LECTURE NOTES

ON

INTERNET AND WEB TECHNOLOGY

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CHAPTER-1(INTERNET BASICS)

NETWORKS

A network is a set of devices (often referred to as nodes) connected by communication links. A node can be a computer, printer, or any other device capable of sending and/or receiving data generated by other nodes on the network. "Computer network'' to mean a collection of autonomous computers interconnected by a single technology. Two computers are said to be interconnected if they are able to exchange information. The connection need not be via a copper wire; fiber optics, microwaves, infrared, and communication satellites can also be used. Networks come in many sizes, shapes and forms, as we will see later. They are usually connected together to make larger networks, with the Internet being the most well-known example of a network of networks. There is considerable confusion in the literature between a computer network and a distributed system. The key distinction is that in a distributed system, a collection of independent computers appears to its users as a single coherent system. Usually, it has a single model or paradigm that it presents to the users. Often a layer of software on top of the operating system, called middleware, is responsible for implementing this model. A well-known example of a distributed system is the World Wide Web. It runs on top of the Internet and presents a model in which everything looks like a document (Web page).

USES OF COMPUTER NETWORKS

1. Business Applications
    - to distribute information throughout the company (resource sharing). sharing physical resources such as printers, and tape backup systems, is sharing information
    - client-server model. It is widely used and forms the basis of much network usage.
    - communication medium among employees.email (electronic mail), which employees generally use for a great deal of daily communication.
    - Telephone calls between employees may be carried by the computer network instead of by the phone company. This technology is called IP telephony or Voice over IP (VoIP) when Internet technology is used.
    - Desktop sharing lets remote workers see and interact with a graphical computer screen
    - doing business electronically, especially with customers and suppliers. This new model is called e-commerce (electronic commerce) and it has grown rapidly in recent years.
2. Home Applications
    - peer-to-peer communication
    - person-to-person communication
    - electronic commerce
    - entertainment(game playing)

3. Mobile Users
    - Text messaging or texting Smart phones
    - GPS (Global Positioning System)
    - m-commerce
    - NFC (Near Field Communication)

4. Social Issues

With the good comes the bad, as this new-found freedom brings with it many unsolved social, political, and ethical issues. Social networks, message boards, content sharing sites, and a host of other applications allow people to share their views with like-minded individuals. As long as the subjects are restricted to technical topics or hobbies like gardening, not too many problems will arise.

THE INTERNET

History of Internet:

A network is a group of connected communicating devices such as computers and printers. An internet (note the lowercase letter i) is two or more networks that can communicate with each other. The most notable internet is called the Internet (uppercase letter I), a collaboration of more than hundreds of thousands of interconnected networks. Private individuals as well as various organizations such as government agencies, schools, research facilities, corporations, and libraries in more than 100 countries use the Internet. Millions of people are users. Yet this extraordinary communication system only came into being in 1969. In the mid-1960s, mainframe computers in research organizations were standalone devices. Computers from different manufacturers were unable to communicate with one another. The Advanced Research Projects Agency (ARPA) in the Department of Defense (DoD) was interested in finding a way to connect computers so that the researchers they funded could share their findings, thereby reducing costs and eliminating duplication of effort. In 1967, at an Association for Computing Machinery (ACM) meeting, ARPA presented its ideas for ARPANET, a small network of connected computers. The idea was that each host computer (not necessarily from the same manufacturer) would be attached to a specialized computer, called an inteiface message processor (IMP). The IMPs, in tum, would be connected to one another. Each IMP had to be able to communicate with other IMPs as well as with its own attached host. By 1969, ARPANET was a reality. Four nodes, at the University of California at Los Angeles (UCLA), the University of California at Santa Barbara (UCSB), Stanford Research Institute (SRI), and the University of Utah, were connected via the IMPs to form a network. Software called the Network Control Protocol (NCP) provided communication between the hosts. In 1972, Vint Cerf and Bob Kahn, both of whom were part of the core ARPANET group, collaborated on what they called the Internetting Projec1. Cerf and Kahn's landmark 1973 paper outlined the protocols to achieve endto-end delivery of packets. This paper on Transmission Control Protocol (TCP) included concepts such as encapsulation, the datagram, and the functions of a gateway. Shortly thereafter, authorities made a decision to split TCP into two protocols: Transmission Control Protocol (TCP) and Internetworking Protocol (IP). IP would handle datagram routing while TCP would be responsible for higher-level functions such as segmentation, reassembly, and error detection. The internetworking protocol became known as TCPIIP. The Internet Today The Internet has come a long way since the 1960s. The Internet today is not a simple hierarchical structure. It is made up of many wide- and local-area networks joined by connecting devices and switching stations. It is difficult to give an accurate representation of the Internet because it is continually changing-new networks are being added, existing networks are adding addresses, and networks of defunct companies are being removed. Today most end users who want Internet connection use the services of Internet service providers (ISPs). There are international service providers, national service providers, regional service providers, and local service providers. The Internet today is run by private companies, not the government.

The Internet

1. The Internet is a public and global communication network that provides direct connectivity to anyone over a local area network (LAN) or Internet Service Provider (ISP).
2. The Internet is a public network that is connected and routed over gateways. End users are connected to local access providers (LANs or ISPs), who are connected to the Internet access providers, to network access providers, and eventually to the Internet backbone.
3. Since access to the Internet is open to all, there is a lack of control that may result in an unruly proliferation of information.

The Intranet

1. An intranet is a corporate LAN or wide area network (WAN) that uses Internet technology and is secured behind company's firewalls (see security and protection).
2. The intranet links various servers, clients, databases, and application programs like Enterprise Resource Planning (ERP). Although intranets are developed on the same TCP/IP protocol as the Internet, they operate as a private network with limited access.
3. Only authorized employees are able to use it. Intranets are limited to information pertinent to the company and contain exclusive and often proprietary and sensitive information.
4. The firewalls protect the intranets from unauthorized outside access; the intranet can be used to enhance the communications and collaboration among authorized employees, customers, suppliers, and other business partners.
5. Since the intranet allows access through the Internet, it does not require any additional implementation of leased networks. This open and flexible connectivity is a major capability and advantage of intranet. Intranets provide the infrastructure for many intrabusiness commerce applications.

The Extranet

1. An extranet, or "extended intranet", uses the TCP/IP protocol network of the Internet, to link intranets in different locations.
2. Extranet transmission is usually conducted over the Internet, which offers little privacy or transmission security.
3. Therefore, when using an extranet, it is necessary to improve the security of connecting portions of the Internet. This can be done by creating tunnels (see paragraph on security and protection) of secured data flows, using cryptography and authorization algorithm.
4. The Internet with tunneling technology is known as a virtually private network (VPN).
5. Extranets provide secured connectivity between corporation's intranets and the intranets of its business partners, material suppliers, financial services, government, and customers.
6. Access to intranets is usually limited by agreements of the collaborating parties, is strictly controlled, and is only available to authorized personnel.
7. The protected environment of the extranet allows groups to collaborate, sharing information exclusively, and exchanging it securely.
8. Since an extranet allows connectivity between businesses through the Internet, it is an open and flexible platform suitable for supply chain management.
9. To increase security, many companies replicate the database they are willing to share with their business partners and separate them physically from their regular intranets.

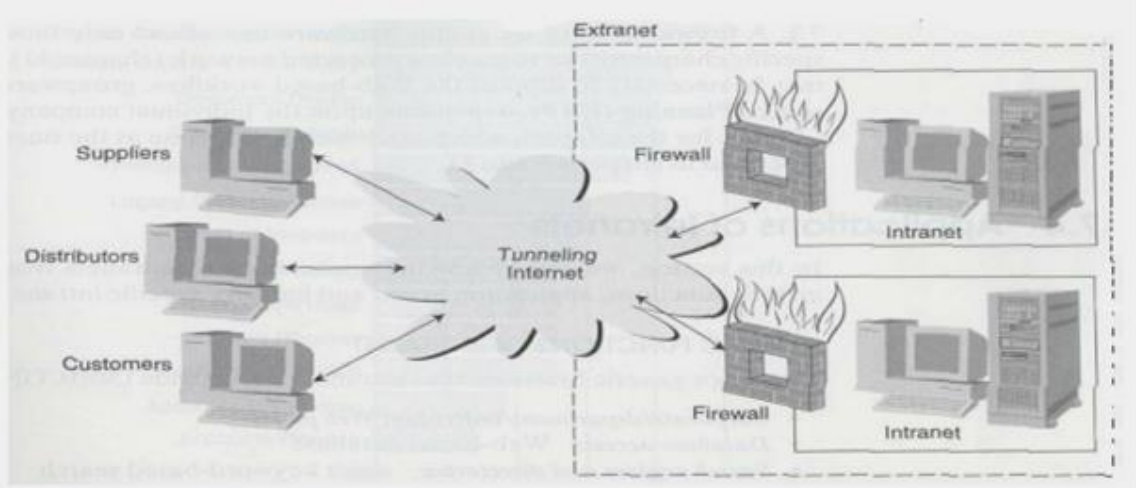


Figure Diagrammatic Contrast of the Internet, Intranet, and Extranet

Q. Compare internet, intranet and extranet? Or different between internet, intranet, and extranet?

Internet	Intranet	Extranet
It is a global system of interconnected computer networks.	It is a private network specific to an organization.	It is a private network that uses public network to information with suppliers vendors
Not regulated by any one	It is regulated by an organization	It is regulated by multiple organizations.
Thus content in the network is accessible to every one connected.	Thus content in the network is accessible only to members of organization.	The content in the network is accessible to members of organization and external members with access to network.
It is largest in terms of number of connected device.	It is small network with minimal number of connected device.	The number of devices connected is comparable with intranet.
It is owned by no one.	It is owned by single organization	It is owned by single/multiple organization.
It is means of sharing information through out the world.	It is means of sharing sensitive information through out organization	It is means of sharing information between members and external members.
Security is depending of the user of device connected to network.	Security is enforced via a firewall.	Security is enforced via a firewall that separates internet and extranet.
Users can access internet anonymously.	Users should have valid username/password to access intranet.	Users should have valid username/password to access extranet.

FIRE WALLS:

Firewalls is a system that prevents un-authorized access to or from a private network. T examines each message entering and leaving the network, and allows only those authorized message to pass through. It can be implemented in hardware and software or both. A firewall helps to keep your computer more secure. It restricts information that comes to your computer from other computers, giving you more control over the data on your computer and providing a line of defence against people or programs.

Importance:

1. It allows only authorized access to inside network.
2. It prevent insider stacks on critical systems.
3. A firewall as a barrier, check information coming from the internet or a network and allow it to pass through to your computer, depending on your firewall settings.
4. It provides the ability to control access to site system. It can greatly improve network security and reduce risk to hosts on the subnet by filtering inherently insecure services.

Benefits or advantages of firewalls:

1. Internet firewalls allow the network administrator to define a centralized 'choke point' that keeps unauthorized users such as hackers, crackers, vandals and spies and providing protection from various types of routing attacks.
2. Firewalls offer a convenient point where internet security can be monitored and alarms generated.
3. An internet firewall is a logical place to deploy a network address translator (NAT) that can help alleviate the address space shortage and eliminate the need to re-number when an organization changes its ISP's.
4. An internet firewall is the perfect point to audit or log internet usage.
5. An internet firewall can also offer a central point of contract for information delivery service to customers.

Types of firewalls:

1. Application Gateways: the first firewalls were application gateways, and are sometimes known as proxy gateways. These are sun with special software to act as a proxy server.
2. Packet filtering: packet filtering is a techniques where by routers have ACLs(Access Control Lists) turned on. By default, a router will pass all traffic sent it, and will do so without any sort of restrictions.
3. Hybrid Systems: in an attempt to marry the security of the application layer gateways with the flexibility and speed of packet filtering, some vendors have created systems that use the principles of both.

NETWORK DEVICE

Hardware devices that are used to connect computers, printers, fax machines and other electronic devices to a network are called **network devices**. These devices transfer data in a fast, secure and correct way over same or different networks. Network devices may be inter-network or intra-network. Some devices are installed on the device, like NIC card or RJ45 connector, whereas some are part of the network, like router, switch, etc.

MODEM:

Modem is a device that enables a computer to send or receive data over telephone or cable lines. The data stored on the computer is digital whereas a telephone line or cable wire can transmit only analog data.

Digital Data Waveform

Analog Data Waveform

The main function of the modem is to convert digital signal into analog and vice versa. Modem is a combination of two devices − **modulator** and **demodulator**. The **modulator** converts digital data into analog data when the data is being sent by the computer. The **demodulator** converts analog data signals into digital data when it is being received by the computer.

Types of Modem

Modem can be categorized in several ways like direction in which it can transmit data, type of connection to the transmission line, transmission mode, etc.

Depending on direction of data transmission, modem can be of these types −

- Simplex − A simplex modem can transfer data in only one direction, from digital device to network (modulator) or network to digital device (demodulator).

- Half duplex − A half-duplex modem has the capacity to transfer data in both the directions but only one at a time.
- Full duplex − A full duplex modem can transmit data in both the directions simultaneously.

WHAT IS AN IP ADDRESS?

"IP address" is a shorter way of saying "Internet Protocol address." IP addresses are the numbers assigned to computer network interfaces. Although we use names to refer to the things we seek on the Internet, such as www.example.org, computers translate these names into numerical addresses so they can send data to the right location. So when you send an email, visit a web site, or participate in a video conference, your computer sends data packets to the IP address of the other end of the connection and receives packets destined for its own IP address.

Why do we need IP addresses?

IP addresses are the numbers that enable our computers, servers, telephones, cameras, printers and sensors to communicate with each other. Without IP addresses, we would have to copy data from device to device manually, using CDs, DVDs, hard disks or flash storage, such as a USB drive. But more importantly, our devices could not send data to each other without human intervention. Without the IP addresses assigned to our computers, we would have to send paper letters and memos instead of sending emails. There would be no streaming video sites. Instead, we would have to send each other discs and tapes. Worst of all, we would not be able to order items online and would have to go to stores to buy them in person. It would be horrific, like the 1970s all over again.

What do IP addresses look like?

There are currently two different versions of IP addresses in use—IPv4 and IPv6. The two versions look quite different from one another. IP addresses are actually just long strings of numbers, like 3221226037, but to make it easier for people to read them, we write them down in a special way. IPv4 addresses are written as a string of four numbers between 0 and 255, separated by dots. A typical IPv4 address looks like this: 192.0.2.53. IPv6 addresses are considerably longer strings of numbers, so they are written using hexadecimals, which can fit more information into fewer digits. Colons separate the segments of IPv6 addresses instead of dots; for example, 2001:0db8::53. In fact, when you see two colons side by side in an IPv6 address, you know that all the segments between them contain only zeros. Without those colons, the example address expands to its fully-written version, 2001:0db8:0000:0000:0000:0000:0000:0053.

What is an Internet domain?

An **Internet domain** is a collection of data describing a self-contained administrative and technical unit on the Internet, according to the principles of the DNS system. This data can comprise the address of a computer, a resource or a service on the domain (www, e-mail, FTP), the name and address of the DNS server, security data for DNSSEC and more. Global visibility of an Internet domain is provided for by the DNS service.

An **Internet domain** name is a textual designation registered by a user for their own use, meeting administrative and technical conditions for the visibility of the Internet domain under that name. At the time of registration, the name is entered into the central registry database, which is administered by the Internet domain Registry. An Internet domain name becomes active once the registration data are entered, including data on the DNS servers, into the DNS table of the central registry database and that table is made active on public DNS servers. Internet domain names were traditionally written using the letters of the English alphabet (ASCII code), but with the development of the IDN standard the possibility has now been established for domain names to be written in other world languages and scripts. An Internet domain name is comprised of a series of alphanumeric segments, separated by full stops, complying with Internet standards. A segment can contain numbers (0-9), letters of the English (or some other) alphabet (a-z) and hyphens (-), and the length of a segment cannot be shorter than two or longer than 63 characters. A segment cannot contain a hyphen at the start or the end, or two consecutive hyphens as the third and fourth characters.

In simple terms, the **Internet domain** is part of a system in which Internet addresses are linked to specific locations on the Internet – servers, websites, e-mail servers etc. An **Internet domain** name is your own Internet address which you have registered as part of a national or international Internet domain (e.g. the Internet address rnids.rs within the .RS domain). It is an integral part of a website and e-mail address and thus identifies you on the Internet. In everyday use the term "Internet domain" is also used when referring to an Internet domain name.

CIDR Notation

A system called Classless Inter-Domain Routing, or CIDR, was developed as an alternative to traditional subnetting. The idea is that you can add a specification in the IP address itself as to the number of significant bits that make up the routing or networking portion.

