Digicoders technologies (P) Ltd.

LECTURE NOTES

ON

INTERNET AND WEB TECHNOLOGY

Unit -1

Compiled by

Team Digicoders
B-36, Sector O, Near Ram Ram Bank Chauraha, Aliganj,
Lucknow Uttar Pradesh 226021

CONTENTS

UNIT-1

INTERNET BASICS

Data Communications : Data communications are the exchange of data between two devices viasome form of transmission medium such as a wire cable.

Components of Data Communication:

The different components of Data communication are shown in the following figure.

1. ***Message:*** The message is the information (data) to be communicated. Popular forms of information include text, numbers, pictures, audio, and video.

2. ***Sender****:* The sender is the device that sends the data message. It can be a computer, workstation, telephone handset, video camera, and so on.

3. ***Receiver:*** The receiver is the device that receives the message. It can be a computer, workstation, telephone handset, television, and so on.

4. ***Transmission medium****:* The transmission medium is the physical path by which a message travels from sender to receiver. Some examples of transmission media include twisted-pair wire, coaxial cable, fiber-optic cable, and radio waves.

5. ***Protocol:*** A protocol is a set of rules that govern data communications. It represents an agreement between the communicating devices.

Computer Networks :

- A network is a set of 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.

Categories of networks

- Network divided in to three primary categories: LAN, MAN, WAN. In to which category a network falls is determined by its Size, Ownership, Distance it covers, and Physical architecture

1. **Local-Area Network(LAN) :**

   - LAN is usually Privately owned and Links devices in single office, building or campus.
   - LAN size is Limited to few kilometres.
   - LANs are designed to allow resources (i.e. hardware or software) to be shared between PCs and workstations.
   - LAN will use a single transmission media.
   - The most common LAN Topologies are Ring, bus, star.

2. **Metropolitan-Area Network (MAN):**

   - A MAN is designed to extend over an entire city.
   - It may be single network such as cable television network, or it may be a means of connecting number of LANs in to a larger networks.

- A MAN be wholly Owned and operated by a private company, or it may be a Service provider by Public company such as a local telephone company.

3. Wide-Area Network(WAN):

WAN provides long-transmission of data, voice, image and video information over large geographic areas that may comprise a country, a continent or even the whole world.

WAN that is wholly owned and used by a single company is often referred to as an enterprise network.

Application of Computer Network:

- Sharing of resources such as printers
- Sharing of expensive software's and database
- Communication from one computer to another computer
- Exchange of data and information among users via network
- Sharing of informationover geographically wide areas.

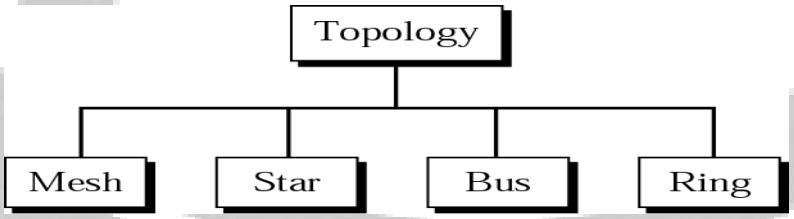
TOPOLOGY:

1. Topology refers to the way in which a network is laid out physically.

2. The topology of a network is the geometric representation of the relationship of all the links and linking devices (usually called nodes) to one another.

Categories of topology:

There are four basic topologies possible.



1.Mesh topology:

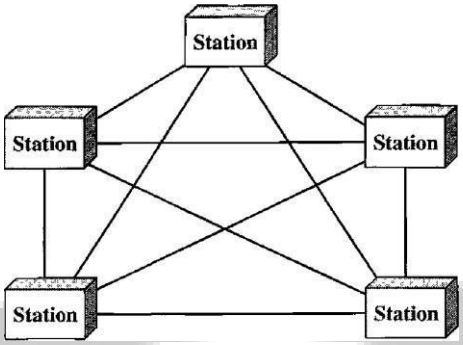
1. In a mesh topology, every device has a dedicated point-to-point link to every other device.

2. The term *dedicated* means that the link carries traffic only between the two devices it connects.

3. A fully connected mesh network therefore has ***n(n -1) /2*** physical channels link n devices.

To accommodate that many links, every device on the network must have *n* - 1

input/output (*I/O)* ports to be connected to the other *n* - 1 stations.



