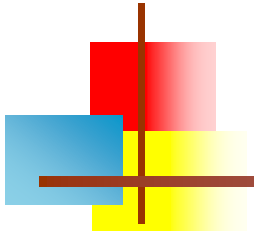


# Introduction



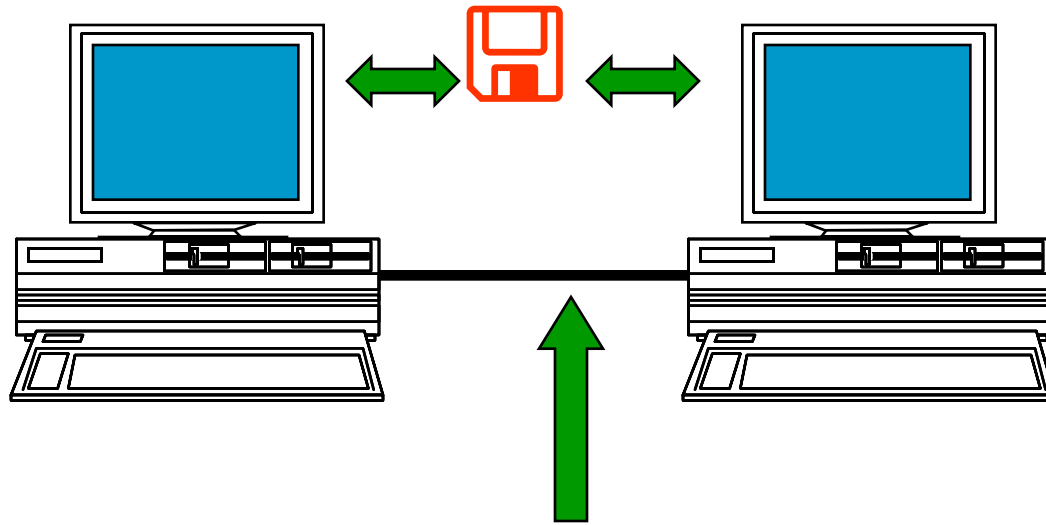
to

# INTERNET



# Network

A **network** is defined as a group of two or more computer systems connected together.



A Cable connecting two **Serial ports** or two **Parallel ports**

A **network** is a set of devices (**computers** or **nodes**) connected by communication links on the network.

- Computer network means an interconnected collection of computers (or multiple processors s/w & h/w) such that they can:
  - *exchange information*
  - *sharing resources* each other(printer, scanner etc.)
  - increase computation power
  - high reliability
  - Internetworking
- **Examples:**
  - Internet, Cellular Network

The **NIC(Network Interface Cards)** provides the physical connection between the network and the computer workstation.

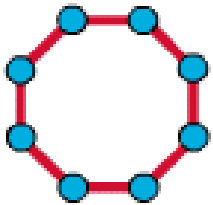
# Categories of topology

The term **topology** refers to the way in which a network is laid out **physically**. Two or more devices connect to a link that forms a topology.



**Bus**

A **bus** network is a network **topology** in which nodes are directly connected to a common linear (or branched) half-duplex link called a **bus**.



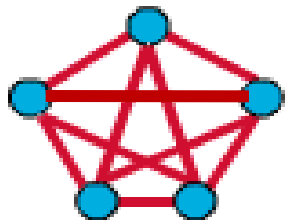
**Ring**

A **ring** network is a network **topology** in which each node connects to exactly two other nodes, forming a single continuous pathway for signals through each node - a **ring**. There are two types of the Ring Topology: 1) Unidirectional 2) Bidirectional



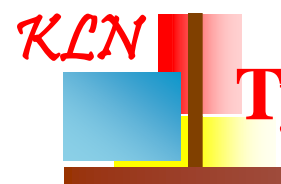
**Star**

A **star topology** is a **topology** for a Local Area Network (LAN) in which all nodes are individually connected to a central connection point, like a hub or a switch. A **star** takes more cable than e.g. a bus, but the benefit is that if a cable fails, only one node will be brought down. It is Full-duplex.



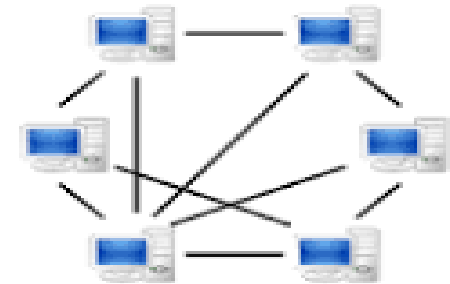
**Mesh**

Each host has its own connection to every other host. Used in situations where communication **must not** be interrupted. It can be applied to both wired and wireless networks.

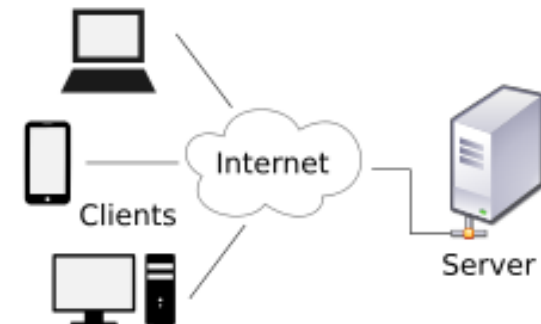


# Types networks based on the roles of the computers

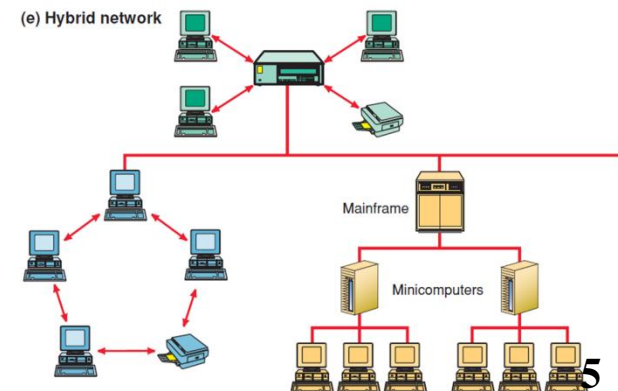
**P2P (also called-peer-to-peer)**, is created when two or more PCs are connected and share resources without going through a separate server computer.



**Server-based (also called client-server)**, is a network in which each computer on the network is either a **client** or a **server**. Servers are powerful computers dedicated to managing disk drives (file servers), printers, or network servers.



**Hybrid networks**, are the networks that are based on both peer-to-peer & client-server relationship.



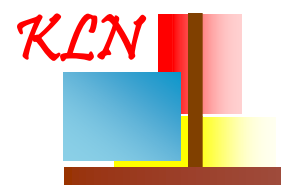


# Categories of Networks based on Topology

**LAN** (Local Area Network) is a network that is confined to a relatively small area. It is generally limited to a geographic area such as a lab, school, or building. LANs can span over a limited range i.e. of 1 km in radius. Many devices such as; routers, Ethernet switches, hubs, repeaters, and bridges are used for LAN.

**MAN** (metropolitan area network) is a network with a size between a LAN and a WAN. It normally covers the area inside a town or a city. A good example of a MAN is the part of the telephone company network that can provide a high-speed DSL(Digital Subscriber Line) line to the customer. MANs can span in the range of 5 to 50 kilometers in diameter.

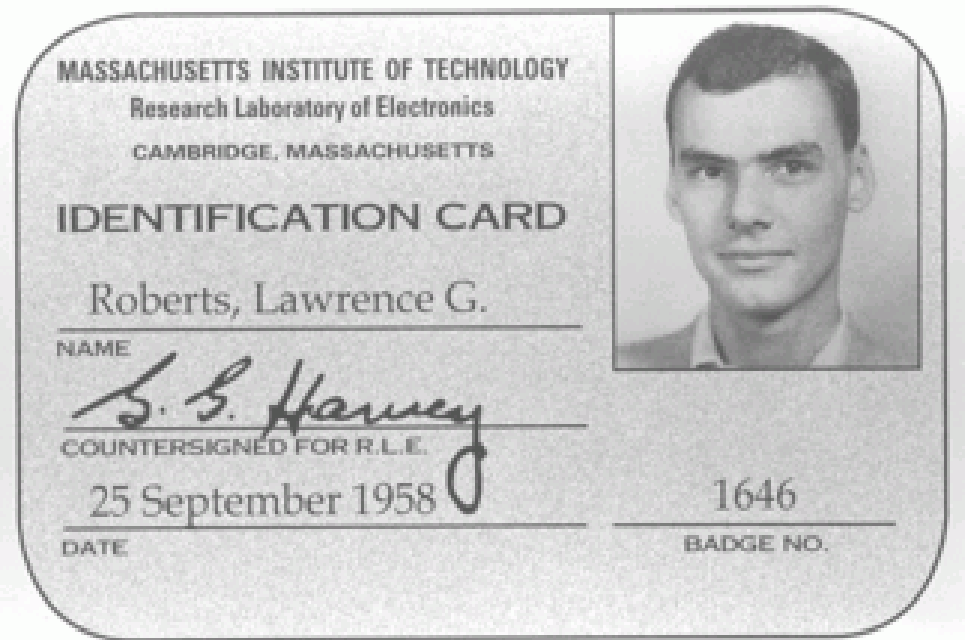
**WAN** (wide area network) provides long-distance transmission of data, image, audio, and video information over large geographic areas that may comprise a country, a continent, or even the whole world. WANs can span over a range of huge area of 100,000 kilometer radius (between the Earth and artificial satellites). A few common devices that are used in WANs are: routers, communication servers, and modems.



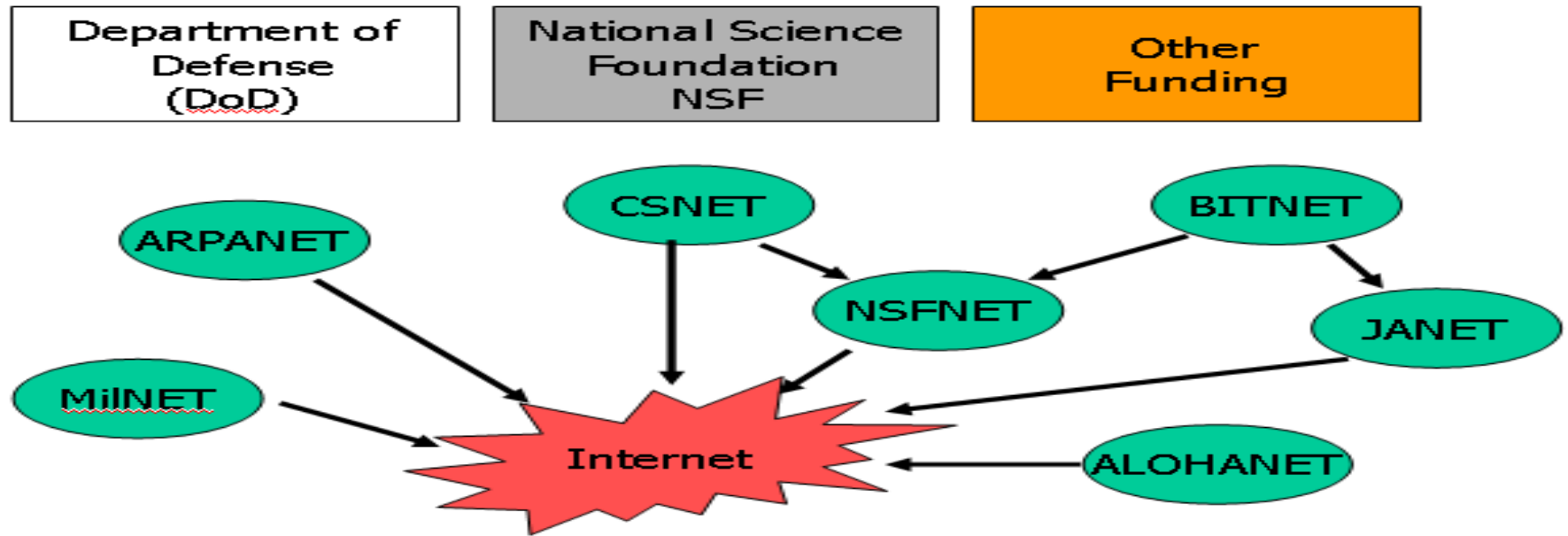
# The Birth of ARPA

**ARPANET was the first wide area packet switching network developed by ARPA (Advanced Research Project Agency) during 1969.**

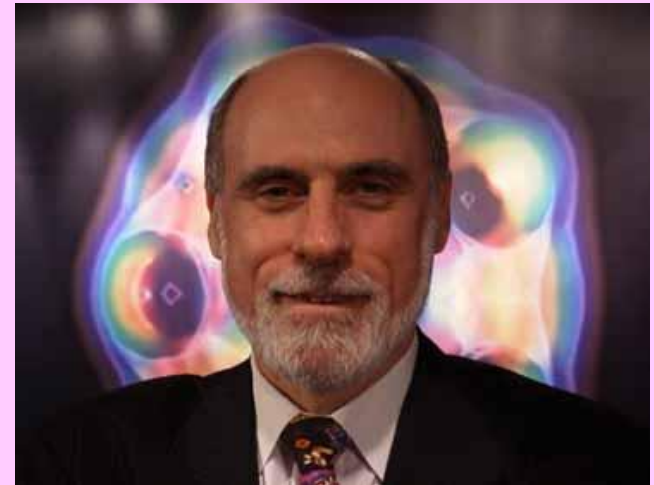
ARPANET was initially funded by the ARPA of the United States Department of Defense (DoD).