For example, we could express the idea that the IP address 192.168.0.15 is associated with the netmask 255.255.255.0 by using the CIDR notation of 192.168.0.15/24. This means that the first 24 bits of the IP address given are considered significant for the network routing.

This allows us some interesting possibilities. We can use these to reference "supernets". In this case, we mean a more inclusive address range that is not possible with a traditional subnet mask. For instance, in a class C network, like above, we could not combine the addresses from the networks 192.168.0.0 and 192.168.1.0 because the netmask for class C addresses is 255.255.255.0.

However, using CIDR notation, we can combine these blocks by referencing this chunk as 192.168.0.0/23. This specifies that there are 23 bits used for the network portion that we are referring to.

So the first network (192.168.0.0) could be represented like this in binary:

```
1100 0000 - 1010 1000 - 0000 0000 - 0000 0000
```

While the second network (192.168.1.0) would be like this:

```
1100 0000 - 1010 1000 - 0000 0001 - 0000 0000
```

The CIDR address we specified indicates that the first 23 bits are used for the network block we are referencing. This is equivalent to a netmask of 255.255.254.0, or:

```
1111 1111 - 1111 1111 - 1111 1110 - 0000 0000
```

As you can see, with this block the 24th bit can be either 0 or 1 and it will still match, because the network block only cares about the first 23 digits.

CIDR allows us more control over addressing continuous blocks of IP addresses. This is much more useful than the subnetting we talked about originally.

Internet Service Provider (ISP)

The term Internet service provider (ISP) refers to a company that provides access to the Internet to both personal and business customers. ISPs make it possible for their customers to surf the web, shop online, conduct business, and connect with family and friends—all for a fee. ISPs may also provide other services including email services, domain registration, web hosting, and browser packages. An ISP may also be referred to as an information service provider, a storage service provider, an Internet service provider (INSP), or any combination of these three based on the services the company offers.

- An Internet service provider (ISP) is a company that provides web access to both businesses and consumers.

- ISPs may also provide other services such as email services, domain registration, web hosting, and browser services.
- An ISP is considered to be an information service provider, storage service provider, Internet network service provider (INSP), or a mix of all of them.
- Internet use has evolved from only those with university or government accounts having access to nearly everyone having access, whether it's paid or free.
- Access has gone from dial-up connections to high-speed broadband technology.

Internet service was originally limited to government agencies and specific university departments. The technology was developed to provide access to the general public through the World Wide Web in the late 1980s. Initially, consumers were able to gain limited access through a few ISPs—America Online (AOL) being one of the most recognized names at the time—that used dial-up connections using a phone line.

The number of ISPs increased to several thousand during the mid-1990s and the boom was on. As the options for connectivity increased and speeds moved away from slower dial-up connections, the Internet economy was born. Providers developed more advanced technology, allowing customers high-speed access via broadband technology through cable and digital subscriber line (DSL) modems.

Behind all of this was a multi-layered web of connections. Local ISPs sold access to customers but paid larger ISPs for their own access. These larger ISPs, in turn, paid even larger ISPs for access. The trail leads to Tier 1 carriers that can reach every network access point without having to pay for access. These Tier 1 companies own the infrastructure in their region.

Internet service providers provide their customers access to the Internet—plain access providers just handle the traffic between the individual and the Internet as a whole. But there may also be other services bundled in depending on the customer's location and availability. Some of these services include:

- Email services
- Web hosting services
- Domain registration
- Browser and software packages

International Internet Service Providers: At the top of the hierarchy are the international service providers that connect nations together.
National Internet Service Providers: The national Internet service providers are backbone networks created and maintained by specialized companies. There are many national ISPs operating in North America; some of the most well known are SprintLink, PSINet, UUNet Technology, AGIS, and internet Mel. To provide connectivity between the end users, these backbone networks are connected by complex switching stations (normally run by a third party) called network access points (NAPs). Some national ISP networks are also connected to one another by private switching stations called peering points. These normally operate at a high data rate (up to 600 Mbps).
Regional Internet Service Providers: Regional internet service providers or regional ISPs are smaller ISPs that are connected to one or more national ISPs. They are at the third level of the hierarchy with a smaller data rate. Local Internet Service Providers: Local Internet service providers provide direct service to the end users. The local ISPs can be connected to regional ISPs or directly to national ISPs. Most end users are connected to the local ISPs. Note that in this sense, a local ISP can be a company that just provides Internet services, a corporation with a network that supplies services to its own employees, or a nonprofit organization, such as a college or a university, that runs its own network. Each of these local ISPs can be connected to a regional or national service provider.

TCP/IP

TCP stands for Transmission Control Protocol and IP stands for Internet Protocol. TCP/IP is a suite of protocols used for the communication of devices on a network. The network can be of any type: Internet or personal networks like the intranet, extranet, etc.

The modern developments that we use on the Internet are only possible because of the TCP/IP suite. Although the name suggests only two protocols, it contains other protocols in it.

Working of TCP/IP

In simple terms, TCP takes care of how data is transferred in a network.

- It breaks down the data into smaller packets that can be shared across a network effectively.
- At the receiver's end, TCP helps to arrange the data packets into a specific order to convey the initial information transferred through the web.
- To share the data packets, we should have a particular address. Each connection will have a specific IP address. It helps the transmitter to know the destination.
- The IP address consists of two addresses: of the receiver and the sender. The subnet mask divides and helps to identify the two addresses from one another.

Layers of TCP/IP

Following are the layers of TCP/IP −

- **Application Layer** − It consists of HTTP (Hypertext Transfer Protocol), FTP (File Transfer Protocol), POP3 (Post Office Protocol 3), SMTP (Simple Mail Transfer Protocol), and SNMP (Simple Network Management Protocol). It is called the application layer because it consists of application data.
- **Transport Layer** − The transfer of data is done in this layer. It is responsible for maintaining the communication between the sender and receiver. TCP or UDP (User Datagram Protocol) is used for this purpose.
- **Network Layer** − It consists of IP and Internet Control Message Protocol (ICMP). IP takes care of the destination and host addresses and makes sure the connection is maintained. ICMP reports errors in case the connection is not proper.
- **Physical Layer** − The protocol in this layer works in the link between different devices in the network. It includes Protocol for Ethernet and Address Resolution Protocol.

Advantages of using TCP/IP

Following are the advantages of using TCP/IP −

- It is used in many varieties of fields even after three to four decades after its introduction.
- It helps to communicate between heterogeneous networks (i.e., networks with many differences like that in protocols, etc.)
- It follows a client-server architecture. Therefore, more devices can be added or removed easily because of its scalability.
- It helps to identify each device on the network via IP address, giving better security to the network. If any device makes any illegal actions, it is easier to identify the device using the IP address.

Disadvantages of using TCP/IP

- Following are the disadvantages of using TCP/IP −
- It cannot represent other protocols than in TCP/IP suite like those used in Bluetooth connection.
- The boundary between the concepts of services, interfaces, protocols is blurry.

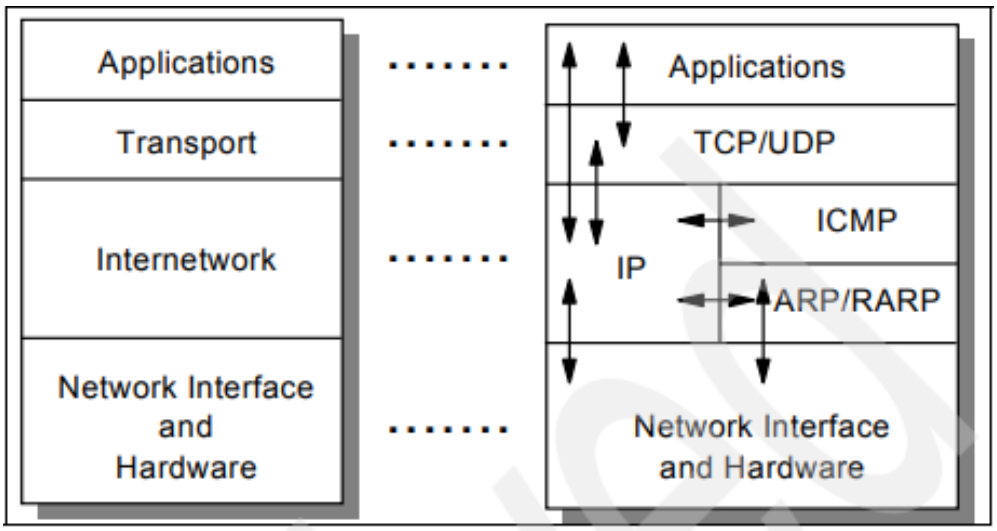


Figure 1-2 The TCP/IP protocol stack: Each layer represents a package of functions

These layers include:

Application layer

The application layer is provided by the program that uses TCP/IP for communication. An application is a user process cooperating with another process usually on a different host (there is also a benefit to application communication within a single host). Examples of applications include Telnet and the File Transfer Protocol (FTP). The interface between the application and transport layers is defined by port numbers and sockets.

Transport layer The transport layer provides the end-to-end data transfer by delivering data from an application to its remote peer. Multiple applications can be supported simultaneously. The most-used transport layer protocol is the Transmission Control Protocol (TCP), which provides connection-oriented reliable data delivery, duplicate data suppression, congestion control, and flow control. Another transport layer protocol is the User Datagram Protocol. It provides connectionless, unreliable, Applications Transport Internetwork Network Interface and Hardware Applications TCP/UDP ICMP IP ARP/RARP Network Interface and Hardware.....8 TCP/IP Tutorial and Technical Overview best-effort service. As a result, applications using UDP as the transport protocol have to provide their own end-to-end integrity, flow control, and congestion control, if desired. Usually, UDP is used by applications that need a fast transport mechanism and can tolerate the loss of some data.

Internetwork layer

The internetwork layer, also called the internet layer or the network layer, provides the "virtual network" image of an internet (this layer shields the higher levels from the physical network architecture below it). Internet Protocol (IP) is the most important protocol in this layer. It is a connectionless protocol that does not assume reliability from lower layers. IP does not provide reliability, flow control, or error recovery. These functions must be provided at a higher level. IP provides a routing function that attempts to deliver transmitted messages to their destination. A message unit in an IP network is called an IP datagram. This is the basic unit of information transmitted across TCP/IP networks. Other internetwork-layer protocols are IP, ICMP, IGMP, ARP, and RARP.

Network interface layer

The network interface layer, also called the link layer or the data-link layer, is the interface to the actual network hardware. This interface may or may not provide reliable delivery, and may be packet or stream oriented. In fact, TCP/IP does not specify any protocol here, but can use almost any network interface available, which illustrates the flexibility of the IP layer. Examples are IEEE 802.2, X.25 (which is reliable in itself), ATM, FDDI, and even SNA. TCP/IP specifications do not describe or standardize any network-layer protocols per se; they only standardize ways of accessing those protocols from the internetwork layer.

TCP/IP applications

The highest-level protocols within the TCP/IP protocol stack are application protocols. They communicate with applications on other internet hosts and are the user-visible interface to the TCP/IP protocol suite. All application protocols have some characteristics in common:

- They can be user-written applications or applications standardized and shipped with the TCP/IP product. Indeed, the TCP/IP protocol suite includes application protocols such as:
    - Telnet for interactive terminal access to remote internet hosts
    - File Transfer Protocol (FTP) for high-speed disk-to-disk file transfers
    - Simple Mail Transfer Protocol (SMTP) as an internet mailing system

  These are some of the most widely implemented application protocols, but many others exist. Each particular TCP/IP implementation will include a lesser or greater set of application protocols.

- They use either UDP or TCP as a transport mechanism. Remember that UDP is unreliable and offers no flow-control, so in this case, the application has to provide its own error recovery, flow control, and congestion control functionality. It is often easier to build applications on top of TCP because it is a reliable stream, connection-oriented, congestion-friendly, flow control-enabled protocol. As a result, most application protocols will use TCP, but there are applications built on UDP to achieve better performance through increased protocol efficiencies.

- Most applications use the client/server model of interaction.

CHAPTER-2(INTERNET CONNECTIVITY & WWW)

Internet Connectivity

The Internet Connectivity of the computers, mobile devices, computer networks to the Internet enables the users to access the various Internet services. There are many ways and technologies of the connection to the Internet with different data signaling rates: Wireless, Ethernet cable, Optical fiber, Dial-up, DSL, broadband Internet access, etc.

Connection Types

There exist several ways to connect to the internet. Following are these connection types available:

1. Dial-up Connection
2. ISDN
3. DSL
4. Cable TV Internet connections
5. Satellite Internet connections
6. Wireless Internet Connections

Dial-up Connection

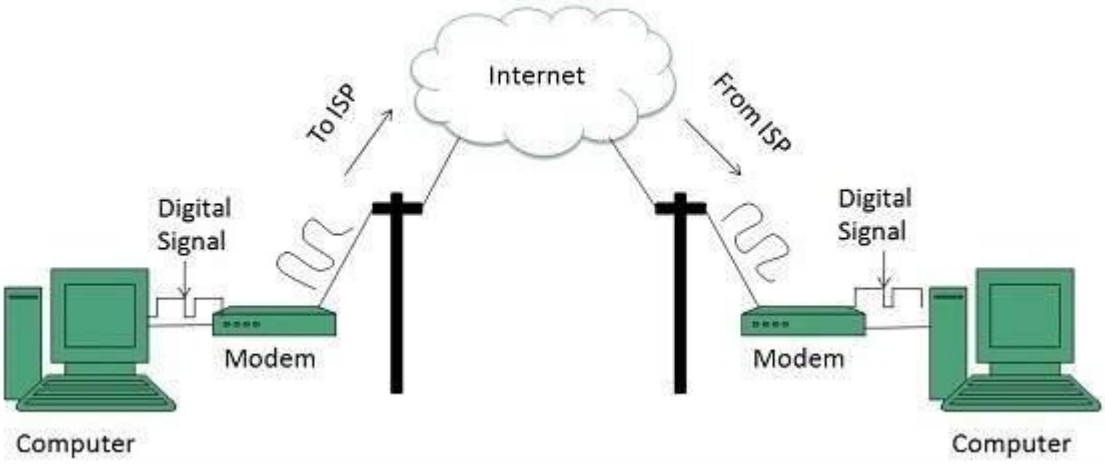
Dial-up connection uses telephone line to connect PC to the internet. It requires a modem to setup dial-up connection. This modem works as an interface between PC and the telephone line.

There is also a communication program that instructs the modem to make a call to specific number provided by an ISP.

Dial-up connection uses either of the following protocols:

1. Serial Line Internet Protocol (SLIP)
2. Point to Point Protocol (PPP)

The following diagram shows the accessing internet using modem:



ISDN

ISDN is acronym of Integrated Services Digital Network. It establishes the connection using the phone lines which carry digital signals instead of analog signals.

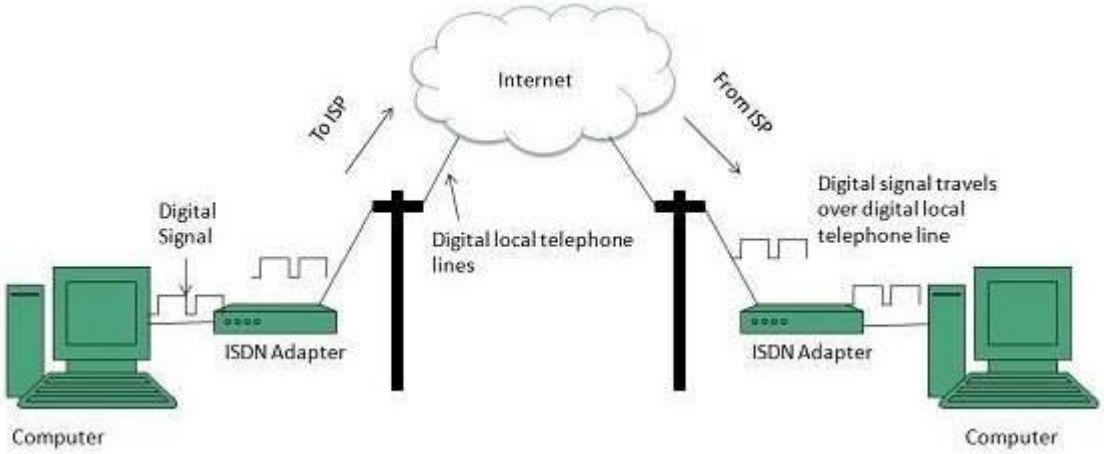
There are two techniques to deliver ISDN services:

1. Basic Rate Interface (BRI)
2. Primary Rate Interface (PRI)

Key points:

The BRI ISDN consists of three distinct channels on a single ISDN line: t1o 64kbps B (Bearer) channel and one 16kbps D (Delta or Data) channels.

