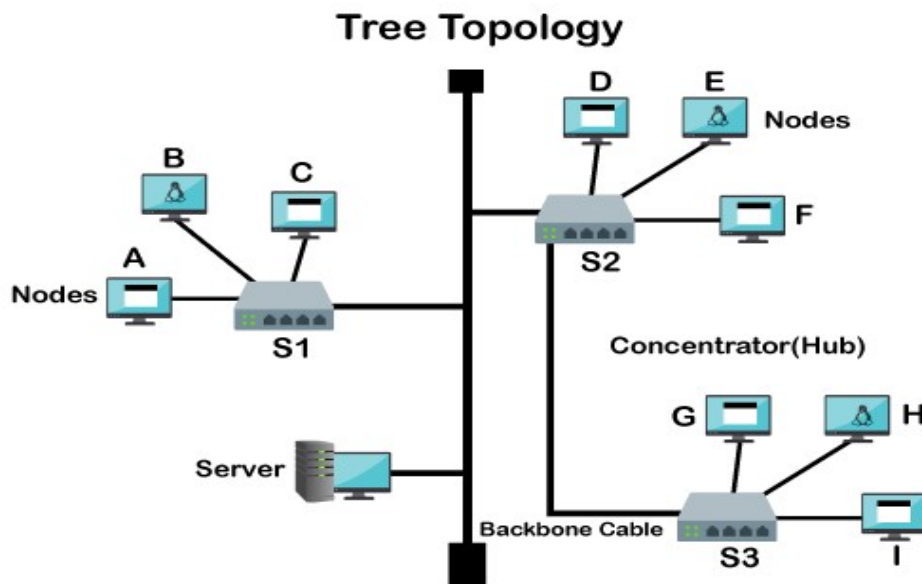
### TREE TOPOLOGY

A tree topology is a type of network topology that resembles a tree, with a root node at the top and leaves at the bottom. In computer networking, tree topologies are often used to create virtual LANs (VLANs).

In a tree topology, there is one central node (the “trunk”), and each node is connected to the central node through a single path. Nodes can be thought of as branches coming off of the trunk. Tree topologies are often used to create large networks.

Tree topology can also be used to create star networks, where each device is connected to a central hub. Star networks are often used in large office buildings or campuses, where each device needs to be able to communicate with all other devices on the network.

One of the most common applications of a tree topology is in computer networks. Tree topology is often used to connect multiple devices, such as printers and computers, in a home or small office. Tree topology is commonly used to create bus networks, where each device is connected to a central server.



#### Advantages of Tree Topology:

- This topology is the combination of bus and star topology.
- This topology provides a hierarchical as well as central data arrangement of the nodes.
- As the leaf nodes can add one or more nodes in the hierarchical chain, this topology provides high scalability.
- The other nodes in a network are not affected if one of their nodes gets damaged or does not work.

- Tree topology provides easy maintenance and easy fault identification can be done.
- A callable topology. Leaf nodes can hold more nodes.
- Supported by several hardware and software vendors.
- Point-to-point wiring for individual segments.
- Tree Topology is highly secure.
- It is used in WAN.
- Tree Topology is reliable.

#### **Disadvantages of Tree Topology:**

- This network is very difficult to configure as compared to the other network topologies.
- The length of a segment is limited & the limit of the segment depends on the type of cabling used.
- Due to the presence of a large number of nodes, the network performance of tree topology becomes a bit slow.
- If the computer on the first level is erroneous, the next-level computer will also go under problems.
- Requires a large number of cables compared to star and ring topology.
- As the data needs to travel from the central cable this creates dense network traffic.
- The Backbone appears as the failure point of the entire segment of the network.
- Treatment of the topology is pretty complex.
- The establishment cost increases as well.
- If the bulk of nodes are added to this network, then the maintenance will become complicated.

#### **COMPLETE TOPOLOGY**

- Complete Topology is also known as Mesh Topology.
- Mesh technology is an arrangement of the network in which computers are interconnected with each other through various redundant connections.
- There are multiple paths from one computer to another computer.

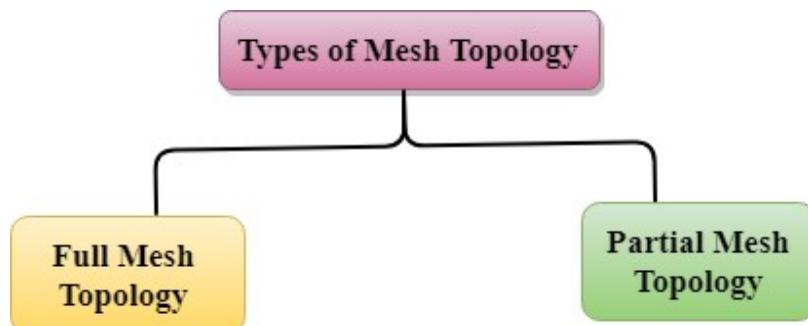


- It does not contain the switch, hub or any central computer which acts as a central point of communication.
- The Internet is an example of the mesh topology.
- Mesh topology is mainly used for WAN implementations where communication failures are a critical concern.
- Mesh topology is mainly used for wireless networks.
- Mesh topology can be formed by using the formula:  
Number of cables =  $(n*(n-1))/2$ ;

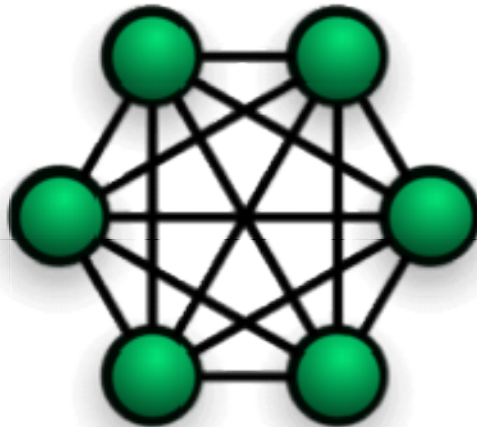
Where n is the number of nodes that represents the network.

**Mesh topology is divided into two categories:**

- ❖ Fully connected mesh topology
- ❖ Partially connected mesh topology



- ❖ **Full Mesh Topology:** In a full mesh topology, each computer is connected to all the computers available in the network.
- ❖ **Partial Mesh Topology:** In a partial mesh topology, not all but certain computers are connected to those computers with which they communicate frequently.



#### **Advantages of Mesh topology:**

- ❖ **Reliable:** The mesh topology networks are very reliable as if any link breakdown will not affect the communication between connected computers.
- ❖ **Fast Communication:** Communication is very fast between the nodes.
- ❖ **Easier Reconfiguration:** Adding new devices would not disrupt the communication between other devices.

#### **Disadvantages of Mesh topology**

- ❖ **Cost:** A mesh topology contains a large number of connected devices such as a router and more transmission media than other topologies.
- ❖ **Management:** Mesh topology networks are very large and very difficult to maintain and manage. If the network is not monitored carefully, then the communication link failure goes undetected.
- ❖ **Efficiency:** In this topology, redundant connections are high that reduces the efficiency of the network.

## **WIRELESS NETWORKING**

A wireless network is a computer network that uses wireless data connections between network nodes.

Wireless networking is a method by which homes, telecommunications networks and business installations avoid the costly process of introducing cables into a building, or as a connection between various equipment locations.

Admin telecommunications networks are generally implemented and administered using radio communication. This implementation takes place at the physical level (layer) of the OSI model network structure.

The first professional wireless network was developed under the brand ALOHA net in 1969 at the University of Hawaii and became operational in June 1971. The first commercial wireless network was the Wave LAN product family, developed by NCR in 1986.

Examples of wireless networks include cell phone networks, wireless local area networks (WLANs), wireless sensor networks, satellite communication networks, and terrestrial microwave networks.

## **TYPES OF WIRELESS NETWORKS**

1. Wireless PAN
2. Wireless LAN
3. Wireless ad hoc network
4. Wireless MAN
5. Wireless WAN
6. Cellular network
7. Private LTE/5G networks

8. Open Source
9. Global area network
10. Space network

### **Wireless PAN**

Wireless personal area networks (WPANs) connect devices within a relatively small area, that is generally within a person's reach.

For example, both Bluetooth radio and invisible infrared light provides a WPAN for interconnecting a headset to a laptop.

Zig Bee also supports WPAN applications. Wi-Fi PANs are becoming commonplace (2010) as equipment designers start to integrate Wi-Fi into a variety of consumer electronic devices.

Intel "My Wi-Fi" and Windows 7 "virtual Wi-Fi" capabilities have made Wi-Fi PANs simpler and easier to set up and configure.

### **Wireless LAN**

A wireless local area network (WLAN) links two or more devices over a short distance using a wireless distribution method, usually providing a connection through an access point for internet access.

The use of spread-spectrum or OFDM technologies may allow users to move around within a local coverage area, and still remain connected to the network.

WLAN standards are marketed under the Wi-Fi brand name.

Fixed wireless technology implements point-to-point links between computers or networks at two distant locations, often using dedicated microwave or modulated laser light beams over line of sight paths.

It is often used in cities to connect networks in two or more buildings without installing a wired link.

To connect to Wi-Fi using a mobile device, one can use a device like a wireless router or the private hotspot capability of another mobile device.

### **Wireless ad hoc network**

A wireless ad hoc network, also known as a wireless mesh network or mobile ad hoc network (MANET), is a wireless network made up of radio nodes organized in a mesh topology.

Each node forwards messages on behalf of the other nodes and each node performs routing.

Ad hoc networks can "self-heal", automatically re-routing around a node that has lost power.

Various network layer protocols are needed to realize ad hoc mobile networks, such as Distance Sequenced Distance Vector routing, Associativity-Based Routing, Ad hoc on-demand Distance Vector routing, and Dynamic source routing.

### **Wireless MAN**

Wireless wide area networks are wireless networks that typically cover large areas, such as between neighboring towns and cities, or city and suburb.

These networks can be used to connect branch offices of business or as a public Internet access system.

The wireless connections between access points are usually point to point microwave links using parabolic dishes on the 2.4 GHz and 5.8 GHz band, rather than omni directional antennas used with smaller networks.

A typical system contains base station gateways, access points and wireless bridging relays. Other configurations are mesh systems where each access point acts as a relay also.

When combined with renewable energy systems such as photovoltaic solar panels or wind systems they can be stand alone systems.

### **Cellular network**

A cellular network or mobile network is a radio network distributed over land areas called cells, each served by at least one fixed-location transceiver, known as a cell site or base station.

In a cellular network, each cell characteristically uses a different set of radio frequencies from all their immediate neighboring cells to avoid any interference.

When joined these cells provide radio coverage over a wide geographic area.

This enables a large number of portable transceivers (e.g., mobile phones, pagers, etc.) to communicate with each other and with fixed transceivers and telephones anywhere in the network, via base stations, even if some of the transceivers are moving through more than one cell during transmission.

Although originally intended for cell phones, with the development of smartphones, cellular telephone networks routinely carry data in addition to telephone conversations:

- ❖ Global System for Mobile Communications (GSM): The GSM network is divided into three major systems: the switching system, the base station system, and the operation and support system. The cell phone connects to the base system station which then connects to the operation and support station; it then connects to the switching station where the call is transferred to where it needs to go. GSM is the most common standard and is used for a majority of cell phones.
- Personal Communications Service (PCS): PCS is a radio band that can be used by mobile phones in North America and South Asia. Sprint happened to be the first service to set up a PCS.

- ❖ D-AMPS: Digital Advanced Mobile Phone Service, an upgraded version of AMPS, is being phased out due to advancement in technology. The newer GSM networks are replacing the older system.

### **Private LTE/5G networks**

Private LTE/5G networks use licensed, shared or unlicensed wireless spectrum thanks to LTE or 5G cellular network base stations, small cells and other radio access network (RAN) infrastructure to transmit voice and data to edge devices (smartphones, embedded modules, routers and gateways).

3GPP defines 5G private networks as non-public networks that typically employ a smaller-scale deployment to meet an organization's needs for reliability, accessibility, and maintainability.

### **Open Source**

Open source private networks are based on a collaborative, community-driven software that relies on peer review and production to use, modify and share the source code.

OAI provides an open source software using talent from around the world to build wireless cellular Radio Access Network (RAN) and Core Network (CN) technologies.

Fire cell provides the world's first open source 4G and 5G private network solutions. They are a strategic member of OAI.

### **Global area network**

A global area network (GAN) is a network used for supporting mobile across an arbitrary number of wireless LANs, satellite coverage areas, etc.

The key challenge in mobile communications is handing off user communications from one local coverage area to the next.

In IEEE Project 802, this involves a succession of terrestrial wireless LANs.

## **Space network**

Space networks are networks used for communication between spacecraft, usually in the vicinity of the Earth.

The example of this is NASA's Space Network.

## **Advantages of wireless networking**

### **❖ Increased efficiency**

Improved data communications lead to faster transfer of information within businesses and between partners and customers. For example, salespeople can remotely check stock levels and prices while on sales calls.

### **❖ Access and availability**

Because wireless technology allows the user to communicate while on the move, you are rarely out of touch - you don't need extra cables or adaptors to access office networks.

### **❖ Flexibility**

Office-based wireless workers can network without sitting at dedicated computers and can continue to do productive work while away from the office. This can lead to new styles of working, such as home working or direct access to corporate data while on customer sites. See more on employees working from home.

### **❖ Cost savings**

Wireless networks can be easier and cheaper to install, especially in listed buildings or where the landlord will not permit the installation of cables.



### ❖ **New opportunities**

Wireless networking could allow you to offer new products or services. For example, many airport departure lounges, train stations, hotels, cafes and restaurants have installed 'hot spot' WiFi services to allow mobile users to connect their equipment to their 'home' offices while travelling.

### **Disadvantages of wireless networking**

Despite the many benefits that wireless can claim over wired networks, there are also potential Wi-Fi disadvantages to keep in mind.

### ❖ **Security**

Wireless transmission is more exposed to attacks by unauthorised users, so you must pay particular attention to security. See securing your wireless systems.

### ❖ **Installation problems**

You may experience interference if others in the same building also use wireless technology, or where other sources of electromagnetic (radio) interference exist. This could lead to poor communication or, in extreme cases, complete loss of wireless communication.

### ❖ **Coverage**

In some buildings, getting consistent coverage can be difficult, leading to 'black spots' where the signal isn't available. For example, in structures built using steel reinforcing materials, you may find it difficult to pick up the radio frequencies used.

### ❖ **Transmission speeds**

Wireless transmission can be slower and less efficient than 'wired' networks. In larger wireless networks, the 'backbone' network is usually wired or fibre rather than wireless.

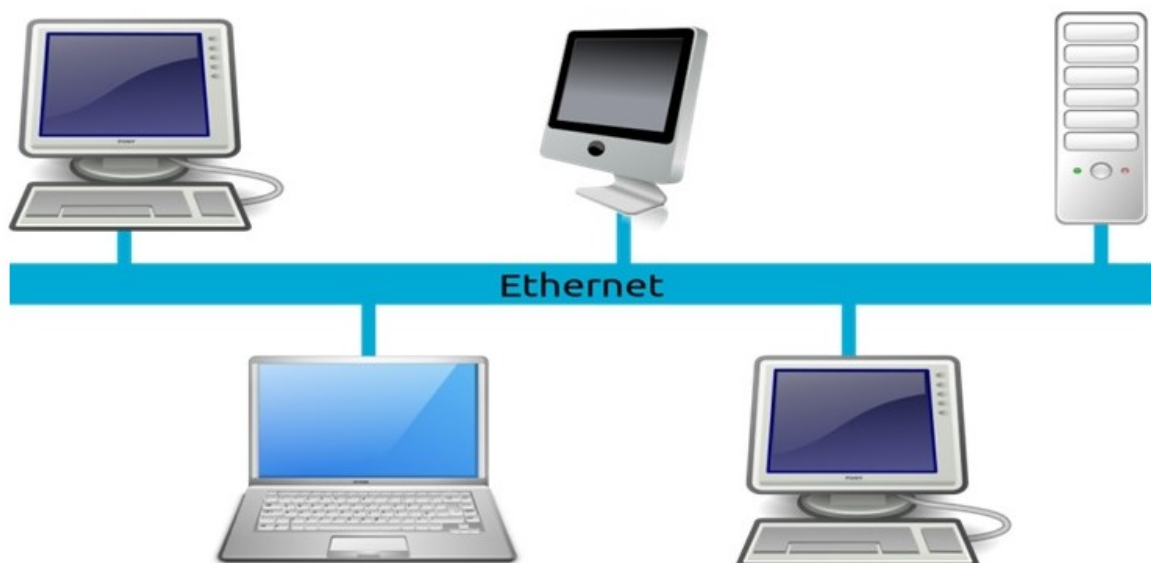
## **TYPES OF NETWORK**

### **LAN**

A LAN (Local Area Network) is a collection of computers or devices linked together within a single, constrained area, typically using Ethernet or Wi-Fi. A local area network can be small or large, with one or thousands of users and devices. A local area network consists of cables, access points, switches, routers, and other components allowing devices to connect to web servers and other LANs via WAN.

LAN allows users to store data in any system and share it throughout the organization. Because backup files are stored on a single server, file transfer and recovery are simple in a local area network. A local area network allows you to store data in any central computer and share it throughout the organization. As a result, you can use it widely in the following scenarios:

- Home and office networking
- School, laboratory, and university networking
- Interconnection of two computers



### **Types of LAN**

Client/server LANs and peer-to-peer LANs are the two types of LANs.

### **Client/Server LANs:**

These local area networks consist of several devices linked to a central server. The server is in charge of many functions, including file storage, printer access, network traffic, etc. A client can be a PC, tablet, or another application device. Clients access the server using either cables or wireless connections.

### **Peer-to-Peer LANs:**

These networks lack a central server and cannot handle heavy workloads like a client/server LAN. Each computer and device contributes equally to the network's operation on a peer-to-peer LAN. The majority of home networks are peer-to-peer.

### **The topologies used in a local area network**

The three basic topologies used in a local area network are:

#### **Star topology:**

In this topology, all nodes are linked to the Central Node. The devices are not linked and send messages to the Central Node.

#### **Ring topology:**

The nodes in this topology are linked together to form a closed loop. Each node uses a token to communicate with the nodes on either side of it.

#### **Bus topology:**

In this topology, all nodes, including computers and servers, are linked by a single cable known as the Bus. This topology is more straightforward and less expensive than other networks.

### **Advantages of LAN**

There are various advantages of a local area network, and some of those advantages are:

- **Resource sharing:**

It allows for the simple sharing of resources such as hard disc drives and printers. It lowers the cost of purchasing hardware.

- **Software sharing:**

Local area network makes it simple to use the same software on multiple devices connected to a computer.

- **High transmission rate:**

A local area network has a high transmission rate to meet the needs of both the user and the equipment.

- **Control:**

It is simple to control and manage the entire LAN.

- **Low error rate:**

The error rate is meager.

- **Internet sharing:**

Allows all LAN users to share a single internet connection.

- **Centralized data:**

You can store data from all network users on a single computer. It allows users to access the necessary data at any time.

- **Efficient communication:**

You can easily share messages and data between computers connected to the network.

- **Increase productivity:**

LANs increase productivity by improving information storage, retrieval, and other functions.

- **Less expensive:**

It is not prohibitively expensive.

- **Simple protocol installation:**

It is simple to set up a security protocol to protect local area network users from hackers.

## **Disadvantages of LAN**

Some of the disadvantages of a local area network are:

- **Covers finite area:**

Local area network only covers a small geographical area, such as an office, building, or home.

- **Low privacy:**

A local area network administrator can see every LAN user's data files and internet history.

- **High maintenance:**

Requires frequent maintenance and upgrades by expert technicians.

- **Long printing queues:**

If printing is too slow, long print queues may form.

- **Low security:**

A virus spreads more easily in this network than in any other network.

- **Degrading performance:**

As the number of users increases, network performance suffers.