Advantages:

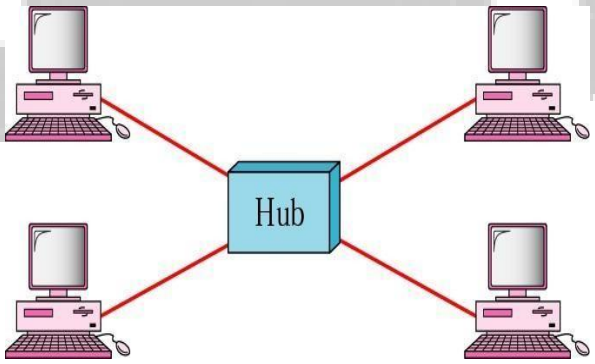
1. The use of dedicated links guarantees that each connection can carry its own data load, thus eliminating the traffic problems
2. A mesh topology is robust. i.e. If one link becomes unusable, it does not incapacitate the entire system.
3. There is the advantage of privacy or security.
4. point-to-point links make fault identification and fault isolation easy.

Disadvantages:

1. Because every device must be connected to every other device, installation and reconnection are difficult.
2. The bulk of the wiring can be greater than the available space (in walls, ceilings, or floors) can accommodate.

2. Star Topology:

1. In a star topology, each device has a dedicated point-to-point link only to a central controller, usually called a hub.
2. The devices are not directly linked to one another.
3. A star topology does not allow direct traffic between devices. The controller acts as an exchange: If one device wants to send data to another, it sends the data to the controller, which then relays the data to the other connected devices.



Advantages:

1. A star topology is less expensive than a mesh topology.
2. It is easy to install and reconfigure.
3. Other advantages include robustness

Disadvantage:

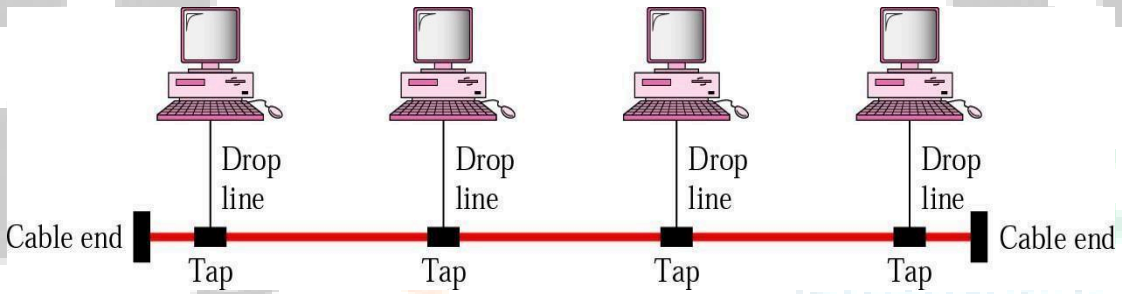
The dependency of the whole topology on one single point, the hub. If the hub goes down, the whole system is dead.

3.Bus Topology:

1. A bus topology, is multipoint connected . One long cable acts as a backbone to link all the devices in a network.

2. Nodes are connected to the bus cable by drop lines and taps. A drop line is a connection

Running between the device and the main cable. A tap is a connector that either splices into the main cable or punctures the sheathing of a cable to create a contact with the metallic core.



Advantages

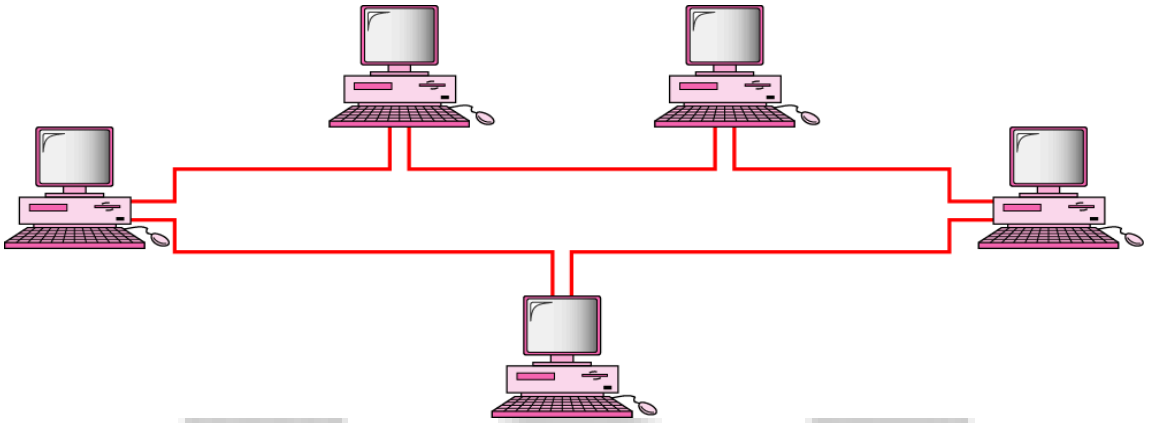
1. Advantages of a bus topology include ease of installation
2. Bus uses less cabling.