The PRI ISDN consists of 23 B channels and one D channels with both have operating capacity of 64kbps individually making a total transmission rate of 1.54Mbps.
The following diagram shows accessing internet using ISDN connection:

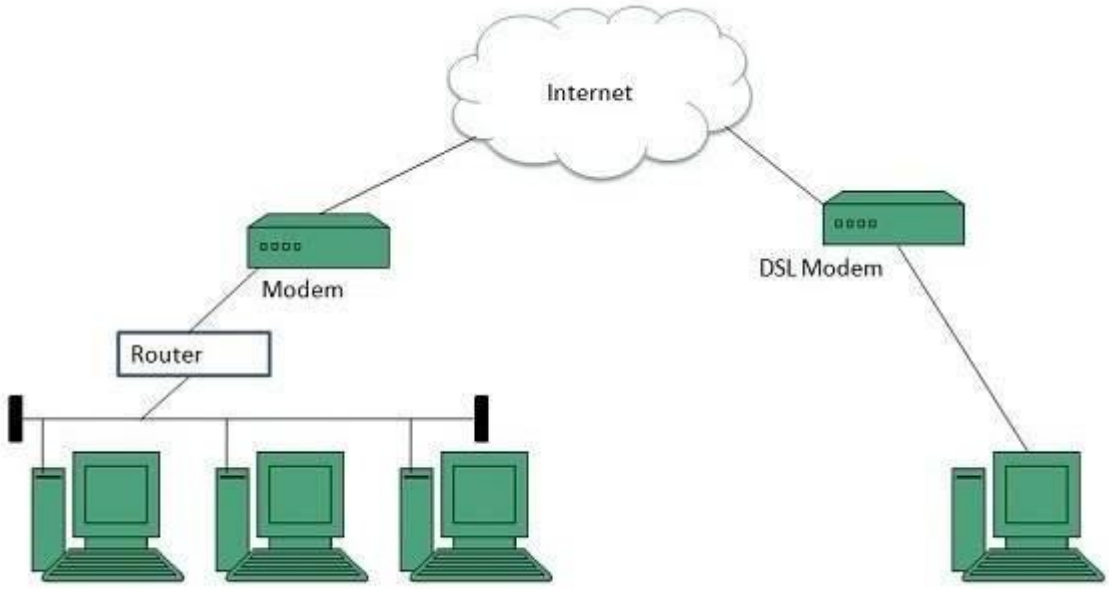


DSL

DSL is acronym of Digital Subscriber Line. It is a form of broadband connection as it provides connection over ordinary telephone lines.
Following are the several versions of DSL technique available today:

1. Asymmetric DSL (ADSL)
2. Symmetric DSL (SDSL)
3. High bit-rate DSL (HDSL)
4. Rate adaptive DSL (RDSL)
5. Very high bit-rate DSL (VDSL)
6. ISDN DSL (IDSL)

All of the above mentioned technologies differ in their upload and download speed, bit transfer rate and level of service.
The following diagram shows that how we can connect to internet using DSL technology:



Internet Access Using DSL Modem

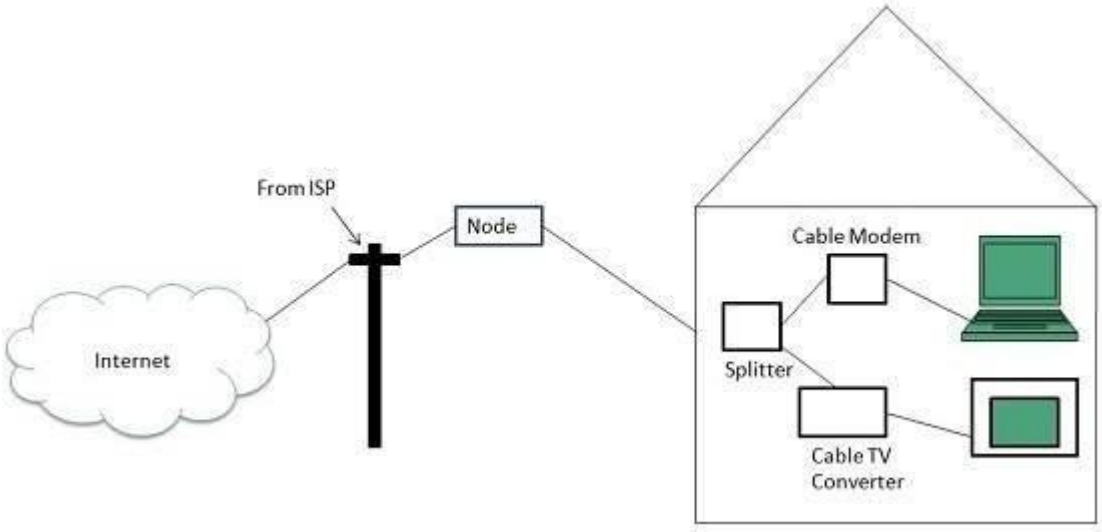
Cable TV Internet Connection

Cable TV Internet connection is provided through Cable TV lines. It uses coaxial cable which is capable of transferring data at much higher speed than common telephone line.

Key Points:

- A cable modem is used to access this service, provided by the cable operator.
- The Cable modem comprises of two connections: one for internet service and other for Cable TV signals.
- Since Cable TV internet connections share a set amount of bandwidth with a group of customers, therefore, data transfer rate also depends on number of customers using the internet at the same time.

The following diagram shows that how internet is accessed using Cable TV connection:



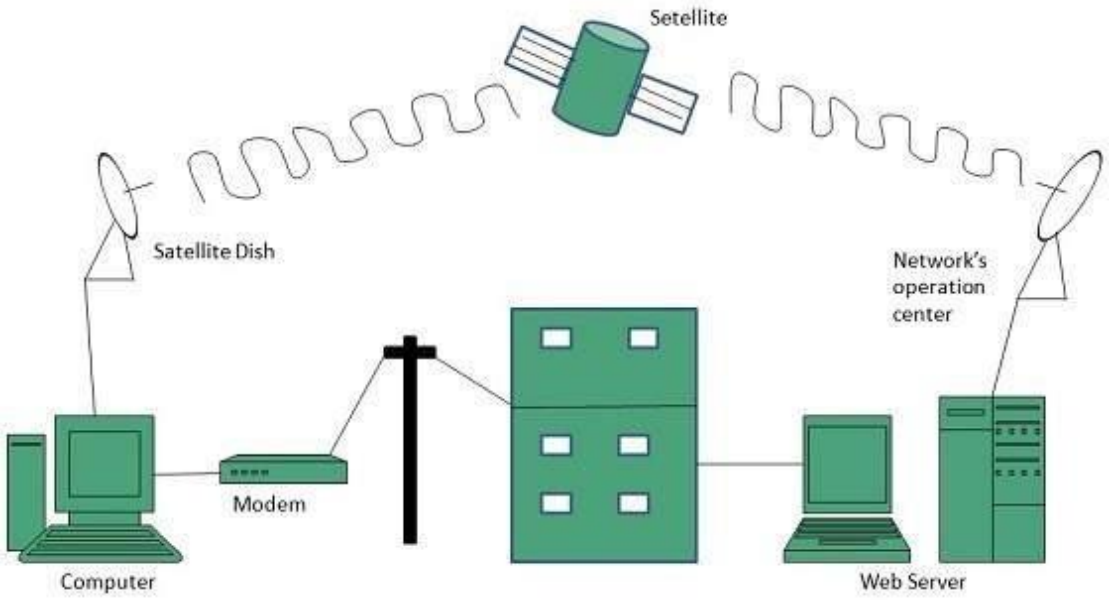
Satellite Internet Connection

Satellite Internet connection offers high speed connection to the internet. There are two types of satellite internet connection: one way connection or two way connection.

In one way connection, we can only download data but if we want to upload, we need a dialup access through ISP over telephone line.

In two way connection, we can download and upload the data by the satellite. It does not require any dialup connection.

The following diagram shows how internet is accessed using satellite internet connection:



Wireless Internet Connection

Wireless Internet Connection makes use of radio frequency bands to connect to the internet and offers a very high speed. The wireless internet connection can be obtained by either WiFi or Bluetooth.

Key Points:

- Wi Fi wireless technology is based on IEEE 802.11 standards which allow the electronic device to connect to the internet.
- Bluetooth wireless technology makes use of short-wavelength radio waves and helps to create personal area network (PAN).

WORKING OF INTERNET

The thing that characterizes the Internet is how data are transferred from one computer to another. Here is what happens to a piece of data (e.g. a Web page) when it is transferred over the Internet:

- It is broken into a lot of same-sized pieces (called packets).
- A header is added to each packet that explains where it came from, where it should end up and how it fits in with the rest of the packets.
- Each packet is sent from computer to computer until it finds its way to its destination.
- Each computer along the way decides where next to send the packet. This could depend on things like how busy the other computers are when the packet was received. The packets may not all take the same route.
- At the destination, the packets are examined. If there is any packet missing or damaged, a message is sent asking for that packet to be resent. This continues until all the packets have been received intact
- The packets are reassembled into their original form.

There are two main concepts that are fundamental to the way the Internet functions: ***packets*** and ***protocols***.

Packets

In networking, a packet is a small segment of a larger message. Each packet contains both data and information about that data. The information about the packet's contents is known as the "header," and it goes at the front of the packet so that the receiving machine knows what to do with the packet. To understand the purpose of a packet header, think of how some consumer products come with assembly instructions.

When data gets sent over the Internet, it is first broken up into smaller packets, which are then translated into bits. The packets get routed to their destination by various networking devices such as routers and switches. When the packets arrive at their destination, the receiving device reassembles the packets in order and can then use or display the data.

Compare this process to the way the United States' Statue of Liberty was constructed. The Statue of Liberty was first designed and built in France. However, it was too large to fit onto a ship, so it was shipped to the United States in pieces, along with instructions about where each piece belonged. Workers who received the pieces reassembled them into the statue that stands today in New York.

While this took a long time for the Statue of Liberty, sending digital information in smaller pieces is extremely fast over the Internet. For instance, a photo of the Statue of Liberty stored on a web server can travel across the world one packet at a time and load on someone's computer within milliseconds.

Packets are sent across the Internet using a technique called packet switching. Intermediary routers and switches are able to process packets independently from each other, without accounting for their source or destination. This is by design so that no single connection dominates the network. If data was sent between computers all at once with no packet switching, a connection between two computers could occupy multiple cables, routers, and switches for

minutes at a time. Essentially, only two people would be able to use the Internet at a time — instead of an almost unlimited number of people, as is the case in reality.

Protocols

Connecting two computers, both of which may use different hardware and run different software, is one of the main challenges that the creators of the Internet had to solve. It requires the use of communications techniques that are understandable by all connected computers, just as two people who grew up in different parts of the world may need to speak a common language to understand each other.

This problem is solved with standardized protocols. In networking, a protocol is a standardized way of doing certain actions and formatting data so that two or more devices are able to communicate with and understand each other.

There are protocols for sending packets between devices on the same network (Ethernet), for sending packets from network to network (IP), for ensuring those packets successfully arrive in order (TCP), and for formatting data for websites and applications (HTTP). In addition to these foundational protocols, there are also protocols for routing, testing, and encryption. And there are alternatives to the protocols listed above for different types of content — for instance, streaming video often uses UDP instead of TCP.

Because all Internet-connected computers and other devices can interpret and understand these protocols, the Internet works no matter who or what connects to it.

What physical infrastructure makes the Internet work?

A lot of different kinds of hardware and infrastructure go into making the Internet work for everyone. Some of the most important types include the following:

- **Routers** forward packets to different computer networks based on their destination. Routers are like the traffic cops of the Internet, making sure that Internet traffic goes to the right networks.

- **Switches** connect devices that share a single network. They use packet switching to forward packets to the correct devices. They also receive outbound packets from those devices and pass them along to the right destination.

- Web servers are specialized high-powered computers that store and serve content (webpages, images, videos) to users, in addition to hosting applications and databases. Servers also respond to **DNS** queries and perform other important tasks to keep the Internet up and running. Most servers are kept in large data centers, which are located throughout the world.

WORLD WIDE WEB

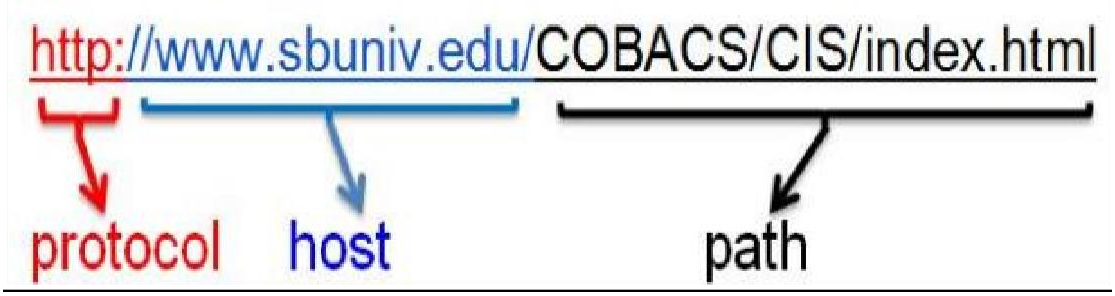
The World Wide Web (abbreviated WWW or the Web) is an information space where documents and other web resources are identified by Uniform Resource Locators (URLs), interlinked by hypertext links, and can be accessed via the Internet. The world wide web consists of billions of pages linked to each other that contain text, graphics, multimedia files, and other interactive software that are accessed using a browser. The term is often mistakenly used as a synonym for the Internet itself, but the Web is a service that operates over the Internet, just as e-mail also does. The Web finds its roots at CERN, the European Organization for Particle Physics Research, in 1989 when Tim Berners-Lee and Robert Cailliau designed a system called Enquire. This system would allow documents to have links between different pieces of data wh the local computer or stored on a remote computer. The main motivation is said to have been the ability to access library information that was spread across multiple servers at CERN. On November 12th, 1990, Tim Berners Management: A Proposal" that outlined the World Wide Web as we know it today by using a system for displaying information called HyperText, which was first described 19 named Vannevar Bush, to link documents into a large scale information pool. The following day on November 13th, 1990, Tim Berners December wrote the first web browser and web server. The name of created, was called the World Wide As development of the World started to get involved , until in 1992 one of the first web browsers that supp introduced called Pei-Yuan Wei's Viola. This led to Marc Andreessen of NCSA, releasing in 1993 a program for UNIX called Mosaic. Mosaic was the spark that marked the rise in popularity of the World Wide Web and no longer kept it confined went on to form Mosaic Communications, which then evolved into Netscape Communications. Netscape was the first mainstream graphical Web Browser.

Working of WEB

The web works on three standards. These standards are generally adhere that make products that work with the World Wide Web.

URL (Uniform Resource Locator):

These are the addresses that you enter into your web browser to connect to a web site. The URL is broken up into 4 parts which are the protocol, the hostname, the port number, and the path that you are requesting .



Protocol: The protocol part of an URL is the funny string of characters that you see before the hostname. Examples are http, ftp, telnet:, etc. They are separated from the hostname with a colon and two forward slashes (://). These protocols tell your browser what type of service to use when you connect with the web browser to the hostname. If you leave the protocol off your address, by default the Web Browser will assume you are using the HTTP protocol.

Hostname: The hostname is the address you are going to.

Port Number: The port number is a number that you can append to the hostname with a colon (:) between them. This tell the port on the server computer.

Path: This is the path on the server, culminating with the filename you are trying to reach. This path corresponds to an actual directory structure on the web server.

Web Browser

In order for the Web to work you need web browsers and web servers which work hand in hand. The web browser is a piece of software that is used to interpret the information found in an HTML document and display the content of that document based upon the HTML tags found within it. When a web browser connects to a web server, the web server sends the requested document, if it exists, back to the web browser for display. In short, you type URLs into your browser or click a link, and the browser requests and displays those pages for you. Web browser can show text, audio, video, animation and more. It is the responsibility of a web browser to interpret text and commands contained in the web page.. The various browser used mostly are Google chrome, Firefox, Opera. Each web browser besides providing the basic function displaying the web page also has various features like history, password maintaining, favorites, bookmarks etc.

Web Servers

A web server is a computer that stores HTML documents or scripts that generate html pages, otherwise known as web pages, and waits for connections from web browsers. The web server machine needs to be switched on, ready, and connected to the internet at all times. It is essentially waiting for an incoming request which could happen at any time. The web server program runs all the time, handling any incoming requests. For simple web pages, the web server program identifies a directory (aka a folder) as the web-root of the files to serve. The "path" part of the url maps into the web-root directory. The various server software used are Apache, IIS.