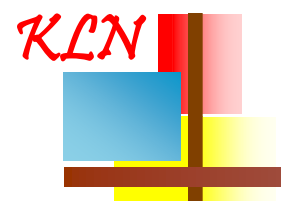
# The Internet



In 1970s **Vint Cerf** (is known as the father of the internet) designed the TCP/IP network protocol and breaks the independent self-contained networks, forms TCP/IP which becomes the standard.







# The Internet

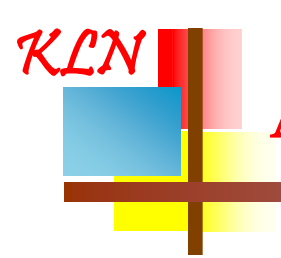
- Internet is a world-wide/global system of interconnected computer networks.
- Internet uses the standard Internet Protocol (TCP/IP)
- Every computer in internet is identified by a unique IP address.
- IP Address is a unique set of numbers (such as 110.22.33.114) which identifies a computer location.
- A special computer **DNS (Domain Name System)** is used to give name to the IP Address so that user can locate a computer by a name.
- For example, a DNS server will resolve a name **nist.edu** to a IP address **205.242.20.43** to uniquely identify the computer on which this website is hosted. For Google.com it is **172.217.161.14**.
- Internet is accessible to every user all over the world.

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.

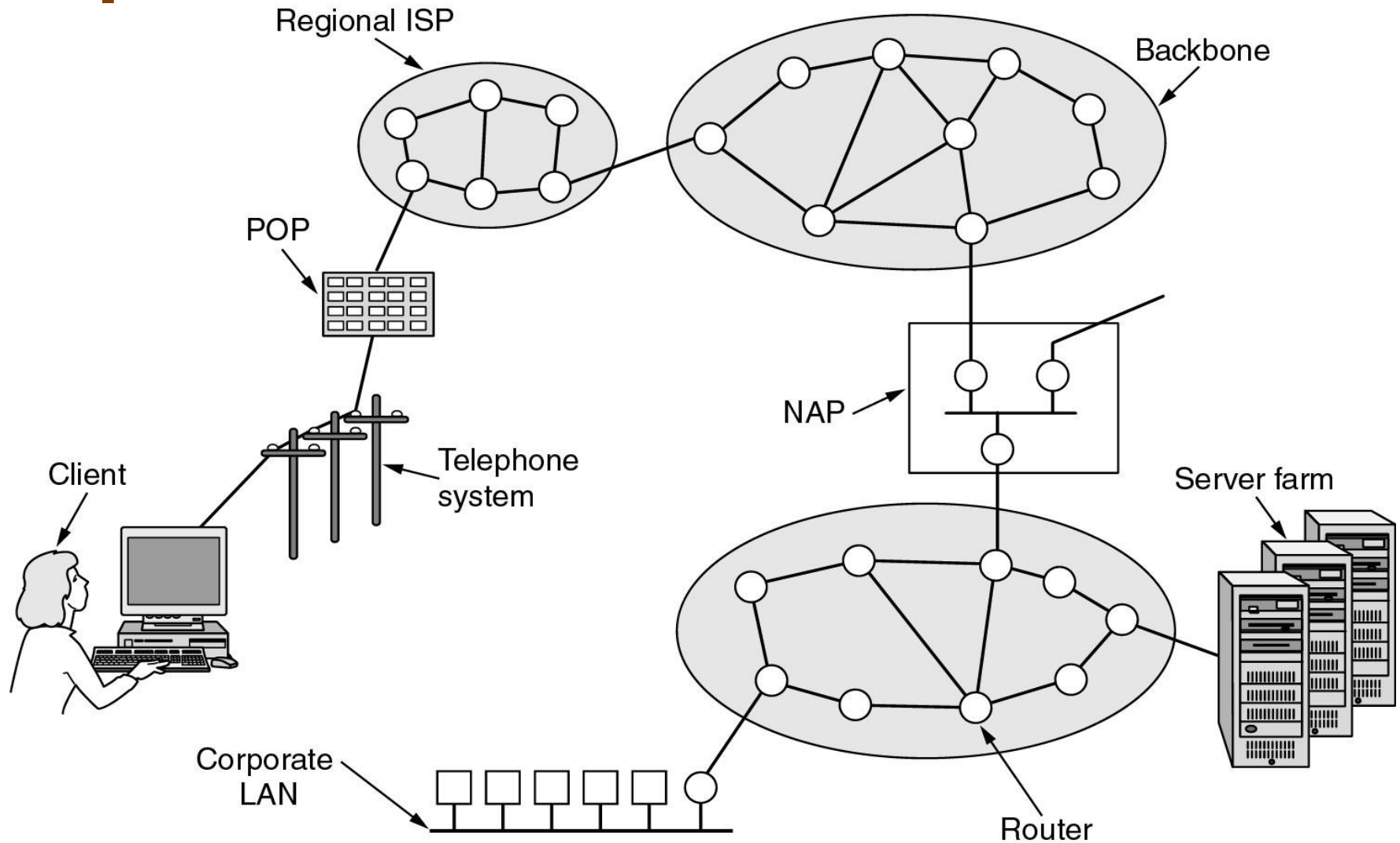
Internet is the largest group of networks, that uses the standard **protocols** to exchange information.

**Protocols:** It is a procedure a computer uses to transmit or exchange files, enabling computers of different platform types to communicate in a standardized fashion.



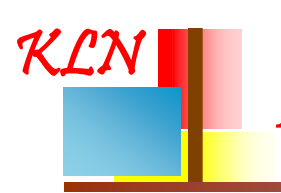


# Architecture of the Internet



In the last two decades the internet of India has changed a lot and that has brought many Internet Service Providers for service. With the increase of users, internet has become one of the biggest challenge in the country.

Rank	Internet Service Provider
1	Aircel
2	Airtel
3	Atria Convergence Technologies
4	BSNL
5	Idea Cellular
6	JIO
7	MTNL
8	Reliance Communications
9	Tata Teleservices
10	Telenor India
11	Videocon
12	Vodafone



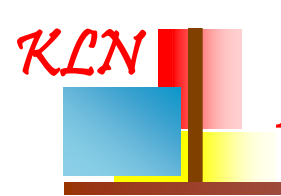
# Advantages of Internet

**E-mail:** With e-mail you can send and receive instant electronic messages, which works like writing letters. Your messages are delivered instantly to people anywhere in the world. Email is free, fast and very cheap when compared to telephone, fax and postal services.

**24 hours a day:** Internet is available in 24x7 days for usage.

**Information:** There is a huge amount of information available on the internet for just about every subject, ranging from government law and services, trade fairs and conferences, market information, new ideas and technical support.

**Online Chat:** You can access many 'chat rooms' on the web that can be used to meet new people, make new friends, as well as to stay in touch with old friends.



# Advantages of Internet

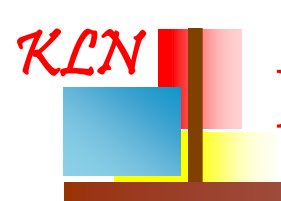
**Services:** Many services are provided on the internet like net banking, job searching, purchasing tickets, hotel reservations etc.

**Communities:** Its a great way to meet up with people of similar interest and discuss common issues.

**E-commerce:** There are many online stores and sites that can be used to look for products sell as well as buy them using your debit/credit card.

**Entertainment:** Internet provides facility to access wide range of Audio/Video songs, plays films. Many of which can be downloaded through YouTube.

**Software Downloads:** You can freely download innumerable, softwares like utilities, games, music, videos, movies, etc from the Internet.



# Limitations of Internet

**Theft of Personal information:** Electronic messages sent over the Internet can be easily snooped and tracked, revealing who is talking to whom and what they are talking about. If you use the Internet, your personal information such as your name, address, credit card, bank details and other information can be accessed or stolen by unauthorized persons.

**Negative effects on family communication:** It is generally observed that due to more time spent on Internet, there is a decrease in communication and feeling of togetherness among the family members.

**Internet addiction:** Some researchers claim that some users are addicted to the Internet. Children using the Internet has become dangerous.

**Virus threat:** Today, not only are humans getting viruses, but computers are also. Computers are mainly getting these viruses from the Internet.

**Spamming:** It is often viewed as the act of sending unsolicited email.

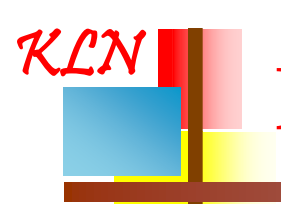
An intranet is a private network or internet connection established within an organization or a building. The information shared among these systems is private and not available to the public networks. Basically, an intranet is built using TCP/ IP protocols and other internet protocols.

The websites and software applications in intranet appear like any others, but the security and firewall surrounded by intranet keep away unauthorized users.

The major purpose of an intranet is to share information and resources among the employees within the company.

Nowadays, Intranets are the fastest growing division of internet as they are very less expensive to build and manage than any other private networks.





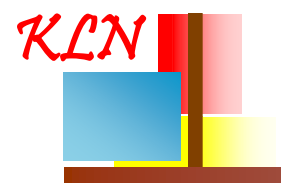
# Benefits of Intranet

**Productivity:** It helps employees to view the information faster and access applications as per their roles. This helps the organizations to restrict access to certain resources and utilize the rest of the data from anywhere within their network it increases the performance of employees.

**Communication:** It provides up-to-date strategic information related to the organization. Example: Nestle has benefited from intranets, which reduced their everyday query calls.

**Web publishing:** Using web technologies we can publish the list of employees, manuals, policies, news, materials, and business documents on the intranet.

**Cost effective:** Data related to employees can be viewed via web-browser, without having to maintain any hard copy which saves money.



# Internet vs. Intranet

## Similarities in Internet & Intranet

Intranet uses the internet protocols such as TCP/IP and FTP.

Intranet sites are accessible via web browser in similar way as websites in internet. But only members of Intranet network can access intranet hosted sites.

In Intranet, own instant messengers can be used as similar to yahoo messenger/gtalk over the internet.

## Differences in Internet & Intranet

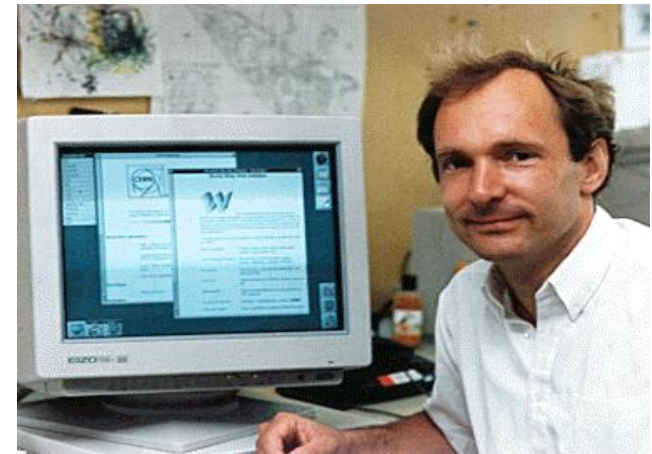
Internet is general to PCs all over the world where Intranet is specific to few PCs.