- **Complex architecture setup:**

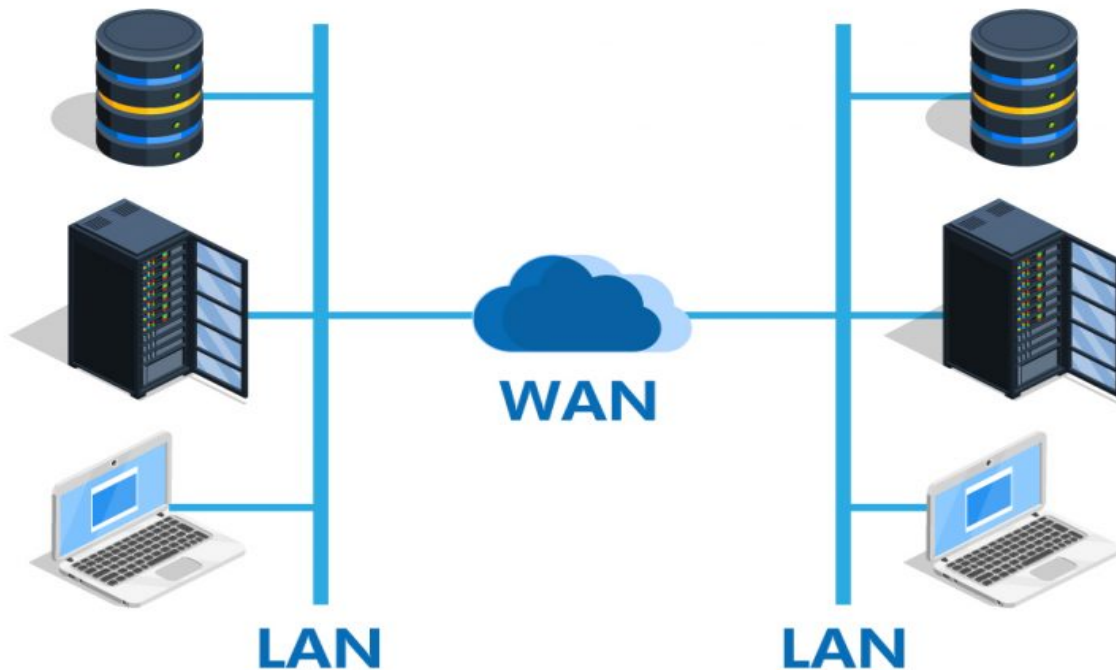
Setting up local area network architecture is difficult.

## WAN

A wide-area network (WAN) is a collection of interconnected local-area networks (LANs) or other networks. This network is not bound to a single location and allows communication, information sharing, and other functions between devices all over the world.

You can lease a private WAN infrastructure as a service from a third-party provider such as an internet service provider or cable company. Large businesses frequently use WANs to connect their office networks; each office usually has its LAN, which connects via a WAN. Wide-area networks are the backbone of an enterprise in today's world. Companies can use WANs for a variety of tasks, such as:

- Use voice and video to communicate.
- Run or host internal applications.
- Access data storage and backup data remotely, etc.



### **WAN network technologies**

In the design of a WAN network, two technologies are used, namely:

#### **Circuit switching:**

All messages will take the same path in a circuit-switched network. And resources along that path will be reserved for this connection. As a result, there is no need to keep track of the fragmentation because the entire message is sent as a single unit.

#### **Packet switching:**

In a packet-switched network, the outgoing link determines the size of the packet, and these packets may take a different path. At the destination, these packets are collected and reassembled.

### **Advantages of using Wide Area Network**

Some of the advantages of using a wide area network are:

- Covers a broader geographic area.
- It benefits the global market and business.
- IT infrastructure is centralized.
- Increase your privacy.
- Assists global markets and businesses.
- Allows users to share resources and application software.
- Allows you to send messages to anyone else on the network very quickly.

### **Disadvantages of using Wide Area Network**

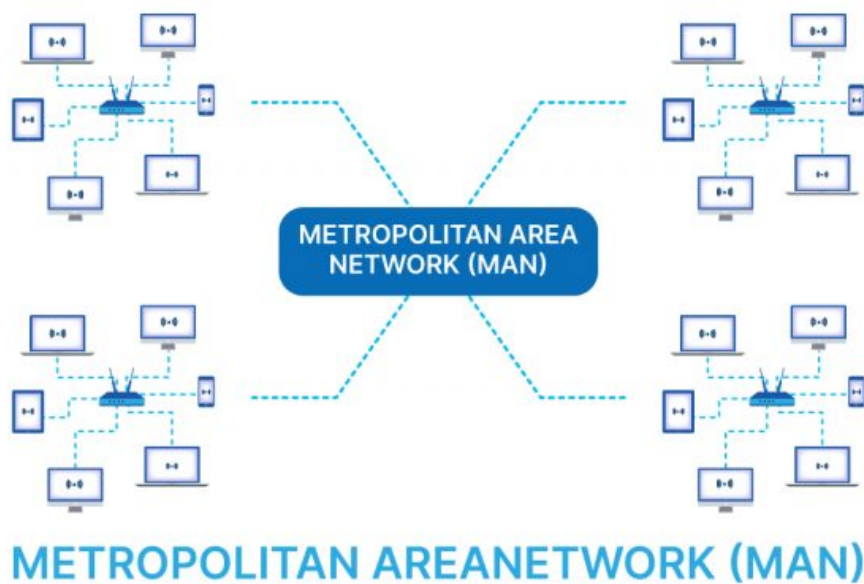
Some of the disadvantages of using a wide area network are:

- It is very expensive because we must pay each time we transfer data.
- Troubleshooting WAN can be time-consuming and challenging.
- WAN is insecure and untrustworthy.
- Because it is a public network, it is heavily reliant on a third party.
- The network is difficult to maintain and requires skilled technicians and network administrators.
- It has more security issues than LAN because it uses more technologies and has a wider coverage area.

### **MAN**

A Metropolitan Area Network is a computer network that connects computers in a metropolitan area, such as a large city or a university. A Metropolitan Area Network is formed by connecting multiple LANs; thus, it covers a larger geographical area than a LAN. A Metropolitan Area Network is more extensive than a LAN network but smaller than a wide-area network (WAN). As the data does not have to travel long distances, MANs are usually more efficient than WANs.

Metropolitan Area Networks provide high-speed data networks for cities and towns while also providing the necessary capacity at a cheaper rate, with greater efficiency than obtaining an equivalent service from a local phone company. A MAN's operating mechanism is similar to that of an Internet Service Provider (ISP), but a single organization does not own a MAN network. A MAN, like a WAN, provides its users with shared network connections.



### Characteristics of MAN network

Metropolitan Area Network have numerous distinguishing characteristics. Among these characteristics are:

- Metropolitan Area Network are local area network (LAN) interconnections.
- A Metropolitan Area Network can range in size from 5 to 50 km.
- Data rates range from moderate to high.
- A single organization does not own a Metropolitan Area Network. It is owned by either a user group or a network provider who sells services to users.
- Metropolitan Area Network allows for the sharing of regional resources.
- Metropolitan Area Network provide uplinks from LANs to WANs and the Internet.
- The Metropolitan Area Network ensures the transmission of high-quality voice, data, and video.

### Advantages of MAN network

Some of the advantages of a Metropolitan Area Network are:

- It can send data in both directions at the same time.
- Metropolitan Area Network allows people to connect LANs.



- It is more comprehensive than a LAN and offers greater security than a WAN.
- Metropolitan Area Network usually encompasses several city blocks or an entire city.
- It improves data handling efficiency while increasing data transfer speed.
- It facilitates the cost-effective sharing of shared resources such as printers.
- It provides an excellent backbone for a vast network, thus increasing WAN access.
- The implementation cost of a Metropolitan Area Network are lower than WAN since it requires fewer resources.

### **Disadvantages of MAN network**

Some of the disadvantages of a Metropolitan Area Network are:

- The data rate is slow in a Metropolitan Area Network compared to LAN.
- Compared to LAN, more cable is required to set up a Metropolitan Area Network.
- Because this network comprises multiple LANs, it is difficult to keep hackers out.
- These networks must be implemented by skilled technicians and network administrators.
- This network's implementation and management costs are higher than those of a local area network.
- It is challenging to manage this network because it's an extensive network of numerous local area networks.
- As skilled technicians and network administrators are needed to implement this network, the overall installation and management costs rise.

### **ERNET**

ERNET operations, i.e. providing state –of-the-art communication infrastructure and services to Academic and Research institutions, Government organizations, NGOs, private sector R&D organizations and various other non-commercial organizations;

- i. Research and Development;
- ii. Training and Consultancy;
- iii. Content development

The Education and Research Network (ERNET) is an autonomous scientific society of the Ministry of Electronics and Information Technology, Government of India.

ERNET was initiated in 1986 by the Department of Electronics (DOE), with funding support from the Government of India and United Nations Development Program (UNDP), involving eight premier institutions as participating agencies— NCST (National Centre for Software Technology) [Now CDAC] Bombay, IISc (Indian Institute of Science) Bangalore, five IITs (Indian Institutes of Technology) at Delhi, Bombay, Kanpur, Kharagpur and Madras, and the DOE, New Delhi.

ERNET began as a multi protocol network with both the TCP/IP and the OSI-IP protocol stacks running over the leased-line portion of the backbone. Since 1995, however, almost all traffic is carried over TCP/IP.

ERNET has made a significant contribution to the emergence of networking in the country. It practically brought the Internet to India and has built up national capabilities in the area of net-working, especially in protocol software engineering. It is the first internet service in india. It has not only succeeded in building a large network that provides various facilities to the intellectual segment of Indian society—the research and education community, it has over the years become a trendsetter in the field of networking.

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ERNET Headquarters is located at New Delhi.

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UNDP has lauded ERNET as one of the most successful programmes it has funded. The Government Of India has committed itself to further strengthen the project by including it in the 9<sup>th</sup> Plan with the allocation of funds and by creation of a new organisational set-up in the form of a Society.

The Science community of the country has also recognized ERNET's contribution-both for infrastructure services as well as for R&D. The Scientific Advisory Committee to the Cabinet has adopted ERNET as the platform for launching an S&T network in the country.

## **Achievements**

## Found of National Capability Building in the Area of Computer Networking Laid through

Setting up of a chain of core groups at the participating agencies with a minimal set of lab facilities and creation of skilled manpower to carry out R&D.

- Generating man power at different levels.
- Making the world of standards (TCP/IP, OSI, etc.) well understood.
- Providing an insight into emerging issues such as ATM networks, networked multi-media and infrastructure.

## Network Infrastructure and services Set-up, Including

- Installation, maintenance and operation of large Campus LANs.
- Design, commissioning and testing of SATWAN hub and the installation of VSATs.
- Seamless interconnection of LAN-WAN segments and multi-protocol capability provided.
- Provision of the whole range of Internet services.
- Deployment of TDM/TDMA-based VSAT network for Internet access.

## **NICNET**

### **Aims and objectives**

NICNET was established to fulfill the following objectives:

- ❖ To design, develop and implement advanced computer based methodology.
- ❖ To promote adoption of computer based management techniques.
- ❖ To join internally together through the computer networks to all of the departments, autonomous bodies and organizations of a central government of India in the form of a government information system of the country.
- ❖ To set-up a computer for connecting the various government departments.
- ❖ To generate specialized manpower in the field of information.

## **NICNET**

NICNET was established by National Information Centre as an information network in the country.

It has primarily been set-up to link various departments of the government for decision optimization, i.e., to use new technologies of computer networking to ensure a systematic procedure for information exchange between the centre and the states, between and their districts and among various departments / ministries of the state and Central government as well as between and the public.

NICNET has more than 250 micro earth stations operating in different parts of the country. It links four regional nodes at Delhi, Pune, Bhubaneswar and Hyderabad and established 32 nodes at the state and union territories levels and 439 nodes at district headquarters.

By this architecture NICNET facilitates the provision of reliable data communication to the government agencies at the place of work.

A number of information systems have been established under this network in the area of accounts, budgets, central excises, import-export distribution, estate duties, etc.

It has established District Information System, which is a network, based data bank of NIC for better planning and efficient decision-making about the districts.

## **Services**

Several types of services are being provided through this network. They are as follows:

**E-mail:** Electronic mail service of NICNET is the value added electronic mail. This service enables all users to transmit and receive mail. This mail service users to transmit and receive mail. This mail service has been custom designed taking into consideration the network architecture and operation environment.

**Bibliographic Service:** A major bibliographic application that is available on this network is the bibliographic biomedical information. NIC has established ICMR-NIC centres for biomedical information in 1986, which has been providing services to users in the country form MED line, POP line, CHEMBANK and cancer databases. This centre also conducts training courses, workshops and seminars aimed at preparing cadre of biomedical librarians, well versed in the latest information technologies.

**Electronic Information Service:** Since 1989 NICNET providing this service for 3 Lokshabha elections held in the country. NIC has also developed software in C language for poll results processing.

**Patent Information System:** NIC also developed a computerized online patent information system based on bibliographic data available from the International Patent Documentation Centre (INPADOC), Vienna. This system creates information and efficient retrieval of patent documents according to the International Patent Classification Code.

## **INFONET**

The UGC-Infonet E-journal consortium is our pride in the field of education and research which has been formally launched on the concluding day of UGC's Golden Jubilee celebrations by his Excellency the President of India, Dr. A.P.J. Abdul Kalam at Vigyan Bhawan on 28<sup>th</sup> December 2003 by dedicating a bouquet of e-journals to the nation.

With globalization of education and competitive research the demand for the journals has increased over the years. Due to scarcity of funds, libraries have been forced to discontinue the scholarly journals, which have great impact to the users. In order to provide the current literature to academia, UGC has initiated the UGC-INFONET: E-Journal consortium. Timely initiative of UGC is a great boon to academia in the country, which enables them to access large number of scholarly journals from reputed publishers, aggregators and society publications. Under the consortium, about 4000 full text scholarly electronic journals from 25 publishers across the globe can be accessed. The consortium provides current as well as archival access to core and peer-reviewed journals in different disciplines. The whole programme has been implemented in different phases. So far 100 Universities out of 171 Indian Universities, which come under the purview of UGC, have been provided access to these journals and it will gradually be extended to affiliated colleges as well. It covers almost all areas of learning like Arts, Humanities, Social Sciences, Physical and Chemical Sciences, Life Sciences, Computer Sciences, Mathematics and Statistics, etc. and other subject areas are to be added in near future. The program is wholly funded by the UGC and monitored by INFLIBNET (Information and Library Network) Centre, Ahmedabad.

## **LIBRARY NETWORKS**

### **OCLC**

The OCLC (Online Computer Library Center) is according to the website, “a non-profit, membership, computer library service and research organization dedicated to the public purpose of furthering access to the world’s information and reducing information costs”.

Founded in 1967 as the Ohio College Library Center, more than 60,000 libraries in 112 countries and territories around the world use OCLC services to locate, acquire, catalog, lend and preserve library materials.

The organization was founded by Fred Kilgour and its offices are located in Dublin, Ohio.

OCLC acquired Net Library, the largest e-content provider, in 2002 and owns 100% of the shares of OCLC PICA, a library automation systems and services company, which has its headquarters in Leiden in the Netherlands, which was renamed into “OCLC” at the end of 2007. In June 2006, the Research Libraries Group (RLG) merged into OCLC.

Founded in 1967, OCLC Online Computer Library Center is a non-profit, membership, computer library service and research organization dedicated to the public purposes of furthering access to the world’s information and reducing the rate of rise of library costs. More than 60,000 libraries in 112 countries and territories around the world use OCLC services to locate, acquire, catalog, lend and preserve library materials.

Researchers, students, faculty, scholars, professional librarians and other information seekers use OCLC services to obtain bibliographic, abstract and full-text information when and where they need it.

OCLC and its member libraries cooperatively produce and maintain WorldCat-the OCLC Online Union Catalog.

## **Membership**

Membership in OCLC is a unique cooperative venture, giving your library access to a wide range of services and databases, including WorldCat. Together OCLC member libraries make up the world's largest consortium.

## **Expanding beyond OHIO**

In 1977, the Ohio members of OCLC adopted changes in the governance structure that enabled libraries outside Ohio to become members and participate in the election of the Board of Trustees; the Ohio College Library Center became OCLC, Inc. In 1981, the legal name of the corporation became OCLC Online Computer Library Center, Inc. Today, OCLC serves more than 60,000 libraries of all types in the U.S. and 112 countries and territories around the world.

## **Mission**

Connecting people to knowledge through library cooperation.

**Vision**

To connect all libraries around the world.

**Quality policy**

OCLC will continually improve the processes used to deliver its products and services to achieve the OCLC Vision.

**How it works?**

Researchers, students, faculty, scholars, professional librarians and other information seekers use OCLC services to obtain bibliographic, abstract and full-text information when and where they need it.

OCLC and its member libraries cooperatively produce and maintain WorldCat-the OCLC Online Union Catalog, the largest Online Public Access Catalog (OPAC) in the world.

World Cat contains holding records from most public and private libraries worldwide. World Cat is available through many libraries and university computer networks.



The Open World Cat program makes records of library-owned materials in OCLC's World Cat database available to Web users on popular Internet search, bibliographic and bookselling sites. OCLC member libraries' catalogs are more accessible from the sites where many people start their search for information.

Open World Cat records may be accessed through Google or Yahoo's advanced search features, by simply limiting the scope of a search to the site or domain "worldcatlibraries.org". In the fall of 2004, the Open World Cat collection was expanded to include information about all World Cat records.

In October 2005, the OCLC technical staff began a wiki-like project that allows readers and librarians to add commentary, and structured-field information, associated with any WorldCat record.

OCLC owns a preservation microfilm and digitization operation called the OCLC Preservation Service Center, with its principal office in Bethlehem, Pennsylvania. Libraries, museums, historical societies, colleges and universities utilize the OCLC Preservation Services to preserve printed works, books, maps, manuscripts, newspapers, etc. in microfilm format for future generations due to its 500-year life expectancy. In addition OCLC Preservation Services converts print and microfilm to digital objects for computer access online database.

OCLC maintains a database for cataloguing and searching purposes which is used by librarians and the public. OCLC Passport was one of the computer programs used. Connexion was introduced in 2001 and replaced Passport when it was phased out in May of 2005.

This database contains records in Machine Readable Cataloging (MARC) format contributed by library cataloguers worldwide who use OCLC as a cataloguing tool.

These MARC format records are then downloaded into the libraries local catalog systems to drive their online catalogs. This allows libraries worldwide to find and download records for materials they want to add their local catalog without having to go through the lengthy process of cataloguing them each individually.

As of February 2007, their database contains over 1.1 billion catalogued items. It remains the world's largest bibliographic database. Connexion is available to professional librarians both as a computer program or on the web at [connexion.oclc.org](http://connexion.oclc.org).

World Cat is also available to the public for searching through a web-based service called First Search, as well as through the Open World Cat program.

## **INFLIBNET**

INFLIBNET Centre (Information and Library Network Centre) is an Inter-University Centre of the University Grants Commission (India) under the Ministry of Education (India). The organisation promotes and facilitates libraries and information resources for Indian further education. Its premises are in Gandhi nagar, Gujarat.

Shodhganga, the digital repository of theses and dissertations submitted to universities in India is maintained by INFLIBNET Centre.

INFLIBNET is a major National Program initiated by the University Grants Commission (India) in March 1991 as a project under the Inter-University Centre for Astronomy and Astrophysics (IUCAA). It became an independent Inter-University Centre in June 1996. INFLIBNET runs a nationwide high speed data network connecting university libraries and other information centers.

INFLIBNET is involved in modernizing university libraries in India using the state-of-art technologies for the optimum utilization of information.

INFLIBNET also performed an important role as an online learning resource by HRD Ministry during COVID-19 lockdown in India.

In 2022, University Grants Commission (India) launched an initiative with the Information and Library Network (INFLIBNET) Centre to assist research scholars and their supervisors in conducting their research.

## **Activities**

The Shodhganga portal of Inflibnet Centre displays the achievement of the competing universities with a detailed index of number of theses contributed by several departments of study. Calcutta University, Savitribai Phule Pune University and Aligarh Muslim University (AMU) have become largest contributors of theses to the Shodhganga portal of Inflibnet Centre.

The Centre leads projects for the development of library services in Indian universities. These have included:

- ❖ Financial support for automation of university libraries.
- ❖ Development of a database of resources in libraries in India.
- ❖ Development of a library management application named SOUL (Software for University Libraries).
- ❖ UGC-Infonet, an Internet connectivity programme

Open access initiatives include:

- ❖ OJAS, a platform for faculty and researchers in universities to host journals.
- ❖ Shodhganga, a digital repository of theses and dissertations by research scholars in universities in India.