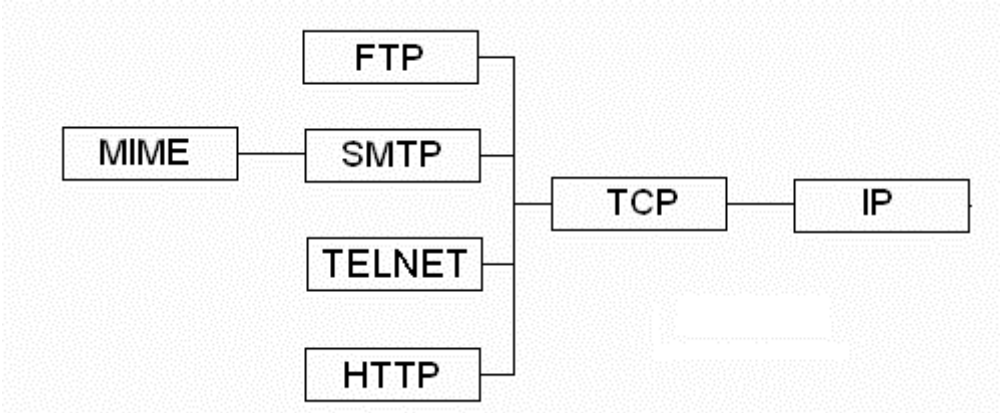
Web server respond to the client request in either of the following two ways:

- ✓ Sending the file to the client associated with the requested URL.
- ✓ Generating response by invoking a script and communicating with database

APPLICATION LEVEL PROTOCOLS

Networks build their various communication protocols on top of each other. While IP allows a computer to communicate across a network, it misses various features which TCP adds. TCP itself is a network protocol that uses IP underneath it. The application software that creates the original source data is also important in determining the protocol that is used: the destination application must understand the data being transmitted to it, and for this a well define communications protocol is needed. While different classes of application each specify their own protocol (such as email, which transfers data differently to, say, HTTP), they each build on top of lower level protocols, such as TCP and IP. These "higher level" protocols are known as application level protocols, and we will investigate a few of these now.

The figure below shows the relation between different protocols.



Few of Application layer protocols are described below:

Domain Name System

The Domain Name System (DNS) works on Client Server model. It uses UDP protocol for transport layer communication. DNS uses hierarchical domain based naming scheme. The DNS server is configured with Fully Qualified Domain Names (FQDN) and email addresses mapped with their respective Internet Protocol addresses.

A DNS server is requested with FQDN and it responds back with the IP address mapped with it. DNS uses UDP port 53.

Simple Mail Transfer Protocol

The Simple Mail Transfer Protocol (SMTP) is used to transfer electronic mail from one user to another. This task is done by means of email client software (User Agents) the user is using. User Agents help the user to type and format the email and store it until internet is available. When an email is submitted to send, the sending process is handled by Message Transfer Agent which is normally comes inbuilt in email client software.

Message Transfer Agent uses SMTP to forward the email to another Message Transfer Agent (Server side). While SMTP is used by end user to only send the emails, the Servers normally use SMTP to send as well as receive emails. SMTP uses TCP port number 25 and 587.

Client software uses Internet Message Access Protocol (IMAP) or POP protocols to receive emails.

File Transfer Protocol

The File Transfer Protocol (FTP) is the most widely used protocol for file transfer over the network. FTP uses TCP/IP for communication and it works on TCP port 21. FTP works on Client/Server Model where a client requests file from Server and server sends requested resource back to the client.

FTP uses out-of-band controlling i.e. FTP uses TCP port 20 for exchanging controlling information and the actual data is sent over TCP port 21.

The client requests the server for a file. When the server receives a request for a file, it opens a TCP connection for the client and transfers the file. After the transfer is complete, the server closes the connection. For a second file, client requests again and the server reopens a new TCP connection.

Post Office Protocol (POP)

The Post Office Protocol version 3 (POP 3) is a simple mail retrieval protocol used by User Agents (client email software) to retrieve mails from mail server.

When a client needs to retrieve mails from server, it opens a connection with the server on TCP port 110. User can then access his mails and download them to the local computer. POP3 works in two modes. The most common mode the delete mode, is to delete the emails from remote server after they are downloaded to local machines. The second mode, the keep mode, does not delete the email from mail server and gives the user an option to access mails later on mail server.

Hyper Text Transfer Protocol (HTTP)

The Hyper Text Transfer Protocol (HTTP) is the foundation of World Wide Web. Hypertext is well organized documentation system which uses hyperlinks to link the pages in the text documents. HTTP works on client server model. When a user wants to access any HTTP page on the internet, the client machine at user end initiates a TCP connection to server on port 80. When the server accepts the client request, the client is authorized to access web pages.

To access the web pages, a client normally uses web browsers, who are responsible for initiating, maintaining, and closing TCP connections. HTTP is a stateless protocol, which means the Server maintains no information about earlier requests by clients.

HTTP versions

- HTTP 1.0 uses non persistent HTTP. At most one object can be sent over a single TCP connection.

- HTTP 1.1 uses persistent HTTP. In this version, multiple objects can be sent over a single TCP connection.

URL (Uniform Resource Locator)

- A URL (Uniform Resource Locator) is a unique identifier used to locate a resource on the Internet. It is also referred to as a web address. URLs consist of multiple parts -- including a protocol and domain name -- that tell a web browser how and where to retrieve a resource.
- End users use URLs by typing them directly into the address bar of a browser or by clicking a hyperlink found on a webpage, bookmark list, in an email or from another application.

How is a URL structured?

The URL contains the name of the protocol needed to access a resource, as well as a resource name. The first part of a URL identifies what protocol to use as the primary access medium. The second part identifies the IP address or domain name -- and possibly subdomain -- where the resource is located.

URL protocols include HTTP (Hypertext Transfer Protocol) and HTTPS (HTTP Secure) for web resources, mail to for email addresses, FTP for files on a File Transfer Protocol (FTP) server, and telnet for a session to access remote computers. Most URL protocols are followed by a colon and two forward slashes; "mail to" is followed only by a colon.

Optionally, after the domain, a URL can also specify:

- ✓ a path to a specific page or file within a domain;
- ✓ a network port to use to make the connection;
- ✓ a specific reference point within a file, such as a named anchor in an HTML file; and
- ✓ a query or search parameters used -- commonly found in URLs for search results.

Importance of a URL design

URLs can only be sent over the Internet using the ASCII character-set. Because URLs often contain non-ASCII characters, the URL must be converted into a valid ASCII format. URL encoding replaces unsafe ASCII characters with a "%" followed by two hexadecimal digits. URLs cannot contain spaces.

URL examples

- ✓ When designing URLs, there are different theories about how to make the syntax most usable for readers and archivists. For example, in the URL's path, dates, authors, and topics can be included in a section referred to as the "slug." Consider, for example, the URL for this definition:

https://www.techtarget.com/searchnetworking/definition/URL

Parts of a URL

Using the URL **https://whatis.techtarget.com/search/query?q=URL** as an example, components of a URL can include:

- **The protocol or scheme.** Used to access a resource on the internet. Protocols include http, https, ftps, mailto and file. The resource is reached through the domain name system (DNS) name. In this example, the protocol is https.
- **Host name or domain name.** The unique reference the represents a webpage. For this example, whatis.techtarget.com.
- **Port name.** Usually not visible in URLs, but necessary. Always following a colon, port 80 is the default port for web servers, but there are other options. For example, :port80.
- **Path.** A path refers to a file or location on the web server. For this example, search/query.
- **Query.** Found in the URL of dynamic pages. The query consists of a question mark, followed by parameters. For this example, ?.
- **Parameters.** Pieces of information in a query string of a URL. Multiple parameters can be separated by ampersands (&). For this example, q=URL.
- **Fragment.** This is an internal page reference, which refers to a section within the webpage. It appears at the end of a URL and begins with a hashtag (#). Although not in the example above, an example could be #history in the URL https://en.wikipedia.org/wiki/Internet#History.

Hyperlink:

The hyperlink contains the URL of the webpages. In a general way, a hyperlink is referenced when a hypertext navigated. These hyperlinks are hidden under the text, image, graphics, audio, video, and gets highlighted once we hover the mouse over it. To activate the hyperlink, we click the hypermedia, which ends up within the opening of the new document. It establishes the connection between the knowledge units, usually known as the target document and therefore the alternate name for the hyperlink is anchor or node.

Hypertext:

Ted Nelson introduced the term Hypertext in 1956. Hypertext is a text which contains the visible text to redirect the targeted page(page URL contained by Hyperlink). It was invented to establish cross-reference in the computer world, similar to that is made in books like an index. However, the usual pattern of reading a book is sequential. But, this hypertext introduces the idea of cross-referencing the data. This cross-referencing is sort of complicated within the world, but it makes the work easier. If we are surfing on the web, at the time of reading a piece of writing we suddenly encounter a term, which we wanted to understand at that moment. If that term may be a hypertext, we will directly attend that page where we will find the information about that term. So, this eliminates the additional time of searching that term.

Hypermedia :

Hypermedia is the extension of Hypertext which includes multiple forms of media such as text, graphics, audio or video etc rather than only text based like hypertext. It provides a facility to connect the web pages to create a network with multimedia elements with a simple click for a better multimedia experience. Hypermedia allows links to be integrate in multimedia elements like images and videos and when we click on that it takes us to that page. **Example** of hypermedia is that when we use e-commerce site say flipkart and when we click on any product it takes us to the specific product page which belongs to that. So here the link is embedded to the image.

Difference between Hyperlink and Hypertext:

Hypertext	Hyperlink
Hypertext contains the Non-linear linking of the text with some other information.	In Hyperlinks the references are used in the hypertext or with other hypermedia.
Hypertext involves only text.	Hyperlink involves Text, media, audio, video, images, and graphics.
Hypertext directed information only generates the related information.	Hyperlink directed link could contain some unrelated information.
Hypertext contains Hyperlink.	Hyperlink contains the comprised of the URLs.
Hypertext associate with the keywords.	Hyperlink associate with the anchor tags.

Difference between hypertext and hypermedia –

Hypertext

- ✓ It refers to the system of managing the information related to the plain text.
- ✓ It involves only text.
- ✓ It becomes a part of the link.
- ✓ It is the part of hypermedia.
- ✓ It allows the user to traverse through text in a non-linear fashion.
- ✓ It allows users to move from one document to another in a single click.
- ✓ The user can click on the hypertext or the 'goto' links.
- ✓ It helps the user move to the next document.
- ✓ It also helps the user move from one page of a document to the other page.
- ✓ It doesn't provide a great user experience to the user.
- ✓ Example includes reading a blog on a website, and click on goto links to move to the next part.

Hypermedia

- ✓ It refers to connecting the hypertext with media such as graphics, sounds, and animations.
- ✓ It involves graphics, image, video, and audio.
- ✓ It can be understood as the improved version of hypertext.
- ✓ Text with multimedia is a part of the link.
- ✓ It allows the user to click on the text or any other multimedia to move from one page to another page.
- ✓ It gives flexibility of movement.
- ✓ It attracts more number of users.
- ✓ It provides a better user experience.
- ✓ Example includes reading an article on a website, and click on an image takes the user to its associated page.

SEARCH ENGINE

Search Engine refers to a huge database of internet resources such as web pages, newsgroups, programs, images etc. It helps to locate information on World Wide Web.

User can search for any information by passing query in form of keywords or phrase. It then searches for relevant information in its database and return to the user.

Search Engine Components

Generally there are three basic components of a search engine as listed below:

1. Web Crawler
2. Database
3. Search Interfaces

Web crawler

It is also known as spider or bots. It is a software component that traverses the web to gather information.

Database

All the information on the web is stored in database. It consists of huge web resources.

Search Interfaces

This component is an interface between user and the database. It helps the user to search through the database.

Search Engine Working

Web crawler, database and the search interface are the major component of a search engine that actually makes search engine to work. Search engines make use of Boolean expression AND, OR, NOT to restrict and widen the results of a search. Following are the steps that are performed by the search engine:

- The search engine looks for the keyword in the index for predefined database instead of going directly to the web to search for the keyword.
- It then uses software to search for the information in the database. This software component is known as web crawler.
- Once web crawler finds the pages, the search engine then shows the relevant web pages as a result. These retrieved web pages generally include title of page, size of text portion, first several sentences etc.

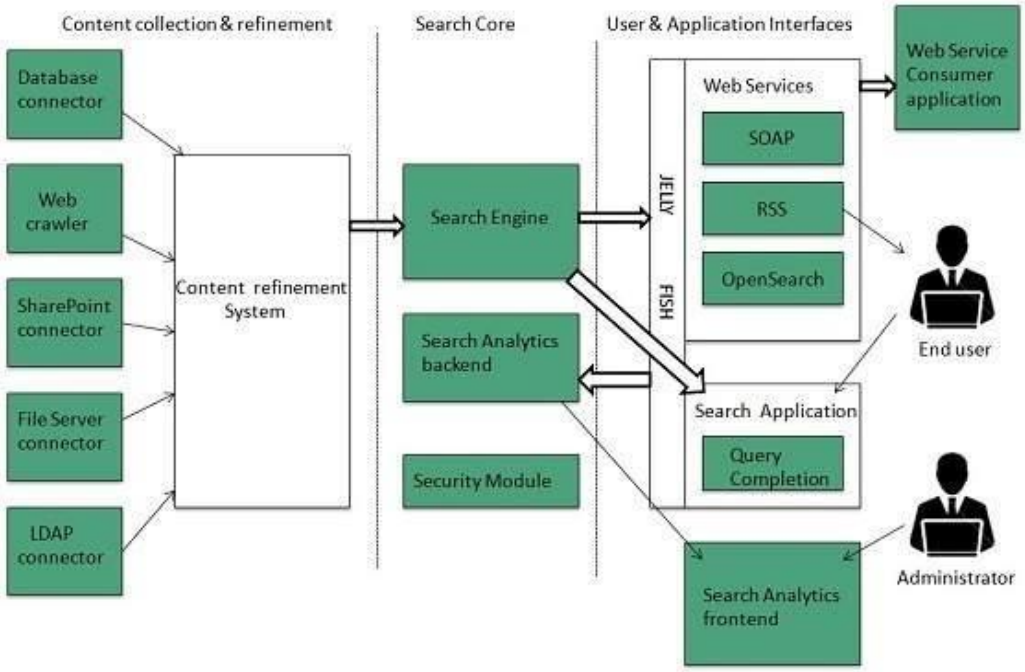
These search criteria may vary from one search engine to the other. The retrieved information is ranked according to various factors such as frequency of keywords, relevancy of information, links etc.

- User can click on any of the search results to open it.

Architecture

The search engine architecture comprises of the three basic layers listed below:

- Content collection and refinement.
- Search core
- User and application interfaces



Search Engine Processing

Indexing Process

Indexing process comprises of the following three tasks:

- Text acquisition
- Text transformation
- Index creation

Text acquisition

It identifies and stores documents for indexing.

Text Transformation

It transforms document into index terms or features.

Index Creation

It takes index terms created by text transformations and create data structures to suport fast searching.

Query Process

Query process comprises of the following three tasks:

- User interaction
- Ranking

- Evaluation

User interaction

It supporst creation and refinement of user query and displays the results.

Ranking

It uses query and indexes to create ranked list of documents.

Evaluation

It monitors and measures the effectiveness and efficiency. It is done offline.

Examples

Following are the several search engines available today:

Search Engine	Description
Google	It was originally called **BackRub.** It is the most popular search engine globally.
Bing	It was launched in 2009 by **Microsoft.** It is the latest web-based search engine that also delivers Yahoo's results.
Ask	It was launched in 1996 and was originally known as **Ask Jeeves.** It includes support for match, dictionary, and conversation question.
AltaVista	It was launched by **Digital Equipment Corporation** in 1995. Since 2003, it is powered by Yahoo technology.
AOL.Search	It is powered by Google.
LYCOS	It is top 5 internet portal and 13th largest online property according to Media Matrix.
Alexa	It is subsidiary of Amazon and used for providing website traffic information.

PROXY SERVER

Proxy server is an intermediary server between client and the internet. Proxy servers offer the following basic functionalities:

- Firewall and network data filtering.
- Network connection sharing
- Data caching

Proxy servers allow to hide, conceal and make your network id anonymous by hiding your IP address.