Disadvantages:

1. Difficult reconnection and fault isolation is also difficult.
2. Signal reflection at the taps can cause degradation in quality.

4. Ring topology:

- In a ring topology, each device has a dedicated point-to-point connection with only the two devices on either side of it.
- A signal is passed along the ring in one direction, from device to device, until it reaches its destination.
- Each device in the ring incorporates a repeater. When a device receives a signal intended for another device, its repeater regenerates the bits and passes them along.



Advantages:

1. A ring is relatively easy to install and reconfigure.
2. Fault isolation is simplified.

Disadvantage:

Unidirectional traffic can be a disadvantage.

INTERNET

Internet is a worldwide network of networks that uses the standard Internet protocol suite (TCP/IP) to link several billion devices worldwide.

Hardware and software Requirements

To connect to the Internet we need the following four things:

1. A computer
2. A modem and telephone line (if you are using dial up access) A data line of some sort (if you are not using dial up access)
3. An Internet browser (software) and software to connect you to the ISP
4. An account with an Internet Service Provider (ISP) Souvenirs

Applications of Internet:

- Sending and receiving email
- Searching and browsing information archives
- Copying files between computers
- Conducting financial transactions
- Navigating (in your car, smart scooter, smart bike, or other)
- Playing interactive games.
- Video and music streaming
- Chat or voice communication (direct messaging, video conferencing) etc.

Intranet

An intranet is a computer network for sharing information, collaboration tools, operationalsystems, and other computing services within an organization, usually to the exclusion ofaccess by outsiders.

Uses of the intranet:

- Streamlining everyday activities by making repeated tasks more feasible.
- Centralizing and managing important information and company data in a single database.
- Making collaboration easier since information can be shared across the entire network.
- Providing personalized content to employees based on their role within the company.
- Improving internal communication by making employee directories, company news and organization charts readily available.
- Providing fast and easy access to information about company policies, benefits and updates.

Extranet:

The extranet is a private network that uses the internet that allows people outside a business partners, vendors or authorized customers to access business information.

Parameter	Internet	Intranet
Usage	Public	Private
User Types	Any user having dial up of Internet access line.	Organization employees and Internal company departments
Usage	Access all kind of information	Internal employee communication , telephone directories etc.
Security	Low security. Configured under 0 security level in firewall	High security. Configured under 100 security level in firewall
Regulated by	Internet Architecture Board (IAB): Oversees the technical and engineering development of the IETF and IRTF. Internet Corporation for Assigned Names and Numbers (ICANN).	It is regulated by an organization.
Coverage	Wide Area	Within an organization
Access	Large number of users	Limited number of users
System failure	Unpredictable	System availability is high since system is monitored by authority

MODEM

Modem, ("*mo*dulator/*dem*odulator") is electronic device that convert digital data signals into modulated analog signals suitable for transmission over analog telecommunications circuits.

Working principle of MODEM

Modulator:

- This unit is used to convert the digital data from computer into analog data This process is called modulation
- This is done by adding a carrier signal to the digital signal.

Demodulator:

- This unit is used to convert the analog data from telephone system into digital data
- This is done by eliminating the carrier signal from analog signal

Types of modems

Two types of modem

- **Internal modem:** Internal Modem is modem that plugged directly into the CPU. Physically internal modem in the form of a card that is plugged into one of the expansion slots on the mainboard, usually on the ISA or PCI slot.
- **External modem:** External Modem is modem that installed outside of the CPU. External modem connected to the CPU via the COM port or USB. This type of modem typically uses separate voltage source in the form of an adapter.

Difference between Internal and External Modem

Internal Modem	External Modem
An internal modem is a modem that fits inside of a computer. Internal modems typically ship with the computer and come pre-installed.	he external modem sits outside the computer. The external modem can be used when a computer is unable to fit an internal modem inside of it.
Low in Price.	Comparatively high in price.
No external accessory has to buy.	In an external modem, RS232 interface cable has to buy.
It is difficult to move the internal modem to another computer.	The external modem can be moved easily.
The internal modem is powered by PC.	The external modem needs plugs into the wall to power on.