Internet is wider access and provides a better access to websites to large population whereas Intranet is restricted.

Internet is not as safe as Intranet as Intranet can be safely privatized as per the need.

# World Wide Web History

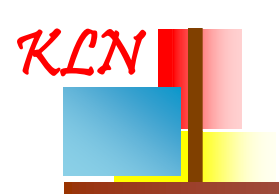
- In the year 1990 Tim Berners-Lee invents the World Wide Web
  - Means for transferring text and graphics simultaneously
  - Client/Server data transfer protocol
    - Communication via application level protocol
    - System ran on top of standard networking infrastructure
  - Text mark up language
    - Simple and easy to use
    - Requires a client application to render text/graphics
    - Established a *common language* for sharing information on computers



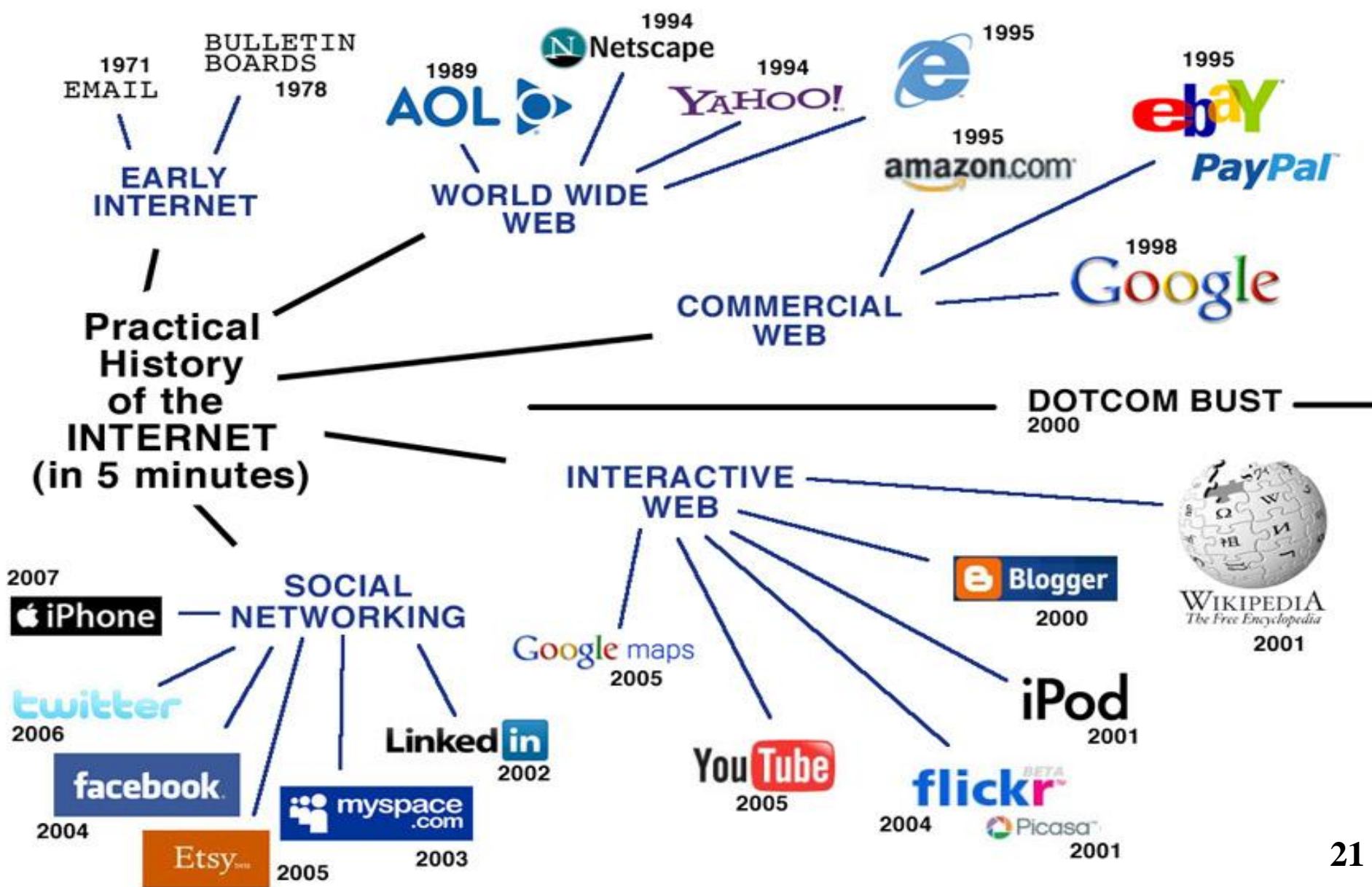


# Internet and WWW

Internet	WWW
Nature of Internet is hardware. Developed by <b>Vint Cerf in 1970.</b>	Nature of www is software. Invented by <b>Tim Berners-Lee in 1989.</b>
The first version of the Internet was known as ARPANET	In the beginning WWW was known as NSFNET
Decentralized design that there is no centralized body controls how the Internet functions.	These documents are accessed by web browsers and provided by web servers.
Internet connecting computers.	World Wide Web connecting people.
It consists of computers, routers, cables, bridges, servers, cellular towers, satellites etc.	It consists of information like text, images, audio, video etc. that are connected by hyper-links.
Internet works on the basis of Internet Protocol (TCP/IP)	WWW works on the basis of Hyper Text Transfer Protocol (HTTP)
Internet is superset of WWW	WWW is a subset of the Internet.



# Growth of Internet



**No one person, company, organization or government runs the Internet. It is a globally distributed network comprising many voluntarily interconnected autonomous networks.**

Internet Corporation for Assigned Names and Numbers (**ICANN**) plays a unique **role** in the infrastructure of the Internet. Through its contracts with registries (such as dot-com or dot-info) and registrars (companies that sell domains names to individuals and organisations).

Internet Assigned Numbers Authority(**IANA**) is a department of ICANN that co-ordinates and maintains the number systems that keep the internet running like IP addresses & DNS.

The Internet Society (**ISOC**) is an American non-profit organization founded in 1992 to provide leadership in Internet-related standards, education, access, and policy. Its mission is "to promote the open development, evolution and use of the Internet for the benefit of all people throughout the world".



The **world wide web** is nothing but a system of interlinked networks of hypertext documents accessed via the internet(multimedia files). With the help of a web browser one can view web pages that may contain text, images, video, audio and other multi media files.

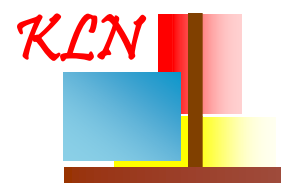
Two important innovations become key elements of the internet are hypertext and GUI for hypertext.

By 1990, with the help of Robert Cailliau, Berners-Lee developed the skeletal outline of the internet, including a web browser and web server.

In 1993, with the release of the Mosaic web browser, which allowed users to explore multimedia online. 1993 also saw the introduction of the first modern search engines.

In this same year, Berners-Lee founded the world wide web Consortium (W3C) to make the web standards.





# Emergence of web cont..

## Web 2.0

Web 2.0 is characterized by interactive websites, social knowledge sharing, user-generated content, online collaboration, embedded applications and multimedia, mobile connections, and social media.

## The Mobile Web

Around the same time more users began to access online content via their mobile phones. Millions of smart phones started selling each year, the internet quickly adapted for mobile users.

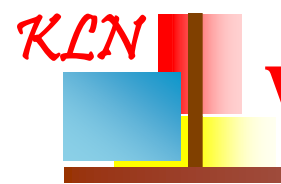
## The Internet of Things(IOT)

The internet allows us to control everyday appliances from across the room or on the other side of the country. Our devices can now contact us, letting us know when our car needs maintenance, alerting us when the room temperature gets too low, etc. **In the coming years, more and more of the devices we interact with every day will be just as connected to the world wide web as we are.**



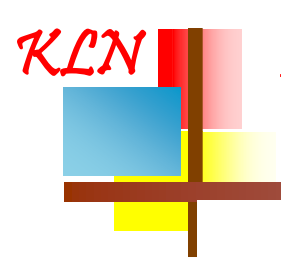
The Web standards are not defined or setup by the browser companies or Microsoft, but the World Wide Web Consortium (W3C). It's goals are:

- **Universal Access:** To make the Web accessible to all by promoting technologies that take into account the vast differences in culture, languages, education, ability, material resources, and physical limitations of users on all continents;
- **Semantic Web:** To develop a software environment that permits each user to make the best use of the resources available on the Web;
- **Web of Trust:** To guide the Web's development with careful consideration for the novel legal, commercial, and social issues rose by this technology.

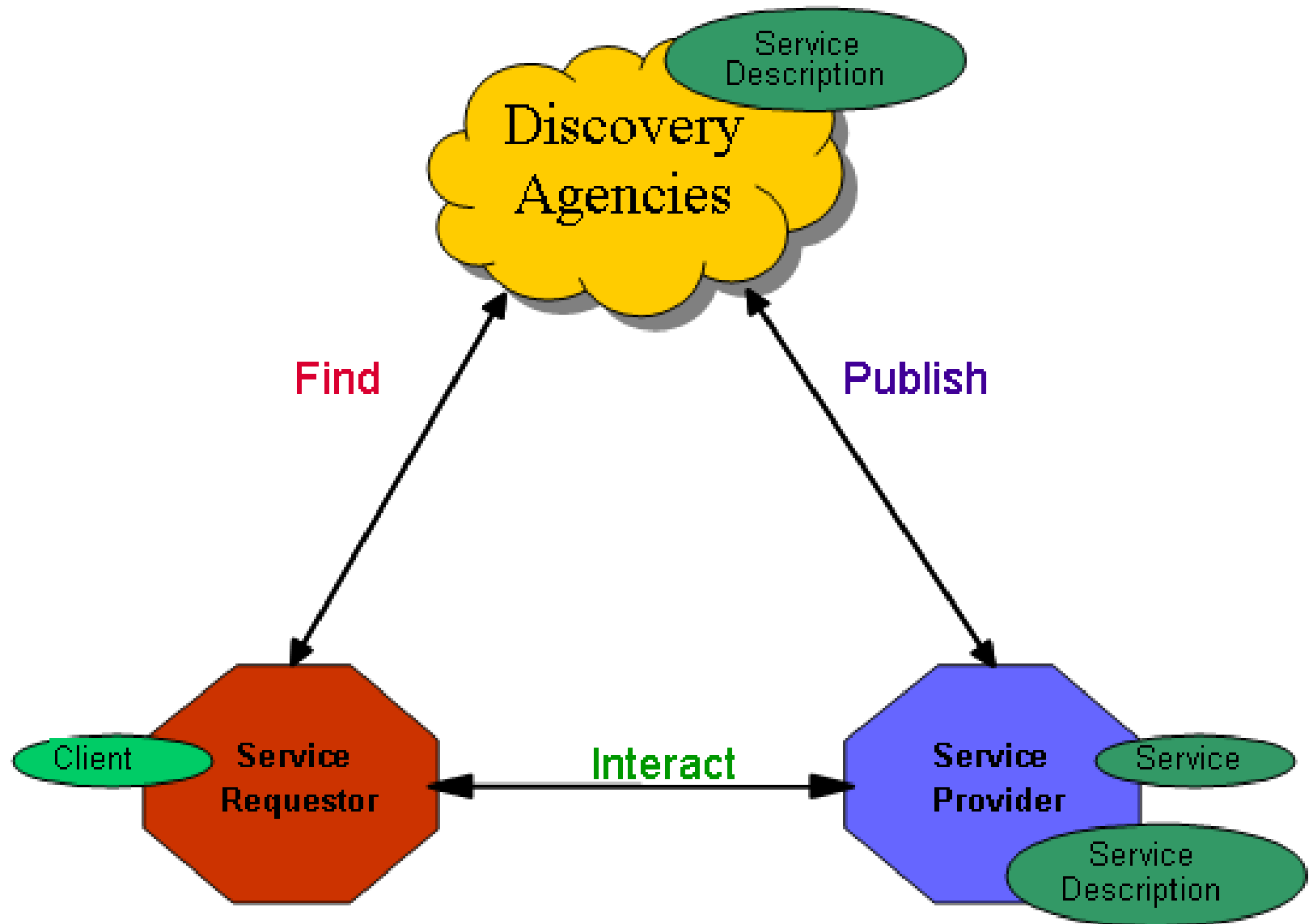


# World Wide Web Consortium(W3C)

- World Wide Web Consortium (**W3C**): Creates standards for the World Wide Web that enable an Open Web Platform, for example, by focusing on issues of accessibility, internationalization, and mobile web solutions.
- In 1994, the **World Wide Web Consortium** (W3C) was created to "Lead the Web to Its Full Potential".
- The W3C was formed with the charter to define the standards for HTML, Cascading Style Sheet(CSS), and Extensible Markup Language (XML) standards, as well as related standards for document addressing on the Web. Members are responsible for drafting, circulating for review, and modifying the standard based on cross-Internet feedback to best meet the needs of the many.