Purpose of Proxy Servers

Following are the reasons to use proxy servers:

- Monitoring and Filtering
- Improving performance

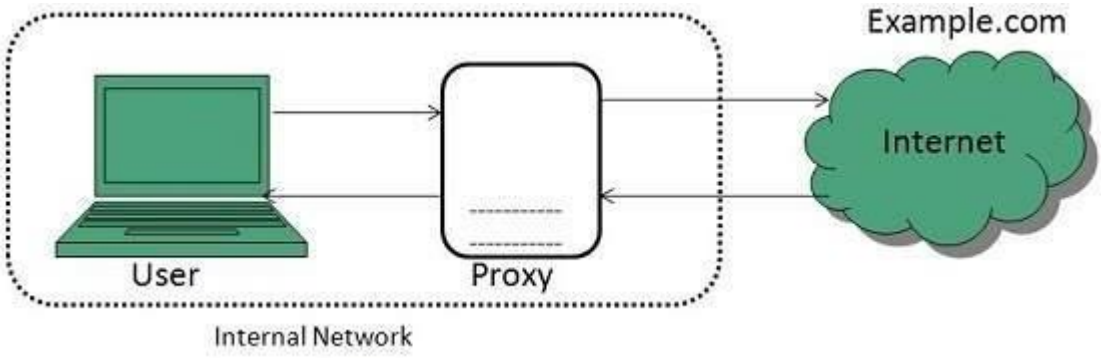
- Translation
- Accessing services anonymously
- Security

Type of Proxies

Following table briefly describes the type of proxies:

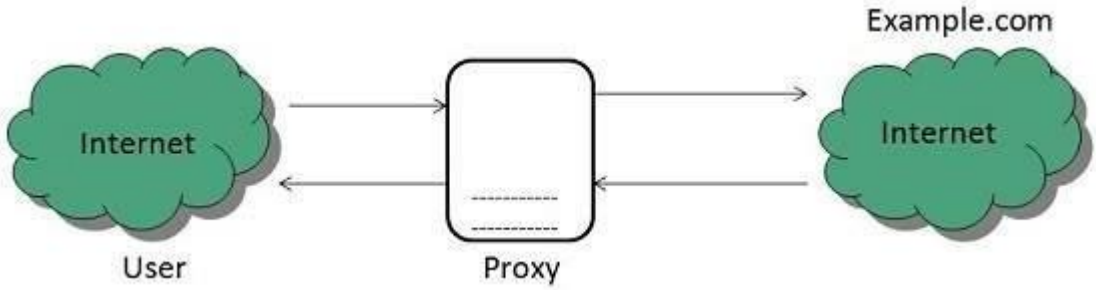
Forward Proxies

In this the client requests its internal network server to forward to the internet.



Open Proxies

Open Proxies helps the clients to conceal their IP address while browsing the web.



CGI: Common Gateway Interface

CGI stands for Common Gateway Interface. It is a technology that enables a web browser to submit forms and connect to programs over a web server. It is the best way for a web server to send forms and connect to programs on the server. CGI can also be described as a set of standards or rules where a program or script can send data back to the webserver where it can be processed.

So, it is an interface for running executable via a web server. In general, it means taking an HTTP request and passing it to an application in order to deliver a dynamically generated HTML page back to a browser. However, any program that can run on a web server is usable as a CGI script. Generally, CGI programs are used to generate pages dynamically or to perform some other action when someone fills out an HTML form and clicks the submit button. CGI applications can be written in any programming language, some of which are Perl, PHP, and Python.

How CGI works?

The browser sends a URL that causes the AOL server to use CGI to run a program. The browser runs on a client machine exchanges information with a Web server using the HyperText Transfer Protocol or HTTP. Depending on the type of request from the browser, the web server may provide a document from its own document directory or executes a CGI program which means it passes the input from the reader (browser) to the program and output from the program back to the reader (browser). Thus, CGI works as a gateway between the AOL server and the program you write.

The steps involved in creating a dynamic HTML document on the fly through CGI are as follows:

1. The client sends an HTTP request through a URL.
2. From the URL, the Web server decides that it should activate the gateway program listed in the URL and send any parameters passed via the URL to that program.
3. The gateway program processes the information and returns HTML text to the Web server. The Web server adds a MIME header and sends the HTML text to the Web browser.
4. The web browser renders the document received from the webserver.

URI

URI stands for **Uniform Resource Identifier**. It is a string identifier that defines a resource on the internet. It is a string of characters that can identify any resource on the internet using location, name, or both.

URIs support a standard approach for resources to be created by several computers across a network or over the World Wide Web. It can be used by software programs including Web browsers and P2P file-sharing programs to find and download files.

Types of URI

There are two types of URI which are as follows −

URL − URL determines a location on the computer network and methods for fetching it.

URN − URN is an internet resource that determines the URN scheme.

The major differences between URI and URL are as follows –

URI	URL
URI stands for Uniform Resource Identifier.	URL stands for Uniform Resource Locator.
A URI aims to recognise a resource and differentiate it from other resources by using the name of the resource or area of the resource.	A URL aims to find the area or address of a resource on the web.
It is generally used in XML and tag library files, including JSTL and XSTL, to recognise the resources and binaries.	It can be used to search the web pages on the internet.
A URI is a superset of URL that recognises a resource either by URL or URN (Uniform Resource Name) or both.	URL is a subset of URI that determines where a resource exists and the mechanism for retrieving it.
There is no protocol data given in URI.	Protocol data is given in the URL.
It can be used in HTML, XML and other files XSLT (Extensible Stylesheet Language Transformations) and more.	URL can locate only web pages.
It includes components like scheme, authority, path, query, fragment component, etc.	It includes components such as protocol, domain, path, hash, query-string, etc.

DREAMWEAVER

Dreamweaver is a **web development tool**. Developed by Adobe Systems, Dreamweaver is a proprietary web development tool first created by Macromedia in 1997. Dreamweaver helps developers build web sites for the Internet or an intranet, letting developers design, code and manage websites as well as mobile content.

Adobe Dreamweaver is a software for designing web pages. These HTML web pages are fully featured. This software provides a WYSIWYG i.e., What You See Is What You Get interface for creating and editing the web pages. The Adobe Dreamweaver software supports many markup languages like HTML, XML, CSS, and JavaScript. It supports English, Spanish, French, German, Japanese, Chinese, etc....

The Dreamweaver was developed by Macromedia, and it was published in 1997. In 2005 the Adobe had purchased Dreamweaver and name it as Adobe Dreamweaver.

Features of Adobe Dreamweaver

1. Fast, flexible coding.

Creating, coding, and managing the websites becomes very easy because of the simplified coding engine. Using this software, HTML, CSS, and other web standards can be quickly learned. It speeds up the development of the web site.

2. Setup to site up in fewer steps.

It becomes very easy to set up a web site, and starter templates can be run very fast. Templates can be customized for email, About pages, blogs, e-commerce pages, newsletters, and portfolios. For reading codes, code coloring and visual hints can be used for quickly editing and updating.

3. Dynamic display on every device.

Using Adobe Dreamweaver responsive websites can build that can be fit into any screen size. This helps in previewing sites and editing makes sure that the page looks and works the same way that you want.

CHAPTER-3(INTERNET SECURITY)

Network security is the security provided to a network from unauthorized access and risks. It is the duty of network administrators to adopt preventive measures to protect their networks from potential security threats.

Computer networks that are involved in regular transactions and communication within the government, individuals, or business require security. The most common and simple way of protecting a network resource is by assigning it a unique name and a corresponding password.

Internet security refers to securing communication over the internet. It includes specific security protocols such as:

- Internet Security Protocol (IPSec)
- Secure Socket Layer (SSL)

Internet Security Protocol (IPSec)

It consists of a set of protocols designed by Internet Engineering Task Force (IETF). It provides security at network level and helps to create authenticated and confidential packets for IP layer.

Secure Socket Layer (SSL)

It is a security protocol developed by Netscape Communications Corporation.). It provides security at transport layer. It addresses the following security issues:

- Privacy
- Integrity
- Authentication

Encryption is a security method in which information is encoded in such a way that only authorized user can read it. It uses encryption algorithm to generate ciphertext that can only be read if decrypted.

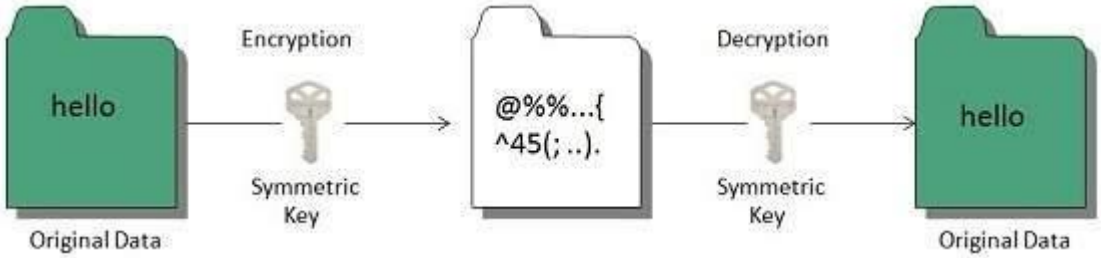
Types of Encryption

There are two types of encryptions schemes as listed below:

- Symmetric Key encryption
- Public Key encryption

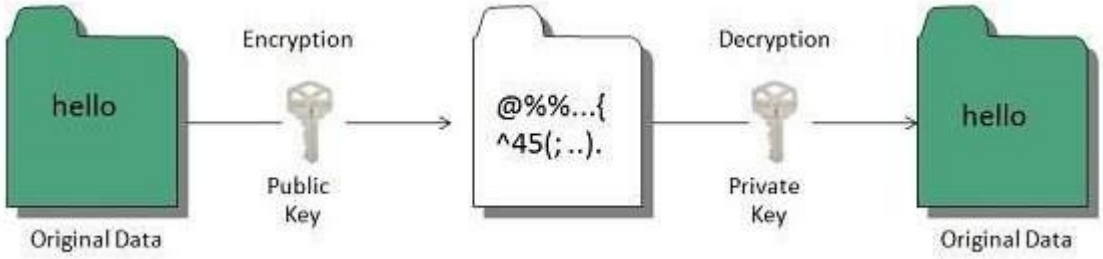
Symmetric Key encryption

Symmetric key encryption algorithm uses same cryptographic keys for both encryption and decryption of cipher text.



Public Key encryption

Public key encryption algorithm uses pair of keys, one of which is a secret key and one of which is public. These two keys are mathematically linked with each other.



Hashing

In terms of security, hashing is a technique used to encrypt data and generate unpredictable hash values. It is the hash function that generates the hash code, which helps to protect the security of transmission from unauthorized users.

Hash function algorithms

Hashing algorithm provides a way to verify that the message received is the same as the message sent. It can take a plain text message as input and then computes a value based on that message.

Key Points

- The length of computed value is much shorter than the original message.
- It is possible that different plain text messages could generate the same value.

Here we will discuss a sample hashing algorithm in which we will multiply the number of a's, e's and h's in the message and will then add the number of o's to this value.

For example, the message is " the combination to the safe is two, seven, thirty-five". The hash of this message, using our simple hashing algorithm is as follows:

```
2 x 6 x 3 ) + 4 = 40
```

The hash of this message is sent to John with cipher text. After he decrypts the message, he computes its hash value using the agreed upon hashing algorithm. If the hash value sent by Bob doesn't match the hash value of decrypted message, John will know that the message has been altered.

For example, John received a hash value of 17 and decrypted a message Bob has sent as "You are being followed, use backroads, hurry"

He could conclude the message had been altered, this is because the hash value of the message he received is:

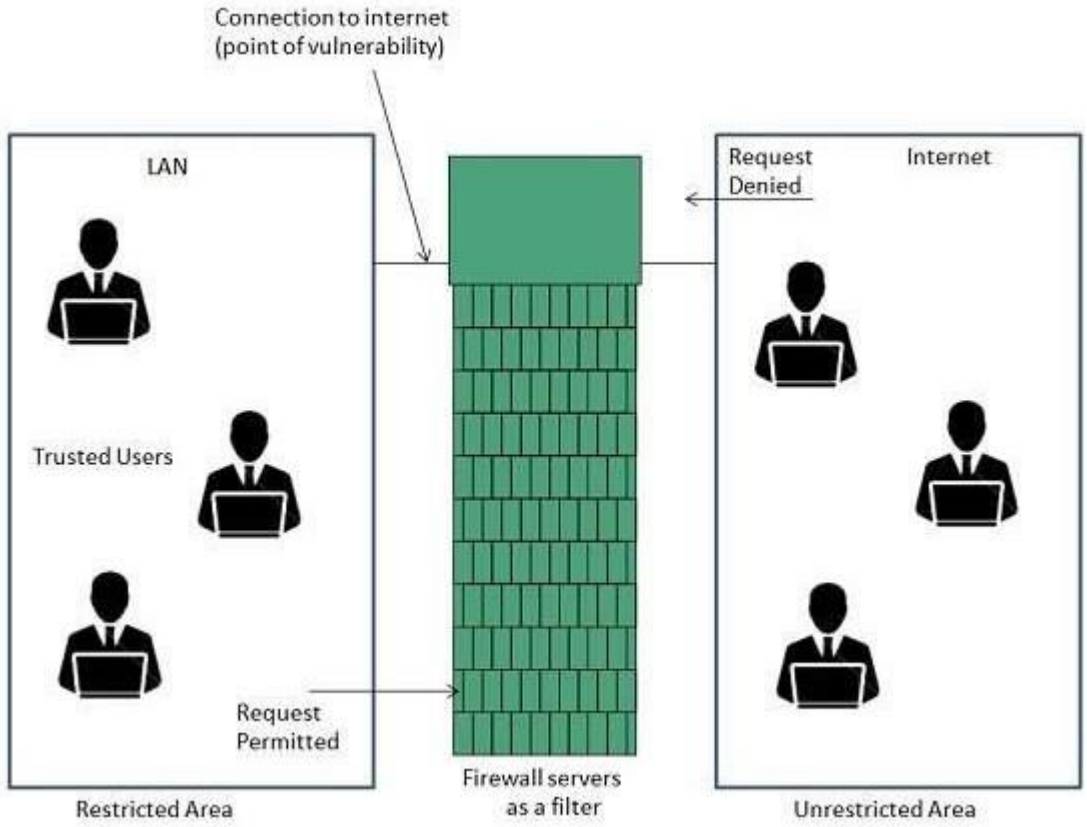
```
(3x4x1)+4 = 16
```

This is different from then value 17 that Bob sent.

Firewall Security

Firewall is a barrier between Local Area Network (LAN) and the Internet. It allows keeping private resources confidential and minimizes the security risks. It controls network traffic, in both directions.

The following diagram depicts a sample firewall between LAN and the internet. The connection between the two is the point of vulnerability. Both hardware and the software can be used at this point to filter network traffic.



There are two types of Firewall system: One works by using filters at the network layer and the other works by using proxy servers at the user, application, or network layer.

CHAPTER-4(INTERNET APPLICATION)

Internet Applications

Internet applications are server-based applications. Following are a few Internet Applications −

- World Wide Web (WWW)
- Electronic mail (e-mail)
- File Transfer Protocol (FTP)
- Telnet (i.e., log-in to the computer located remotely)
- Internet Relay Chat (IRC) (Real time video chatting)

World Wide Web (WWW)

The World Wide Web is a system of interlinked hypertext documents accessed via the Internet .
With a web browser, one can view web pages that may contain text, images, videos, and other multimedia and navigate between them via hyperlinks.
It use a protocol called HTTP – Hypertext Transfer Protocol . HTTP defines how messages are formatted and transmitted, and what actions Web servers and browsers should take in response to various commands.
A Uniform Resource Locator, or URL is the address of a document you'll find on the WWW.
The elements in a URL: Protocol://server's address/filename
Example: http://www.google.com/index.html.

Types of website:

Static – A static website is one that has web pages stored on the server in the format that is sent to a client web browser. It is primarily coded in Hypertext Markup Language (HTML) .
Dynamic – A dynamic website is one that changes or customizes itself frequently and automatically, based on certain criteria.

Electronic Mail (Email)

The transmission of messages over communications networks.
It is a fast and efficient way to communicate with friends or colleagues.
You can communicate with one person at a time or thousands; you can receive and send files and other information.
Basic email functions:
– send and receive mail messages
– save your messages in a file
– print mail messages
– reply to mail messages
– attach a file to a mail message

Email address someone@mail server
The email address has three parts:
– a user name
– an "at" sign (@)
– the address of the user's mail server

Example Harris@ftms.edu.my

Email Client
An email client is a computer program used to manage a user's email.
Popular email clients include Microsoft Outlook, Pegasus Mail, Mozilla's Thunderbird, and Apple Inc.'s Mail.