Features of Modems:

- **Speed**: The speed at which the modem can send data in bps (bits per second). Typically modem speeds are: 300, 600, 1200, 2400, 4800, 9600, 14.4K, 19.2K, 28.8K bps
- **Auto Dial /Redial**: Smart Modems can dial the phone number and & auto redial if a busy signal is received.
- **Auto Answer**: Most modems can automatically answer the phone when an incoming call comes in. They have Ring Detect capability.
- **Self-Testing:** New modems have self-testing features. They can test the digital connection to the terminal /computer and the analog connection to a remote modem. They can also check the modem's internal electronics.
- **Voice over Data:** Voice over Data modems allow a voice conversation to take place while data is being transmitted. This requires both the source and destination modems to have this feature.
- **Synchronous or Asynchronous Transmission:** Newer modems allow a choice of synchronous or asynchronous transmission of data. Normally, modem transmission is asynchronous. We send individual characters with just start and stop bits. Synchronous transmission or packet transmission is used in specific applications.

Functions of Modems:

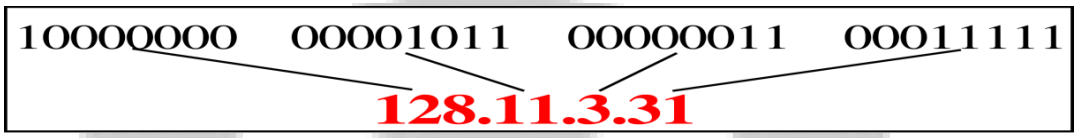
- **Data Compression:** Data compression is the ability of the modem to take data in from the computer, reduce it in volume, and then send it out via the modem.
- **Error correction:** Error correction standards provide a way of correcting errors that result from outside interference, such as noise on the phone line. Error correction ensures that data coming out of the receiving modem is exactly the same as data going into the sending modem.
- **Flow Control:** Individual modems send information at different speeds. It's necessary for faster modems to slow down so that slower modems can catch up, otherwise the slower modem will receive more data than it can process.

<u>IP ADDRESS</u> :

- An IP (Internet Protocol) address is a 32 bit binary number which uniquely identify a node or host connection on an IP network.
- Each Internet address consists of 4 bytes (32-bits) defining 3 fields: class type, network identification (netid) and host identification (hosted).
- These parts are of varying lengths, depending on the class of the address

Dotted decimal notation:

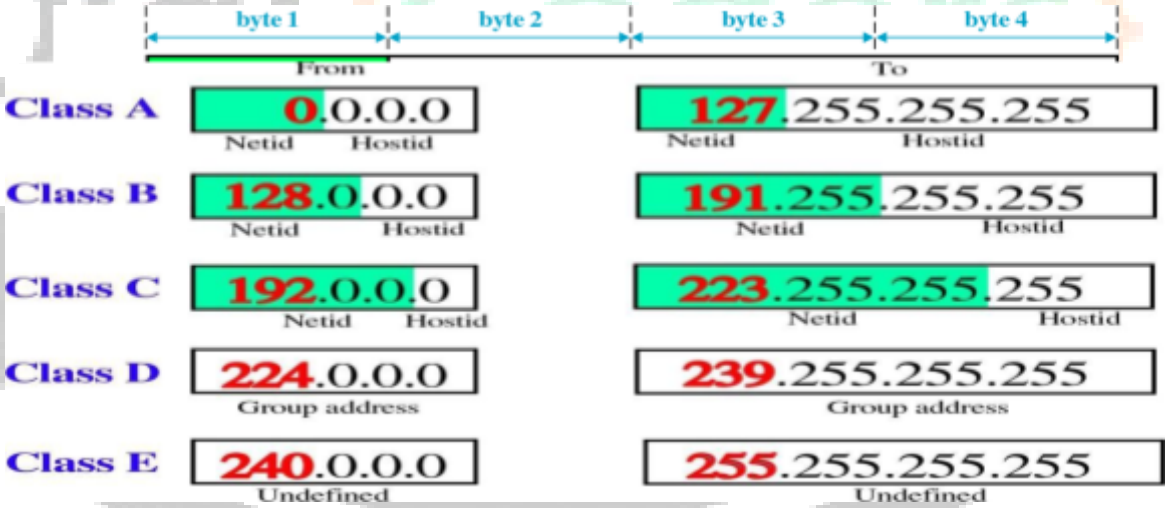
- Machines read the IP address as a stream of 32 bits.
- However, for human consumption, the IP address is written in dotted decimal notation.
  – The 32-bit address is divided into 4 groups of 8 bits (an octet or a byte).
  – Each octet is written as a decimal number ranging from 0 to 255.
  – The decimal numbers are separated by periods, or dots.