# Web Service Architecture



## ■ Client

- Any computer on the network that requests services from another computer on the network.

## ■ Server

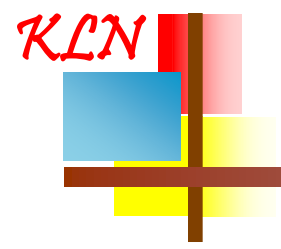
- Any computer that receives requests from client computers, processes and sends the output.

## ■ Web Page

- Any page that is hosted on the Internet.

## ■ Web Development

- The process of creating, modifying web pages.



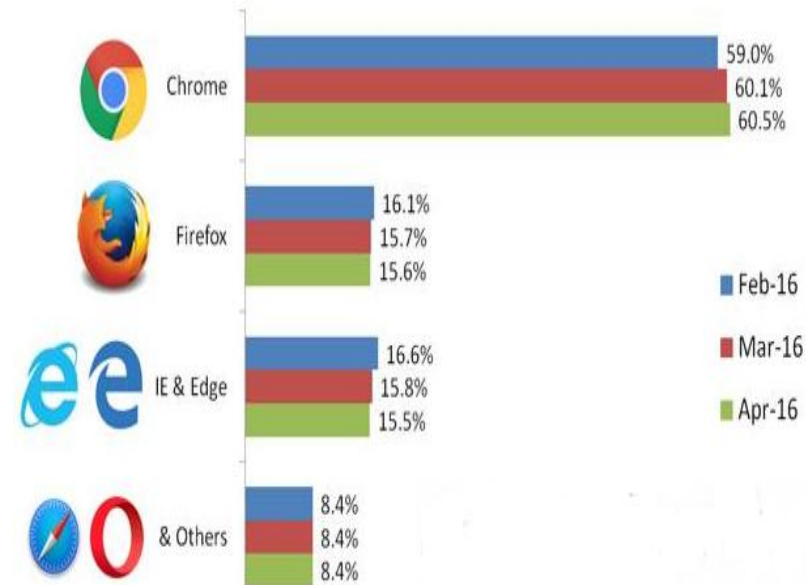
# How does the Web work?

- The web information is stored in the Web pages.
  - In HTML format.
- The web pages are stored in the computers called Web servers.
  - In the Web server file system.
- The computer reading the pages is called web clients with specific web browser.
  - Most commonly Internet Explorer or Netscape.
- The web server waits for the request from the web clients over the Internet.
  - Internet Information Server (IIS) or Apache.

- A browser is a Web application that uses HTTP protocol to interact with the Web server.
- It obtains files and data requested by the user through the server from remote sites.
- The location of the page is written as a URL (Uniform Resource Locator)
- It renders (formats and displays) text and graphics in the browser window.

## Types of Browsers

Worldwide Desktop Browser Usage Share



# Different Types of Servers

## 1. Application Server

It occupies a substantial amount of computing space between database servers and the end user and is commonly sometimes used to connect the two.

## 2. Chat Server

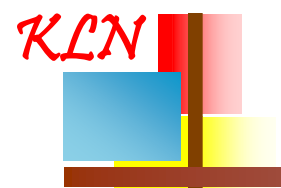
It serves the users to exchange data in an environment similar to Internet newsgroup which provides real time discussion capabilities.

## 3. FTP Server

It works on one of the oldest of the Internet services, the file transfer protocol. It provides a secure file transfer between computers while ensuring file security and transfer control.

## 4. Telnet Server

Telnet is a terminal emulation program that runs on your computer and connects your PC to a server on the network. You can then enter commands through the Telnet program and they will be executed as if you were entering them directly on the server console. This enables you to control the server and communicate with other servers on the network. To start a Telnet session, you must log in to a server by entering a valid username and password.



# Different Types of Servers

## 5. Mail Server

It transfers and stores mails over corporate networks through LANs, WANs and across the Internet.

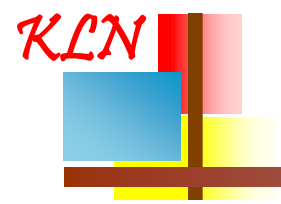
## 6. News Server

It serves as a distribution and delivery source for many public news groups, approachable over the USENET news network.

## 7. Proxy Server

A proxy server is a computer that offers a computer network service to allow clients to make indirect network connections to other network services. A client connects to the proxy server, then requests a connection, file, or other resource available on a different server. The proxy provides the resource either by connecting to the specified server or by serving it from a cache. It acts as a mediator between a client program and an external server to filter requests and improve performance.





# Different Types of Servers

## 8 Web Server

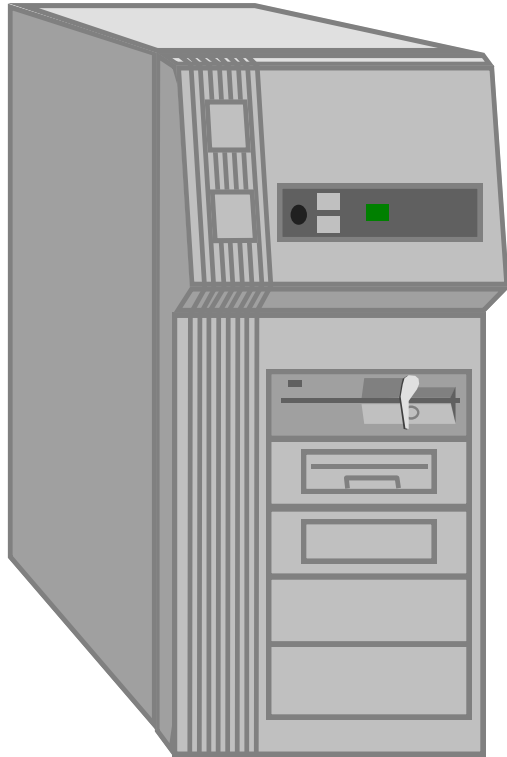
It provides static content to a web browser by loading a file from a disk and transferring it across the network to the user's web browser. This exchange is intermediated by the browser and the server, communicating using HTTP.

## 9 Database servers

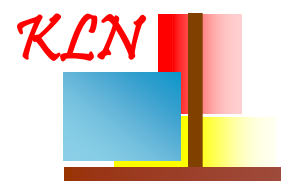
In database servers, clients pass SQL (Structured Query Language) requests as messages to the server and the results of the query are returned over the network.

## 10 Transaction servers

Clients invoke remote procedures that reside on servers which also contain an SQL database engine. There are procedural statements on the server to execute a group of SQL statements (transactions) which either all succeed or fail as a unit. The applications based on transaction servers are called On-line Transaction Processing (OLTP).



- A WWW server is where the information that you browse on the Internet is held
- It may be located anywhere in the world
- You can use WWW search engines to search for information published on Internet servers
- Servers are connected to the rest of the Internet 24 hours a day!
- They allow you to send your learning content over the internet using the Hypertext markup language (HTML)
- The web server accepts page requests that are generated when users type a URL (uniform resource locator) into web browsers like internet explorer and netscape and then returns that appropriate HTML documents.



# Popular Web Servers

## Web Server

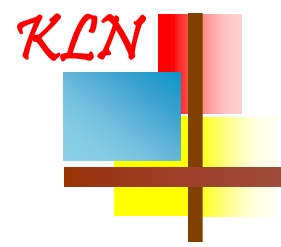
## Supported platforms

Internet information server	WINDOWS NT, WINDOWS 2000+
Apache	WINDOWS NT, LINUX, WINDOWS 95 WINDOWS 98+, SOLARIS, UNIX.
Java server	WINDOWS NT, LINUX, WINDOWS 95 WINDOWS 98+, SOLARIS, UNIX.
Lotus Domino Go Webserver	UNIX, WINDOWS NT, WINDOWS 95+ SOLARS
Stronghold secure web server	UNIX, LINUX, SOLARIS
Oracle Web application server	WINDOWS NT, WINDOWS 95+, SOLARIS
I planet	SOLARIS, WINDOWS NT

A firewall is a **network security system** designed to prevent unauthorized access to or from a private network. Firewalls can be implemented in both hardware and software, or a combination of both.

A firewall is a software program or piece of hardware that helps screen out hackers, viruses, and worms that try to reach your computer over the Internet.





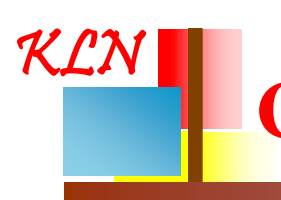
# Data Communication

- The word **data** refers to information presented in whatever form is agreed upon by the parties creating and using the data.
- **Data communications** are the **exchange of data between two or more devices** through **some form of transmission medium**. Data communication is the active process of transporting data from one point to another.
- Transmission Medium used can be a **wired medium** or a **wireless medium**.



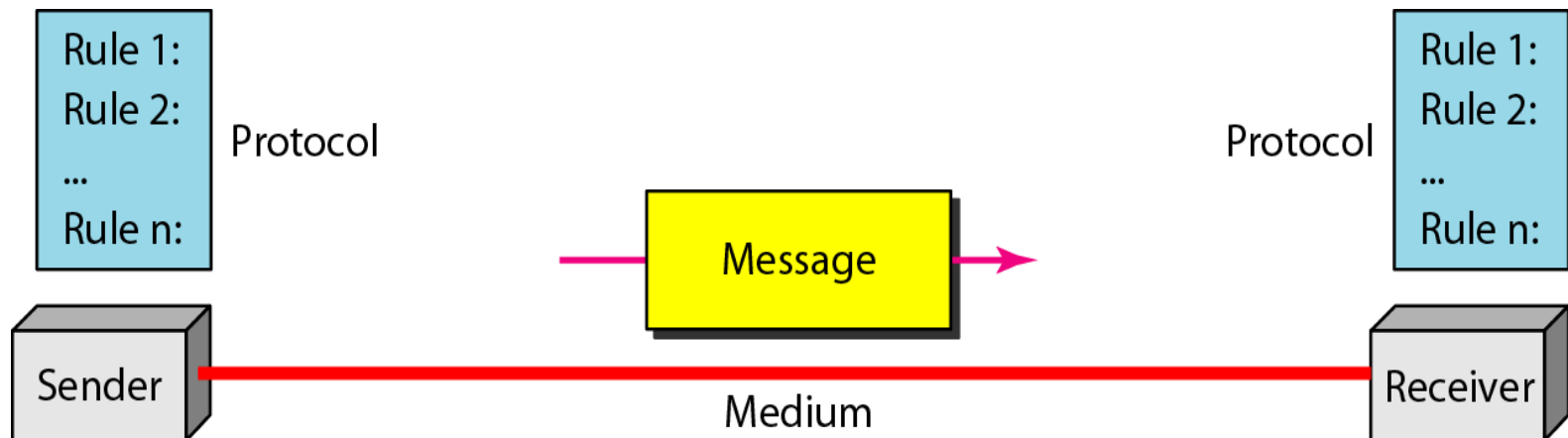
# Characteristics of Data Communication

- **Delivery**
  - ✓ The system must deliver data to the correct destination
- **Accuracy**
  - ✓ The system must deliver the data accurately.
- **Timeliness**
  - ✓ The system must deliver data in a timely manner
  - ✓ Data delivered late are useless.