Web-based mail
Is an e-mail service intended to be primarily accessed via a web browser.
Very popular webmail providers:
– Gmail
– Yahoo! Mail
– Hotmail
• Web mail is popular as it allows you to send or receive e-mail from anywhere.

File Transfer Protocol (FTP)
• The protocol for exchanging files over the Internet.
• Used for moving files between two hosts on a TCP/IP network.
• FTP is most commonly used to download a file from a server using the Internet or to upload a file to a server.
To do FTP, a user invokes one of two commands:
– **get** - the command for transferring a file from another server to your own computer.
– **put** - the command for moving a file from your computer to another one.

Chatting
• Chatting is the other method for Internet conversation.
• It enables people connected anywhere on the Internet to join in live discussions .
• Chat sessions allow many users to join in the same free -form conversation, usually centered around a discussion topic .
Examples:
• MSN Messenger
• Yahoo Messenger
• IRC
• Pidgin

Video Conferencing
• A videoconference or video conference is a set of interactive telecommunication technologies which allow two or more locations to interact via two-way video and audio transmissions simultaneously.
The other components required for a videoconferencing system include:
• Video input and output
• Audio input and output
• Data transfer
• Computer

E-Commerce
• Electronic commerce or ECommerce consists of the buying and selling of products or services over electronic systems such as the Internet and other computer networks.
• It includes the entire online process of developing, marketing, selling, delivering, servicing and paying for products and services.
Some common applications related to electronic commerce are the following:
• Domestic and international payment systems
• Group buying
• Automated online assistants
• Online shopping and order tracking
• Online banking
• Shopping cart software
• Electronic tickets

CHAPTER-5(WEBSITE CLASSIFICATIONS)

Website

Website is a collection of related web pages that may contain text, images, audio and video. The first page of a website is called home page. Each website has specific internet address (URL) that you need to enter in your browser to access a website.

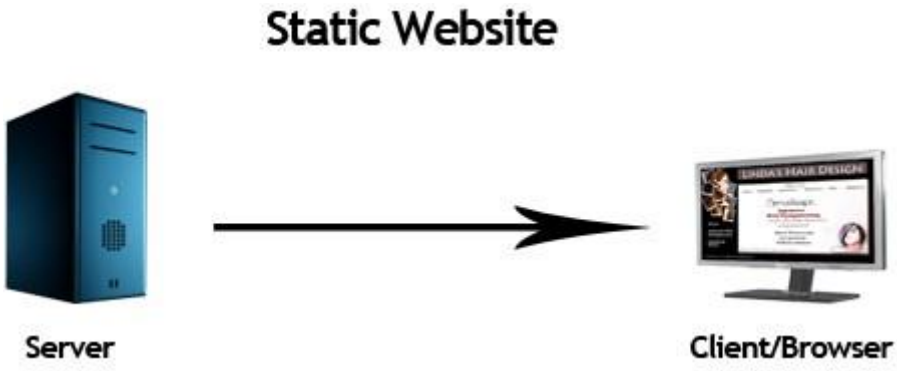
Website is hosted on one or more servers and can be accessed by visiting its homepage using a computer network. A website is managed by its owner that can be an individual, company or an organization.

A website can be of two types:

- Static Website
- Dynamic Website

Static website

Static website is the basic type of website that is easy to create. You don't need the knowledge of web programming and database design to create a static website. Its web pages are coded in HTML. The codes are fixed for each page so the information contained in the page does not change and it looks like a printed page.



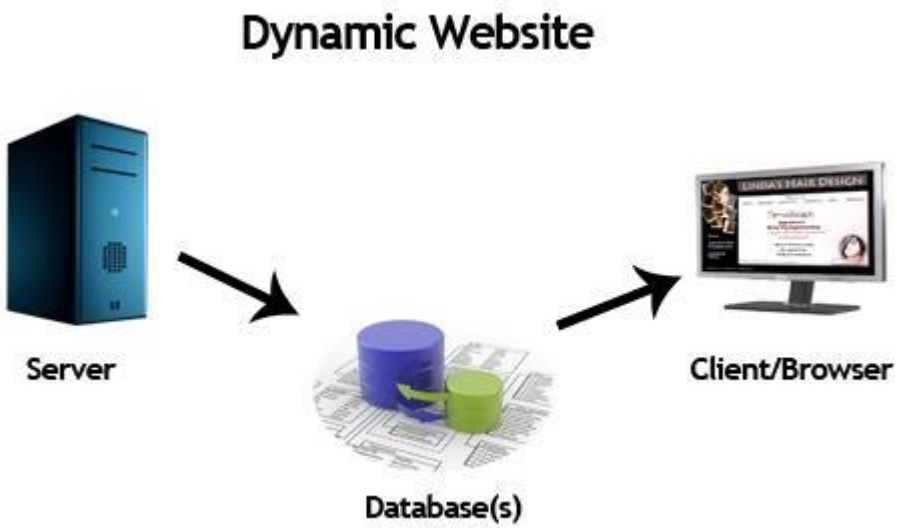
Dynamic website

Dynamic website is a collection of dynamic web pages whose content changes dynamically. It accesses content from a database or Content Management System (CMS). Therefore, when you alter or update the content of the database, the content of the website is also altered or updated.

Dynamic website uses client-side scripting or server-side scripting, or both to generate dynamic content.

Client side scripting generates content at the client computer on the basis of user input. The web browser downloads the web page from the server and processes the code within the page to render information to the user.

In server side scripting, the software runs on the server and processing is completed in the server then plain pages are sent to the user.



Static vs Dynamic website

Static Website	Dynamic Website
Prebuilt content is same every time the page is loaded.	Content is generated quickly and changes regularly.
It uses the **HTML** code for developing a website.	It uses the server side languages such as **PHP,SERVLET, JSP, and ASP.NET** etc. for developing a website.
It sends exactly the same response for every request.	It may generate different HTML for each of the request.
The content is only changed when someone publishes and updates the file (sends it to the web server).	The page contains "server-side" code which allows the server to generate the unique content when the page is loaded.
Flexibility is the main advantage of static website.	Content Management System (CMS) is the main advantage of dynamic website.

WEB PORTAL

A web portal is a specially designed website that often serves as the single point of access for information. It can also be considered a library of personalized and categorized content. A web portal helps in search navigation, personalization, notification and information integration, and often provides features like task management, collaboration, and business intelligence and application integration.

Web portals are also known simply as portals.

Functions of Web Portal

- **Upgrading your website** Web Portal development help you in improving the capability of the web pages that help you deliver a quality information, thus a web portal is the new world toolset that makes implementation of information better and behaves as a different communication approach.
- **Improves Relations immensely** It helps in enhanced customer-company relations as it helps in improving their customer relations by providing high-end and filtered information on a user-friendly and comprehensive platform.

- **Domain Specific** Domain Specific development of web portals helps you attract the users that seek information and services on that domain. Thus, helping you attract a particular area of domain.
- **Interaction** When done efficiently web portal design services help you a lot in interacting better with your customers and clients. They help you make your web pages very interactive and target better to your audience.
- **Process of web portal designing services** Web portal development and designing is a complex art as its functionality is highly difficult to render. The complex process of web portal development includes similar steps as website development. However, the difference is in its features, functionality, coding, testing and integration. Since we have covered the features and functionality let's start with the languages and frameworks that are used dominantly in web portal development services by eminent web portal development companies and web portal developers.
- **Languages and Frameworks prominently used in developing web portals** Since web portals are differently designed websites, the languages are similar that we use in building and web designing services in a website development. Thus, the top 10 frameworks that we use in building web portals are 1. AngularJS 2. Laravel 3. React.JS 4. NodeJS 5. Ruby on Rails 6. Symfony 7. Asp.Net 8. Yii 9. Metor.JS and 10. CakePHP.

Now The difference between Website and Webportal

Websites and web portals thus can be differentiated on different aspects, firstly websites are majorly focused on driving traffic while web portals are for limiting the traffic. Whereas the web portals require users to login while websites are open to being visited by any individual.

Thus, on differentiating it based on their uses, a web portal is creating and attract a specific audience experience, control user's functionality on your page, multiple source integrations to provide uniform information and other user management and permitting features.

Website	Web portal
Location on internet, publically accessible with a unique URL(Web Address)	A private location on the internet it can be accessible with unique url and unique username and password
No any requirement of any login	Login required
Any one can visit and can see content of website	Only member of the webportal having access can see the content of web portal
Content does not change by different individuals	Dynamic content changes more frequently than typical websites

Social Networking Sites

Social networking sites (SNS) are a way for people in the offline world to stay connected regardless of geographical distance, difference in time, or other context-specific barriers. They are spaces of socialization for common communities, communities in practice, or those united by

a shared interest. They have gained global popularity as a medium through which people transmit, coordinate, and, in some cases, live their lives. Powered by Web 2.0 technology, SNS are explicitly participatory, dialogical, and user-content fed. Sites such as MySpace, Facebook, Twitter, and YouTube are dissemination portals, showcasing in vivid multimedia ways expressions of everyday life that invite comment and discussion. They offer a continuously updating diary or inventory of the self. SNS are both product and part of an age of globalization and are at once a powerful example of social and economic interconnectivity and democratic empowerment; an unparalleled information resource and educational tool; a mechanism for identity work and cultural enterprise; and also a barometer of local, national, and international inequality and medium for illicit, criminal, and terrorist behavior.

Advantages and Disadvantages of Social Networking

Social networking has the ability to affect both individuals and corporations—both positively and negatively. That's why it's important to weigh out both the advantages and disadvantages of using these social media sites.

Pros

- Allows people to connect with others, including friends and family
- Companies can reach new and existing clients as well as build and improve their brand name
- Corporations can demonstrate their customer service

Cons

- Helps spread misinformation
- Complaints about companies can spread and create public relations issues
- Costs to advertise and develop corporate profiles can be high

RSS FEED

An RSS feed consolidates information sources in one place and provides updates when a site adds new content. With social media, all you see is the favorite stuff that people share. With an RSS feed, you see everything a website publishes.
To find an RSS feed on a website, look on the site's main or home page. Some sites display their RSS feed as an orange button that may contain the acronyms RSS or XML.

Not all RSS icons look alike. RSS icons come in different sizes and colors. Not all these icons contain the acronyms RSS or XML. Some sites use a Syndicate This link or another type of link to indicate an RSS feed.

BLOG

A blog is a discussion or informational website published on the World Wide Web consisting of discrete, often informal diary-style text entries. Posts are typically displayed in reverse chronological order, so that the most recent post appears first, at the top of the web page.
The purpose of a blog is to provide content on your website that answers your prospective customers' questions and helps them learn about your product or service. It expands your

brand's visibility by giving Google and other search engines content to index and serve up in search results.

ETIQUETTE IN TECHNOLOGY

Social Etiquette in real life is ingrained into our social life, although etiquette in technology, colloquially referred to as netiquette, is a fairly recent concept.

Follow these basic rules of netiquette to avoid damaging your online and offline relationships and protect your reputation.

- Make Real People a Priority. ...
- Use Respectful Language. ...
- Share With Discretion. ...
- Don't Exclude Others. ...
- Choose Friends Wisely. ...
- Respect People's Privacy. ...
- Fact Check Before Reposting. ...
- Don't Spam.

CHAPTER-9(SERVER SIDE PROGRAMMING USING PHP)

PHP is a server scripting language, and a powerful tool for making dynamic and interactive Web pages.
PHP is a widely-used, free, and efficient alternative to competitors such as Microsoft's ASP.
The **PHP Hypertext Preprocessor (PHP)** is a programming language that allows web developers to create dynamic content that interacts with databases. PHP is basically used for developing web based software applications.
PHP is an open-source, interpreted, and object-oriented scripting language that can be executed at the server-side. PHP is well suited for web development. Therefore, it is used to develop web applications (an application that executes on the server and generates the dynamic page.).
PHP was created by **Rasmus Lerdorf in 1994** but appeared in the market in 1995. **PHP 7.4.0** is the latest version of PHP, which was released on **28 November**.

- PHP stands for Hypertext Preprocessor.
- PHP is an interpreted language, i.e., there is no need for compilation.
- PHP is faster than other scripting languages, for example, ASP and JSP.
- PHP is a server-side scripting language, which is used to manage the dynamic content of the website.
- PHP can be embedded into HTML.
- PHP is an object-oriented language.
- PHP is an open-source scripting language.
- PHP is simple and easy to learn language.

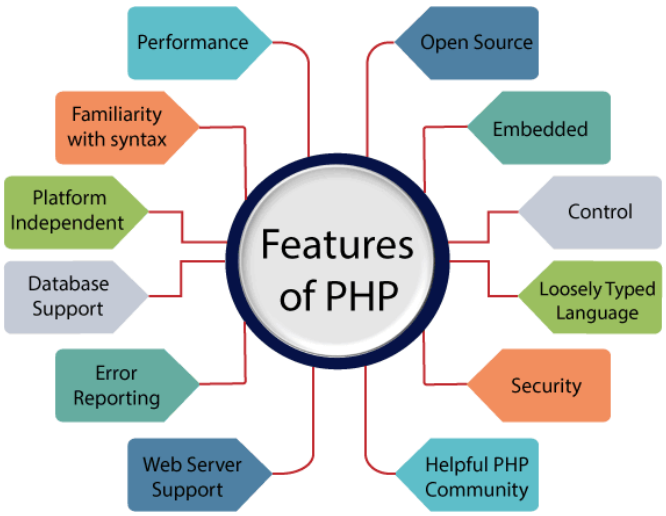
Why use PHP

PHP is a server-side scripting language, which is used to design the dynamic web applications with MySQL database.

- It handles dynamic content, database as well as session tracking for the website.
- You can create sessions in PHP.
- It can access cookies variable and also set cookies.
- It helps to encrypt the data and apply validation.
- PHP supports several protocols such as HTTP, POP3, SNMP, LDAP, IMAP, and many more.
- Using PHP language, you can control the user to access some pages of your website.
- As PHP is easy to install and set up, this is the main reason why PHP is the best language to learn.
- PHP can handle the forms, such as - collect the data from users using forms, save it into the database, and return useful information to the user. **For example** - Registration form.

PHP Features

- PHP is very popular language because of its simplicity and open source. There are some important features of PHP given below:



Performance:
PHP script is executed much faster than those scripts which are written in other languages such as JSP and ASP. PHP uses its own memory, so the server workload and loading time is automatically reduced, which results in faster processing speed and better performance.
Open Source:
PHP source code and software are freely available on the web. You can develop all the versions of PHP according to your requirement without paying any cost. All its components are free to download and use.
Familiarity with syntax:
PHP has easily understandable syntax. Programmers are comfortable coding with it.
Embedded:
PHP code can be easily embedded within HTML tags and script.
Platform Independent:
PHP is available for WINDOWS, MAC, LINUX & UNIX operating system. A PHP application developed in one OS can be easily executed in other OS also.
Database Support:
PHP supports all the leading databases such as MySQL, SQLite, ODBC, etc.
Error Reporting -
PHP has predefined error reporting constants to generate an error notice or warning at runtime. E.g., E_ERROR, E_WARNING, E_STRICT, E_PARSE.
Loosely Typed Language:
PHP allows us to use a variable without declaring its datatype. It will be taken automatically at the time of execution based on the type of data it contains on its value.
Web servers Support:
PHP is compatible with almost all local servers used today like Apache, Netscape, Microsoft IIS, etc.
Security:
PHP is a secure language to develop the website. It consists of multiple layers of security to prevent threads and malicious attacks.
Control:
Different programming languages require long script or code, whereas PHP can do the same work in a few lines of code. It has maximum control over the websites like you can make changes easily whenever you want.
A Helpful PHP Community:
It has a large community of developers who regularly updates documentation, tutorials, online help, and FAQs. Learning PHP from the communities is one of the significant benefits.

Characteristics of PHP

Five important characteristics make PHP's practical nature possible −

- Simplicity
- Efficiency
- Security
- Flexibility
- Familiarity

Applications of PHP

As mentioned before, PHP is one of the most widely used language over the web. I'm going to list few of them here:

- PHP performs system functions, i.e. from files on a system it can create, open, read, write, and close them.
- PHP can handle forms, i.e. gather data from files, save data to a file, through email you can send data, return data to the user.
- You add, delete, modify elements within your database through PHP.
- Access cookies variables and set cookies.
- Using PHP, you can restrict users to access some pages of your website.
- It can encrypt data.

PHP Variables

In PHP, a variable starts with the $ sign, followed by the name of the variable:

Example

```
<?php
$txt = "Hello world!";
$x = 5;
$y = 10.5;
?>
```

After the execution of the statements above, the variable $txt will hold the value Hello world!, the variable $x will hold the value 5, and the variable $y will hold the value 10.5.