ADDRESS CLASSES

The designers of the Internet decided to create classes of networks based on network size. For the small number of networks possessing a very large number of nodes, they created the rank *Class A network*. At the other extreme is the *Class C network*, reserved for the numerous networks with a small number of nodes. The class distinction for networks in between very large and very small is predictably called a *Class B network*. How one would subdivide an IP address into a network and node address is determined by the class designation of one's network.

- There are 5 different address classes (A, B,C,D and E). We can determine which class any IP address is in by examining the first 4 bits of the IP address.



- Class A – C widely used. Class D for multicasting (allows copies of a datagram to be passed to select group of hosts rather than to an individual host.) and class E for future use.**Class Ranges of Internet Addresses**

Class A addresses were designed for large organizations with a large number of attached hosts or routers. Class B addresses were designed for midsize organizations with tens of thousands of attached hosts or routers. Class C addresses were designed for small organizations with a small number of attached hosts or routers.

Flaw in Classful Address

- A block in class A address is too large for almost any organization
- A block in class B is also very large, probably too large for any of the organizations that received a class B block.
- A block in class C is probably too small.
- A and B always wasted. But C is always not enough
- In Overall, classful addressing, a large part of the available addresses were wasted.

Domain Name System (DNS)

- DNS Stands for ***D****omain* ***N****ame* ***S****ystem* (or ***S****ervice* or ***S****erver*).
- It is an Internet service that translates *domain names* into IP addresses.
- Because domain names are alphabetic, they're easier to remember. The Internet however, is really based on IP addresses. Every time you use a domain name, therefore, a DNS service musttranslate the name into the corresponding IP address. For example, the domain name *www.example.com* might translate to *198.105.232.4*.

Three main components of DNS

1. Name resolver
2. Name server
3. database of resource records(RRs)

DNS resolver

The client-side of the DNS is called a DNS resolver. It is responsible for initiating and sequencing the queries that ultimately lead to a full resolution (translation) of the resource sought, e.g., translation of adomain name into an IP address.

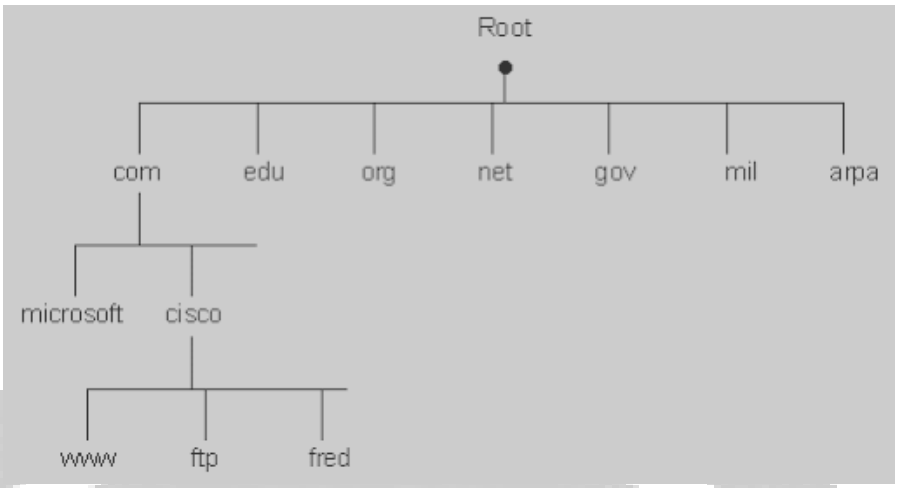
Name Sever

Server responsible for answering DNS queries

- Exists at all levels of hierarchy.
- Authoritative name servers hold part of the DNS database.
- One name server can serve more then one zone.
- Many name servers “should” serve the same zone.
- Some name servers are authoritative for certain zones.

STRUCTURE

The structure of DNS is hierarchical or tree structure. At the top node is called the root and it is the startof all other branches in the DNS tree. It is designated with a period. Each branch moves down from levelto level. 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.".



DNS is hierarchical in structure. A domain is a subtree of the domain name space. From the root, theassigned top-level domains in the U.S. are:

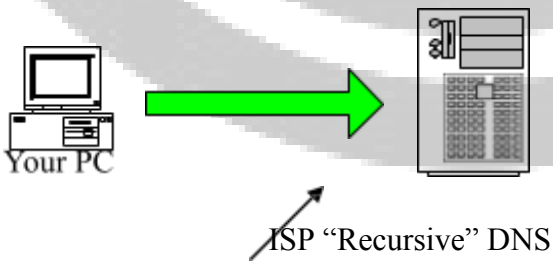
- GOV - Government body.
- EDU - Educational body.
- INT - International organization
- NET - Networks
- COM - Commercial entity.
- MIL - U. S. Military.
- ORG - Any other organization not previously listed.