- ❖ Shodhgangotri, a digital repository of synopses of research topics submitted to universities in India.
- ❖ IR@INFLBNET, an repository of papers.
- ❖ Creation of R&D facilities and working groups to study and contribute to the open source movement.
- ❖ Maintenance of a database of scientists, researchers and faculty members at academic institutions and organisations involved in teaching and research in India.
- ❖ Bibliometric and scientometric studies.
- ❖ e-PG Pathshala, a gateway to Postgraduate courses.
- ❖ Training courses in Library Management and Information and Communication Technology (ICT).

## **Objectives**

1. To promote and establish communication facilities to improve capability in information transfer and access, that provide support to scholarship, learning, research and academic pursuit through cooperation and involvement of agencies concerned.
- 
2. Information and Library Network a computer communication network for linking libraries and information centers in universities, deemed to be universities, colleges, UGC information centers, institutions of national importance and R & D institutions, etc. avoiding duplication of efforts.

## **Functions**

In order to fulfill the broad objectives, INFLIBNET will do the following:

- 
- ❖ Promote and implement computerization of operations and services in the libraries and information centers of the country, following a uniform standard;

- ❖ Evolve standards and uniform guidelines in techniques, methods, procedures, computer hardware and software, services and promote their adoption in actual practice by all libraries, in order to facilitate pooling, sharing and exchange of information towards optimal use of resources and facilities:
  
- ❖ Evolve a national network interconnecting various libraries and information centers in the country and to improve capability in information handling and service.
  
- ❖ Provide reliable access to document collection of libraries by creating on-line union catalogue of serials, theses/ dissertations, books, monographs and non-book materials (manuscripts, audio-visuals, computer data, multimedia, etc.) in various libraries in India.
  
- ❖ Provide access to bibliographic information sources with citations, abstracts, etc. through indigenously created databases of the Sectoral Information Centers of NISSAT, UGC Information Centers, City Networks and such others and by establishing gateways for on-line accessing of national and international databases held by national and international information networks and centers respectively;
  
- ❖ Develop new methods and techniques for archival of valuable information available as manuscripts and information documents in different Indian languages, in the form of digital images using high density storage media;
  
- ❖ Optimize information resource utilization through shared cataloguing, inter-library loan service, catalogue production, collection development and thus avoiding duplication in acquisition to the extent possible.
  
- ❖ Enable the users dispersed all over the country, irrespective of location and distance, to have access to information regarding serials, theses/dissertation, books, monographic and non-book materials by locating the sources wherefrom available

and to obtain it through the facilities of INFLIBNET and union catalogue of documents.

- ❖ Create databases of projects, institutions, specialists, etc. for providing on-line information service.
- ❖ Encourage co-operation among libraries, documentation centers and information centers in the country, so that the resources can be pooled for the benefit of helping the weaker resource centers by stronger ones.
- ❖ Train and develop human resources in the field of computerized library operations and networking to establish, manage and sustain INFLIBNET.
- ❖ Facilitate academic communication amongst scientist, engineers, social scientists, academics, faculties, researchers and students through electronic mail, file transfer, computer/audio/video conferencing, etc.
- ❖ Undertake system design and studies in the field of communications, computer networking, information handling and data management.
- ❖ Establish appropriate control and monitoring system for the communication network and organize maintenance.
- ❖ Collaborate with institutions, libraries, information centers and other organizations in India and abroad in the field relevant to the objectives of the Centre.
- ❖ Promote R&D and develop necessary facilities and create technical positions for realizing the objectives of the Centre.
- ❖ Generate revenue by providing consultancies and information services.

## **Membership**

### **Primary Membership**

The University Libraries entitled to receive grants from UGC will become primary members immediately on receipt of the initial grant under the INFLIBNET programme. The responsibility in Memorandum of Understanding (MOU) which is signed by the member Library with INFLIBNET.

### **Associate Membership: [Under Consideration]**

The Libraries who are not entitled to receive the grants from the UGC but are public funded academic and research organisation, Government department, Non-profit making organisation can become the associate membership of INFLIBNET by signing an MOU and by paying the requisite fees. The details are given in MOU.

## **DELNET**

DELNET was started at the India International Centre Library in January 1988 and was registered as a society in 1992.

It was initially supported by the National Information System for Science and Technology (NISSAT), Department of Scientific and Industrial Research, Government of India.

It was subsequently supported by the National Informatics Centre, Department of Information Technology, Ministry of Communications and Information Technology, Government of India and The Ministry of Culture, Government of India.

DELNET has been established with the prime objective of promoting resource sharing among the libraries through the development of a network of libraries.

It aims to collect, store, and disseminate information besides offering computerised services to users, to coordinate efforts for suitable collection development and also to reduce unnecessary duplication wherever possible.

DELNET has been actively engaged with the compilation of various Union Catalogues of the resources available in member-libraries. It has already created the Union Catalogue of Books, Union List

of Current Periodicals, Union Catalogue of Periodicals, CD-ROM Database, Database of Indian Specialists, Database of Periodical Articles, Union List of Video Recordings, Urdu Manuscripts' Database, Database of Theses and Dissertations, sample databases of language publications using GIST technology and several other databases. The data is being updated in each of these databases and is growing rapidly. All the DELNET databases have been resident on DELSIS, in-house software developed on BASISPlus, an RDBMS, the product of Information Dimensions Inc. of USA which has been provided to DELNET courtesy National Informatics Centre, New Delhi.

DELNET provides an array of facilities including E-mail to its member-libraries including both institutional and associate institutional members. DELNET'S relentless efforts in resource sharing have proved extremely effective. It has indeed been a big leap towards the modernisation of libraries in India.

## **UNIT 5**

### **SEARCH ENGINES**

A search engine is a coordinated set of programs that searches for and identifies items in a database that match specified criteria. Search engines are used to access information on the World Wide Web.

### **PROCESS OF SEARCH ENGINE**

Google is the most commonly used internet search engine. Google search takes place in the following three stages:



## 1. **Crawling**

Crawlers discover what pages exist on the web. A search engine constantly looks for new and updated pages to add to its list of known pages. This is referred to as *URL discovery*. Once a page is discovered, the crawler examines its content. The search engine uses an algorithm to choose which pages to crawl and how often.

## 2. **Indexing**

After a page is crawled, the textual content is processed, analyzed and tagged with attributes and metadata that help the search engine understand what the content is about. This also enables the search engine to weed out duplicate pages and collect signals about the content, such as the country or region the page is local to and the usability of the page.

## 3. **Searching and ranking.**

When a user enters a query, the search engine searches the index for matching pages and returns the results that appear the most relevant on the search engine results page (SERP). The engine ranks content on a number of factors, such as the authoritativeness of a page, back links to the page and keywords a page contains.

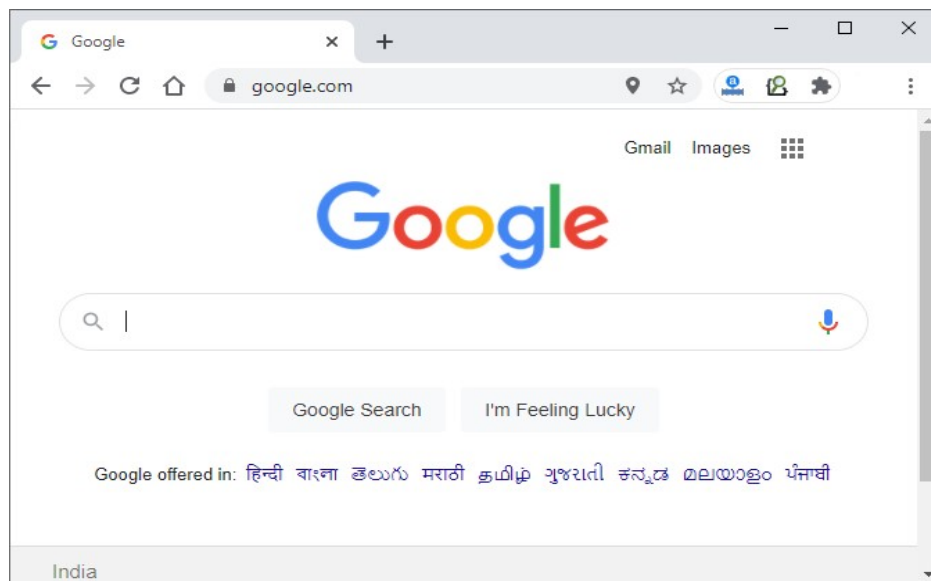
Specialized content search engines are more selective about the parts of the web they crawl and index. For example, Creative Commons Search is a search engine for content shared explicitly for reuse under Creative commons license. This search engine only looks for that specific type of content.

Country-specific search engines may prioritize websites presented in the native language of the country over English websites. Individual websites, such as large corporate sites, may use a search engine to index and retrieve only content from that company's site. Some of the major search engine companies license or sell their search engines for use on individual sites.

## **EXAMPLES OF SEARCH ENGINE**

### **Google**

Google takes first place in search engines. According to the research of **statista** and **Statcounter**, around 92.16% of searches are happening on Google, demanding in the market. Google offers easy to use interface to the users; that is why it is the most popular search engine. According to the calculation of Alex, Google is ranking at the top and secured 1<sup>st</sup> rank all over the world and in the United States as well.



## **ADVANTAGES**

- Google provides quality search and provides the best result to its users.
- It offers a simple and easy-to-use interface.
- Google regularly updates its algorithms to provides the best services to the users.
- It is available in about 109 languages. So, it is almost accessible all over the world.

## **DISADVANTAGES**

- It provides too many results back or returns too many webpages to the user, in which the best information is difficult to find.
- It delivers the information with several advertisements.

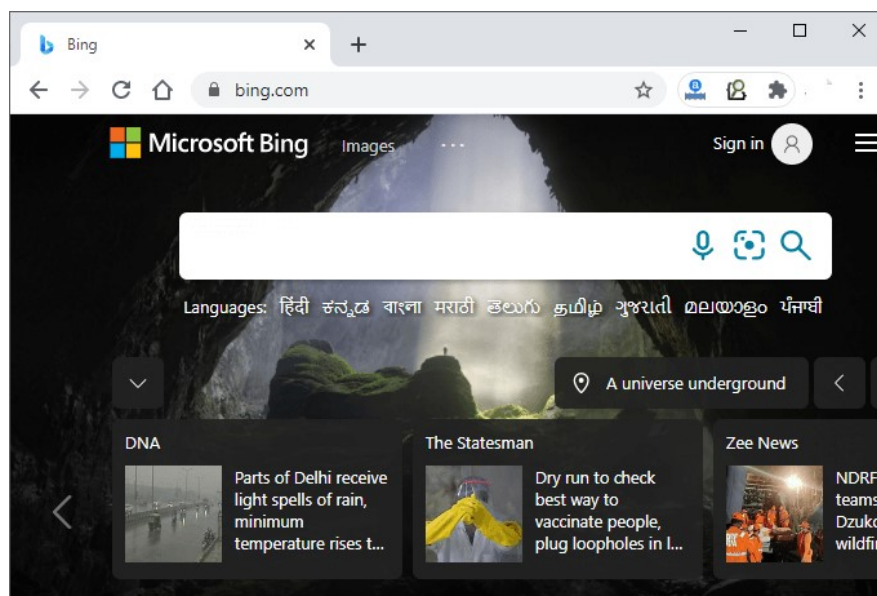
- It uses cookies that store user data.

## BING

Bing is a Microsoft product now, which is known as **Microsoft Bing**. Bing has now renamed to Microsoft Bing in October 2020.

Microsoft Bing is another popular search engine that takes place after Google. Although the searching ratio on Bing is less than Google, but it takes second place after Google. Around 2.18% of searches are happening on Microsoft Bing.

By default, Microsoft Bing comes with the Windows operating system. Bing has a reward program for starters. It allows to collect the points while searching. You can redeem these points at Microsoft or Windows stores, which is a good perk.



## ADVANTAGES

- Microsoft Bing comes with the Windows Operating system by default. So, you do not need to install it separately.
- Microsoft Bing ranks home pages, not blogs.

- Microsoft Bing has a larger character limit than Google. It allows for 40 characters title while Google for 25 only.

## DISADVANTAGES

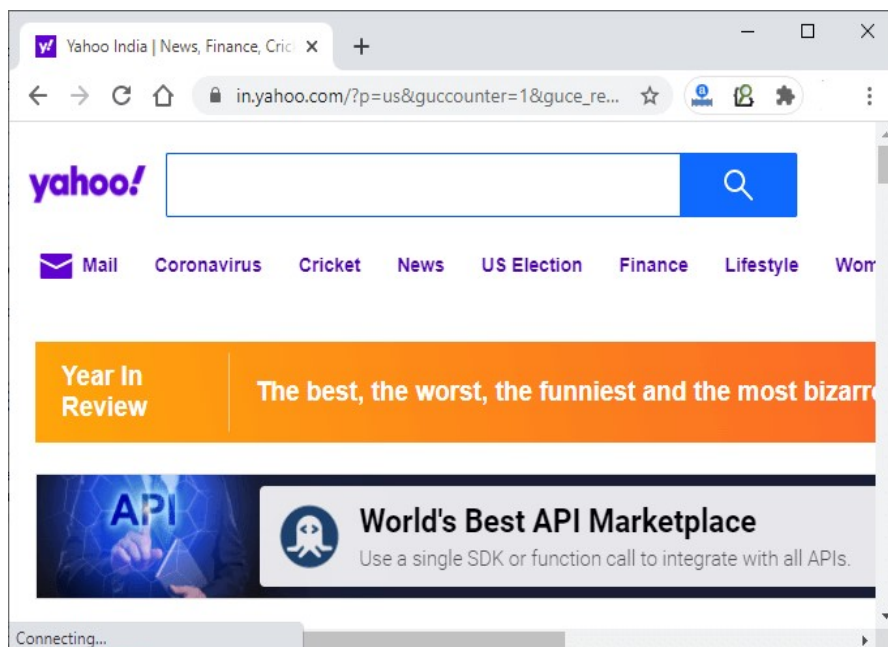
- When it comes to comparison, Bing provides a slow search result comparing with Google.
- It does not provide a simple interface like Google.
- Bing + Yahoo collectively are not close to Google.

## YAHOO

Before Google entered the market, Yahoo was the most popular search engine. When Google came into use, Yahoo's popularity began to wane and it went off the market. Nowadays, very few people use the Yahoo search engine.

In the United States, Yahoo is the default search engine for Mozilla Firefox since 2014 till now. Don't be confused between the Yahoo search engine and the Mozilla Firefox web browser. Yahoo is the most used search engine in the United States. Its market share in the United States is 49.15%.

According to the calculation of Alexa, the world rank of Yahoo is 12, and the US rank is 4 now.



## **ADVANTAGES**

- Yahoo is a search engine that offers comprehensive organic results.
- Other than the search engine, Yahoo also offers Yahoo mail, Yahoo Answers, and many other apps.
- Unlike other search engines, Yahoo has a better shopping search feature.
- Yahoo is the default search engine of Mozilla Firefox.

## **DISADVANTAGES**

- One of the biggest disadvantages of Yahoo is that it provides undated search results and also without labeling the ads and original data. This makes it difficult for the user to differentiate between ads and useful information.
- Yahoo + Bing collectively are not close to Google.
- Yahoo had not updated itself regularly; that is why it has gone from the market. So, it is not accepted by users.

Some of the other popular search engines are Baidu, DuckDuckGo, Yandex, Ask.com, Ecosia, AOL, and Internet Archive etc...

## **ADVANTAGES OF SEARCH ENGINE**

- Different search results can be provided depending upon the choice and information needs of users.
- It exploits user information and search context to learning in which sense a query refer.
- Save the searching time of user's. So an efficient search engine which provide results to a user according to his/her interest in less search time

## **DISADVANTAGES OF SEARCH ENGINE**

- When different users give same query, same result will be returned by a typical search engine.
- It becomes difficult for the user to get the relevant content.
- Time Consuming for user to search for a query. So, we are providing a user relevant information according to his interest by generating personalized search engine.

## **META SEARCH ENGINES**

Popular search engines, like Google, Yahoo or Bing, crawl billions of sites and create a directory for these websites. So, when a user searches a term, it checks its database and ranks the most relevant content as search results.

This is not the case with a Meta search engine. It's a search engine without a directory of its own and, therefore, relies on the data provided by several queried search engines to provide results.

It sends queries to various search engines, compiles, and index search results; and categorizes them based on proprietary search or result-ranking methods.

Basically, Meta search engines are information aggregation tools that rely solely on the database of several other search engines.

## **EXAMPLES OF META SEARCH ENGINES**

Some examples of Meta search engines include:

1. **Dogpile:**

This is one of the major meta search engine owned by Info Space. It links to help users concentrate their search on specific categories like News, Audio. It keeps track of the 15 most recent searches you performed. When browser gets close the list is automatically reset.

2. **Vivisimo:**

Vivisimo will compile matching results from different search engines for your query and also index the result pages automatically.

3. **Mamma:**

Mamma, built in 1996, is one of the oldest meta search engines. It makes a paid listings option available to advertisers.

4. **Kartoo:**

It analyzes search results data by visually displaying result pages that are linked by keywords.

5. **SurfWax:**

Surfwax users with free accounts can choose their preferred search engines from a list. You can also check where your keywords appear in a result page using the “SiteSnaps” feature. It saves results for later.

6. **Clusty:**

Clusty displays the standard web search results and allows you to index up to ten different web content-including blogs, images, and shopping database-using Vivisimo’s dynamic clusters.

7. **CurryGuide:**

CurryGuide is for the US and diverse European countries. It saves your results for future use.

8. **Excite:**

It was formerly a crawler-based search engine. In 2002, Excite was acquired and modified by Info Space, but it retains its portal features.

9. **Fizzle:**

Fizzle was formerly SearchOnline. It offers a very flexible custom interface to a ton of information sources.

10. **Gimenei:**

Gimenei has an advanced search feature for country-specific searches. It sends queries to search engines (numbers concealed) and eliminates duplicates from search results.

## **ADVANTAGES OF META SEARCH ENGINE:**

### **1. Unlimited knowledge Base**

Using the internet for research or studying is great since you get broadband unlimited access to knowledge and information. However, it takes a lot of time to compare different results from the various search engines. Different search engines have a different crawler, a different index, a different algorithm and the list go on.

### **2. Don't Miss Any Information**

Using a single search engine to conduct a search may leave a chance of missing out on important information simply because the search engine does not rank prominently enough. The biggest advantage of meta search engines is that it eliminates this risk and gives you more information than a standard search engine would.

### **3. Use Less Well Known Search Engines**

Meta search engines provide the ability to use less-well-known search engines. This helps the user to get more information and discover new sites that they may otherwise may not have been found with the same search request using a single search engine.

### **4. Save Time**

Meta search engines are very useful if the user only wants to get an overview of the topic or get quick answers. It saves you the time of going through multiple search engines and comparing the results. A Meta search engine will quickly combine and compile the results by ranking them by their guidelines or listing from each engine queried with no additional post-processing.

### **5. Privacy Protection**

Another advantage of Meta search engines is that it can also provide privacy to a search by hiding the searcher's IP address from the search engine queries. Meta search engines also have helpful features that help to search linguistic and textual analysis, related term suggestions, and search results clustering.



## **DISADVANTAGE OF META SEARCH ENGINE:**

### **1. Limited to Basic Queries**

Even with the advantage of a Meta search engine, they still have their limitations. When you compare them with search engines like Bing or Google, Meta search engines are still very simple. Users are limited to relatively basic queries as Meta search engines do not interpret syntax accurately or fully as standard search engines.

### **2. Fewer Results**

Even with access to a huge amount of information, Meta search engines still produce fewer results than standard search engines. This disadvantage undermines the main advantage of a Meta search engine. They also prioritize sponsored results and feature them more prominently.

### **3. Identical Results**

Meta search engines can present identical websites and pages into their aggregated results. This is because they enter the same query to do different search engines, and most of the time, the results are almost similar.

## **INTERNET**

Internet is the world's largest computer network, the network of networks, scattered all over the world. It was created nearly 30 years ago as a project for the U.S. Department of Defense. Its goal was to create a method for widely separated computers to transfer data efficiently whether war or peace. From a handful of computer and users in the 1960s.

Today the Internet has grown to thousands of regional networks that connect millions of users round the earth. Any single individual, company, or country does not own this global network.

A network of networks, or Internet, is a group of networks that are:

- Interconnected Physically.
- Capable of communicating and sharing data with each other.