PHP Variables

A variable can have a short name (like x and y) or a more descriptive name (age, carname, total_volume).

Rules for PHP variables:

- A variable starts with the $ sign, followed by the name of the variable
- A variable name must start with a letter or the underscore character
- A variable name cannot start with a number
- A variable name can only contain alpha-numeric characters and underscores (A-z, 0-9, and _)
- Variable names are case-sensitive ($age and $AGE are two different variables)

Remember that PHP variable names are case-sensitive!

Output Variables

The PHP echo statement is often used to output data to the screen.

The following example will show how to output text and a variable:

Example

```
<?php
$txt = "W3Schools.com";
echo "I love $txt!";
?>
```

The following example will produce the same output as the example above:

Example

```
<?php
$txt = "W3Schools.com";
echo "I love " . $txt . "!";
?>
```

The following example will output the sum of two variables:

Example

```
<?php
$x = 5;
$y = 4;
echo $x + $y;
?>
```

PHP is a Loosely Typed Language

In the example above, notice that we did not have to tell PHP which data type the variable is.

PHP automatically associates a data type to the variable, depending on its value. Since the data types are not set in a strict sense, you can do things like adding a string to an integer without causing an error.

In PHP 7, type declarations were added. This gives an option to specify the data type expected when declaring a function, and by enabling the strict requirement, it will throw a "Fatal Error" on a type mismatch.

PHP Variables Scope

In PHP, variables can be declared anywhere in the script.

The scope of a variable is the part of the script where the variable can be referenced/used.

PHP has three different variable scopes:

- local
- global
- static

Global and Local Scope

A variable declared **outside** a function has a GLOBAL SCOPE and can only be accessed outside a function:

Example

Variable with global scope:

```
<?php
$x = 5; // global scope
```

```
function myTest() {
  // using x inside this function will generate an error
  echo "<p>Variable x inside function is: $x</p>";
}
myTest();

echo "<p>Variable x outside function is: $x</p>";
?>
```

A variable declared **within** a function has a LOCAL SCOPE and can only be accessed within that function:

Example

Variable with local scope:

```
<?php
function myTest() {
  $x = 5; // local scope
  echo "<p>Variable x inside function is: $x</p>";
}
myTest();

// using x outside the function will generate an error
echo "<p>Variable x outside function is: $x</p>";
?>
```

PHP The global Keyword

The global keyword is used to access a global variable from within a function.

To do this, use the global keyword before the variables (inside the function):

Example

```
<?php
$x = 5;
$y = 10;

function myTest() {
  global $x, $y;
  $y = $x + $y;
}
```

```
myTest();
echo $y; // outputs 15
?>
```

PHP also stores all global variables in an array called $GLOBALS[*index*]. The *index* holds the name of the variable. This array is also accessible from within functions and can be used to update global variables directly.

The example above can be rewritten like this:

Example

```
<?php
$x = 5;
$y = 10;

function myTest() {
  $GLOBALS['y'] = $GLOBALS['x'] + $GLOBALS['y'];
}

myTest();
echo $y; // outputs 15
?>
```

PHP The static Keyword

Normally, when a function is completed/executed, all of its variables are deleted. However, sometimes we want a local variable NOT to be deleted. We need it for a further job.

To do this, use the static keyword when you first declare the variable:

Example

```
<?php
function myTest() {
  static $x = 0;
  echo $x;
  $x++;
}

myTest();
myTest();
myTest();
?>
```

PHP echo and print Statements

With PHP, there are two basic ways to get output: echo and print.

In this tutorial we use echo or print in almost every example. So, this chapter contains a little more info about those two output statements.

PHP echo and print Statements

echo and print are more or less the same. They are both used to output data to the screen.

The differences are small: echo has no return value while print has a return value of 1 so it can be used in expressions. echo can take multiple parameters (although such usage is rare) while print can take one argument. echo is marginally faster than print.

The PHP echo Statement

The echo statement can be used with or without parentheses: echo or echo().

Display Text

The following example shows how to output text with the echo command (notice that the text can contain HTML markup):

Example

```
<?php
echo "<h2>PHP is Fun!</h2>";
echo "Hello world!<br>";
echo "I'm about to learn PHP!<br>";
echo "This ", "string ", "was ", "made ", "with multiple parameters.";
?>
```

Display Variables

The following example shows how to output text and variables with the echo statement:

Example

```
<?php
$txt1 = "Learn PHP";
$txt2 = "W3Schools.com";
$x = 5;
$y = 4;

echo "<h2>" . $txt1 . "</h2>";
echo "Study PHP at " . $txt2 . "<br>";
echo $x + $y;
?>
```

The PHP print Statement

The print statement can be used with or without parentheses: print or print().

Display Text

The following example shows how to output text with the print command (notice that the text can contain HTML markup):

Example

```
<?php
print "<h2>PHP is Fun!</h2>";
print "Hello world!<br>";
print "I'm about to learn PHP!";
?>
```

Display Variables

The following example shows how to output text and variables with the print statement:

Example

```
<?php
$txt1 = "Learn PHP";
$txt2 = "W3Schools.com";
$x = 5;
$y = 4;

print "<h2>" . $txt1 . "</h2>";
print "Study PHP at " . $txt2 . "<br>";
```

```
print $x + $y;
?>
```

PHP Data Types

Variables can store data of different types, and different data types can do different things.

PHP supports the following data types:

- String
- Integer
- Float (floating point numbers - also called double)
- Boolean
- Array
- Object
- NULL
- Resource

PHP String

A string is a sequence of characters, like "Hello world!".

A string can be any text inside quotes. You can use single or double quotes:

Example

```
<?php
$x = "Hello world!";
$y = 'Hello world!';

echo $x;
echo "<br>";
echo $y;
?>
```

PHP Integer

An integer data type is a non-decimal number between -2,147,483,648 and 2,147,483,647.

Rules for integers:

- An integer must have at least one digit
- An integer must not have a decimal point

- An integer can be either positive or negative
- Integers can be specified in: decimal (base 10), hexadecimal (base 16), octal (base 8), or binary (base 2) notation

In the following example $x is an integer. The PHP var_dump() function returns the data type and value:

Example

```
<?php
$x = 5985;
var_dump($x);
?>
```

PHP Float

A float (floating point number) is a number with a decimal point or a number in exponential form.

In the following example $x is a float. The PHP var_dump() function returns the data type and value:

Example

```
<?php
$x = 10.365;
var_dump($x);
?>
```

PHP Boolean

A Boolean represents two possible states: TRUE or FALSE.

```
$x = true;
$y = false;
```

Booleans are often used in conditional testing. You will learn more about conditional testing in a later chapter of this tutorial.

PHP Array

An array stores multiple values in one single variable.

In the following example $cars is an array. The PHP var_dump() function returns the data type and value:

Example

```
<?php
$cars = array("Volvo","BMW","Toyota");
var_dump($cars);
?>
```

PHP Object

Classes and objects are the two main aspects of object-oriented programming.

A class is a template for objects, and an object is an instance of a class.

When the individual objects are created, they inherit all the properties and behaviors from the class, but each object will have different values for the properties.

Let's assume we have a class named Car. A Car can have properties like model, color, etc. We can define variables like $model, $color, and so on, to hold the values of these properties.

When the individual objects (Volvo, BMW, Toyota, etc.) are created, they inherit all the properties and behaviors from the class, but each object will have different values for the properties.

If you create a __construct() function, PHP will automatically call this function when you create an object from a class.

Example

```
<?php
class Car {
  public $color;
  public $model;
  public function __construct($color, $model) {
    $this->color = $color;
    $this->model = $model;
  }
  public function message() {
    return "My car is a " . $this->color . " " . $this->model . "!";
  }
}

$myCar = new Car("black", "Volvo");
echo $myCar -> message();
echo "<br>";
$myCar = new Car("red", "Toyota");
```

```
echo $myCar -> message();
?>
```

PHP NULL Value

Null is a special data type which can have only one value: NULL.

A variable of data type NULL is a variable that has no value assigned to it.

Tip: If a variable is created without a value, it is automatically assigned a value of NULL.

Variables can also be emptied by setting the value to NULL:

Example

```
<?php
$x = "Hello world!";
$x = null;
var_dump($x);
?>
```

PHP Strings

PHP String Functions

In this chapter we will look at some commonly used functions to manipulate strings.

---

strlen() - Return the Length of a String

The PHP strlen() function returns the length of a string.

Example

Return the length of the string "Hello world!":

```
<?php
echo strlen("Hello world!"); // outputs 12
?>
```

str_word_count() - Count Words in a String

The PHP str_word_count() function counts the number of words in a string.

Example

Count the number of word in the string "Hello world!":

```
<?php
echo str_word_count("Hello world!"); // outputs 2
?>
```

strrev() - Reverse a String

The PHP strrev() function reverses a string.

Example

Reverse the string "Hello world!":

```
<?php
echo strrev("Hello world!"); // outputs !dlrow olleH
?>
```

strpos() - Search For a Text Within a String

The PHP strpos() function searches for a specific text within a string. If a match is found, the function returns the character position of the first match. If no match is found, it will return FALSE.

Example

Search for the text "world" in the string "Hello world!":

```
<?php
echo strpos("Hello world!", "world"); // outputs 6
?>
```

str_replace() - Replace Text Within a String

The PHP str_replace() function replaces some characters with some other characters in a string.

Example

Replace the text "world" with "Dolly":

```php
<?php
echo str_replace("world", "Dolly", "Hello world!"); // outputs Hello Dolly!
?>
```

PHP Operators

Operators are used to perform operations on variables and values.

PHP divides the operators in the following groups:

- Arithmetic operators
- Assignment operators
- Comparison operators
- Increment/Decrement operators
- Logical operators
- String operators
- Array operators
- Conditional assignment operators

PHP Arithmetic Operators

The PHP arithmetic operators are used with numeric values to perform common arithmetical operations, such as addition, subtraction, multiplication etc.

Operator	Name	Example	Result
+	Addition	$x + $y	Sum of $x and $y
-	Subtraction	$x - $y	Difference of $x and $y
*	Multiplication	$x * $y	Product of $x and $y
/	Division	$x / $y	Quotient of $x and $y
%	Modulus	$x % $y	Remainder of $x divided by $y
**	Exponentiation	$x ** $y	Result of raising $x to the $y'th power

PHP Assignment Operators

The PHP assignment operators are used with numeric values to write a value to a variable.
The basic assignment operator in PHP is "=". It means that the left operand gets set to the value of the assignment expression on the right.

Assignment	Same as...	Description
x = y	x = y	The left operand gets set to the value of the expression on the right
x += y	x = x + y	Addition
x -= y	x = x - y	Subtraction
x *= y	x = x * y	Multiplication
x /= y	x = x / y	Division
x %= y	x = x % y	Modulus

PHP Comparison Operators

The PHP comparison operators are used to compare two values (number or string):

Operator	Name	Example	Result
==	Equal	$x == $y	Returns true if $x is equal to $y
===	Identical	$x === $y	Returns true if $x is equal to $y, and they are of the same type
!=	Not equal	$x != $y	Returns true if $x is not equal to $y
<>	Not equal	$x <> $y	Returns true if $x is not equal to $y
!==	Not identical	$x !== $y	Returns true if $x is not equal to $y, or they are not of the same type
>	Greater than	$x > $y	Returns true if $x is greater than $y
<	Less than	$x < $y	Returns true if $x is less than $y
>=	Greater than or equal to	$x >= $y	Returns true if $x is greater than or equal to $y
<=	Less than or equal to	$x <= $y	Returns true if $x is less than or equal to $y
<=>	Spaceship	$x <=> $y	Returns an integer less than, equal to, or greater than zero, depending on if $x is less than, equal to, or greater than $y. Introduced in PHP 7.

PHP Increment / Decrement Operators

The PHP increment operators are used to increment a variable's value.
The PHP decrement operators are used to decrement a variable's value.

Operator	Name	Description
++$x	Pre-increment	Increments $x by one, then returns $x
$x++	Post-increment	Returns $x, then increments $x by one
--$x	Pre-decrement	Decrements $x by one, then returns $x
$x--	Post-decrement	Returns $x, then decrements $x by one

PHP Logical Operators

The PHP logical operators are used to combine conditional statements.

Operator	Name	Example	Result
and	And	$x and $y	True if both $x and $y are true
or	Or	$x or $y	True if either $x or $y is true
xor	Xor	$x xor $y	True if either $x or $y is true, but not both
&&	And	$x && $y	True if both $x and $y are true
||	Or	$x || $y	True if either $x or $y is true
!	Not	!$x	True if $x is not true

PHP String Operators

PHP has two operators that are specially designed for strings.

Operator	Name	Example	Result
.	Concatenation	$txt1 . $txt2	Concatenation of $txt1 and $txt2
.=	Concatenation assignment	$txt1 .= $txt2	Appends $txt2 to $txt1

PHP Array Operators

The PHP array operators are used to compare arrays.

Operator	Name	Example	Result
+	Union	$x + $y	Union of $x and $y
==	Equality	$x == $y	Returns true if $x and $y have the same key/value pairs
===	Identity	$x === $y	Returns true if $x and $y have the same key/value pairs in the same order and of the same types
!=	Inequality	$x != $y	Returns true if $x is not equal to $y
<>	Inequality	$x <> $y	Returns true if $x is not equal to $y
!==	Non-identity	$x !== $y	Returns true if $x is not identical to $y

PHP Conditional Assignment Operators

The PHP conditional assignment operators are used to set a value depending on conditions:

Operator	Name	Example	Result
?:	Ternary	$x = *expr1* ? *expr2* : *expr3*	Returns the value of $x. The value of $x is *expr2* if *expr1* = TRUE. The value of $x is *expr3* if *expr1* = FALSE
??	Null coalescing	$x = *expr1* ?? *expr2*	Returns the value of $x. The value of $x is *expr1* if *expr1* exists, and is not NULL. If *expr1* does not exist, or is NULL, the value of $x is *expr2*. Introduced in PHP 7

PHP Conditional Statements

Very often when you write code, you want to perform different actions for different conditions. You can use conditional statements in your code to do this.

In PHP we have the following conditional statements:

- if statement - executes some code if one condition is true
- if...else statement - executes some code if a condition is true and another code if that condition is false
- if...elseif...else statement - executes different codes for more than two conditions
- switch statement - selects one of many blocks of code to be executed

PHP - The if Statement

The if statement executes some code if one condition is true.

Syntax

```
if (condition) {
  code to be executed if condition is true;
}
```

Example

Output "Have a good day!" if the current time (HOUR) is less than 20:

```
<?php
$t = date("H");

if ($t < "20") {
  echo "Have a good day!";
}
?>
```

PHP - The if...else Statement

The if...else statement executes some code if a condition is true and another code if that condition is false.

Syntax

```
if (condition) {
  code to be executed if condition is true;
} else {
  code to be executed if condition is false;
}
```

Example

Output "Have a good day!" if the current time is less than 20, and "Have a good night!" otherwise:

```
<?php
$t = date("H");

if ($t < "20") {
  echo "Have a good day!";
} else {
  echo "Have a good night!";
}
?>
```

PHP - The if...elseif...else Statement

The if...elseif...else statement executes different codes for more than two conditions.

Syntax

```
if (condition) {
  code to be executed if this condition is true;
} elseif (condition) {
```

```
  code to be executed if first condition is false and this condition is true;
} else {
  code to be executed if all conditions are false;
}
```

Example

Output "Have a good morning!" if the current time is less than 10, and "Have a good day!" if the current time is less than 20. Otherwise it will output "Have a good night!":

```
<?php
$t = date("H");

if ($t < "10") {
  echo "Have a good morning!";
} elseif ($t < "20") {
  echo "Have a good day!";
} else {
  echo "Have a good night!";
}
?>
```

The PHP switch Statement

The switch statement is used to perform different actions based on different conditions.
Use the switch statement to **select one of many blocks of code to be executed**.

Syntax

```
switch (n) {
  case label1:
    code to be executed if n=label1;
    break;
  case label2:
    code to be executed if n=label2;
    break;
  case label3:
    code to be executed if n=label3;
    break;
    ...
  default:
    code to be executed if n is different from all labels;
}
```

This is how it works: First we have a single expression *n* (most often a variable), that is evaluated once. The value of the expression is then compared with the values for each case in the structure. If there is a match, the block of code associated with that case is executed. Use break to prevent the code from running into the next case automatically. The default statement is used if no match is found.