# Components of Data Communication System

- **Sender:** Sends the data message
  - ✓ **Ex:-** Computer, workstation, telephone handset, Video camera & so on.
- **Receiver:** Receives the data message
  - ✓ **Ex:-** Computer, telephone, television etc.
- **Transmission Medium:** A message travels from sender to receiver.
  - ✓ **Ex:-** A twisted-pair wire, coaxial cable, fiber-optic cable or radio waves
- **Messages:** The information (data) to be communicated
  - ✓ **Ex:-** Text, numbers, pictures, sound, video etc.
- **Protocol:** A set of rule that governs the data communication.



- ✓ Protocol is a set of rules.
- ✓ It represents an agreement between the communicating devices.
- ✓ Without a protocol two devices may be connected but not communicating.

**A protocol defines what is communicated, how it is communicated, and when it is communicated.** The key elements of a protocol are:

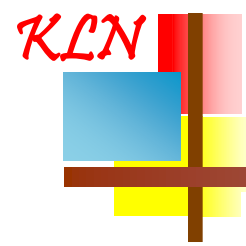
- **Syntax:** The structure or format of the data.
- **Semantics:** The meaning of each section of bits. How is a particular pattern to be interpreted & what action is to be taken.
- **Timing:** Two characteristics
  - ✓ When data should be sent
  - ✓ how fast they can be sent.



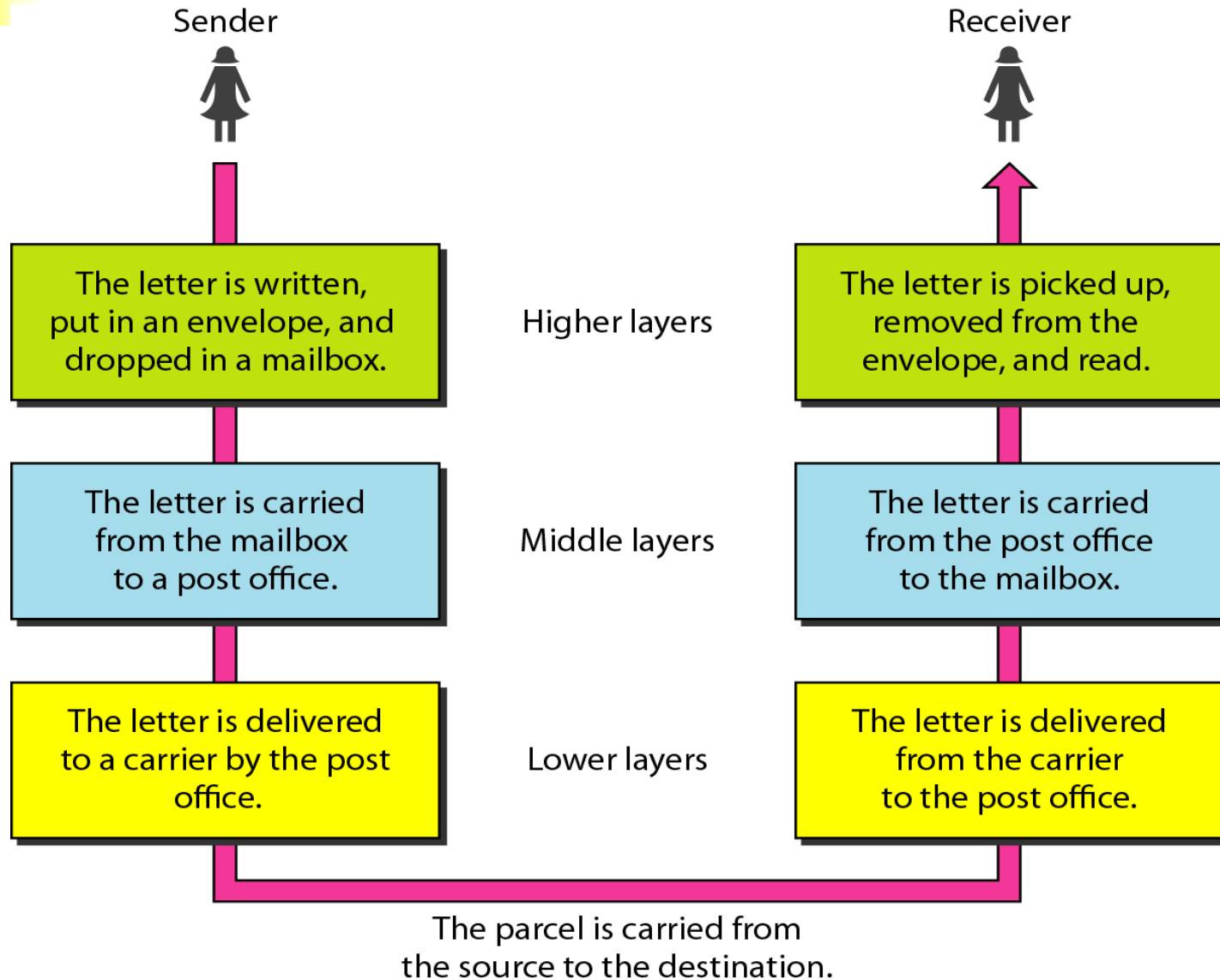


# Layered Task

- We use the concept of **layers** in our daily life.
- As an example, let us consider two friends who communicate through postal mail.
- The process of sending a letter to a friend would be complex if there were no services available from the post office.
- Three component
  - ✓ Sender
  - ✓ Receiver
  - ✓ Carrier



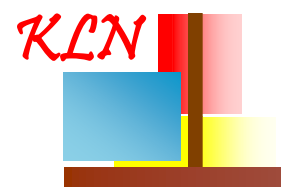
# Layered Task (cont...)





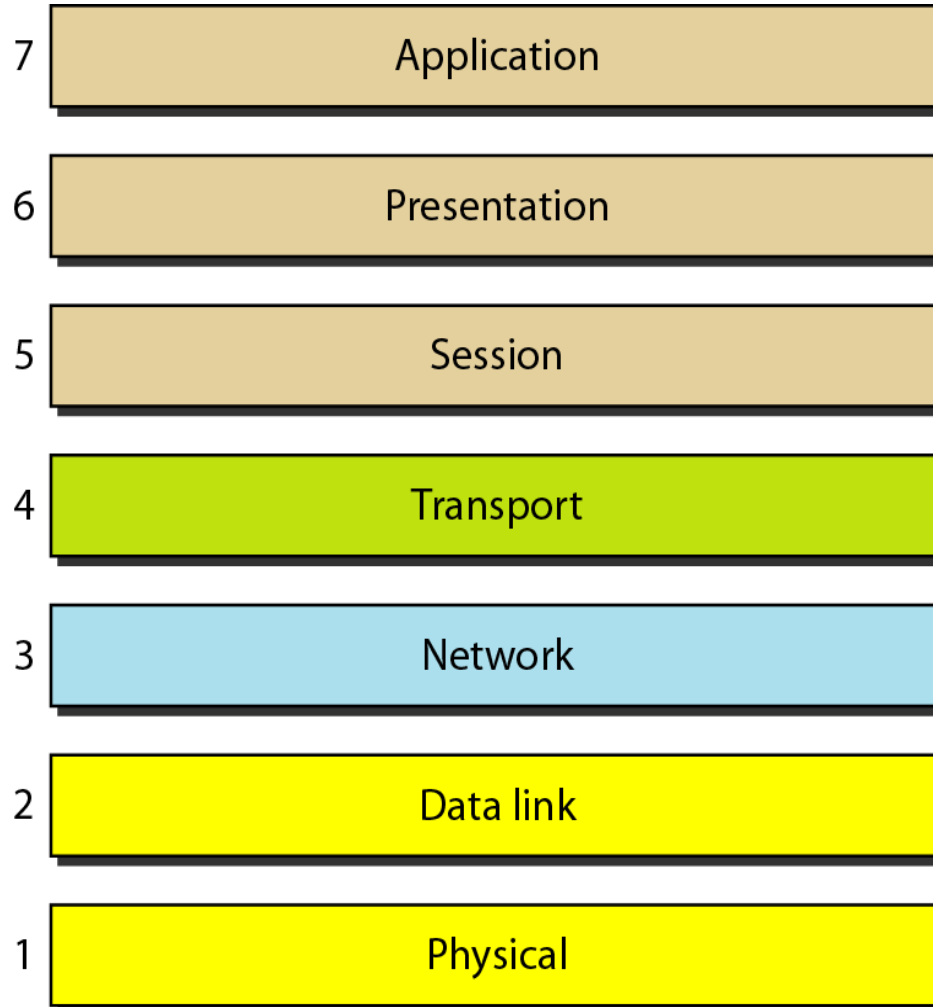
# The OSI Model

- An ISO(International Standards Organization) standard that covers all aspects of network communications is the OSI(**Open Systems Interconnection**) model.
- It was first introduced in the late 1970s.
- An **open system** is a set of protocols that **allows any two different systems to communicate** regardless of their underlying architecture.
- The purpose of the OSI model is to show **how to facilitate communication between different systems** without requiring changes to the logic of the underlying hardware and software.
- **The OSI model is not a protocol; it is a model.**



# The Seven Layers in OSI Model

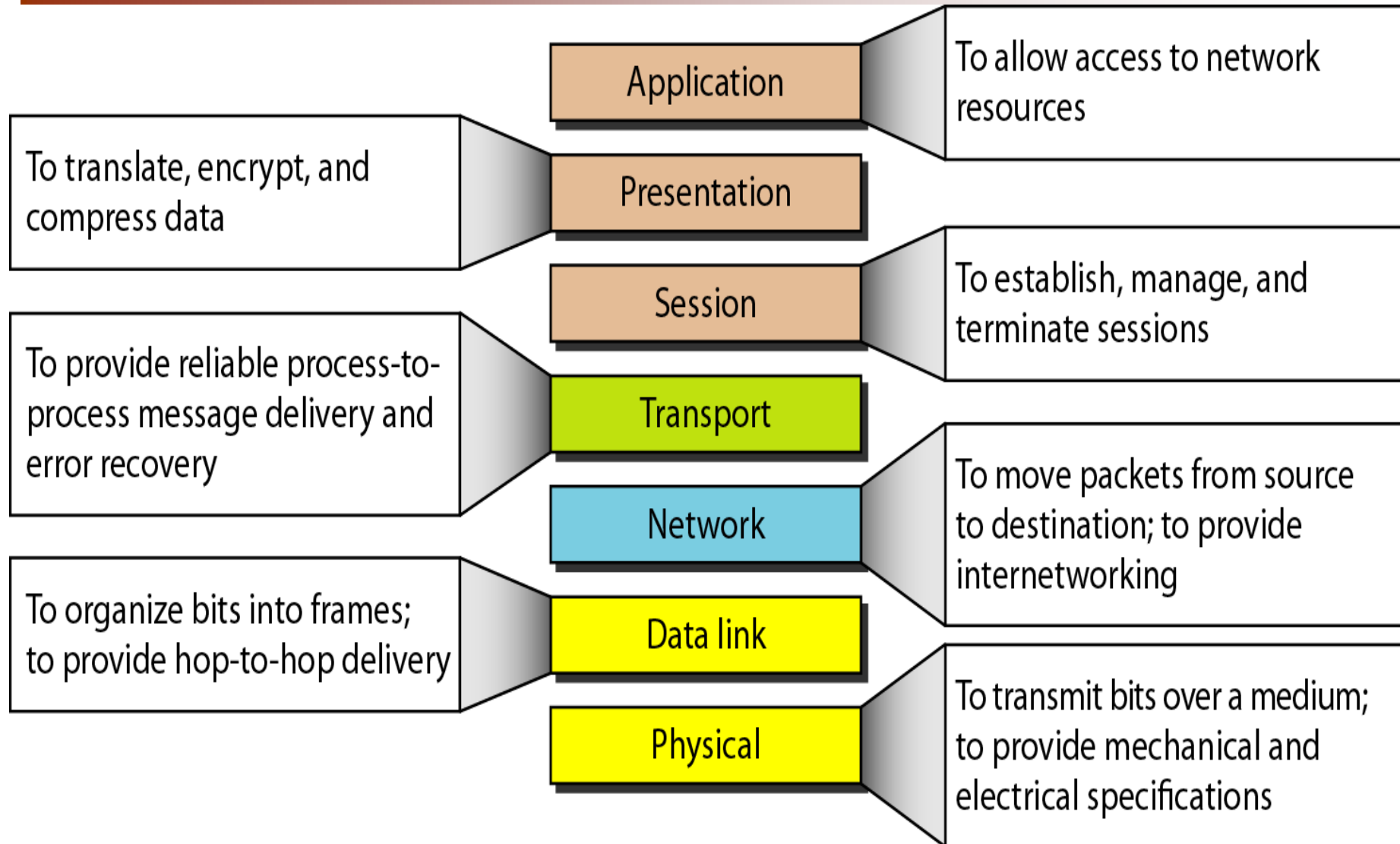
It consists of **seven layers**, each of which defines a part of the process of moving information across a network.