MAPPING OF DOMAIN NAME TO IP ADDRESS

The domain mechanism for making name to addresses consists of a mane server. In name server there is a serverapplication does the work of mapping of domain name to IP address. When the name is translated from client to name server , the task is performed by a client software called name resolver.

FOR EXAMPLE:-

Step 1: Your PC sends a resolution request to its configured DNS Server, typically at your ISP.

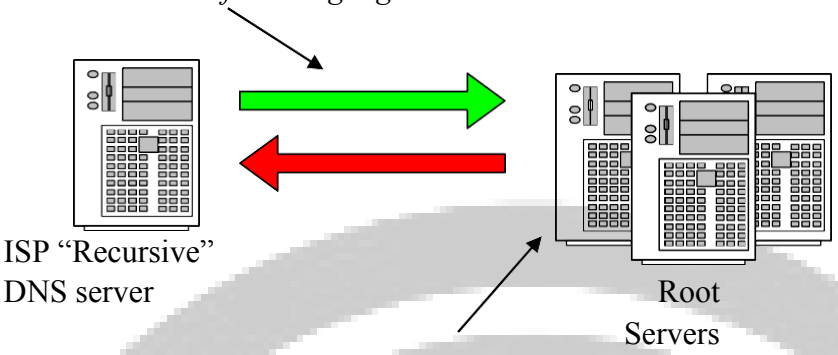


Tell me the Address of "www.google.com

Step 2: Your ISPs recursive name server starts by asking one of the root servers predefined in its

“hints” file

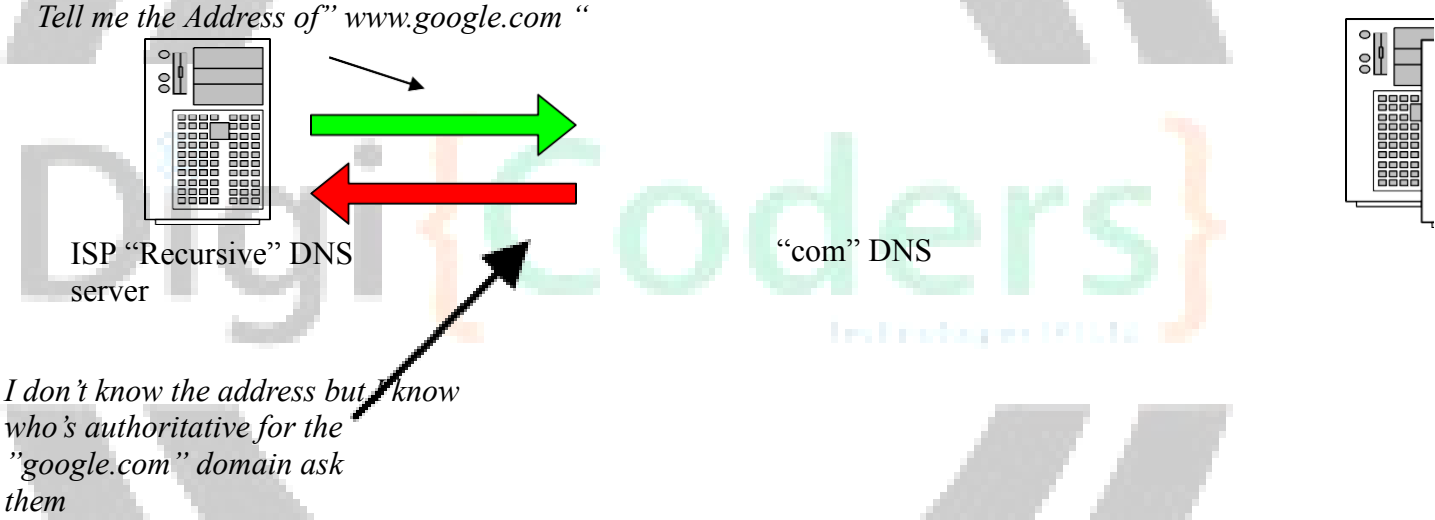
Tell me the Address of “www.google.com”



I don’t know the address but I know who’s authoritative for the”com” domain ask them

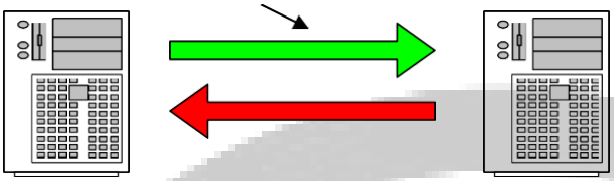
Step 3: Your ISPs recursive name server then asks one of the “com” name servers as directed.