- Able to act together as a single network.

Machines on one network can communicate with machines on other networks send data, files and other information back and forth.

For this to work, the networks and machines that are part of the Internet have to agree either to speak the same “language” when they are communicating or to use an “interpreter”. This “Language” is known as software that enables the different types of machines on separate networks to communicate and exchange information.

To be used by different types of machines and yet be understood by all of them, the software must follow a set of rules. Those set of rules are called protocol. The Internet, with a capital “I”, is the network of networks, which either uses the TCP/IP protocol; or interacts with TCP/IP networks via gateways (the interpreters). The Internet presents these networks as one, seamless network for its users.

Internet covers the globe and includes large, international networks as well as many smaller, local-area networks (LANs).

Internet offers access to data, graphics, voice, sound, software, text and people through a variety of services and tools for communication and data exchange. The value of Internet is highly commendable due to three obvious reasons:

### **Internet is the cheapest and Fastest Means to**

- Get Information
- Provide Information
- Compile Information

Given below is a list of activities that one could do with a web browser:

- ❖ Visit websites
- ❖ Send and receive electronic mail
- ❖ Read and post articles in newsgroups
- ❖ Download files to your PC
- ❖ Chat with other users online
- ❖ Play games with others online

- ❖ Access online multimedia including radio and video broadcasts.
- ❖ Search the Internet for Information
- ❖ Join contests
- ❖ Contribute articles, and other materials
- ❖ Do online shopping and find jobs
- ❖ Post one's resume on the Internet
- ❖ Create your own websites
- ❖ Create an Email account
- ❖ Use the Email reminder service
- ❖ Find a person's details
- ❖ Send greetings to others

The above list is by no means a complete and comprehensive one. There are a lot of other things that one can do on the internet.

## **HISTORY OF INTERNET**

“In 1957, the Soviet Union launched the first satellite, Sputnik I, triggering the US military to create the DARPA agency to regain the technological lead.

The IPTO (Information Processing Techniques Office) funded the research that led to the development of the ARPANET – Advanced Research Projects Agency”

“DARPA worked on developing technologies to protect the US against a space-based nuclear attack.

Some people in the IPTO considered the potential benefits of a country wide communications network. Lawrence Roberts led development of the network architecture, and based it on the new idea of packet switching, first discovered by Leonard Klein rock”

In October, 1969, the ARPANET first went live with communications between the University of California at Los Angeles and the Stanford Research Institute. The first networking protocol used on the ARPANET was the network Control PROGRAM.

In 1983, it was replaced with the TCP/IP protocol developed by Bob Kahn and Vinton Cerf, which is still the standard used today.

In 1990, the National Science Foundation took over the management of what was then called the NAFNET and significantly expanded its reach by connecting it to the CSNET in Universities throughout North America, and later to the EUNET throughout research facilities in Europe large part to the NSF's enlightened management, and fueled by the growing popularity of the web, the use of the net has been exploding.

## **GETTING INFORMATION ON THE INTERNET**

The amount of information available through the Internet is staggering. To make all of it more easily available to users, programs such as the gopher were developed to help present material in some logical fashion, The most recent and very successful attempt at presenting information over the internet is the World Wide Web you could get information about people. Products, Organizations, research data electronic versions of the printed media etc from the Internet.

## **PROVIDING INFORMATION ON THE INTERNET**

Most of what you want to provide could be considered advertising, while that may sound somewhat commercial, it is the best and most inexpensive way to let people know who you are, what you are doing, have done and how. For an organization or institution setting up a home page is a good way to let the world know what its products and services are. In addition to advertising, the other critical functions that relate to provision of information are.

- ❖ **Publishing**, include full text articles, reports illustrated articles, abstracts computer programs and demonstrations.
- ❖ **Extension**, in which some of the delays associated with the printed media, may be reduced.
- ❖ **Teaching**, the possibilities on her include both distance learning and assistant for students, Compiling information from the Internet.

There is obviously a special case of "getting" information. The distinction is that it is possible to get specialized information from the web. For instance if you wanted to poll the readership for a magazines or conduct a survey to detect the pulse of selected community, the web provides you with the ideal platform and opportunity. Using forms, e-mail, etc., you can conduct survey; get opinion of people across the world. There are hundreds of discussion groups and list servers, where one can post a question and get in answered by hindered of people who participate in these discussions.

## **WEB BROWSER**

Web Browser is a common term which is frequently used by people while discussing the Internet. However, the exact definition of a web browser is known by few only.

### **Web Browser Definition:**

A software application used to access information on the World Wide Web is called a Web Browser. When a user requests some information, the web browser fetches the data from a web server and then displays the webpage on the user's screen.

## **HISTORY OF WEB BROWSER**

- “**World Wide Web**” was the first web browser created by Tim Berners Lee in 1990. This is completely different from the World Wide Web we use today
- In 1993, the “**Mosaic**” web browser was released. It had the feature of adding images and an innovative graphical interface. It was the “the world's first popular browser”
- After this, in 1994, Marc Andreessen (leader of Mosaic Team) started working on a new web browser, which was released and was named “**Netscape Navigator**”
- In 1995, “**Internet Explorer**” was launched by Microsoft. It soon overtook as the most popular web browser
- In 2002, “**Mozilla Firefox**” was introduced which was equally as competent as Internet Explorer
- Apple too launched a web browser in the year 2003 and named it “**Safari**”. This browser is commonly used in Apple devices only and not popular with other devices
- Finally, in the year 2008, Google released “**Chrome**” and within a time span of 3 years it took over all the other existing browsers and is one of the most commonly used web browsers across the world

## **PURPOSE OF WEB BROWSER**

- ❖ Web browser is used to run the software application that allows retrieving, presenting and traversing the information from one place to another.
- ❖ Web browser provides the resources using the WWW (World Wide Web) this can be identified by URI (Uniform Resource Identifier).
- ❖ Web browser fetches the data like web page, image, video or other piece of content from the server and displays it accordingly.
- ❖ Web browser uses hyperlinks to display the resources and allow the users to navigate their browsers according to the resources.
- ❖ Web browser defines the application software that is designed for the user to access and retrieve the documents using the Internet.

## **FUNCTIONS OF WEB BROWSER**

- The main function is to retrieve information from the World Wide Web and making it available for users
- Visiting any website can be done using a web browser. When a URL is entered in a browser, the web server takes us to that website
- To run Java applets and flash content, plugins are available on the web browser
- It makes Internet surfing easy as once we reach a website we can easily check the hyperlinks and get more and more useful data online
- Browsers use internal cache which gets stored and the user can open the same webpage time and again without losing extra data
- Multiple web pages can be opened at the same time on a web browser
- Options like back, forward, reload, stop reload, home, etc. are available on these web browsers, which make using them easy and convenient.

## **DIFFERENT WEB BROWSERS**

### **1. World Wide Web**

- The first web browser ever
- Launched in 1990
- It was later named “Nexus” to avoid any confusion with the World Wide Web
- Had the very basic features and less interactive in terms of graphical interface
- Did not have the feature of bookmark

## **2. Mosaic**

- It was launched in 1993
- The second web browser which was launched
- Had a better graphical interface. Images, text and graphics could all be integrated
- It was developed at the National Center for Supercomputing Applications
- The team which was responsible for creating Mosaic was lead by Marc Andreessen
- It was named “the world’s first popular browser”

## **3. Netscape Navigator**

- It was released in 1994
- In the 1990s, it was the dominant browser in terms of usage share
- More versions of this browser were launched by Netscape
- It had an advanced licensing scheme and allowed free usage for non-commercial purposes

## **4. Internet Explorer**

- It was launched in 1995 by Microsoft
- By 2003, it has attained almost 95% of usage share and had become the most popular browsers of all
- Close to 10 versions of Internet Explorer were released by Microsoft and were updated gradually
- It was included in the Microsoft Windows operating system
- In 2015, it was replaced with “Microsoft Edge”, as it became the default browser on Windows 10

## **5. Firefox**

- It was introduced in 2002 and was developed by Mozilla Foundation

- Firefox overtook the usage share from Internet Explorer and became the dominant browser during 2003-04
- Location-aware browsing was made available with Firefox
- This browser was also made available for mobile phones, tablets, etc.

## **6. Google Chrome**

- It was launched in 2008 by Google
- It is a cross-platform web browser
- Multiple features from old browsers were amalgamated to form better and newer features
- To save computers from malware, Google developed the ad-blocking feature to keep the user data safe and secure
- Incognito mode is provided where private searching is available where no cookies or history is saved
- Till date, it has the best user interface

Apart from these, Opera Mini web browser was introduced in 2005 which was specially designed for mobile users. Before the mobile version, the computer version “Opera” was also released in 1995. It supported a decent user interface and was developed by Opera Software.

## **INTERNET EXPLORER**

Internet Explorer is a free web browser, commonly called IE or MSIE, that allows users to view web pages on the internet. It is also used to access online banking, online marketing over the internet, listen to and watch streaming videos, and many more. It was introduced by Microsoft in 1995. It was produced in response to the first graphical browser, Netscape Navigator.

Microsoft Internet Explorer was a more popular web browser for many years from 1999 to 2012 as it surpassed the Netscape Navigator during this time. It includes network file sharing, several internet connections, active Scripting, and security settings. It also provides other features such as:

- Remote administration
- Proxy server configuration



- VPN and FTP client capabilities

## **Internet Explorer history**

Internet Explorer was first introduced on August 16, 1995, by Microsoft as version 1.0 and it came with Microsoft Windows 95. Internet Explorer is included in all Windows versions before Windows 10. The last version of IE, included with Windows 8, was Internet Explorer 11.

With the introduction of Windows 10 in 2015, Microsoft also introduced Microsoft Edge, which is a replacement browser for Internet Explorer.

On June 15, 2022, after 25 years Microsoft announced it was discontinuing the Internet Explorer browser in favor of Edge.

## **VERSIONS OF INTERNET EXPLORER**

The following are the release versions and dates of Internet Explorer.

- Internet Explorer 1 (IE 1) - Released in 1995.
- Internet Explorer 1.5 (IE 1.5) - Released in 1995 for Windows NT.
- Internet Explorer 2 (IE 2) - Released on November 22, 1995, for PC and later in 1996 for the Mac.
- Internet Explorer 3 (IE 3) - Released on August 13, 1996, for PC and Mac.
- Internet Explorer 4 (IE 4) - Released in September 1997 for PC and Mac.
- Internet Explorer 4.5 (IE 4.5) - Released in 1999 for the Mac
- Internet Explorer 5 (IE 5) - Released in 1999 for the PC and Mac.
- Internet Explorer 5.5 (IE 5.5) - Released in July 2000.
- Internet Explorer 6 (IE 6) - Released on August 27, 2001.
- Internet Explorer 7 (IE 7) - Released on October 18, 2006.
- Internet Explorer 8 (IE 8) - Released on March 19, 2009.

- Internet Explorer 9 (IE 9) - Released on March 14, 2011.
- Internet Explorer 10 (IE 10) - Released on October 26, 2012.
- Internet Explorer 11 (IE 11) - Released on October 17, 2013.

## **SEARCH BY INTERNET EXPLORER**

This section explains how to enable and use Internet Explorer mode in the Edge browser for Windows 11.

### **Open the Edge settings**

To enable Internet Explorer mode, click on the Options button in the top-right corner of the Edge browser and select Settings.

### **Allow Internet Explorer mode**

Click on Default browser on the left-hand side, then click on the dropdown menu for Allow sites to be reloaded in Internet Explorer mode. You may see a message explaining Internet Explorer mode. If so, click Got It! Return to the drop-down menu and select Allow.

### **Restart the browser**

If you're prompted to restart the browser, click Restart.

### **Switching modes**

If you're using a website in the Edge browser and you want to switch to Internet Explorer mode, click the Options button and select Reload in Internet Explorer mode.

**NOTE:** The Ability Net site, like most modern websites, will work better in the Edge browser's standard mode than in Internet Explorer mode. Only switch to Internet Explorer mode if a site or tool or its features aren't working.

### **Leaving Internet Explorer mode**

When you open a website or web page in Internet Explorer, you'll get a warning message. You can click Leave to return to Microsoft Edge's standard mode, or click Show in toolbar to add

an Exit button to the toolbar. Clicking this will switch back to Edge's normal mode, or you can click the Options button and select Exit Internet Explorer mode.

### **Switch to Internet Explorer mode automatically**

You can also add websites or web pages to Internet Explorer mode so that they load in it automatically. They will only do so for the next 30 days. Click the Options button then Settings then Default Browser. Click the Add button next to Internet Explorer mode pages.

### **Add a website or web page**

Enter the web address of the site or page, including the HTTP:// or HTTPS:// prefix. Click **Add** and the site will be added to the Page list.

## **NETSCAPE**

Netscape Navigator or Netscape was a leading browser in the 1990s. Netscape was based on Mosaic and the Netscape team was led by Marc Andreessen, a programmer who also wrote code for Mosaic.

Netscape helped make the Web graphical rather than a text-only experience. Many browsing features became standard after Netscape introduced them. Netscape could display a webpage while loading, used JavaScript for forms and interactive content, and stored session information in cookies. Despite Netscape's technical advantages and initial dominance, by the late 1990s Internet Explorer swiftly overtook Netscape in market share.

## **INTERNET SECURITY**

Internet security is a term that describes security for activities and transactions made over the internet. It's a particular component of the larger ideas of cyber security and computer security, involving topics including browser security, online behavior and network security. We spend a large proportion of our lives online, and some of the internet security threats we can encounter include:

- Hacking, where unauthorized users gain access to computer systems, email accounts, or websites.

- Viruses or malicious software (known as malware) which can damage data or make systems vulnerable to other threats.
- Identity theft, where criminals can steal personal and financial information.

Individuals and organizations can protect themselves from these kinds of threats by practicing internet security.

## **MOST COMMON INTERNET SECURITY THREATS**

To ensure privacy and security on the internet, it's important to be aware of different types of internet attacks. Common internet security threats include:

### **Phishing**

Phishing is a cyber-attack involving disguised emails. Hackers try to trick email recipients into believing that a message is genuine and relevant – a request from their bank or a note from a co-worker, for example – so that they click on a link or open an attachment. The goal is to deceive people into handing over their personal information or downloading malware.

Phishing is one of the oldest internet security threats, dating back to the 1990s. It has remained popular to this day since it is one of the cheapest and easiest ways for criminals to steal information. In recent years, phishing techniques and messages have become increasingly sophisticated.

### **Hacking and remote access**

Hackers are always looking to exploit a private network or system's vulnerabilities so they can steal confidential information and data. Remote access technology gives them another target to exploit. Remote access software allows users to access and control a computer remotely – and since the pandemic, with more people working remotely, its usage has increased.

The protocol which allows users to control a computer connected to the internet remotely is called Remote Desktop Protocol, or RDP. Because businesses of all sizes so widely use RDP, the chances of an improperly secured network are relatively high. Hackers use different techniques to exploit RDP vulnerabilities until they have full access to a network and its devices. They may carry out data theft themselves or else sell the credentials on the dark web.

## **Malware and malvertising**

Malware is a portmanteau of "malicious" and "software". It's a broad term related to viruses, worms, Trojans, and other harmful programs that hackers use to cause havoc and steal sensitive information. Any software intended to damage a computer, server, or network can be described as malware.

Malvertising is a portmanteau of "malicious" and "advertising". The term refers to online advertising, which distributes malware. Online advertising is a complex ecosystem involving publisher websites, ad exchanges, ad servers, retargeting networks, and content delivery networks. Malvertisers exploit this complexity to place malicious code in places that publishers and ad networks don't always detect. Internet users who interact with a malicious ad could download malware onto their device or be redirected to malicious websites.

## **Ransom ware**

Ransom ware is a type of malware that prevents you from using your computer or accessing specific files on your computer unless a ransom is paid. It is often distributed as a trojan – that is, malware disguised as legitimate software. Once installed, it locks your system's screen or certain files until you pay.

Because of their perceived anonymity, ransom ware operators typically specify payment in crypto currencies such as Bit coin. Ransom prices vary depending on the ransom ware variant and the price or exchange rate of digital currencies. It isn't always the case that if you pay, the criminals will release the encrypted files.

Ransom ware attacks are on the rise, and new ransom ware variants continue to emerge. Some of the most talked-about ransom ware variants include Maze, Conti, Golden Eye, Bad Rabbit, Jigsaw, Locky, and Wanna Cry.

## **Botnets**

The term botnet is a contraction of "robot network". A botnet is a network of computers that have been intentionally infected by malware so they can carry out automated tasks on the internet without the permission or knowledge of the computers' owners.

Once a botnet's owner controls your computer, they can use it to carry out malicious activities. These include:

- Generating fake internet traffic on third party websites for financial gain.
- Using your machine's power to assist in Distributed Denial of Service (DDoS) attacks to shut down websites.
- Emailing spam to millions of internet users.
- Committing fraud and identity theft.
- Attacking computers and servers.

Computers become part of a botnet in the same ways that they are infected by any other type of malware – for example, opening email attachments that download malware or visiting websites infected with malware. They can also spread from one computer to another via a network. The number of bots in a botnet varies and depends on the ability of the botnet owner to infect unprotected devices.

### **Wi-Fi threats, in public and at home**

Public Wi-Fi carries risks because the security on these networks – in coffee shops, shopping malls, airports, hotels, restaurants, and so on – is often lax or non-existent. The lack of security means that cybercriminals and identity thieves can monitor what you are doing online and steal your passwords and personal information. Other public Wi-Fi dangers include:

- **Packet sniffing** – attackers monitor and intercept unencrypted data as it travels across an unprotected network.
- **Man-in-the-middle-attacks** – attackers compromise a Wi-Fi hotspot to insert themselves into communications between the victim and the hotspot to intercept and modify data in transit.
- **Rogue Wi-Fi networks** – attackers set up a honey pot in the form of free Wi-Fi to harvest valuable data. The attacker's hotspot becomes the conduit for all data exchanged over the network.

You don't have to worry so much about someone spying on the Wi-Fi network at home because you own the network hardware. But there are still threats – in the US, internet service providers (ISPs) are allowed to sell data about their users. While the data is anonymized, it can still be an unsettling thought for those who value privacy and security on the internet. A VPN at home makes it much harder for outsiders to correlate your online activity to you.

## **REFERENCE SOURCES**

Reference sources generally summarize topics or assist in finding secondary literature. These sources provide background information or help you to find other sources. They are also great for quick facts, statistics, or contact information, and can be useful for learning specific vocabulary. Many contain bibliographies for further reading or additional sources on your topic. They are a great starting point for your research.

Most print reference sources cannot be checked out from the library. However, online reference sources are available on the library's website and can be accessed from home, with your SSU Navigator (current students) or Polaris (faculty/staff) username and password.

## **OTHER SOURCES USEFUL TO LIBRARIES FOR REFERENCE**

### **Encyclopedias**

Use to get an overview of a topic or background information, to identify concepts, people and keywords, and to find references for further reading. General encyclopedias are well known, but we also have many subject specific encyclopedias which should not be overlooked. Examples include Encyclopedia of Early Childhood Education, International Encyclopedia of Human Geography, and Encyclopedia of Nursing Education. Online resources: Britannica Library (Encyclopedia) and Funk & Wagnalls of New World Encyclopedia.

### **Guides and Bibliographies**

These provide lists of materials (books, journal articles, etc.) on a subject. Use them to identify references for your research. Bibliographies provide literature on a subject specific or by a specific author. Print Nursing 2019 Drug Handbook. Online resource: Oxford Bibliographies

### **Dictionaries**

Works containing brief explanatory entries for terms and topics related to a specific subject or field of inquiry, usually arranged alphabetically. Entries are usually shorter than those found in encyclopedias.

An alphabetical listing of words in a language with their definitions, pronunciation, etymology, and syllabication. Online examples: New Oxford Rhyming Dictionary and Oxford English Dictionary (Links to an external site.)andLinksto an external sitand

### **Biographical Sources**

These sources provide information on the lives of specific people. Usually they are one volume. Examples include Who's Who in America and Twentieth Century British Humorists. Online biographical reference sources: Biography in Context and Biography.com (Links to an external site.)Links to an external site.

### **Handbooks**

Works that present concise factual information on a specific subject. Usually they are one volume. Examples include CRC handbook of chemistry and physics, The Oxford Handbook Of Zooarchaeology, Handbook of American Popular Culture, Handbook of Green Chemistry, and the Business Plans Handbook.