# Organization of Layers

- The seven layers can be thought of as belonging to **three subgroups**.
- **Layers 1, 2, and 3** are the **network support layers**; they deal with the physical aspects of moving data from one device to another (such as electrical specifications, physical connections, physical addressing, and transport timing and reliability).
- **Layers 5, 6, and 7** can be thought of as the **user support layers**; they allow interoperability among unrelated software systems.
- **Layer 4 links the two subgroups** and ensures that what the lower layers have transmitted is in a form that the upper layers can use.
- **NOTE**
  - ✓ The **upper OSI layers** are almost always **implemented in software**; **lower layers** are a combination of **hardware and software**, except for the **physical layer, which is mostly hardware**.

# Summary of Layers





# Introduction to TCP/IP

- The initial **host-to-host communications** protocol introduced in the **ARPANET** was called the Network Control Protocol (NCP).
- In 1974, a new, **more robust suite of communications protocols** was proposed and implemented throughout the ARPANET, based upon the **Transmission Control Protocol (TCP)** for end-to-end network communication.
- But it seemed like overkill for the **intermediate gateways** (what we would today call *routers*) to needlessly have to deal with an end-to-end protocol.
- so in 1978 a new design split responsibilities between a pair of protocols; the new **Internet Protocol (IP)** for **routing packets** and **device-to-device communication** (i.e., host-to-gateway or gateway-to-gateway) and **TCP** for **reliable, end-to-end host communication**.
- Since TCP and IP were originally envisioned functionally as a single protocol, the protocol suite, which actually refers to a large collection of protocols and applications, is usually referred to simply as *TCP/IP*.



# TCP/IP Layers

Application	Protocols
Transport	
Internet	Networks
Network Access	

**IP** - is responsible for moving packet of data from node to node. IP forwards each packet based on a four byte destination address (the IP number). The Internet authorities assign ranges of numbers to different organizations. The organizations assign groups of their numbers to departments. IP operates on gateway machines that move data from department to organization to region and then around the world.

**TCP** - is responsible for verifying the correct delivery of data from client to server. Data can be lost in the intermediate network. TCP adds support to detect errors or lost data and to trigger retransmission until the data is correctly and completely received.

**Sockets** - is a name given to the package of subroutines that provide access to TCP/IP on most systems.

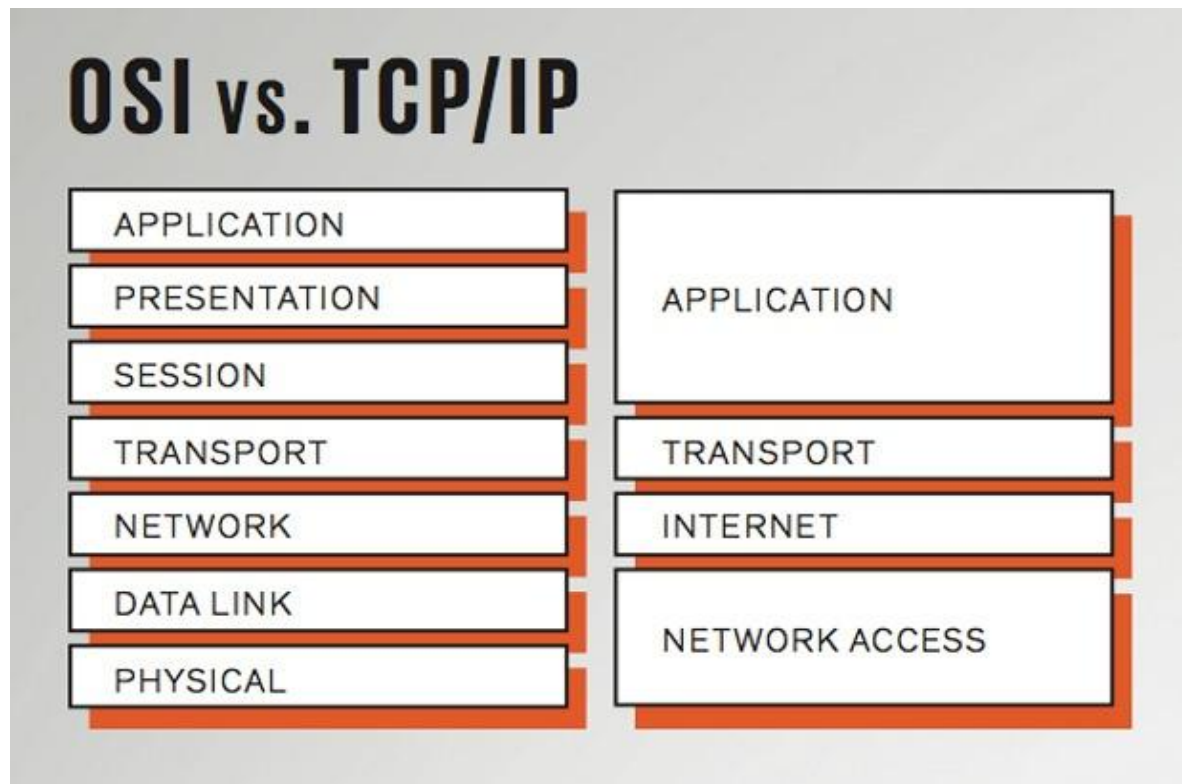


# TCP/IP Protocol Suite

- TCP/IP is a hierarchical protocol made up of interactive modules, each of which provides a specific functionality.
- *At the transport layer, TCP/IP defines three protocols:* Transmission Control Protocol (TCP), User Datagram Protocol (UDP), and Stream Control Transmission Protocol (SCTP).
- *At the network layer, the main protocol defined by TCP/IP is the* Internetworking Protocol (IP).
- **The Transmission Control Protocol (TCP)** provides full transport-layer services to applications. TCP is a reliable stream (connection-oriented) transport protocol.
- The **User Datagram Protocol (UDP)** is a process-to-process protocol that adds only port addresses, checksum error control, and length information to the data from the upper layer.
- The **Internetworking Protocol (IP)** is the transmission mechanism used by the TCP/IP protocols. It is an unreliable and connectionless protocol. IP transports data in packets called *datagrams* which can travel along different routes.

# OSI ~ TCP/IP

- ✓ The TCP/IP protocol suite is made of **four layers: application, transport, internet and network access.**
- ✓ The three topmost layers in the OSI model, are represented in TCP/IP by a single layer called the **application layer**, and down two layers are represented as **Network Access Layer**.





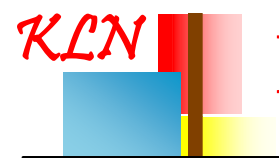
# Comparing TCP/IP with OSI (cont.)

## ■ Differences:

- ✓ TCP/IP combines the presentation and session layer issues into its application layer.
- ✓ TCP/IP combines the OSI data link and physical layers into one layer.
- ✓ TCP/IP appears simpler because it has fewer layers.
- ✓ Typically networks aren't built on the OSI protocol, even though the OSI model is used as a guide.

## ✓ Similarities:

- ✓ Both have layers.
- ✓ Both have application layers, though they include very different services.
- ✓ Networking professionals need to know both.



# List of Network Protocols

<b>Name(layer)</b>	<b>Importance</b>	<b>Names of protocols</b>	<b>What it does</b>
Hardware(link)	Essential	ethernet, SLIP, PPP, Token Ring, ARCnet	Allows messages to be packaged and sent between physical locations.
Package management(network)	Essential	IP, ICMP	Manages movement of messages and reports errors. It uses message protocols and software to manage this process. (includes routing)
Inter layer communication	Essential	ARP	Communicates between layers to allow one layer to get information to support another layer. This includes broadcasting
Service control(transport)	Critical	TCP, UDP	Controls the management of service between computers. Based on values in TCP and UDP messages a server knows what service is being requested.
Application and user support	Important	DNS, RPC	DNS provides address to name translation for locations and network cards. RPC allows remote computer to perform functions on other computers.
Network Management	Advanced	RARP, BOOTP, DHCP, IGMP, SNMP, RIP, OSPF, BGP, CIDR	Enhances network management and increases functionality
Utility (Application)	Useful	FTP, TFTP, SMTP, Telnet, NFS, ping, Rlogin	Provides direct services to the user.

# KLN The Transmission Control Protocol (TCP) <sup>Internet</sup>

FTP is the primary method of transferring files over the Internet. By using FTP you can transfer files across the globe.

- Runs over TCP/IP protocols, and secure access through passwords.

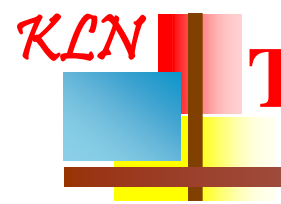
In the Internet, Inter-Process Communications is implemented using the TCP. TCP provides an "end-to-end" (or point-to-point) IPC service which is:

**Reliable:** All data is delivered correctly, **without errors**, even though the underlying delivery service may be unreliable.

**connection-oriented:** The protocol provides procedures for establishing and concluding inter process connections.

**full duplex:** Data can flow in either direction over an established connection, without restriction.

TCP is widely regarded as the best transport protocol ever developed, and has no serious competitors.



# The User Datagram Protocol (UDP)

The User Datagram Protocol (UDP) is a transport layer protocol defined for use with the IP network layer protocol. It is defined by RFC 768 written by John Postel.

The service provided by UDP is an unreliable service that provides no guarantees for delivery and no protection from duplication.

UDP provides a minimal, unreliable, best-effort, message-passing transport to applications and upper-layer protocols.

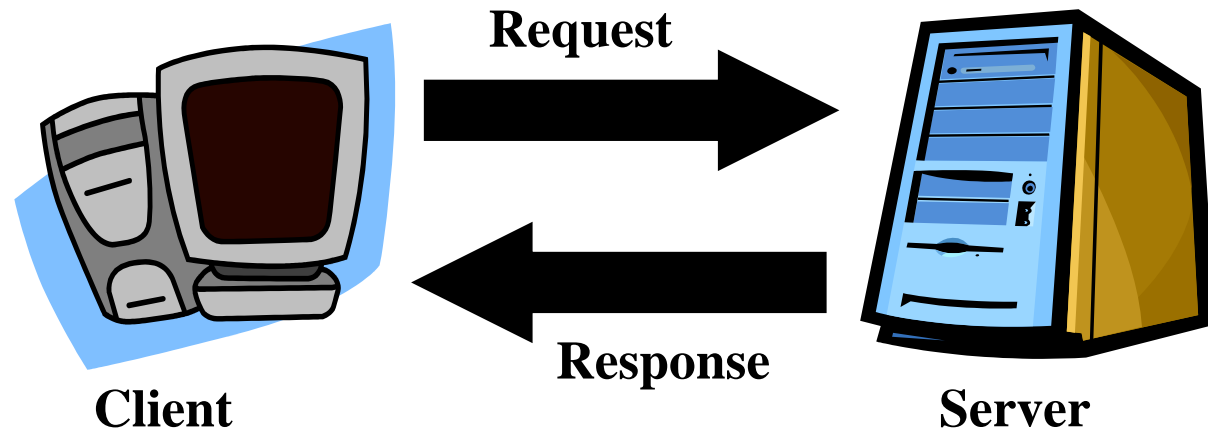
UDP does not provide any communications security.