Tell me the Address of” www.google.com “



Step 4: Your ISPs recursive name server then asks one of the "google.com" name servers as directed.

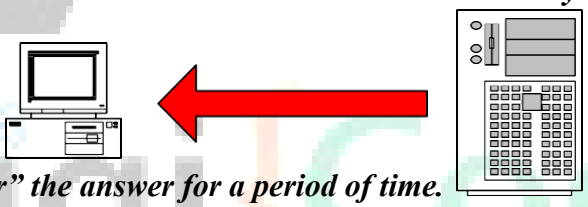
Tell me the Address of "www.google.com"



ISP "Recursive" DNS server google.com DNS server

The Address of www.google.com is 216.239.53.99

Step 5: ISP DNS server then send the answer back to your PC. The DNS server will "remember" the answer for a period of time.

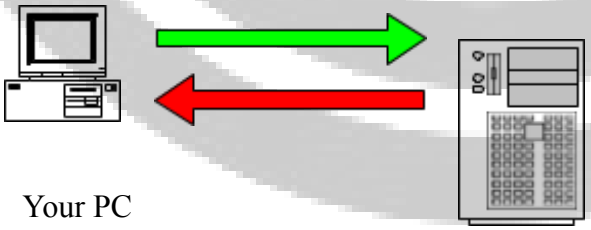


Your PC

ISP "Recursive" DNS server

The Address of www.google.com is 216.239.53.99

Step 6: Your PC can then make the actual HTTP request to the web server.



Your PC www.google.com web server

Here it is!

INTERNET SERVICE PROVIDER

An Internet service provider (ISP) is an organization that provides a myriad of services for accessing,using, or participating in the Internet.

Factors to consider when choosing ISP

- **Bandwidth :** Data transferring speed provided by ISP Company**.**
- **Availability :** Availiability of Network & performance to its users
- **COST** : Refers pricing of the connection as well as services
- **Network security :** It is an important issue related to the network over the Internet. Everyone hasits own private information being safe on their servers & nodes.
- **Customer Services** : Better Customer service is highly required an ISP.
- **Location & they need for speed** : It is an also a important factor, when we looking an Internetprovider is the location where we live or work. A better location refers a good level of customers support.

CIDR Notation

CIDR, which stands for Classless Inter-Domain Routing, is an IP addressing scheme that improves theallocation of IP addresses. It replaces the old system based on classes A, B, and C.

How does CIDR work?

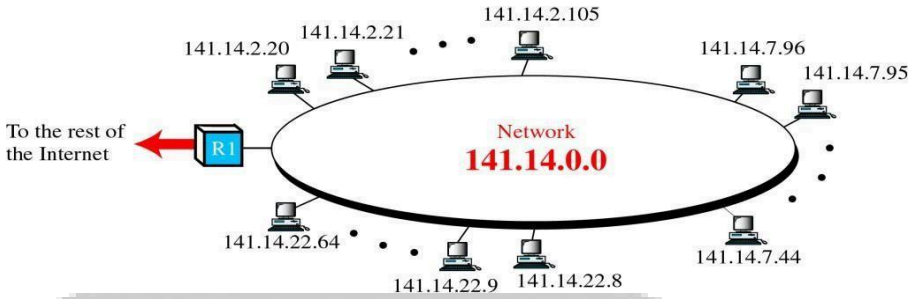
CIDR is based on variable-length subnet masking (VLSM). This allows it to define prefixes of arbitrary lengths making it much more efficient than the old system. CIDR IP addresses are composed of two setsof numbers. The network address is written as a prefix, like you would see a normal IP address (e.g.
192.255.255.255). The second part is the suffix which indicates how many bits are in the entire address(e.g. /12). Putting it together, a CIDR IP address would look like the following:

192.255.255.255/12

The network prefix is also specified as part of the IP address. This varies depending upon the number ofbits required. Therefore, taking the example above, we can say that the first 12 bits are the network partof the address while the last 20 bits are for host addresses.