### **Statistical Sources**

Use to find specific statistical information about a given place and time. Online - Sage Stats database. Print resource - ProQuest statistical abstract of the United States 2019

### **Chronologies and Timelines**

Use these to see what was happening in a particular time and place, or to compare events taking place around the world at the same time. Oxford Reference Timelines.



## **Concordances**

Alphabetical listings of keywords or phrases found in work of an author or work in a collection of writings. Examples -The Concordance of Federal Legislation and A concordance to Beowulf.

## **Atlases**

These are collections of maps in book form. In addition to purely geographical atlases, there are specialized ones for a variety of subjects: history, religion, art, architecture, commercial, diseases, sports, exploration, ocean, stars, etc. Atlases are located on the atlas cases in the reference print collection section. Examples are Atlas of World Geography and Atlas of the Great Plains. The Census Atlas of the United States (Links to an external site.)Links to an external site. is available online.

## **Gazetteers**

A listing of geographical features and locations, complete with longitude and latitudes, and short descriptions. Examples include the Historical Gazetteer of the United States and the Utah Atlas & Gazetteer.

## **Almanacs**

Yearly compilations of facts, dates, and statistics. They can be general or subject specific. Examples include Library and Book Trade Almanac, World Almanac and Book of Facts 2019, and Old Farmer's Almanac.

## **Directories**

A listing of organizations, people, companies, institutions, etc., with a brief description of each including contact information. Online resource ReferenceUSA

## **Manuals**

Manuals provide "how to" information, such as how to write a correct citation. Examples include The Merck Manual Of Diagnosis And Therapy and Publication Manual of the American Psychological Association, 7th edition.

## **Yearbooks**

These are annual documentary, historical, or memorial compendiums of facts, photographs, statistics, and other information from the preceding year, often limited to a specific country, institution, discipline, or subject. Print resource - Broadcasting & cable yearbook

The above types of reference sources list is adapted from Carol Zoppel, Research and Instruction librarian's types of reference sources list.

## **NEED OF INTERNET SOURCES**

Internet sources can be many things but most basically it is the information found on web pages. The internet sources are online databases that are available through the many library websites, newspapers, journals, magazines, television and documentaries. When so many computers are interconnected through a network, a pool of information is created. This pool of internet information is called a database. These databases of information are set up in networks between many computers can be accessed by individuals by clicking on a specific internet web page that has the information one is seeking. The internet network is set up in a way that information can be shared via interconnecting several networks together. Unlike the print source of information, the internet provides a wide range of information to different users over different geographical zones at the same time. The information available on internet sources are collected are placed on the web pages by the web site owners. External users can there after access the information by accessing the web pages.

## NEED FOR EVALUATION OF INTERNET INFORMATION RESOURCES

A library selects documents for its collection after careful evaluation and adds them to its collection in their proper context. The process of selective acquisition adds value to information resources available in a library that, in turn, helps library users to harvest the information that they need. Internet resources cannot be treated differently from those in printed media considering the fact that most of the Internet information resources do not go through the process of filtration prevalent in the printed world. The web is merely a new medium that acts as an effective system for delivering electronic information. Librarians have been traditionally selecting, evaluating, describing and providing intelligent access to information resources for decades, they are, therefore, best suited to do this job. The need for evaluation of Internet-based information resources can be justified on the following grounds:

- (i) Authenticity of information published on the web need to be established;
- (ii) The author of published information may not be an authority or an expert in the area;
- (iii) The information on the Internet may be outdated;
- (iv) Reliability of information on the network may not have been established;
- (v) The information needs to be presented for a given audience. The librarian needs to establish its relevance for the targeted audience.

## METHODS OF EVALUATING INTERNET INFORMATION RESOURCES

The process of evaluation of Internet information resources consists of the following steps:

Authority	<ul style="list-style-type: none"><li>• Is it clear who is responsible for the contents of the page?</li><li>• Is there a way of verifying the legitimacy of the organization, group, company or individual?</li><li>• Is there any indication of the author's qualifications for writing on a particular topic?</li><li>• Is the information from sources known to be reliable?</li></ul>
Accuracy	<ul style="list-style-type: none"><li>• Are the sources for factual information clearly listed so they can be verified in another source?</li><li>• Is the information free of grammatical, spelling, and other typographical</li></ul>

	errors?
Objectivity	<ul style="list-style-type: none"> <li>• Does the content appear to contain any evidence of bias?</li> <li>• Is there a link to a page describing the goals or purpose of the sponsoring organization or company?</li> <li>• If there is any advertising on the page, is it clearly differentiated from the informational content?</li> </ul>
Currency	<ul style="list-style-type: none"> <li>• Are there dates on the page to indicate when the page was written, when the page was first placed on the Web, or when the page was last revised?</li> </ul>
Coverage	<ul style="list-style-type: none"> <li>• Are these topics successfully addressed, with clearly presented arguments and adequate support to substantiate them?</li> <li>• Does the work update other sources, substantiate other materials you have read, or add new information?</li> <li>• Is the target audience identified and appropriate for your needs?</li> </ul>
Appearance	<ul style="list-style-type: none"> <li>• Does the site look well organized?</li> <li>• Do the links work?</li> <li>• Does the site appear well maintained?</li> </ul>

## PROTOCOLS

It is a digital language through which we communicate with others on the Internet. Protocol meaning is that it a set of mutually accepted and implemented rules at both ends of the communications channel for the proper exchange of information. By adopting these rules, two devices can communicate with each other and can interchange information. We can't even think of using the Internet without Protocols. Each protocol is defined in different terms and different use with unique name. Message travel from sender to receiver via a medium (The medium is the physical path over which a message travels) using a protocol.

'Protocols' are developed by industry wide organizations. All data of protocols are stored in binary information. Protocol language is a mixture of bits, characters, integers, etc.

## **TYPES OF PROTOCOL**

There are various types of protocols that support a major and compassionate role in communicating with different devices across the network. Some of them are:

1. Transmission Control Protocol (TCP)/Internet Protocol (IP)
2. User Datagram Protocol (UDP)
3. Post office Protocol (POP)
4. Simple mail transport Protocol (SMTP)
5. File Transfer Protocol (FTP)
6. Hyper Text Transfer Protocol (HTTP)
7. Hyper Text Transfer Protocol Secure (HTTPS)
8. Telnet
9. Gopher

## **TCP/IP**

TCP/IP stands for Transmission Control Protocol/Internet Protocol. TCP/IP is actually a collection of protocol, or rules, that govern the way data travels from one machine to another across networks. The Internet is based on TCP/IP. TCP/IP has two major components TCP and IP.

**IP:** The IP component does the following:

- ❖ Envelopes and addresses the data.
- ❖ Enables the network to read the envelope and forward the data to its destination.
- ❖ Defines how much data can fit in a single "envelope" (a packet).

The relationship between the data, IP, and networks is often compared to the relationship between a letter, its addressed envelope, and the postal system. The addressed and packages data is sent over the network to its destination.

**TCP:** The TCP component does the following:

- ❖ Breaks up data into packers that the network can handle efficiently.
- ❖ Verifies whether all the packers have arrived at their destination.
- ❖ “Reassembles” the data.

TCP/IP can be compared to moving across country. You pack your house in boxes and put your new address on them. The moving company picks them up; makes a list of the boxes, and ships them across the country along the most efficient route – this may mean putting your dishes and your furniture on different trucks, your belongings arrive at your new address. You consult your list to make sure that everything you shipped has arrived (in good shape), and then you unpack your boxes and “reassemble” your house.

## **The TCP/IP Model**

It consists of 4 layers: Application, Transport, Internet and Network.

- **Application layer** (applications and processes running on the network).
- **Transport layer** (provides end-to-end data delivery services).
- **Internet layer** (makes data grams and handles data routing).
- **Network layer** (provides routines allowing access to the physical network).

## **ADVANTAGES OF TCP/IP**

The following are some of the benefits of TCP:

- ❖ TCP is connection-oriented.
- ❖ It establishes a connection between sender and receiver over the network before sending a message.
- ❖ It uses a congestion control policy to avoid congestions.
- ❖ Supports data retransmission. If the packets get lost failing to reach their destination, they will be sent back to the sender from the receiver. The sender can retransmit the packets.
- ❖ Performs in-order delivery by rearranging all packets at the receiving end.
- ❖ Error detection, such as corrupted and missing packets is easier. It is done through a three-step mechanism – checksum, retransmission, and acknowledgment.

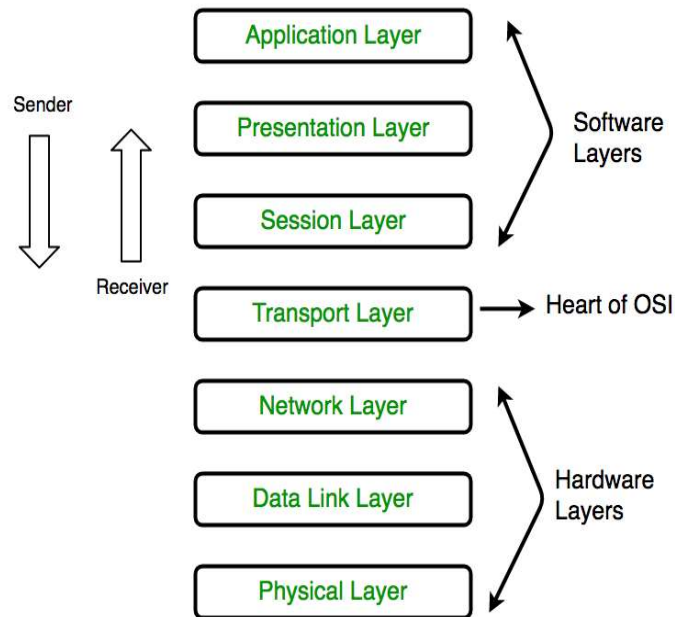
## **DISADVANTAGES OF TCP/IP**

Some of the limitations of using TCP are:

- ❖ It does not support broadcast or multicast transmission.
- ❖ TCP offers several features that we may not want. These features may result in a waste of bandwidth, time, or effort.
- ❖ While establishing a connection, TCP performs a handshake between the sender and the receiver. This slows down the connection establishment. However, this issue can be solved using high latency devices.

## **OSI**

OSI stands for Open Systems Interconnection. It has been developed by ISO – ‘International Organization for Standardization’, in the year 1984. It is of seven layers architecture with each layer having specific functionality to perform. All these 7 layers work collaboratively to transmit the data from one person to another across the globe.



## Physical Layer (Layer 1)

The lowest layer of the OSI reference model is the physical layer. It is responsible for the actual physical connection between the devices. The physical layer contains information in the form of bits. It is responsible for transmitting individual bits from one node to the next. When receiving data, this layer will get the signal received and convert it into 0s and 1s and send them to the Data Link layer, which will put the frame back together.

The functions of the physical layer are as follows:

1. **Bit synchronization:**

The physical layer provides the synchronization of the bits by providing a clock. This clock controls both sender and receiver thus providing synchronization at bit level.

2. **Bit rate control:**



The Physical layer also defines the transmission rate i.e. the number of bits sent per second.

**3. Physical topologies:**

Physical layer specifies the way in which the different, devices/nodes are arranged in a network i.e. bus, star, or mesh topology.

**4. Transmission mode:**

Physical layer also defines the way in which the data flows between the two connected devices. The various transmission modes possible are Simplex, half-duplex and full-duplex.

### **Data Link Layer (DLL) (Layer 2)**

The data link layer is responsible for the node-to-node delivery of the message. The main function of this layer is to make sure data transfer is error free from one node to another, over the physical layer. When a packet arrives in a network, it is the responsibility of DLL to transmit it to the Host using its MAC address.

Data Link Layer is divided into two sub layers:

1. Logical Link Control (LLC)
2. Media Access Control (MAC)

The packet received from the Network layer is further divided into frames depending on the frame size of NIC (Network Interface Card). DLL also encapsulates Sender and Receiver's MAC address in the header.

The Receiver's MAC address is obtained by placing an ARP(Address Resolution Protocol) request onto the wire asking "Who has that IP address?" and the destination host will reply with its MAC address.

The functions of the Data Link layer are

1. **Framing:**

Framing is a function of the data link layer. It provides a way for a sender to transmit a set of bits that are meaningful to the receiver. This can be accomplished by attaching special bit patterns to the beginning and end of the frame.

**2. Physical addressing:**

After creating frames, the Data link layer adds physical addresses (MAC address) of the sender and/or receiver in the header of each frame.

**3. Error control:**

Data link layer provides the mechanism of error control in which it detects and retransmits damaged or lost frames.

**4. Flow Control:**

The data rate must be constant on both sides else the data may get corrupted thus, flow control coordinates the amount of data that can be sent before receiving acknowledgement.

**5. Access control:**

When a single communication channel is shared by multiple devices, the MAC sub-layer of the data link layer helps to determine which device has control over the channel at a given time.

### **Network Layer (Layer 3)**

The network layer works for the transmission of data from one host to the other located in different networks. It also takes care of packet routing i.e. selection of the shortest path to transmit the packet, from the number of routes available. The sender & receiver's IP addresses are placed in the header by the network layer.

The functions of the Network layer are:

**1. Routing:**

The network layer protocols determine which route is suitable from source to destination. This function of the network layer is known as routing.

## 2. **Logical Addressing:**

In order to identify each device on internet uniquely, the network layer defines an addressing scheme. The sender & receiver's IP addresses are placed in the header by the network layer. Such an address distinguishes each device uniquely and universally.

### **Transport Layer (Layer 4)**

The transport layer provides services to the application layer and takes services from the network layer. The data in the transport layer is referred to as Segments. It is responsible for the End to End Delivery of the complete message. The transport layer also provides the acknowledgement of the successful data transmission and re-transmits the data if an error is found.

At sender's side: Transport layer receives the formatted data from the upper layers, performs Segmentation, and also implements Flow & Error control to ensure proper data transmission. It also adds Source and Destination port numbers in its header and forwards the segmented data to the Network Layer.

Generally, this destination port number is configured, either by default or manually. For example, when a web application makes a request to a web server, it typically uses port number 80, because this is the default port assigned to web applications. Many applications have default ports assigned.

At receiver's side: Transport Layer reads the port number from its header and forwards the Data which it has received to the respective application. It also performs sequencing and reassembling of the segmented data.

The functions of the transport layer are as follows:

#### 1. **Segmentation and Reassembly:**

This layer accepts the message from the (session) layer, and breaks the message into smaller units. Each of the segments produced has a header associated with it. The transport layer at the destination station reassembles the message.

## 2. **Service Point Addressing:**

In order to deliver the message to the correct process, the transport layer header includes a type of address called service point address or port address. Thus by specifying this address, the transport layer makes sure that the message is delivered to the correct process.

The services provided by the transport layer :

**A. Connection-Oriented Service:** It is a three-phase process that includes

1. Connection Establishment
2. Data Transfer
3. Termination / disconnection

In this type of transmission, the receiving device sends an acknowledgement, back to the source after a packet or group of packets is received. This type of transmission is reliable and secure.

**B. Connectionless service:** It is a one-phase process and includes Data Transfer. In this type of transmission, the receiver does not acknowledge receipt of a packet. This approach allows for much faster communication between devices. Connection-oriented service is more reliable than connectionless Service.

- ❖ Data in the Transport Layer is called as **Segments**.
- ❖ Transport layer is operated by the Operating System. It is a part of the OS and communicates with the Application Layer by making system calls.
- ❖ Transport Layer is called as **Heart of OSI** model.

## **Session Layer (Layer 5) :**

This layer is responsible for the establishment of connection, maintenance of sessions, authentication, and also ensures security.

The functions of the session layer are:

❖ **Session establishment, maintenance, and termination:**

The layer allows the two processes to establish, use and terminate a connection.

❖ **Synchronization:**

This layer allows a process to add checkpoints which are considered synchronization points into the data. These synchronization points help to identify the error so that the data is re-synchronized properly, and ends of the messages are not cut prematurely and data loss is avoided.

❖ **Dialog Controller:**

The session layer allows two systems to start communication with each other in half-duplex or full-duplex.

**Presentation Layer (Layer 6):**

The presentation layer is also called the **Translation layer**. The data from the application layer is extracted here and manipulated as per the required format to transmit over the network.

The functions of the presentation layer are:

❖ **Translation:**

For example, ASCII to EBCDIC.

❖ **Encryption/ Decryption:**

Data encryption translates the data into another form or code. The encrypted data is known as the ciphertext and the decrypted data is known as plain text. A key value is used for encrypting as well as decrypting data.

❖ **Compression:**

Reduces the number of bits that need to be transmitted on the network.

## **Application Layer (Layer 7)**

At the very top of the OSI Reference Model stack of layers, we find the Application layer which is implemented by the network applications. These applications produce the data, which has to be transferred over the network. This layer also serves as a window for the application services to access the network and for displaying the received information to the user.

The functions of the Application layer are:

- ❖ Network Virtual Terminal
- ❖ FTAM-File transfer access and management
- ❖ Mail Services
- ❖ Directory Services

## **ADVANTAGES OF THE OSI MODEL ARE**

- ❖ It is a generic model and acts as a guidance tool to develop any network model.
- ❖ It is a layered model. Changes in one layer do not affect other layers, provided that the interfaces between the layers do not change drastically.
- ❖ It distinctly separates services, interfaces, and protocols. Hence, it is flexible in nature. Protocols in each layer can be replaced very conveniently depending upon the nature of the network.
- ❖ It supports both connection-oriented services and connectionless services.

## **DISADVANTAGES OF THE OSI MODEL ARE**

- ❖ It is purely a theoretical model that does not consider the availability of appropriate technology. This restricts its practical implementation.
- ❖ The launching timing of this model was inappropriate. When OSI appeared, the TCP/IP protocols were already implemented. So, the companies were initially reluctant to use it.
- ❖ The OSI model is very complex. The initial implementation was cumbersome, slow and costly.
- ❖ Though there are many layers, some of the layers like the session layer and presentation layer have very little functionality when practically deployed.

- ❖ There is a duplication of services in various layers. Services like addressing, flow control and error control are offered by multiple layers.
- ❖ The standards of OSI model are theoretical and do not offer adequate solutions for practical network implementation.
- ❖ After being launched, the OSI model did not meet the practical needs as well as the TCP/IP model. So it was labeled as inferior quality.
- ❖ TCP/IP model was very much preferred by the academia. It was believed that OSI was a product of the European communities and the US government, who were trying to force an inferior model to researchers and programmers. Hence, there was considerable resistance in adopting it.

## **OTHER PROTOCOLS**

### **SMTP**

SMTP stands for Simple Mail Transfer Protocol. SMTP is a set of communication guidelines that allow software to transmit an electronic mail over the internet is called **Simple Mail Transfer Protocol**. It is a program used for sending messages to other computer users based on e-mail addresses. It provides a mail exchange between users on the same or different computers, and it also supports:

- ❖ It can send a single message to one or more recipients.
- ❖ Sending message can include text, voice, video or graphics.
- ❖ It can also send the messages on networks outside the internet.

The main purpose of SMTP is used to set up communication rules between servers. The servers have a way of identifying themselves and announcing what kind of communication they are trying to perform. They also have a way of handling the errors such as incorrect email address. For example, if the recipient address is wrong then receiving server reply with an error message of some kind.

### **PROCESS OF SMTP**

#### **1. Composition of Mail:**

A user sends an e-mail by composing an electronic mail message using a Mail User Agent (MUA). Mail User Agent is a program which is used to send and receive mail. The

message contains two parts: body and header. The body is the main part of the message while the header includes information such as the sender and recipient address. The header also includes descriptive information such as the subject of the message. In this case, the message body is like a letter and header is like an envelope that contains the recipient's address.

## 2. **Submission of Mail:**

After composing an email, the mail client then submits the completed e-mail to the SMTP server by using SMTP on TCP port 25.

## 3. **Delivery of Mail:**

E-mail addresses contain two parts: username of the recipient and domain name. For example, vivek@gmail.com, where "vivek" is the username of the recipient and "gmail.com" is the domain name. If the domain name of the recipient's email address is different from the sender's domain name, then MSA will send the mail to the Mail Transfer Agent (MTA). To relay the email, the MTA will find the target domain. It checks the MX record from Domain Name System to obtain the target domain. The MX record contains the domain name and IP address of the recipient's domain. Once the record is located, MTA connects to the exchange server to relay the message.