# KLN TCP vs UDP

	TCP	UDP
<b>Stands for:</b>	Transmission Control Protocol	User Datagram Protocol
<b>Type of Connection:</b>	It is a connection oriented protocol	It is a connection less protocol
<b>Usage:</b>	TCP is used in case of applications in which fast transmission of data is not required	UDP is preferred in case of the applications which have the priority of sending the data on time and on faster rates
<b>Examples:</b>	HTTP, FTP, SMTP Telnet etc	DNS, DHCP, TFTP, SNMP, RIP, VOIP etc
<b>Reliability:</b>	Reliable (defines that data will be definitely sent across)	Unreliable
<b>Data Flow Control:</b>	TCP controls the flow of data	UDP does not have an option for flow control

# Hyper Text Transfer Protocol

- HTTP stands for Hypertext Transfer Protocol. It's a stateless, application-layer protocol for communicating between distributed systems, and is the foundation of the modern world wide web(www).
- The communication usually takes place over TCP/IP, but any reliable transport can be used. The default port for TCP/IP is **80**, but other ports can also be used.



Communication between a host and a client occurs, via a **request/response pair**. The client initiates an HTTP request message, which is serviced through a HTTP response message in return.

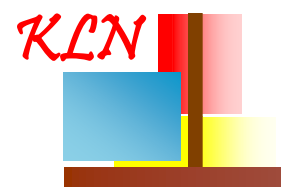


HTTPS (HTTP Secure) is Hypertext Transfer Protocol (HTTP) for secure communication over a computer network, and is widely used on the Internet.

In HTTPS, the communication protocol is encrypted by Transport Layer Security (TLS), or formerly, its predecessor, Secure Sockets Layer (SSL).

The principal motivation for HTTPS is authentication of the accessed website and protection of the privacy and integrity of the exchanged data.

Historically, HTTPS connections were primarily used for payment transactions, e-mail and for sensitive transactions in corporate information systems. Now a days HTTPS was increasingly used for protecting page authenticity on all types of websites, securing accounts and keeping user communications, identity and web browsing private.



# Addressing Schemes

An **addressing scheme** is clearly a requirement for communications in a computer network. With an **addressing scheme**, packets are forwarded from one location to another.

The Internet addresses are 32 bits in length; this gives us a maximum of  $2^{32}$  addresses. These addresses are referred to as IPv4 (IP version 4) addresses or simply IP addresses. IPv4 had provision for 4 billion IP addresses. Unfortunately, IP addresses are not use consequently. There are gaps in the addressing. Consequently, what seemed like a large number in 1981 is actually a small number in 2014.

In 1995 the new version was called IPv6 (IP version 6) was invented it uses 128 bit addresses.

IPv4 addresses are unique. They are unique in the sense that each address defines one, and only one, connection to the Internet.

IPv4 uses 32-bit addresses, which means that the address space is  $2^{32}$  or 4,294,967,296 (more than 4 billion).

## **Notations**

There are two prevalent notations to show an IPv4 address: binary notation and dotted decimal notation.

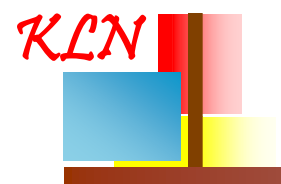
Example of an IPv4 address in binary notation:

01110101 10010101 00011101 00000010

Example of an IPv4 address in dotted notation:

**172.61.25.52**

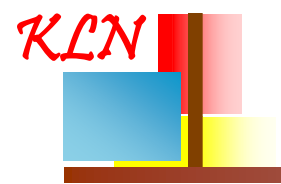
Each number in dotted-decimal notation is a value ranging from 0 to 255.



# Class full Addressing

- IPv4 addressing, at its inception, used the concept of classes. This architecture is called classfull addressing.
- In classful addressing, the address space is divided into five classes.

Class	Leading bits	Size of <b>NET-ID</b>	Size of <b>HOST-ID</b>	Number of networks	Addresses per network	Start address	End address
Class A	0	<b>8</b>	<b>24</b>	128 ( $2^7$ )	16,777,216 ( $2^{24}$ )	0.0.0.0	<b>127.255.255.255</b>
Class B	10	<b>16</b>	<b>16</b>	16,384 ( $2^{14}$ )	65,536 ( $2^{16}$ )	128.0.0.0	<b>191.255.255.255</b>
Class C	110	<b>24</b>	<b>8</b>	2,097,152 ( $2^{21}$ )	256 ( $2^8$ )	192.0.0.0	<b>223.255.255.255</b>
Class D (multicast)	1110	not defined	not defined	not defined	not defined	224.0.0.0	<b>239.255.255.255</b>
Class E (reserved)	1111	not defined	not defined	not defined	not defined	240.0.0.0	<b>255.255.255.255</b>



# Mask or Subnet Mast

Although the length of the netid and hostid (in bits) is predetermined in classfull addressing. The mask can help us to find the netid and the hostid. For example, the mask for a class A address has eight 1s, which means the first 8 bits of any address in class A define the netid; the next 24 bits define the hostid.

## *Default masks for classfull addressing*

A	11111111 00000000 00000000 00000000	255.0.0.0 18
B	11111111 11111111 00000000 00000000	255.255.0.0 116
C	11111111 11111111 11111111 00000000	255.255.255.0 124

An IPv6 address is made of 128 bits divided into eight 16-bits blocks.

Each block is then converted into 4-digit Hexadecimal numbers separated by colon symbols.

For example, given below is a 128 bit IPv6 address represented in binary format:

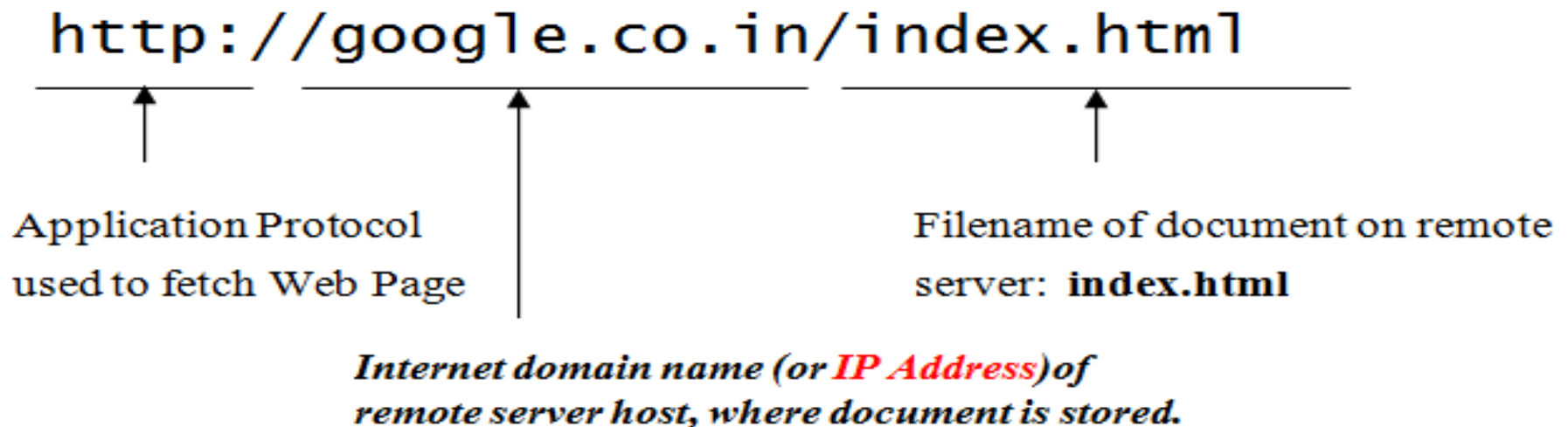
```
0010000000000001 0000000000000000 0011001000111000  
1101111111100001 0000000001100011 0000000000000000  
0000000000000000 1111111011111011
```

Each block is then converted into Hexadecimal and separated by ‘:’ symbol:

```
2001:0000:3238:DFE1:0063:0000:0000:FEFB
```

# KLN IP address

- the numerical identifier for a computer connected to a TCP/IP network, such as the Internet. IP addresses consist of a set of four numbers from 0 - 255 and separated by periods. For example 199.104.230.26.
- IP addresses are assigned by the Network Information Center (NIC), a central authority with the responsibility of assigning network addresses.



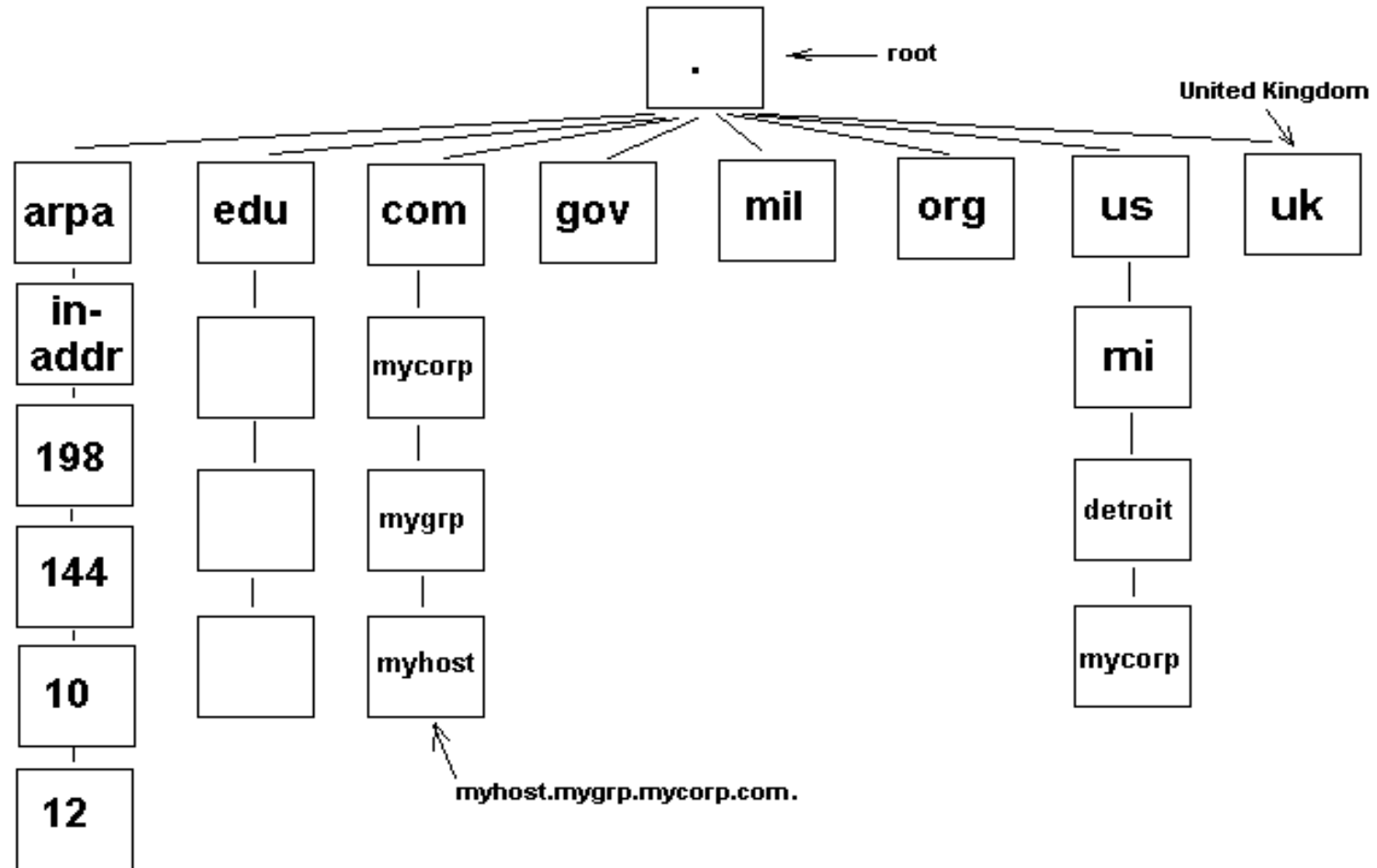
The **Domain Name System (DNS)** translates Internet domain and host names to IP addresses and vice versa.

DNS names are assigned through the Internet Registries by the Internet Assigned Number Authority (**IANA**). The domain name is a name assigned to an internet domain.

<b>.com</b>	for commercial organisations or companies
<b>.edu</b>	for educational institutions
<b>.gov</b>	for government organisations
<b>.org</b>	for nonprofit organisations
<b>.mil</b>	for military organisations
<b>.in</b>	for Indian networks
<b>.au</b>	for Australia
<b>.uk</b>	for United Kingdom
<b>.ca</b>	for Canada
<b>.jp</b>	for Japan



DNS is hierarchical in structure. A domain is a sub-tree of the domain name space.