Example

```
<?php
$favcolor = "red";

switch ($favcolor) {
  case "red":
    echo "Your favorite color is red!";
    break;
  case "blue":
    echo "Your favorite color is blue!";
    break;
  case "green":
    echo "Your favorite color is green!";
    break;
  default:
    echo "Your favorite color is neither red, blue, nor green!";
}
?>
```

PHP Loops

Often when you write code, you want the same block of code to run over and over again a certain number of times. So, instead of adding several almost equal code-lines in a script, we can use loops. Loops are used to execute the same block of code again and again, as long as a certain condition is true.

In PHP, we have the following loop types:

- while - loops through a block of code as long as the specified condition is true
- do...while - loops through a block of code once, and then repeats the loop as long as the specified condition is true
- for - loops through a block of code a specified number of times
- foreach - loops through a block of code for each element in an array

The PHP while Loop

The while loop executes a block of code as long as the specified condition is true.

Syntax

```
while (condition is true) {
  code to be executed;
}
```

Examples

The example below displays the numbers from 1 to 5:

Example

```
<?php
$x = 1;
```

```
while($x <= 5) {
  echo "The number is: $x <br>";
  $x++;
}
?>
```

Example Explained

- $x = 1; - Initialize the loop counter ($x), and set the start value to 1
- $x <= 5 - Continue the loop as long as $x is less than or equal to 5
- $x++; - Increase the loop counter value by 1 for each iteration

This example counts to 100 by tens:

Example

```
<?php
$x = 0;

while($x <= 100) {
  echo "The number is: $x <br>";
  $x+=10;
}
?>
```

Example Explained

- $x = 0; - Initialize the loop counter ($x), and set the start value to 0
- $x <= 100 - Continue the loop as long as $x is less than or equal to 100
- $x+=10; - Increase the loop counter value by 10 for each iteration

The PHP do...while Loop

The do...while loop will always execute the block of code once, it will then check the condition, and repeat the loop while the specified condition is true.

Syntax

```
do {
  code to be executed;
} while (condition is true);
```

Examples

The example below first sets a variable $x to 1 ($x = 1). Then, the do while loop will write some output, and then increment the variable $x with 1. Then the condition is checked (is $x less than, or equal to 5?), and the loop will continue to run as long as $x is less than, or equal to 5:

Example

```
<?php
$x = 1;

do {
  echo "The number is: $x <br>";
  $x++;
```

```
} while ($x <= 5);
?>
```

Note: In a do...while loop the condition is tested AFTER executing the statements within the loop. This means that the do...while loop will execute its statements at least once, even if the condition is false. See example below.

This example sets the $x variable to 6, then it runs the loop, **and then the condition is checked**:

Example

```
<?php
$x = 6;

do {
  echo "The number is: $x <br>";
  $x++;
} while ($x <= 5);
?>
```

The PHP for Loop

The for loop is used when you know in advance how many times the script should run.

Syntax

for (*init counter; test counter; increment counter*) {
  code to be executed for each iteration;
}

Parameters:

- *init counter*: Initialize the loop counter value
- *test counter*: Evaluated for each loop iteration. If it evaluates to TRUE, the loop continues. If it evaluates to FALSE, the loop ends.
- *increment counter*: Increases the loop counter value

Examples

The example below displays the numbers from 0 to 10:

Example

```
<?php
for ($x = 0; $x <= 10; $x++) {
  echo "The number is: $x <br>";
}
?>
```

Example Explained

- $x = 0; - Initialize the loop counter ($x), and set the start value to 0
- $x <= 10; - Continue the loop as long as $x is less than or equal to 10
- $x++ - Increase the loop counter value by 1 for each iteration

This example counts to 100 by tens:

Example

```
<?php
for ($x = 0; $x <= 100; $x+=10) {
  echo "The number is: $x <br>";
}
?>
```

Example Explained

- $x = 0; - Initialize the loop counter ($x), and set the start value to 0
- $x <= 100; - Continue the loop as long as $x is less than or equal to 100
- $x+=10 - Increase the loop counter value by 10 for each iteration

The PHP foreach Loop

The foreach loop works only on arrays, and is used to loop through each key/value pair in an array.

Syntax

```
foreach ($array as $value) {
  code to be executed;
}
```

For every loop iteration, the value of the current array element is assigned to $value and the array pointer is moved by one, until it reaches the last array element.

Examples

The following example will output the values of the given array ($colors):

Example

```
<?php
$colors = array("red", "green", "blue", "yellow");

foreach ($colors as $value) {
  echo "$value <br>";
}
?>
```

The following example will output both the keys and the values of the given array ($age):

Example

```
<?php
$age = array("Peter"=>"35", "Ben"=>"37", "Joe"=>"43");

foreach($age as $x => $val) {
  echo "$x = $val<br>";
}
?>
```

PHP Break

You have already seen the break statement used in an earlier chapter of this tutorial. It was used to "jump out" of a switch statement.
The break statement can also be used to jump out of a loop.
This example jumps out of the loop when **x** is equal to **4**:

Example

```
<?php
for ($x = 0; $x < 10; $x++) {
  if ($x == 4) {
    break;
  }
  echo "The number is: $x <br>";
}
?>
```

PHP Continue

The continue statement breaks one iteration (in the loop), if a specified condition occurs, and continues with the next iteration in the loop.
This example skips the value of **4**:

Example

```
<?php
for ($x = 0; $x < 10; $x++) {
  if ($x == 4) {
    continue;
  }
  echo "The number is: $x <br>";
}
?>
```

Break and Continue in While Loop

You can also use break and continue in while loops:

Break Example

```
<?php
$x = 0;

while($x < 10) {
  if ($x == 4) {
  break;
  }
  echo "The number is: $x <br>";
  $x++;
}
?>
```

Continue Example

```
<?php
$x = 0;

while($x < 10) {
  if ($x == 4) {
    $x++;
    continue;
  }
  echo "The number is: $x <br>";
  $x++;
}
?>
```

PHP Arrays

An array stores multiple values in one single variable:

Example

```
<?php
$cars = array("Volvo", "BMW", "Toyota");
echo "I like " . $cars[0] . ", " . $cars[1] . " and " . $cars[2] . ".";
?>
```

What is an Array?

An array is a special variable, which can hold more than one value at a time.
If you have a list of items (a list of car names, for example), storing the cars in single variables could look like this:

$cars1 = "Volvo";

$cars2 = "BMW";

$cars3 = "Toyota";

However, what if you want to loop through the cars and find a specific one? And what if you had not 3 cars, but 300?
The solution is to create an array!
An array can hold many values under a single name, and you can access the values by referring to an index number.

Create an Array in PHP

In PHP, the array() function is used to create an array:
array();

In PHP, there are three types of arrays:

- **Indexed arrays** - Arrays with a numeric index
- **Associative arrays** - Arrays with named keys
- **Multidimensional arrays** - Arrays containing one or more arrays

---

Get The Length of an Array - The count() Function

The count() function is used to return the length (the number of elements) of an array:

Example

```
<?php
$cars = array("Volvo", "BMW", "Toyota");
echo count($cars);
?>
```

PHP Indexed Arrays

There are two ways to create indexed arrays:
The index can be assigned automatically (index always starts at 0), like this:
$cars = array("Volvo", "BMW", "Toyota");

or the index can be assigned manually:

```
$cars[0] = "Volvo";
$cars[1] = "BMW";
$cars[2] = "Toyota";
```

The following example creates an indexed array named $cars, assigns three elements to it, and then prints a text containing the array values:

Example

```
<?php
$cars = array("Volvo", "BMW", "Toyota");
echo "I like " . $cars[0] . ", " . $cars[1] . " and " . $cars[2] . ".";
?>
```

Loop Through an Indexed Array

To loop through and print all the values of an indexed array, you could use a for loop, like this:

Example

```
<?php
$cars = array("Volvo", "BMW", "Toyota");
$arrlength = count($cars);

for($x = 0; $x < $arrlength; $x++) {
  echo $cars[$x];
  echo "<br>";
}
?>
```

PHP Associative Arrays

Associative arrays are arrays that use named keys that you assign to them.

There are two ways to create an associative array:

```
$age = array("Peter"=>"35", "Ben"=>"37", "Joe"=>"43");
```

or:

```
$age['Peter'] = "35";
$age['Ben'] = "37";
$age['Joe'] = "43";
```

The named keys can then be used in a script:

Example

```
<?php
$age = array("Peter"=>"35", "Ben"=>"37", "Joe"=>"43");
echo "Peter is " . $age['Peter'] . " years old.";
?>
```

Loop Through an Associative Array

To loop through and print all the values of an associative array, you could use a foreach loop, like this:

Example

```
<?php
$age = array("Peter"=>"35", "Ben"=>"37", "Joe"=>"43");

foreach($age as $x => $x_value) {
  echo "Key=" . $x . ", Value=" . $x_value;
  echo "<br>";
}
?>
```

PHP - Multidimensional Arrays

A multidimensional array is an array containing one or more arrays.

PHP supports multidimensional arrays that are two, three, four, five, or more levels deep. However, arrays more than three levels deep are hard to manage for most people.

The dimension of an array indicates the number of indices you need to select an element.

- For a two-dimensional array you need two indices to select an element
- For a three-dimensional array you need three indices to select an element

---

PHP - Two-dimensional Arrays

A two-dimensional array is an array of arrays (a three-dimensional array is an array of arrays of arrays).

First, take a look at the following table:

Name	Stock	Sold
Volvo	22	18
BMW	15	13
Saab	5	2
Land Rover	17	15

We can store the data from the table above in a two-dimensional array, like this:

```
$cars = array (
  array("Volvo",22,18),
  array("BMW",15,13),
  array("Saab",5,2),
  array("Land Rover",17,15)
);
```

Now the two-dimensional $cars array contains four arrays, and it has two indices: row and column.
To get access to the elements of the $cars array we must point to the two indices (row and column):

Example

```
<?php
echo $cars[0][0].": In stock: ".$cars[0][1].", sold: ".$cars[0][2].".<br>";
echo $cars[1][0].": In stock: ".$cars[1][1].", sold: ".$cars[1][2].".<br>";
echo $cars[2][0].": In stock: ".$cars[2][1].", sold: ".$cars[2][2].".<br>";
echo $cars[3][0].": In stock: ".$cars[3][1].", sold: ".$cars[3][2].".<br>";
?>
```

We can also put a for loop inside another for loop to get the elements of the $cars array (we still have to point to the two indices):

Example

```
<?php
for ($row = 0; $row < 4; $row++) {
  echo "<p><b>Row number $row</b></p>";
  echo "<ul>";
  for ($col = 0; $col < 3; $col++) {
    echo "<li>".$cars[$row][$col]."</li>";
  }
  echo "</ul>";
}
?>
```

PHP - Sort Functions For Arrays

In this chapter, we will go through the following PHP array sort functions:

- sort() - sort arrays in ascending order
- rsort() - sort arrays in descending order
- asort() - sort associative arrays in ascending order, according to the value

- ksort() - sort associative arrays in ascending order, according to the key
- arsort() - sort associative arrays in descending order, according to the value
- krsort() - sort associative arrays in descending order, according to the key

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Sort Array in Ascending Order - sort()

The following example sorts the elements of the $cars array in ascending alphabetical order:

Example

```
<?php
$cars = array("Volvo", "BMW", "Toyota");
sort($cars);
?>
```

The following example sorts the elements of the $numbers array in ascending numerical order:

Example

```
<?php
$numbers = array(4, 6, 2, 22, 11);
sort($numbers);
?>
```

Sort Array in Descending Order - rsort()

The following example sorts the elements of the $cars array in descending alphabetical order:

Example

```
<?php
$cars = array("Volvo", "BMW", "Toyota");
rsort($cars);
?>
```

The following example sorts the elements of the $numbers array in descending numerical order:

Example

```
<?php
$numbers = array(4, 6, 2, 22, 11);
rsort($numbers);
?>
```

Sort Array (Ascending Order), According to Value - asort()

The following example sorts an associative array in ascending order, according to the value:

Example

```
<?php
$age = array("Peter"=>"35", "Ben"=>"37", "Joe"=>"43");
asort($age);
?>
```

Sort Array (Ascending Order), According to Key - ksort()

The following example sorts an associative array in ascending order, according to the key:

Example

```
<?php
$age = array("Peter"=>"35", "Ben"=>"37", "Joe"=>"43");
ksort($age);
?>
```

Sort Array (Descending Order), According to Value - arsort()

The following example sorts an associative array in descending order, according to the value:

Example

```
<?php
$age = array("Peter"=>"35", "Ben"=>"37", "Joe"=>"43");
arsort($age);
?>
```

Sort Array (Descending Order), According to Key - krsort()

The following example sorts an associative array in descending order, according to the key:

Example

```
<?php
$age = array("Peter"=>"35", "Ben"=>"37", "Joe"=>"43");
krsort($age);
?>
```

PHP $_GET

PHP $_GET is a PHP super global variable which is used to collect form data after submitting an HTML form with method="get".

$_GET can also collect data sent in the URL.

Assume we have an HTML page that contains a hyperlink with parameters:

```
<html>
<body>

<a href="test_get.php?subject=PHP&web=W3schools.com">Test $GET</a>

</body>
</html>
```

When a user clicks on the link "Test $GET", the parameters "subject" and "web" are sent to "test_get.php", and you can then access their values in "test_get.php" with $_GET.
The example below shows the code in "test_get.php":

Example

```
<html>
<body>

<?php
echo "Study " . $_GET['subject'] . " at " . $_GET['web'];
?>

</body>
</html>
```

PHP $_POST

PHP $_POST is a PHP super global variable which is used to collect form data after submitting an HTML form with method="post". $_POST is also widely used to pass variables.
The example below shows a form with an input field and a submit button. When a user submits the data by clicking on "Submit", the form data is sent to the file specified in the action attribute of the <form> tag. In this example, we point to the file itself for processing form data. If you wish to use another PHP file to process form data, replace that with the filename of your choice. Then, we can use the super global variable $_POST to collect the value of the input field:

Example

```
<html>
<body>

<form method="post" action="<?php echo $_SERVER['PHP_SELF'];?>">
  Name: <input type="text" name="fname">
  <input type="submit">
</form>

<?php
if ($_SERVER["REQUEST_METHOD"] == "POST") {
  // collect value of input field
  $name = $_POST['fname'];
  if (empty($name)) {
    echo "Name is empty";
  } else {
    echo $name;
  }
}
?>
```

```
</body>
</html>
```

PHP Sessions

When you work with an application, you open it, do some changes, and then you close it. This is much like a Session. The computer knows who you are. It knows when you start the application and when you end. But on the internet there is one problem: the web server does not know who you are or what you do, because the HTTP address doesn't maintain state.
Session variables solve this problem by storing user information to be used across multiple pages (e.g. username, favorite color, etc). By default, session variables last until the user closes the browser.
So; Session variables hold information about one single user, and are available to all pages in one application.

Start a PHP Session

A session is started with the session_start() function.
Session variables are set with the PHP global variable: $_SESSION.
Now, let's create a new page called "demo_session1.php". In this page, we start a new PHP session and set some session variables:

Example

```
<?php
// Start the session
session_start();
?>
<!DOCTYPE html>
<html>
<body>

<?php
// Set session variables
$_SESSION["favcolor"] = "green";
$_SESSION["favanimal"] = "cat";
echo "Session variables are set.";
?>

</body>
</html>
```

Get PHP Session Variable Values

Next, we create another page called "demo_session2.php". From this page, we will access the session information we set on the first page ("demo_session1.php").
Notice that session variables are not passed individually to each new page, instead they are retrieved from the session we open at the beginning of each page (session_start()).
Also notice that all session variable values are stored in the global $_SESSION variable:

Example

```
<?php
session_start();
?>
<!DOCTYPE html>
<html>
<body>

<?php
// Echo session variables that were set on previous page
echo "Favorite color is " . $_SESSION["favcolor"] . ".<br>";
echo "Favorite animal is " . $_SESSION["favanimal"] . ".";
?>

</body>
</html>
```

Another way to show all the session variable values for a user session is to run the following code:

Example

```
<?php
session_start();
?>
<!DOCTYPE html>
<html>
<body>

<?php
print_r($_SESSION);
?>

</body>
</html>
```

Modify a PHP Session Variable

To change a session variable, just overwrite it:

Example

```
<?php
session_start();
?>
<!DOCTYPE html>
<html>
<body>
```

```php
<?php
// to change a session variable, just overwrite it
$_SESSION["favcolor"] = "yellow";
print_r($_SESSION);
?>

</body>
</html>
```

Destroy a PHP Session

To remove all global session variables and destroy the session,
use session_unset() and session_destroy():

Example

```php
<?php
session_start();
?>
<!DOCTYPE html>
<html>
<body>

<?php
// remove all session variables
session_unset();

// destroy the session
session_destroy();
?>

</body>
</html>
```