## 4. **Receipt and Processing of Mail:**

Once the incoming message is received, the exchange server delivers it to the incoming server (Mail Delivery Agent) which stores the e-mail where it waits for the user to retrieve it.

## 5. **Access and Retrieval of Mail:**

The stored email in MDA can be retrieved by using MUA (Mail User Agent). MUA can be accessed by using login and password.

## **ADVANTAGES OF SMTP**

- ❖ All you have to do is use your credentials and it will work.
- ❖ In case of failure, the message will include an explanation about why email failed to be delivered.



- ❖ It is extremely easy to start using mail for your transactional emails. All you have to do is exchange ceremonial and you are set to go. Unlike with API, where coding is required.

### **DISADVANTAGES OF SMTP:**

- ❖ Some firewalls can block port commonly used with SMTP.
- ❖ Security matter for SMTP is worse.
- ❖ Transmission of binary files using SMTP is not possible without converting it into text files. Use MIME to send mail in another format.
- ❖ Its usefulness is limited by its simplicity.
- ❖ It is limited to only 7 bit ASCII characters.
- ❖ SMTP servers may reject all mail messages beyond some specific length.
- ❖ Usually require more back and forth conversion between servers in order to deliver your message, which can delay sending and also increase the chance of the message not being delivered.

### **TELNET**

Telnet is a protocol, or set of rules, that enables one computer to connect to another computer. This process is also referred to as remote login.

The user's computer, which initiates the connection, is referred to as the local computer, and the machine being connected to, which accepts the connection, is referred to as the remote, or host computer. The remote computer can be physically located in the next room, the next town, or in another country.

Once connected, the user's computer emulates the remote computer. When the user types in commands, they are executed on the remote computer. The user's monitor displays what is taking place on the remote computer during the telnet session.

The procedure for connecting to a remote computer will depend on how your Internet access is set-up. Once a connection to a remote computer is made, instructions or menus may appear. Some remote machines may require a user to have an account on the machine, and may prompt users for a username and password. Many resources, such as library catalogs, are available via telnet without an account and password.

Telnet also operates on the client/server principle. The local computer uses a telnet client program to establish the connection and display data on the local computer's monitor. The remote, or host, computer uses a telnet server program to accept the connection and send responses to requests for information back to the local computer.

Telnet allows the user to access Internet resources on other computers around the world. A variety of resources is available through telnet. For example, Library catalogs, Databases, other Internet tools such as FTP, Gopher, and the World Wide Web, etc.

### **ADVANTAGES OF TELNET**

- It makes itself available for many different operating systems.
- It permits the school network to test access from a device to specific ports on an external server.
- Configuration elements of networking hardware can be achieved using it.
- Accessing Remote Computers: the greatest advantage of this software is so as to its consent to remote access to a different computer.
- It helps save a large amount of time, connectivity establishment, and task accomplishment on different computers very instantly.
- Router configuration: problem fixing is very much easy here since it uses plain text for transfer. Hence data transmission is accomplished with more access and less amount of transfer.
- Universal: It can be flexibly deployed on any of the computers. Even Different OS can connect each other irrespective of their version and time of release.
- It makes available users by an interactive and bidirectional text-oriented message system exploit an effective terminal connection which is much more than 8 byte. User data is sprinkled in the band long with telnet control information above the TCP. It helps to achieve some functions in a remote manner.

### **DISADVANTAGES OF TELNET**

- ❖ User ID and password are transmitted without any encryption. This leads to security risk in Telnet protocol as eavesdropping and snooping are easier to implement by intruders or hackers.
- ❖ It is not possible to run GUI based tools over Telnet connection as it is character based communication tool. It is not possible to transmit cursor movements and other GUI information.
- ❖ It is very inefficient protocol.
- ❖ Each key strokes require several context switches before it reaches the other end. It is expensive due to slow typing speeds.

## **FTP**

FTP stands for File Transfer Protocol, and is part of the TCP/IP protocol suite. It is the protocol, or set of rules, which enables files to be transferred between computers. FTP is a powerful tool which allows files to be transferred from “computer A” to “computer B”, or vice versa.

FTP works on the client/server principle. A client program enables the user to interact with server in order to access information and services on the server access these files, an FTP client program is used, This interface allows the user to locate the file to be transferred and initiate the transfer process.

### **The Basic Steps to Use FTP**

- ❖ Connect to the FTP server.
- ❖ Navigate the file structure to find the file you want.
- ❖ Transfer the file.

The specifics of each step will vary, depending on the client program being used and the type of Internet Connection. Anonymous FTP allows a user to access or password is needed.

However, an anonymous FTP site will sometimes ask that users login with the name “anonymous” and use their electronic mail address as the password.

There are wide varieties of files that are publicly available through anonymous FTP:

- ❖ **Software:** Software that you can use free for a trial period but then pay a fee for.

- ❖ **Freeware:** completely free software, for example fonts, clipart and games.
- ❖ **Upgrades & Patches:** upgrades to current software and “fixes” for software problem.
- ❖ **Documents:** examples include research papers, articles and Internet documentation.

Files on FTP servers are often compressed. Compression decreases file size. This enables more files to be stored on the server and makes file transfer times shorter. In order to use a compressed file to be stored on the server and makes file transfer times shorter. In order to use a compressed file it needs to be decompressed using appropriate software. It is a good idea to have current virus checking software on the computer before files are transferred to it.

### **ADVANTAGES OF FTP**

- ❖ FTP servers offer a level of security.
- ❖ FTP server gives the user a level of control.
- ❖ FTP server allows a user to send big files at once.
- ❖ It improves workflow.
- ❖ It allows data recovery.
- ❖ It has a resumption facility i.e., it allows the transfer of files even after a break-in connection occurs.

### **DISADVANTAGES OF FTP**

- ❖ All the files, passwords, and usernames are sent in unencrypted text.
- ❖ TLS 1.2 might not work over HTTPS as it is not always supported.
- ❖ It is possible to spoof servers to send data to an unpremeditated computer or on a random port.

### **HTTP**

HTTP is short for Hypertext Transfer Protocol. It is the set of rules, or protocol that governs the transfer of hypertext between two or more computers. The World Wide Web encompasses the universe of information that is available via HTTP.

Hypertext is text that is specially coded using a standard system called Hypertext Markup Language (HTML). The HTML code are used to create links. These links can be textual or graphic, and when clicked on, can “link” the user to another resource such as other HTML documents, text files, graphics, animation and sound.

HTTP is based on the client/server principle. HTTP allows “computer A” (the client) to establish a connection with “computer B” (the server) and make a request. The server accepts the connection initiated by the client and sends back a response. An HTTP request identifies the resource that the client is interested in and tells the server what “action” to take on the resource.

When a user selects a hypertext link, the client program on their computer uses HTTP to contact the server, identify a resource, and ask the server to responds with an action. The server accepts the request, and then uses HTTP to respond to or perform the action.

Usually hypertext links will be blue in colors and will be underlined (this is the normal convention, which is not always followed). When you move the mouse pointer over a hypertext link the pointer changes its shape to that of a hand. In the case of text-based browsers, the hypertext links will be highlighted and you can navigate between them using the keyboard.

HTTP also provides access to other Internet Protocols like File Transfer Protocol (FTP), Simple Mail Transfer Protocol (SMTP), Network News Transfer Protocol (NNTP).

#### **ADVANTAGES OF HTTP**

- ❖ It offers lower CPU and memory usage due to less simultaneous connections.
- ❖ It enables HTTP pipelining of requests/responses.
- ❖ It offers reduced network congestion as there are fewer TCP connections.
- ❖ Handshaking is done at the initial connection establishment stage. Hence it offers reduced latency in subsequent requests as there is no handshaking.
- ❖ It reports errors without closing the TCP connection.

#### **DISADVANTAGES OF HTTP**

- ❖ It can be used for point to point connection.

- ❖ It is not optimized for mobile.
- ❖ It does not have push capabilities.
- ❖ It is too verbose.
- ❖ It does not offer reliable exchange (without retry logic).
- ❖ Client does not close the connection when all the data it needs have been received. Hence Server will not be available during this time period.

## **Z39.50**

Z39.50 is an international standard protocol used by networked computer systems for information retrieval. It enables information seekers to search different systems on a network or the Internet through the use of a single user interface. Software and system vendors offer access to information from a diversity of unique systems with different hardware, software, interfaces, and database search commands. Compounding matters for the information seeker, the Internet provides access to a mind-boggling array of databases that grows daily. The challenge for users becomes how to find the right information painlessly amidst this vast array. The goal of Z39.50 is to reduce the complexity and difficulties of searching and retrieving information. Z39.50 makes it easier to use the wealth of information resources on the Internet. When using Z39.50-enabled systems, a user in one system can search for electronic information in another system without having to know how that system works.

### **ADVANTAGES OF Z39.50:**

- ❖ Uses common language, thus user's does not require to master in all the languages used by different software/sources
- ❖ Uses TCP/IP protocol common internet protocol, thus cost efficient and no extra hardware/software requirement.

- ❖ Z 39.50 supports open system (i.e. it is nonproprietary or vendor independent).
- ❖ Display results as per choice of user.
- ❖ A single query for search intently and simultaneously different databases/networks/servers.
- ❖ It saves the valuable time of the user.
- ❖ Provides quick and seamless access and easy to use.
- ❖ No need to learn new software/language, even a layman can use it.
- ❖ Knowledge of searching techniques not essential.

#### **DISADVANTAGES OF Z39.50:**

- ❖ Not widely used as it is a new concept.
- ❖ Most of the Library software providers are not using or implementing it in their software.
- ❖ User's awareness is quiet low.
- ❖ Non updation of library records/catalogues could hinder its implementation and use.
- ❖ Non-cooperation by the libraries is the biggest drawback.
- ❖ The associated cost of delivery of documents after their retrieval from the Z39.50 search hinders its implementations.
- ❖ It is costly, so small libraries cannot afford it.
- ❖ Software, hardware & Library Management Software matching the world standard are costly, thus increases the cost of Z39.50 client server protocol implementation.
- ❖ The training of manpower to handle it increases its cost.

## MARKUP LANGUAGES

Markup language refers to a text-encoding system consisting of a set of symbols inserted in a text document to control its structure, formatting, or the relationship between its parts.

Markup is often used to control the display of the document or to enrich its content to facilitating automated processing.

A markup language is a set of rules governing what markup information may be included in a document and how it is combined with the content of the document in a way to facilitate use by humans and computer programs.

The idea and terminology evolved from the "marking up" of paper manuscripts (i.e., the revision instructions by editors), which is traditionally written with a red pen or blue pencil on authors' manuscripts.

Older markup languages, which typically focus on typography and presentation, include troff, TeX, and LaTeX.

Scribe and most modern markup languages, for example XML, identify document components (for example headings, paragraphs, and tables), with the expectation that technology such as stylesheets will be used to apply formatting or other processing.

Some markup languages, such as the widely used HTML, have pre-defined presentation semantics, meaning that their specification prescribes some aspects of how to present the structured data on particular media.

HTML, like DocBook, Open eBook, JATS, and many others is based on the markup meta-languages SGML and XML.

That is, SGML and XML allow designers to specify particular schemas, which determine which elements, attributes, and other features are permitted, and where.

One extremely important characteristic of most markup languages is that they allow intermingling markup with document content such as text and pictures.

For example, if a few words in a sentence need to be emphasized, or identified as a proper name, defined term, or another special item, the markup may be inserted between the characters of the sentence.



This is quite different structurally from traditional databases, where it is by definition impossible to have data that is within a record but not within any field. Furthermore, markup for human-readable texts must maintain order: it would not suffice to make each paragraph of a book into a "paragraph" record, where those records do not maintain order.

## HTML

The Hyper Text Markup Language or HTML is the standard markup language for documents designed to be displayed in a web browser.

It can be assisted by technologies such as Cascading Style Sheets (CSS) and scripting languages such as JavaScript.

Web browsers receive HTML documents from a web server or from local storage and render the documents into multimedia web pages.

HTML describes the structure of a web page semantically and originally included cues for the appearance of the document.

HTML elements are the building blocks of HTML pages. With HTML constructs, images and other objects such as interactive forms may be embedded into the rendered page.

HTML provides a means to create structured documents by denoting structural semantics for text such as headings, paragraphs, lists, links, quotes, and other items. HTML elements are delineated by tags, written using angle brackets.

Tags such as `<img />` and `<input />` directly introduce content into the page. Other tags such as `<p>` surround and provide information about document text and may include other tags as sub-elements.

Browsers do not display the HTML tags but use them to interpret the content of the page.

HTML can embed programs written in a scripting language such as JavaScript, which affects the behavior and content of web pages. The inclusion of CSS defines the look and layout of content.

The World Wide Web Consortium (W3C), former maintainer of the HTML and current maintainer of the CSS standards, has encouraged the use of CSS over explicit presentational HTML since 1997.

A form of HTML, known as HTML5, is used to display video and audio, primarily using the `<canvas>` element, in collaboration with JavaScript.

In 1989, computer scientist Sir Tim Berners-Lee wrote a memo proposing an Internet-based hypertext system, then specified HTML and wrote the browser and server software in the last part of 1990.

The first publicly available description of HTML was a document called "HTML Tags", first mentioned on the Internet by Berners-Lee in late 1991.

It describes 18 elements comprising the initial, relatively simple design of HTML. Except for the hyperlink tag, these were strongly influenced by SGMLguid, an in-house SGML-based documentation format at CERN, and very similar to the sample schema in the SGML standard.

Eleven of these elements still exist in HTML 4.

Berners-Lee considered HTML an SGML application.

The Internet Engineering Task Force (IETF) formally defined it as such with the mid-1993 publication of the first proposal for an HTML specification: "Hypertext Markup Language (HTML)" Internet-Draft by Berners-Lee and Dan Connolly, which included an SGML Document Type Definition to define the grammar.

Many of the HTML text elements are found in the 1988 ISO technical report TR 9537 Techniques for using SGML, which in turn covers the features of early text formatting languages such as that used by the RUNOFF command developed in the early 1960s for the CTSS (Compatible Time-Sharing System) operating system.

These formatting commands were derived from those used by typesetters to manually format documents. Steven De Rose argues that HTML's use of descriptive markup (and the influence of SGML in particular) was a major factor in the success of the Web, because of the flexibility and extensibility that it enabled.

HTML became the main markup language for creating web pages and other information that can be displayed in a web browser and is quite likely the most used markup language in the world today.

## **XML**

Extensible Markup Language (XML) is a markup language and file format for storing, transmitting, and reconstructing arbitrary data.

It defines a set of rules for encoding documents in a format that is both human-readable and machine-readable.

The World Wide Web Consortium's XML 1.0 Specification of 1998 and several other related specifications—all of them free open standards—define XML.

The design goals of XML emphasize simplicity, generality, and usability across the Internet.

It is a textual data format with strong support via Unicode for different human languages.

Although the design of XML focuses on documents, the language is widely used for the representation of arbitrary data structures such as those used in web services.

Several schema systems exist to aid in the definition of XML-based languages, while programmers have developed many application programming interfaces (APIs) to aid the processing of XML data.

XML is a meta markup language that is very widely used. XML was developed by the World Wide Web Consortium, in a committee created and chaired by Jon Bosak.

The main purpose of XML was to simplify SGML by focusing on a particular problem — documents on the Internet.

XML remains a meta-language like SGML, allowing users to create any tags needed (hence "extensible") and then describing those tags and their permitted uses.

XML adoption was helped because every XML document can be written in such a way that it is also an SGML document, and existing SGML users and software could switch to XML fairly easily.

However, XML eliminated many of the more complex features of SGML to simplify implementation environments such as documents and publications.

It appeared to strike a happy medium between simplicity and flexibility, as well as supporting very robust schema definition and validation tools, and was rapidly adopted for many other uses.

XML is now widely used for communicating data between applications, for serializing program data, for hardware communications protocols, vector graphics, and many other uses as well as documents.

Many XML-based applications now exist, including the Resource Description Framework as RDF/XML, XForms, DocBook, SOAP, and the Web Ontology Language (OWL). For a partial list of these, see List of XML markup languages.

## **WEB**

The World Wide Web (WWW), commonly known as the Web, is an information system enabling documents and other web resources to be accessed over the Internet.

Documents and downloadable media are made available to the network through web servers and can be accessed by programs such as web browsers.

Servers and resources on the World Wide Web are identified and located through character strings called uniform resource locators (URLs).

The original and still very common document type is a web page formatted in Hypertext Markup Language (HTML).

This markup language supports plain text, images, embedded video and audio contents, and scripts (short programs) that implement complex user interaction.

The HTML language also supports hyperlinks (embedded URLs) which provide immediate access to other web resources.

Web navigation or web surfing, is the common practice of following such hyperlinks across multiple websites.

Web applications are web pages that function as application software.

The information in the Web is transferred across the Internet using the Hypertext Transfer Protocol (HTTP).

Multiple web resources with a common theme and usually a common domain name make up a website. A single web server may provide multiple websites, while some websites, especially the most popular ones, may be provided by multiple servers.

Website content is provided by a myriad of companies, organizations, government agencies, and individual users; and comprises an enormous amount of educational, entertainment, commercial, and government information.

## **Content**

Web content is the text, visual or audio content that is made available online and user encountered as part of the online usage and experience on websites.

It may include text, images, sounds and audio, online videos, among other items placed within web pages.

In the book Information Architecture for the World Wide Web, Lou Rosenfeld and Peter Morville wrote, "We define content broadly as 'the stuff in your website'".

Web content may include webpage document pages, information, software data and applications, e-services, images, audio and video files, personal Web pages, archived e-mail messages stored on email servers, and more.

We include future web content as well as present web content roadmap.

Because websites are often complex, a term "content management" appeared in the late 1990s identifying a method or in some cases a tool to organize all the diverse elements to be contained on a website.

Content management often means that within a business there is a range of people who have distinct roles to do with content management, such as content author, editor, publisher, and administrator.

But it also means there may be a content management system whereby each of the different roles is organized to provide their assistance in operating the system and organizing the information for a website.

A business may also employ various content protection measures, which are typically technologies used to attempt to frustrate copying without permission.

Web content refers to the textual, aural, or visual content published on a website. Content means any creative element, for example, text, applications, images, archived e-mail messages, data, e-services, audio and video files, and so on.

Web content is the key behind traffic generation to websites.

Creating engaging content and organizing it into various categories for easy navigation is most important for a successful website.

Also, it is important to optimize the web content for search engines so that it responds to the keywords used for searching.

## **TYPES OF WEB CONTENT**

There are hundreds of different types of web content, these 50 in-particular are our favourite types of digital content.

### **1. Articles**

This type of web content develops an idea and incorporates interviews, quotes, and data to support the article's hypothesis. Articles are usually long-form content, between 1,000 and 3,000 words.

### **2. Blog posts**

Blog posts typically range between 500 and 750 words, focusing on a variety of topics. Some of these topics can include news in the industry, bios of industry leaders, reviews of new products, and more.

### **3. Surveys**

Adding surveys to your content arsenal can gauge your readers' interest and to increase reader engagement with your brand. Surveys are also fun for the reader and is one of the more interactive content types.

#### **4. Quizzes**

Quizzes are another way to engage your reader, by having a question on one page and the answer on the next, which adds extra potential for ad revenue and click-throughs.

#### **5. Photos**

Images help make your content more visually appealing and contributes to the overall user experience. Additionally, optimizing your photos with alt-text and captions to your images can even help with your rankings on Google Images.

#### **6. Videos**

Using videos is a great way to diversify your content and add visual interest to your pages. These can be videos you take yourself or videos from sources like YouTube or Vimeo. (Just make sure to give credit where credit is due).

#### **7. Case studies**

Case studies outline how a particular individual or company used a product or service. Seeing a real person use your product can help potential buyers see themselves using it and thus, encouragement to purchase from you.

#### **8. Website content**

Website content encompasses many content types. This can include website pages detailing your individual services, products, people, locations, etc.

#### **9. Guest blogs or posts**

Find guest writers from notable people in your industry, writers of other blogs or websites that focus on your topic, or on social media pages or groups related to your topic. Adding a few posts by guest writers adds a new voice to your pages and helps to bring in new readers to your website.

## **10. Interviews**

First person interviews with people actively involved in your topic is a way to share different points of view with your readers and expand their knowledge of your topic. You can ask readers to submit questions in advance to increase your user engagement.