When referring to DNS addresses, they are referred to from the bottom up with the root designator (period) at the far right. Example: "myhost.mycompany.com." 65

# Uniform Resource Locator (URL)

URL specifies the location of the page to be obtained from a web server. The page is usually displayed or some times simply downloaded as a file onto local disk.

**`http://facebook.com:80/career/index.html`**

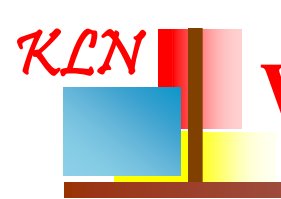
**Protocol to communicate with the server**  
HTTP is normal  
HTTPS is a secure version of HTTP

**The domain name of the server. The client has to use DNS to convert this into an IP address before connecting to the server**

**The address of the web server application on the server (optional the default is 80)**

**The location of the page on the server**

**The name of the page**



# Well Known (Reserved) Port Numbers

A **port number** is a way to identify a specific process to which an Internet or other network message is to be forwarded when it arrives at a server. For the Transmission Control Protocol and the User Datagram Protocol, a **port number** is a 16-bit integer that is put in the header appended to a message unit.

**TCP/IP reserves up to 1024 ports for specific protocols.**

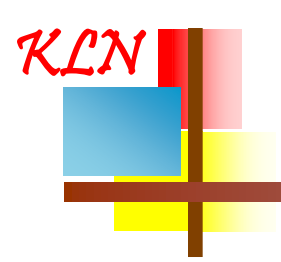
<b>5</b>	<b>ECHO</b>
<b>13</b>	<b>Date and Time services</b>
<b>21</b>	<b>FTP which transfers files</b>
<b>23</b>	<b>TELNET which provides remote login</b>
<b>25</b>	<b>SMTP which delivers mail</b>
<b>67</b>	<b>BOOTP, which provides configuration at boot time</b>
<b>80</b>	<b>HTTP which transfers web pages</b>
<b>53</b>	<b>DOMAIN</b>
<b>100</b>	<b>POP which is access mail box</b>

- The telnet commands allow you to communicate with a remote computer that is using the Telnet protocol.
- Telnet allows you to ``log-on" to any computer on the network.
- Typically you need a login name and password on the machine that you want to log on to.

## Telnet Commands

### Telnet [host [port]]

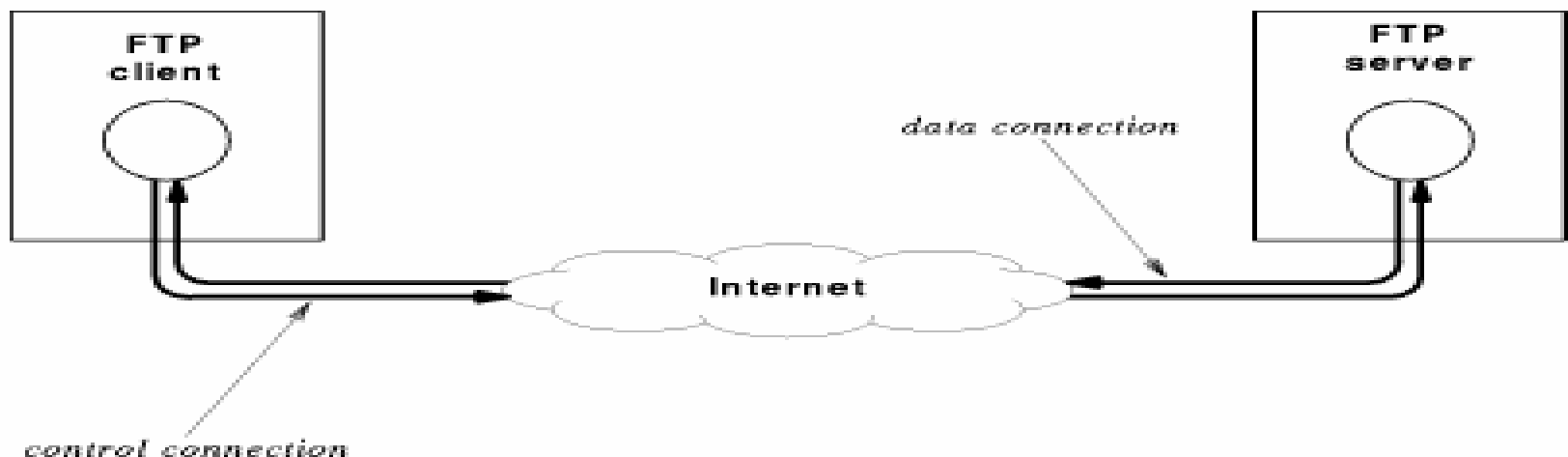
- Host specifies the hostname or IP address of the remote computer to connect to.
- Port Specifies the port number or service name.



# Telnet Commands

<b>close</b>	close current connection
<b>display</b>	display operating parameters
<b>open</b>	connect to a site
<b>quit</b>	exit telnet
<b>set</b>	set options (type 'set ?' for a list)
<b>status</b>	print status information
<b>unset</b>	unset options (type 'unset ?' for a list)
<b>?/help</b>	print help information

- The File Transfer **Protocol** (**FTP**) is the standard network **protocol** used for the transfer of computer files between a client and server on a computer network. **FTP** is built on a client-server model architecture and uses separate control and data connections between the client and the server.
- To transfer files between two computers for both download and upload.
- Runs over TCP/IP protocols.
- Secure access through passwords.
- Anonymous access can be allowed.



- 1) cd - changes remote working directory.
- 2) lcd - changes local working directory.
- 3) open - establishes a connection to specified remote host.
- 4) close - terminates the connection to remote host.
- 5) get, mget - copies file(s) from remote host.
- 6) put, mput - sends file(s) to remote host.
- 7) dir/ls - lists contents of remote directory.
- 8) ascii/binary - sets the file transfer type.
- 9) bye/quit - ends file transfer session and exits ftp.
- 10) prompt - toggles interactive mode.

# Network Performance Measures

## ■ latency

- latent period: time between stimulus and first indication of a response
- minimum latency = ping/echo time
- Time from sending a bit until it arrives
- *seconds (or seconds per geographic distance)*

## ■ throughput

- rate of data transfer

## ■ round trips

- number of interactions per user action

## ■ Bandwidth

- the amount of data that can be transmitted in a given amount of time, typically expressed as bits per second (bps).

## ■ overhead

- setup: time to enable application-level interaction
- message control



# Classifications of Web sites

***Informational Web site:*** A Web site that does little more than provide information about the business and its products and services

***Interactive Web site:*** A Web site that provides opportunities for the customers and the business to communicate and share information

***Attractors:*** Web site features that attract and interact with visitors in the target stakeholder group

***Transactional Web site:*** A Web site that sells products and services

## Appearance

- Is the Site Aesthetically Pleasing?
- Conduct Quality Assurance
  - Check the readiness of a website
  - Examine how easy it passes under the stress of a Web production schedule
- Use a Style Guide
  - Ensure consistency within the site

## Navigation

- How a Visitor Gets from One Page to Another
- Give out Function Descriptions of Each Icon

## Security

- Protect from Hackers
- Critical – Website Access
- Knowledge of Developers

## Consistency

- *Look and feel*: The elements that visually distinguish a site from any other, including layout, typeface, colors, graphics, and navigation aids
- Elements of page content also should be consistent:
  - company logo
  - contact information
  - short, descriptive title
- Design a portable Web site so that it will run in all browsers.

## Performance

- The most widely recognized cause of long download times is a large graphic or a large number of small graphics on a single page

## Quality Assurance

- make sure the Web site design is properly tested before it is launched
- ensure that it continues to perform up to expectations after launch
- design the site for easy maintenance
- responsible owners frequently test all features of the site personally
- quality Web sites are tested regularly
- Web site performance is also an ongoing concern

## Time Rules

- 12-second rule: Every page on the Web site should appear within 12 seconds
- 4-second rule: something should appear in the visitor's browser in 4 seconds or less



Web navigation refers to the process of navigating a network of information resources, which is organized as hypertext. Website navigation is important to the success of your website visitor's experience to your website. The website's navigation system is like a road map to all the different areas and information contained within the website.

## Types of Website Navigation

- **Hierarchical website navigation**

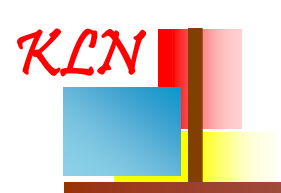
This provides a clear, simple path to all the web pages from anywhere on the website.

- **Global website navigation**

It is available on each page and lists the main content sections/pages of the website.

- **Local website navigation**

Local navigation would the links with the text of your web pages, linking to other pages within the website.



# Styles of Website Navigation

Styles of website navigation refers to how the navigation system is presented.

## **Text Links**

Text links are words (text) which are surrounded by the anchor set of tags to create clickable hyper texts.

## **Breadcrumbs**

Breadcrumb navigation shows the website visitor the path within your website to the page they are currently on.

## **Navigation Bar**

A navigation bar is the collection of website navigation links all grouped together.

## **Tab Navigation**

Tab navigation is where the website navigations links appear as tabs.

## **Sitemap**

A sitemap is a page within your website that lists all the sections and web pages.

## **Dropdown Menu**

A dropdown menu is a style of website navigation where when the visitor places their mouse over a menu item, another menu is exposed.

## **Flyout Menu**

Flyout menus are constructed properly, they can be accessible and readable by the search engines.

The two-tier architecture is like client server application. The direct communication takes place between client and server. There is no intermediate between client and server.

Here the communication is one to one. For example now we have a need to save the employee details in database. The two tiers of two-tier architecture is

- Database (Data tier)
- Client Application (Client tier)

### Advantages:

- Understanding and maintenances is easier.

### Disadvantages:

- Performance will be reduced when there are more users.

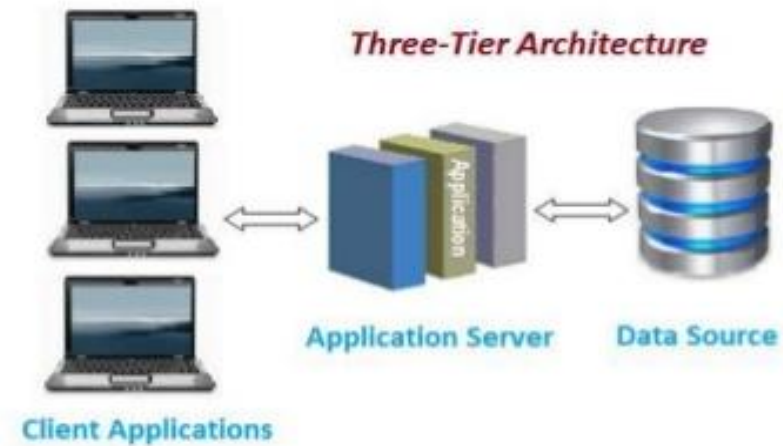


# KLN 3-Tier Architecture

Internet

Three tier architecture having three layers:

- Client layer
- Business layer
- Data layer



**Client layer:** Here we design the form using textbox, label etc.

**Business layer:** It is the intermediate layer which has the functions for client layer and it is used to make communication faster between client and data layer. It provides the business processes logic and the data access.

**Data layer:** it has the database.

## Advantages

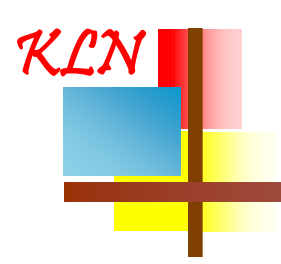
- Easy to modify with out affecting other modules
- Fast communication
- Performance will be good in three tier architecture.



Cookies are a tool that web developers and designers can use to store data. If you want to do any client tracking or data retrieval, one of the best ways to do this is with persistent HTTP cookies.

The most common method to save information is in hidden fields. These are passed to the server along with all the other form entries.

Cookies gave web developers the ability to save information from forms onto the client machine. Since the customer is filling out the form or buying the merchandise, storing the information provided on their machine seemed a like good solution.



*Thank You*