## **11. FAQs**

Everyone has questions. A FAQ (frequently asked questions) page is one of the best content types to help address common questions all in one place. This helps you better manage your time and not have to answer the same question over and over again.

## **12. Press releases**

Press releases from companies in your field make good fodder for your blog or website. Just make sure that you don't copy the release directly to avoid a duplicate content penalty from the search engines.

## **13. Announcements**

Let your readers know about it in an announcement post. Market your site as the place readers can learn about news from your company before any other source.

## **14. Contests**

Contests are a good content type for getting new readers and to keep your readers coming back to your site. Like quizzes, this repeat traffic is good for increasing your click-through rate.



## **15. E-books**

Having an e-book that your readers can download, or read directly on your site, can expand on your regular content types with more in-depth information. Promoting an e-book is an excellent way to promote your company as an expert in your field.

## **16. Landing pages**

Landing pages are designed as the first page that a site visitor sees when they take an action like clicking on an ad. It's important that these remain your highest-quality pages, so they make a good first impression to the user.

## **17. Infographics**

Out of all the other types of content, infographics remain one of the best at providing a visual representation of data or information to your reader. Plus, they also just look cool and can often illustrate a point much more clearly than if you explained the point with only text.

## **18. White Papers**

A white paper is a concise report that seeks to educate the reader about a complex issue, which you can post directly on your site or offered as a download. Like e-books, they help to establish your site as a leader in your industry.

## **19. “How to” posts**

Readers like to learn how to use a product or accomplish a task. (Look at the proliferation of YouTube videos of this ilk). “How to” posts can range from recipes to instructions on installing a hot water tank.

## **20. E-courses**

E-courses are designed to teach your reader about your topic. Generally divided into several sections, the reader can complete one each day or week. This type of post is another good way to get readers to return to your site.

## **21. Lists**

Lists are, arguably, the most popular type of web content. Whether it's "9 ways to attract a new boyfriend", "The 10 hottest guys on the PGA circuit" or "5 ways to cook acorn squash", there's just something compelling about a list. List headline are very clickable and a good way to introduce new readers to your site.

## **22. Reader questions**

You probably get questions from readers. Rather than answering the same questions privately over and over again, it just makes sense to create a page or two of real questions you've received from readers. (Just make sure that you get permission from the reader if you use their question verbatim).

## **23. Roundups**

Roundups are compilations of links to other sources posted elsewhere on the internet. This can include things in the news related to your industry this week or something like the best places to shop online for a product related to your industry. Make sure not to copy text from the other site, just the link, to avoid having your SEO suffer.

## **24. Book reviews**

Every topic has books written about it. Share with your readers the ones you've read and what you thought of them. (Just make sure not to spoil any plot twists or surprises). You might even ask readers about their favourite books to increase engagement.

## **25. Product reviews**

One of the perks of having a successful blog or website is that companies are often willing to send you a product to review at no cost to you. You can also purchase a product to review (with none of the potential ethical problems of accepting gifts).

## **26. Predictions**

Look for this web content type towards the end of the year, when everyone with a web address is offering their opinion about what will happen in the new year. Prediction posts are fun and, until January 1st, you can't be wrong. This is another way to encourage readers to view you as an industry expert.

## **27. Demos**

Similar to "How to" posts, demos show how to use a specific product and can be a useful way to market your wares.

## **28. Live streams**

Live streams, such as Facebook Live broadcasts, let your readers attend events, board meetings, product unveiling, contest drawings and other happenings right from their homes or office. This is another good way to engage site visitors.

## **29. Awards**

Awards are a fun way to get other businesses and individuals involved in your site. "Best of 2021"-type awards can start with nominations, move on to have readers vote on the top picks and end with an announcement of the winners. This type of content not only engages readers, but draws in fans of the nominated companies that may not have been familiar with your site before.

## **30. Guides**

Guides are a comprehensive look at a topic or destination. For example, if you have a site about Ohio travel, you might create a "Travel Guide to the Lake Erie

Islands”. With several of these pieces, you can market your website as a comprehensive resource about your topic.

### **31. Templates**

Templates are examples for readers to use to create their own documents or crafts. This type of content might be a sample resume format or how to write a letter of recommendation.

### **32. Check lists**

Checklists are useful lists that help readers prepare for something. For example, a checklist might be “things to pack when you hike the Appalachian Trail” or “Documents to take when you apply for Social Security benefits”.

### **33. Memes**

Memes are just silly, funny content that combine images with jokes, sarcasm or political humor.

### **34. User-generated content**

These can be blog posts, videos, images or full articles. Just make sure that you post guidelines and that your readers understand that you have editorial control.

### **35. Research and data**

Recent statistics and research can make for interesting content and help your site provide industry-leading resources for your readers.

### **36. Maps**

Maps are useful to illustrate where a user can find an attraction, business or other sites.

### **37. Essays**

If your website is like most sites, the bulk of your content is informational and written in the second or third person. Essays give you an opportunity to share your own, first-person experiences and create a rapport with your readers.

### **38. Event calendars**

Event calendars list things that are happening during a particular time frame. For example, you might post “What to Do in Nashville in May” or “Stephen King Book Events in the Midwest”. These can be a useful resource and bring new visitors to your site.

### **39. Giveaways**

You can ask them to take an action like signing up for your newsletter or liking your social media page in order to qualify for the freebie.

### **40. Social media posts**

Posts on Facebook, Twitter, Instagram and LinkedIn are generally shorter versions of the content on your website. You can include a link to your longer content, so readers can learn more if they are interested in your topic.

### **41. Podcasts**

Podcasts are increasingly popular. These might be interviews or instructional talks and work to support your other marketing efforts.

### **42. Testimonials**

Share what your readers and/or customers are saying about you with a testimonial page. (Again, it’s important to ask permission before you use someone else’s words.) Testimonials are great from a marketing point of view because they come from (presumably) unbiased third parties.

### **43. Industry news**

This might be a roundup, a recap of a press release or an article about a single happening in your field.

#### **44. Glossary**

This type of content page is especially useful if your industry or topic has a lot of jargon within your field. Prevent readers from becoming confused by creating a glossary page that defines these terms and then link back to it when you use those terms on other pages.

#### **45. Comparisons**

A type of product review, comparisons show a side-by-side look at two or more products. This might be a face-off between a Ford Mustang and a Chevy Camaro.

#### **46. Best practices**

This type of page gives readers advice on how they can make their life a little easier. It's even better if you can include how your product or service can make a reader's life easier.

#### **47. Recipes**

Just make sure that you only post original recipes. While ingredient lists aren't subject to copyright restrictions, the instructions on how to cook a dish are.

#### **48. Cheat sheets**

Everyone likes to learn about an easier way to do something. Again, see if you can work this around one of your products or services.

#### **49. Screenshots**

Screenshots are images of what's on your computer screen at a particular moment. These are useful when you're trying to explain to readers how to do something on their computer.

## **50. Calculators**

Calculators can be useful for things like figuring compound interest, paying off a mortgage early or estimating retirement income.

## **USEFULNESS OF WEB**

There are so many fields in which we can see the use of the World Wide Web. There are some real-life services or resources we are using. We can see 10 uses of the World Wide Web given below -

1. **Website:** On a website we put multiple web resources at web pages with a particular theme by using a single domain name, which can be accessed from anywhere. For example, [www.infomogli.com](http://www.infomogli.com), [www.wikipedia.org](http://www.wikipedia.org), etc.
2. **Email:** Email is known as electronic mail which is used to communicate with others by the message sent via the Internet. Example: [gmail.com](http://gmail.com), [yahoo.com](http://yahoo.com).
3. **Online Study Materials:** We can find study material online for learning. E.g. Udemy, Khan Academy, etc.
4. **Web Services:** It is a service offered by an electronic device to another electronic device.
5. **Downloadable Video:** There are many examples Youtube, Max player, Netflix, etc.
6. **Online Music:** Online mp3 files are available to download and to listen to.
7. **E-Commerce:** Online shopping is a part of our life today. E.g. Amazon, Flipkart, Walmart, etc.
8. **News Sectors:** We can see many news channels working online.
9. **Online Payment:** Paying online is possible because of WWW and the Internet.

10. **Online Banking:** Almost every bank provides online banking to its customers for balance check, transfer funds, receive funds within one's bank account.

### **Smart Uses of World Wide Web in Business**

After reading about the uses of the World Wide Web, we can see some specific uses of WWW (World Wide Web) in business. There are some uses mentioned below -

- ❖ Marketing and Advertising.
- ❖ Branding.
- ❖ Product or Service Representation.
- ❖ Online Shop.
- ❖ Business Research and Development.
- ❖ Business Communication.
- ❖ Collaboration with Other Business.
- ❖ Payment Methods.

### **CONTENT DEVELOPMENT**

Content development is the process of researching, writing, gathering, organizing, and editing information for publication.

Content development is the process of originating (creating), editing, manipulating and maintaining the contents in order to provide knowledgeable fillings to the users.

Contents developed aid a lot in establishing and growing the thinking and gaining overall information about the person, company, organization, nation and almost all the fields.

Content development can be distinct from topic selection (a high-level idea such as “productivity”, “social media” and so on), topic development (the main points to express in a piece of content about a given topic) and presenting the content (public speaking, writing etc).



## **BENEFITS**

A few benefits of investing in content development include:

1. **Improved efficiency:**

Carefully planning and executing a content strategy increases your chances of success. You can **target your ideal audience and create content that meets their needs and solves their struggles**. Having a plan also keeps you consistent, which helps you maintain traction and build trust with your audience.

2. **Better progress monitoring:**

A content development plan makes it easier to analyze your progress and make adjustments as needed. You can **monitor the key performance metrics and track how well your content is performing**—helping you meet and exceed your targets.

3. **Effective collaboration:**

With a content development process, **everyone on the team is on the same page**. Your team will know what to do with each piece of content and what to expect for performance. Again, this raises your chances of success.

## **5 Vital Steps for a Successful Content Development Process**

1. Set Content Goals
2. Perform Audience Research
3. Hone Your Content Strategy
4. Write
5. Publish and Distribute

### **1. Set Content Goals**

As you set content goals, you'll also need to decide how to measure content marketing success. Some commonly used metrics are:

- Blog traffic
- SERP rankings
- Social shares
- Lead generation
- Number of sales
- Client retention

Remember to set SMART (Specific, Measurable, Achievable, Realistic, and Time-Anchored) goals for your content development process. Also, besides having an overarching content marketing goal, you may need to set goals for each piece of content.

## **2. Perform Audience Research**

Many experts recommend creating a buyer persona, and research has shown buyer personas to be highly effective. Hubspot states that marketing personas made websites 2 to 5 times more effective for targeted users. A buyer persona is a specific, detailed profile of your target audience.

Your buyer persona should include answers to the following questions:

- Who is my content made for?
- What is my audience's main pain point?
- Where does my ideal audience live and work?
- Which social media platforms do they prefer?
- Who does my target audience follow on social media?
- Which sites does my audience typically visit?
- How would my ideal audience prefer to have their pain point solved?

To build a compelling buyer persona, use audience research tools like SparkToro to study audience behaviour online.

Send surveys to existing customers and potential customers to discover their preferences.

Lastly, mine customer interviews and interactions from Customer Service and Sales to see how well your product is already solving pain points—and where you can improve.

### **3. Hone Your Content Strategy**

Content strategy is a major part of the content development process. It involves researching, planning, and executing content ideas.

Decide which types of content you'll be sticking with:

- Will you focus on social media posts or long-form content, or both?
- If you're doing long-form content, will you be publishing more helpful how-to posts or thought-leadership articles?
- Will search engine optimization (SEO) play a significant role in your content marketing?

This would also be a great time to draft a content calendar, start creating content briefs and decide on a brand voice for your articles. In-depth keyword research using tools like Ahrefs and Semrush will make your pieces stronger.

Finally, you'll need to decide whether you'll be using freelance writers or content marketing agencies to write all this content you've dreamed up.

### **4. Write**

In this age of search engines, basic SEO best practices—such as incorporating your keyword into your meta title, URL, and meta description—make a massive difference for search engine result page (SERP) rankings.

But don't get carried away writing for robots alone.

Focus on readability and sharing helpful information.

Use storytelling and make your content actionable by using examples, illustrations, charts, and other elements.

Ensure that your audience learns from each piece of content, and you're not simply regurgitating competitor content.

To make the most of your written content, you'll need to collaborate with multiple team members.

For example, while the content strategist creates the brief, an in-house or freelance writer will likely write the content.

Ideally, there'll also be an editor to review and fact-check your pieces.

Make sure that everyone knows when it's their turn to tap in by using a content hub that supports seamless collaboration.

While most teams use Google Docs, GatherContent is a central content tool that allows you to automate the process by using content templates, building an editorial calendar, and assigning collaborator roles, all in one tool!

## **5. Publish and Distribute**

Don't be fooled: hitting publish is far from the final step in the content development process. Still, it's an important step that GatherContent can also facilitate.

With GatherContent, you can import your content straight to your content management system with zero hassle.

Once the content is live, use your pre-determined content distribution channels (see content strategy) to promote it.

You'll need to do this more than once or twice.

Get the most out of your content by repurposing it.

Convert podcasts to blog posts and blog posts to LinkedIn posts.

Make YouTube videos using content from past articles. Repurposing content gets more eyeballs on your hard work.

As you publish and distribute, track the content to see how it's performing. You'll also need to do some outreach to gain quality backlinks from other sites in your industry.

Content marketing is trial and error and requires that you tweak your strategy from time to time.

The following roles demand knowledge of content development:

- **Content strategists:**

As those chiefly responsible for brainstorming ideal content formats, planning briefs, and analyzing content success, content strategists are at the forefront of content development.

- **Head of content:**

Heads of content often have a broader role than strategists but are also involved in strategizing and executing content plans.

- **Project managers:**

Project managers oversee the content workflow and ensure that all involved parties work efficiently.

- **Content creators:**

Anyone steeped in content creation is involved in the content development process. They'll need to understand their audience and develop a strategy to match them.

- **Social media marketers:**

Social media marketers also engage in content marketing. They, too, must understand the process.

- **Bloggers:**

Lastly, bloggers regularly interact with their audience via comments and feedback—priceless audience research that can help them nail the content development process.

### **The Future of Content Development**

Regardless of your role—whether you're a writer, marketer, blogger, or content creator—you will benefit from improving your content workflow by using a better content creation hub.

The days of using six different tools to conceptualize, plan, and produce content are far gone.

## **WEB DESIGN**

Web design encompasses many different skills and disciplines in the production and maintenance of websites.

The different areas of web design include web graphic design; user interface design (UI design); authoring, including standardised code and proprietary software; user experience design (UX design) and search engine optimization.

Often many individuals will work in teams covering different aspects of the design process, although some designers will cover them all.

The term "web design" is normally used to describe the design process relating to the front-end (client side) design of a website including writing markup.

Web design partially overlaps web engineering in the broader scope of web development.

Web designers are expected to have an awareness of usability and be up to date with web accessibility guidelines.

## **History**

## **1988–2001**

Although web design has a fairly recent history, it can be linked to other areas such as graphic design, user experience, and multimedia arts, but is more aptly seen from a technological standpoint.

It has become a large part of people's everyday lives.

It is hard to imagine the Internet without animated graphics, different styles of typography, background, videos and music.

In November 1992, Cern was the first website to ever launch to go live. The web was announced on August 6, 1991, and CERN was the first website to go live on the World Wide Web.

During this period, websites were structured by using the <table> tag which created numbers on the website.

Eventually, web designers were able to find their way around it to create more structures and format.

In early history, the structure of the websites was fragile and hard to contain, so it became very difficult to use them.

In November 1993 ALIWEB was the first ever search engine to be created (Archie Like Indexing for the WEB).

### **The start of the web and web design**

In 1989, whilst working at CERN, Tim Berners-Lee proposed to create a global hypertext project, which later became known as the World Wide Web.

From 1991 to 1993 the World Wide Web was born.

Text-only HTML pages could be viewed using a simple line-mode web browser.

In 1993 Marc Andreessen and Eric Bina, created the Mosaic browser.

At the time there were multiple browsers, however the majority of them were Unix-based and naturally text-heavy.

There had been no integrated approach to graphic design elements such as images or sounds.

The Mosaic browser broke this mould.

The W3C was created in October 1994 to “lead the World Wide Web to its full potential by developing common protocols that promote its evolution and ensure its interoperability”.

This discouraged any one company from monopolizing a propriety browser and programming language, which could have altered the effect of the World Wide Web as a whole.

The W3C continues to set standards, which can today be seen with JavaScript and other languages.

In 1994 Andreessen formed Mosaic Communications Corp. that later became known as Netscape Communications, the Netscape 0.9 browser.

Netscape created its own HTML tags without regard to the traditional standards process.

For example, Netscape 1.1 included tags for changing background colours and formatting text with tables on web pages.

From 1996 to 1999 the browser wars began, as Microsoft and Netscape fought for ultimate browser dominance. During this time there were many new technologies in the field, notably Cascading Style Sheets, JavaScript, and Dynamic HTML. On the whole, the browser competition did lead to many positive creations and helped web design evolve at a rapid pace.

## **EVOLUTION OF WEB DESIGN**

In 1996, Microsoft released its first competitive browser, which was complete with its own features and HTML tags.

It was also the first browser to support style sheets, which at the time was seen as an obscure authoring technique and is today an important aspect of web design.

The HTML markup for tables was originally intended for displaying tabular data.

However, designers quickly realized the potential of using HTML tables for creating complex, multi-column layouts that were otherwise not possible.



At this time, as design and good aesthetics seemed to take precedence over good markup structure, little attention was paid to semantics and web accessibility.

HTML sites were limited in their design options, even more so with earlier versions of HTML. To create complex designs, many web designers had to use complicated table structures or even use blank spacer.

GIF images to stop empty table cells from collapsing.

CSS was introduced in December 1996 by the W3C to support presentation and layout.

This allowed HTML code to be semantic rather than both semantic and presentational and improved web accessibility, see table less web design.

In 1996, Flash (originally known as FutureSplash) was developed.

At the time, the Flash content development tool was relatively simple compared to now, using basic layout and drawing tools, a limited precursor to ActionScript, and a timeline, but it enabled web designers to go beyond the point of HTML, animated GIFs and JavaScript.

However, because Flash required a plug-in, many web developers avoided using it for fear of limiting their market share due to lack of compatibility.

Instead, designers reverted to GIF animations (if they didn't forego using motion graphics altogether) and JavaScript for widgets.

But the benefits of Flash made it popular enough among specific target markets to eventually work its way to the vast majority of browsers, and powerful enough to be used to develop entire sites.

### **End of the first browser wars**

In 1998, Netscape released Netscape Communicator code under an open-source licence, enabling thousands of developers to participate in improving the software.

However, these developers decided to start a standard for the web from scratch, which guided the development of the open-source browser and soon expanded to a complete application platform.

The Web Standards Project was formed and promoted browser compliance with HTML and CSS standards.

Programs like Acid1, Acid2, and Acid3 were created in order to test browsers for compliance with web standards.

In 2000, Internet Explorer was released for Mac, which was the first browser that fully supported HTML 4.01 and CSS 1.

It was also the first browser to fully support the PNG image format.

By 2001, after a campaign by Microsoft to popularize Internet Explorer, Internet Explorer had reached 96% of web browser usage share, which signified the end of the first browsers wars as Internet Explorer had no real competition.

## **2001–2012**

Since the start of the 21st century, the web has become more and more integrated into people's lives.

As this has happened the technology of the web has also moved on.

There have also been significant changes in the way people use and access the web, and this has changed how sites are designed.

Since the end of the browsers wars new browsers have been released.

Many of these are open source meaning that they tend to have faster development and are more supportive of new standards.

The new options are considered by many to be better than Microsoft's Internet Explorer.

The W3C has released new standards for HTML (HTML5) and CSS (CSS3), as well as new JavaScript API's, each as a new but individual standard.

While the term HTML5 is only used to refer to the new version of HTML and some of the JavaScript APIs, it has become common to use it to refer to the entire suite of new standards (HTML5, CSS3 and JavaScript).

## **2012 and later**

With the improvement of 3G and LTE internet coverage, a large part of website traffic became mobile-generated.

This affected the web design industry, pushing it towards a minimalistic, lightened and simplistic style.

In particular, the "Mobile first" approach emerged, which implies creating website design with a mobile-oriented layout first, and then adapting it to higher screen dimensions.

## **TOOLS AND TECHNOLOGIES**

Web designers use a variety of different tools depending on what part of the production process they are involved in.

These tools are updated over time by newer standards and software but the principles behind them remain the same.

Web designers use both vector and raster graphics editors to create web-formatted imagery or design prototypes.

A website can be created using WYSIWYG website builder software or content management system, or the individual web pages can be hand-coded in just the same manner as the first web pages were created.

Other tools web designers might use include markup validators and other testing tools for usability and accessibility to ensure their websites meet web accessibility guidelines.

## **UX DESIGN**

One popular tool in web design is UX Design, it is a type of art that designs products to perform an accurate user background.

UX design is very deep.

UX is more than the web, it is very independent, and its fundamentals can be applied to many other browsers or apps.

Web design is mostly based on web-based things.

UX can overlap both web design and design. UX design mostly focuses on products that are less web based.

## **SKILLS AND TECHNIQUES**

### **Marketing and communication design**

Marketing and communication design on a website may identify what works for its target market.

This can be an age group or particular strand of culture; thus the designer may understand the trends of its audience.

Designers may also understand the type of website they are designing, meaning, for example, that (B2B) business-to-business website design considerations might differ greatly from a consumer-targeted website such as a retail or entertainment website.

Careful consideration might be made to ensure that the aesthetics or overall design of a site do not clash with the clarity and accuracy of the content or the ease of web navigation,<sup>[12]</sup> especially on a B2B website.

Designers may also consider the reputation of the owner or business the site is representing to make sure they are portrayed favourably.

Web designers normally oversee all the websites that are made on how they work or operate on things.

They constantly are updating and changing everything on websites behind the scenes. All the elements they do are text, photos, graphics, and layout of the web.

Before beginning work on a website, web designers normally set an appointment with their clients to discuss layout, colour, graphics, and design.

Web designers spend the majority of their time designing websites and making sure the speed is right.

Web designers typically engage in testing and working, marketing, and communicating with other designers about laying out the websites and finding the right elements for the websites.

### **User experience design and interactive design**

User understanding of the content of a website often depends on user understanding of how the website works.

This is part of the user experience design. User experience is related to layout, clear instructions, and labelling on a website.

How well a user understands how they can interact on a site may also depend on the interactive design of the site.

If a user perceives the usefulness of the website, they are more likely to continue using it.

Users who are skilled and well versed in website use may find a more distinctive, yet less intuitive or less user-friendly website interface useful nonetheless.

However, users with less experience are less likely to see the advantages or usefulness of a less intuitive website interface.

This drives the trend for a more universal user experience and ease of access to accommodate as many users as possible regardless of user skill.

Much of the user experience design and interactive design are considered in the user interface design.

Advanced interactive functions may require plug-ins if not advanced coding language skills. Choosing whether or not to use interactivity that requires plug-ins is a critical decision in user experience design.

If the plug-in doesn't come pre-installed with most browsers, there's a risk that the user will have neither the know-how nor the patience to install a plug-in just to access the content.

If the function requires advanced coding language skills, it may be too costly in either time or money to code compared to the amount of enhancement the function will add to the user experience.

There's also a risk that advanced interactivity may be incompatible with older browsers or hardware configurations.

Publishing a function that doesn't work reliably is potentially worse for the user experience than making no attempt.

It depends on the target audience if it's likely to be needed or worth any risks.

### **Progressive enhancement**

Progressive enhancement is a strategy in web design that puts emphasis on web content first, allowing everyone to access the basic content and functionality of a web page, whilst users with additional browser features or faster Internet access receive the enhanced version instead.

In practice, this means serving content through HTML and applying styling and animation through CSS to the technically possible extent, then applying further enhancements through JavaScript.

Pages' text is loaded immediately through the HTML source code rather than having to wait for JavaScript to initiate and load the content subsequently, which allows content to be readable with minimum loading time and bandwidth, and through text-based browsers, and maximizes backwards compatibility.

As an example, MediaWiki-based sites including Wikipedia use progressive enhancement, as they remain usable while JavaScript and even CSS is deactivated, as pages' content is included in the page's HTML source code, whereas counter-example Everipedia relies on JavaScript to load pages' content subsequently; a blank page appears with JavaScript deactivated.

### **Page layout**

Part of the user interface design is affected by the quality of the page layout.

For example, a designer may consider whether the site's page layout should remain consistent on different pages when designing the layout.

Page pixel width may also be considered vital for aligning objects in the layout design.

The most popular fixed-width websites generally have the same set width to match the current most popular browser window, at the current most popular screen resolution, on the current most popular monitor size.

Most pages are also center-aligned for concerns of aesthetics on larger screens.

Fluid layouts increased in popularity around 2000 to allow the browser to make user-specific layout adjustments to fluid layouts based on the details of the reader's screen (window size, font size relative to window, etc.).

They grew as an alternative to HTML-table-based layouts and grid-based design in both page layout design principles and in coding technique but were very slow to be adopted.

This was due to considerations of screen reading devices and varying windows sizes which designers have no control over.

Accordingly, a design may be broken down into units (sidebars, content blocks, embedded advertising areas, navigation areas) that are sent to the browser and which will be fitted into the display window by the browser, as best it can.

Although such a display may often change the relative position of major content units, sidebars may be displaced below body text rather than to the side of it.

This is a more flexible display than a hard-coded grid-based layout that doesn't fit the device window.

In particular, the relative position of content blocks may change while leaving the content within the block unaffected. This also minimizes the user's need to horizontally scroll the page.

Responsive web design is a newer approach, based on CSS3, and a deeper level of per-device specification within the page's style sheet through an enhanced use of the CSS `@media` rule.

In March 2018 Google announced they would be rolling out mobile-first indexing.

Sites using responsive design are well placed to ensure they meet this new approach.

## **Typography**

Web designers may choose to limit the variety of website typefaces to only a few which are of a similar style, instead of using a wide range of typefaces or type styles.

Most browsers recognize a specific number of safe fonts, which designers mainly use in order to avoid complications.

Font downloading was later included in the CSS3 fonts module and has since been implemented in Safari 3.1, Opera 10, and Mozilla Firefox 3.5.

This has subsequently increased interest in web typography, as well as the usage of font downloading.

Most site layouts incorporate negative space to break the text up into paragraphs and also avoid center-aligned text.

## **Motion graphics**

The page layout and user interface may also be affected by the use of motion graphics.

The choice of whether or not to use motion graphics may depend on the target market for the website.

Motion graphics may be expected or at least better received with an entertainment-oriented website.

However, a website target audience with a more serious or formal interest (such as business, community, or government) might find animations unnecessary and distracting if only for entertainment or decoration purposes.

This doesn't mean that more serious content couldn't be enhanced with animated or video presentations that is relevant to the content.

In either case, motion graphic design may make the difference between more effective visuals or distracting visuals.



Motion graphics that are not initiated by the site visitor can produce accessibility issues. The World Wide Web consortium accessibility standards require that site visitors be able to disable the animations.

## **Quality of code**

Website designers may consider it to be good practice to conform to standards.

This is usually done via a description specifying what the element is doing.

Failure to conform to standards may not make a website unusable or error-prone, but standards can relate to the correct layout of pages for readability as well as making sure coded elements are closed appropriately.

This includes errors in code, a more organized layout for code, and making sure IDs and classes are identified properly.

Poorly coded pages are sometimes colloquially called tag soup.

Validating via W3C can only be done when a correct DOCTYPE declaration is made, which is used to highlight errors in code.

The system identifies the errors and areas that do not conform to web design standards. This information can then be corrected by the user.

## **Generated content**

There are two ways websites are generated: statically or dynamically.

### **Static websites**

A static website stores a unique file for every page of a static website.

Each time that page is requested, the same content is returned. This content is created once, during the design of the website.

It is usually manually authored, although some sites use an automated creation process, similar to a dynamic website, whose results are stored long-term as completed pages.

These automatically created static sites became more popular around 2015, with generators such as Jekyll and Adobe Muse.

The benefits of a static website are that they were simpler to host, as their server only needed to serve static content, not execute server-side scripts.

This required less server administration and had less chance of exposing security holes. They could also serve pages more quickly, on low-cost server hardware.

This advantage became less important as cheap web hosting expanded to also offer dynamic features, and virtual servers offered high performance for short intervals at low cost.

Almost all websites have some static content, as supporting assets such as images and style sheets are usually static, even on a website with highly dynamic pages.

## **Dynamic websites**

Dynamic websites are generated on the fly and use server-side technology to generate web pages.

They typically extract their content from one or more back-end databases: some are database queries across a relational database to query a catalog or to summarise numeric information, and others may use a document database such as MongoDB or NoSQL to store larger units of content, such as blog posts or wiki articles.

In the design process, dynamic pages are often mocked-up or wire framed using static pages.

The skill set needed to develop dynamic web pages is much broader than for a static page, involving server-side and database coding as well as client-side interface design.

Even medium-sized dynamic projects are thus almost always a team effort.

When dynamic web pages first developed, they were typically coded directly in languages such as Perl, PHP or ASP.

Some of these, notably PHP and ASP, used a 'template' approach where a server-side page resembled the structure of the completed client-side page, and data was inserted into places defined by 'tags'.

This was a quicker means of development than coding in a purely procedural coding language such as Perl.

Both of these approaches have now been supplanted for many websites by higher-level application-focused tools such as content management systems.

These build on top of general-purpose coding platforms and assume that a website exists to offer content according to one of several well-recognised models, such as a time-sequenced blog, a thematic magazine or news site, a wiki, or a user forum.

These tools make the implementation of such a site very easy, and a purely organizational and design-based task, without requiring any coding.

## **HOMEPAGE DESIGN**

Usability experts, including Jakob Nielsen and Kyle Soucy, have often emphasised homepage design for website success and asserted that the homepage is the most important page on a website.

Nielsen, Jakob; Tahir, Marie (October 2001),Homepage Usability: 50 Websites Deconstructed, New Riders Publishing, ISBN 978-0735711020

However practitioners into the 2000s were starting to find that a growing number of website traffic was bypassing the homepage, going directly to internal content pages through search engines, e-newsletters and RSS feeds.

Leading many practitioners to argue that homepages are less important than most people think.

Jared Spool argued in 2007 that a site's homepage was actually the least important page on a website.

In 2012 and 2013, carousels (also called 'sliders' and 'rotating banners') have become an extremely popular design element on homepages, often used to showcase featured or recent content in a confined space. Many practitioners argue that carousels are an ineffective design element and hurt a website's search engine optimisation and usability.

## **OCCUPATIONS**

There are two primary jobs involved in creating a website: the web designer and web developer, who often work closely together on a website.

The web designers are responsible for the visual aspect, which includes the layout, colouring, and typography of a web page.

Web designers will also have a working knowledge of markup languages such as HTML and CSS, although the extent of their knowledge will differ from one web designer to another.

Particularly in smaller organizations, one person will need the necessary skills for designing and programming the full web page, while larger organizations may have a web designer responsible for the visual aspect alone.

Further jobs which may become involved in the creation of a website include:

1. Graphic designers to create visuals for the site such as logos, layouts, and buttons
2. Internet marketing specialists to help maintain web presence through strategic solutions on targeting viewers to the site, by using marketing and promotional techniques on the internet
3. SEO writers to research and recommend the correct words to be incorporated into a particular website and make the website more accessible and found on numerous search engines
4. Internet copywriter to create the written content of the page to appeal to the targeted viewers of the site.
5. User experience (UX) designer incorporates aspects of user-focused design considerations which include information architecture, user-centred design, user testing, interaction design, and occasionally visual design.

## **WEB DESIGN METHODS**

### **1. Goal identification:**

Where I work with the client to determine what goals the new website needs to fulfil. i.e., what its purpose is.

## 2. **Scope definition:**

Once we know the site's goals, we can define the scope of the project. I.e., what web pages and features the site requires to fulfill the goal, and the timeline for building those out.

## 3. **Sitemap and wireframe creation:**

With the scope well-defined, we can start digging into the sitemap, defining how the content and features we defined in scope definition will interrelate.

## 4. **Content creation:**

Now that we have a bigger picture of the site in mind, we can start creating content for the individual pages, always keeping search engine optimization (SEO) in mind to help keep pages focused on a single topic. It's vital that you have real content to work with for our next stage:

## 5. **Visual elements:**

With the site architecture and some content in place, we can start working on the visual brand. Depending on the client, this may already be well-defined, but you might also be defining the visual style from the ground up. Tools like style tiles, moodboards, and element collages can help with this process.

## 6. **Testing:**

By now, you've got all your pages and defined how they display to the site visitor, so it's time to make sure it all works. Combine manual browsing of the site on a variety of devices with automated site crawlers to identify everything from user experience issues to simple broken links.

## 7. **Launch:**

Once everything's working beautifully, it's time to plan and execute your site launch! This should include planning both launch timing and communication strategies

— i.e., when will you launch and how will you let the world know? After that, it's time to break out the bubbly.

## 1. Goal identification

In this initial stage, the designer needs to identify the end goal of the website design, usually in close collaboration with the client or other stakeholders. Questions to explore and answer in this stage of the design and website development process include:

- 1) Who is the site for?
- 2) What do they expect to find or do there?
- 3) Is this website's primary aim to inform, to sell (ecommerce, anyone?), or to amuse?
- 4) Does the website need to clearly convey a brand's core message, or is it part of a wider branding strategy with its own unique focus?
- 5) What competitor sites, if any, exist, and how should this site be inspired by/different than, those competitors?

This is the most important part of any web development process. If these questions aren't all clearly answered in the brief, the whole project can set off in the wrong direction.

It may be useful to write out one or more clearly identified goals, or a one-paragraph summary of the expected aims.

This will help to put the design on the right path. Make sure you understand the website's target audience, and develop a working knowledge of the competition.

For more on this design phase, check out "The modern web design process: setting goals."

Tools for website goal identification stage

- Audience personas.

- Creative brief.
- Competitor analyses.
- Brand attributes.

## **2. Scope definition**

One of the most common and difficult problems plaguing web design projects is scope creep.

The client sets out with one goal in mind, but this gradually expands, evolves, or changes altogether during the design process — and the next thing you know, you're not only designing and building a website, but also a web app, emails, and push notifications.

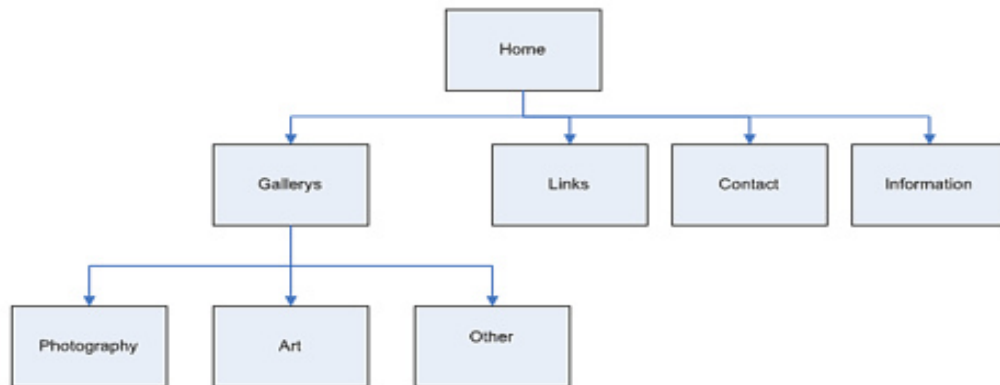
This isn't necessarily a problem for designers, as it can often lead to more work.

But if the increased expectations aren't matched by an increase in budget or timeline, the project can rapidly become utterly unrealistic.

Tools for scope definition

- A contract
- Gantt chart (or other timeline visualization)

## **3. Sitemap and wireframe creation**



The sitemap provides the foundation for any well-designed website. It helps give web designers a clear idea of the website's information architecture and explains the relationships between the various pages and content elements.

Building a site without a sitemap is like building a house without a blueprint. And that rarely turns out well.

The next step is to find some design inspiration and build a mockup of the wireframe. Wireframes provide a framework for storing the site's visual design and content elements, and can help identify potential challenges and gaps with the sitemap.

### **Tools for site mapping and wire framing**

- Pen/pencil and paper.
- Balsamiq.
- Moqups.
- Sketch.
- Axure.
- Webflow.
- Slickplan.
- Writemaps.
- Mindnode.



## **4. Content creation**

Content serves two essential purposes:

### **Purpose 1: Content drives engagement and action**

First, content engages readers and drives them to take the actions necessary to fulfil a site's goals.

This is affected by both the content itself (the writing), and how it's presented (the typography and structural elements).

Dull, lifeless, and overlong prose rarely keeps visitors' attention for long. Short, snappy, and intriguing content grabs them and gets them to click through to other pages.

Even if your pages need a lot of content — and often, they do — properly “chunking” that content by breaking it up into short paragraphs supplemented by visuals can help it keep a light, engaging feel.

### **Purpose 2: SEO**

Content also boosts a site's visibility for search engines. The practice of creation and improving content to rank well in search is known as search engine optimization, or SEO.

Getting your keywords and key-phrases right is essential for the success of any website. I always use Google Keyword Planner.

This tool shows the search volume for potential target keywords and phrases, so you can hone in on what actual human beings are searching on the web.

While search engines are becoming more and more clever, so should your content strategies.

Google Trends is also handy for identifying terms people actually use when they search.

My design process focuses on designing websites around SEO.

Keywords you want to rank for need to be placed in the title tag — the closer to the beginning, the better.

Keywords should also appear in the H1 tag, meta description, and body content.

Content that's well-written, informative, and keyword-rich is more easily picked up by search engines, all of which helps to make the site easier to find.

#### **Awesome content creation tools**

- Google Docs
- Dropbox Paper
- Quip
- Gather Content
- Webflow CMS (content management system)

#### **Handy SEO tools**

- Google Keyword Planner
- Google Trends
- Screaming Frog's SEO Spider

### **5. Visual elements**

Finally, it's time to create the visual style for the site.

This part of the design process will often be shaped by existing branding elements, colour choices, and logos, as stipulated by the client.

But it's also the stage of the web design process where a good web designer can really shine.

Images are taking on a more significant role in web design now than ever before.

Not only do high-quality images give a website a professional look and feel, but they also communicate a message, are mobile-friendly, and help build trust.

Visual content is known to increase clicks, engagement, and revenue.

But more than that, people want to see images on a website.

Not only do images make a page feel less cumbersome and easier to digest, but they also enhance the message in the text, and can even convey vital messages without people even needing to read.

I recommend using a professional photographer to get the images right. You can try free stock photos but keep in mind that massive, beautiful images can seriously slow down a site.

I use Optimizilla to compress images without losing quality, saving on page-load times.

You'll also want to make sure your images are as responsive as your site.

The visual design is a way to communicate and appeal to the site's users. Get it right, and it can determine the site's success.

Get it wrong, and you're just another web address.

### **Tools for visual elements**

- The usual suspects (Sketch, Illustrator, Photoshop, etc.)
- Moodboards, style tiles, element collages
- Visual style guides

## **6. Testing**

Once the site has all its visuals and content, you're ready for testing.

Thoroughly test each page to make sure all links are working and that the website loads properly on all devices and browsers.

Errors may be the result of small coding mistakes, and while it is often a pain to find and fix them, it's better to do it now than present a broken site to the public..

Have one last look at the page meta titles and descriptions too.

Even the order of the words in the meta title can affect the performance of the page on a search engine.

Web flow has an excellent article on the pre-launch process.

### **Website testing tools**

- W3C Link Checker
- SEO Spider

## **7. Launch**

Now it's time for everyone's favourite part of the website design process: When everything has been thoroughly tested, and you're happy with the site, it's time to launch.

Don't expect this to go perfectly.

There may be still some elements that need fixing.

Web design is a fluid and ongoing process that requires constant maintenance.

Web design — and really, design in general — is all about finding the right balance between form and function.

You need to use the right fonts, colours, and design motifs.

But the way people navigate and experience your site is just as important.

Skilled designers should be well versed in this concept and able to create a site that walks the delicate tightrope between the two.

A key thing to remember about the launch stage is that it's nowhere near the end of the job.

The beauty of the web is that it's never finished. Once the site goes live, you can continually run user testing on new content and features, monitor analytics, and refine your messaging.