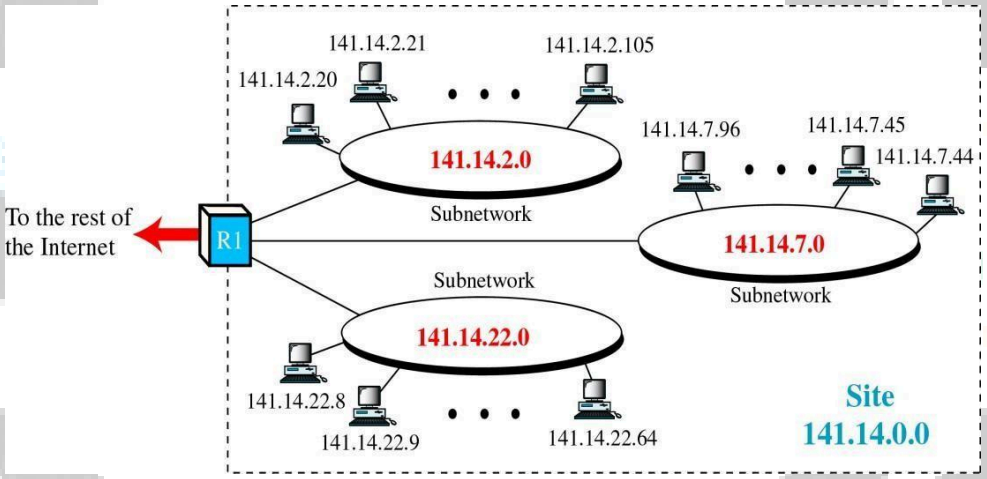
Subnetting

- Basically without subnetting, most of organization is limited to two levels of hierarchy

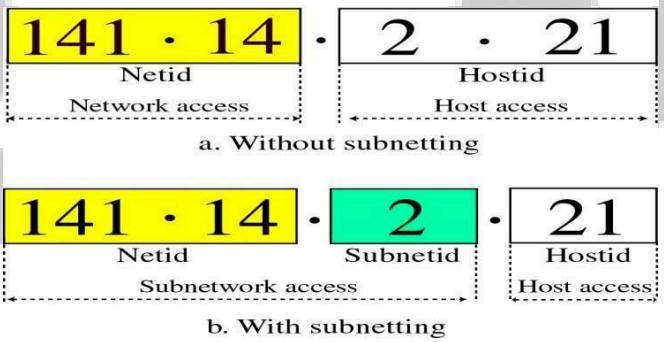


(A Network with Two Levels of Hierarchy)

- In this case, the hosts cannot be organized into groups, and all of the hosts are at the same level.
- As a result the organization has one network with many many hosts .
- To make a network more organize, three levels of hierarchy is implemented.
- Subnetting creates an intermediate level of hierarchy in the IP addressing system. Now we have 3 levels: netid, subnetid, and hostid.



(A Network with Three Levels of Hierarchy)



(Addresses with and without Subnetting)

Masking

- A process that extracts the address of the physical network from an IP address.
- Masking can be done whether we have subnetting or not.
- If we have not subnetted the network, masking extracts the network address from an IP address.
- If we have subnetted, masking extracts the subnetwork address from an IP address.

Finding the subnetwork address

To find the subnetwork address , apply the mask to the IP address.

Boundary Level Masking:

If the masking is at the boundary level the mask numbers are either 255 or 0),finding the subnetwork address is very easy. Follow these two rules:

1. The bytes in the IP address that correspond to 255 in the mask will be repeated in the subnetwork address.
2. The bytes in the IP address that correspond to 0 in the mask will change to 0 in the subnetwork address.

Example

IP address	**45**	**.**	**23**	**.**	**21**	**.**	**8**
Mask	**255**	**.**	**255**	**.**	**0**	**.**	**0**
Subnetwork address	**45**	**.**	**23**	**.**	**0**	**.**	**0**

Example

IP address	**173**	**.**	**23**	**.**	**21**	**.**	**8**
Mask	**255**	**.**	**255**	**.**	**255**	**.**	**0**
Subnetwork address	**173**	**.**	**23**	**.**	**21**	**.**	**0**

onboundary Level Masking:

If the masking is not at the boundary level (the mask numbers are not just 255 or 0),finding the subnetwork address involves using the bit-wise AND operator. Follow these two rules:

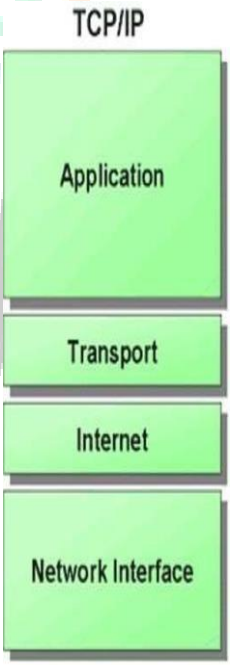
1. The bytes in the IP address that correspond to 255 in the mask will be repeated in the subnetwork address.
2. The bytes in the IP address that correspond to 0 in the mask will change to 0 in the subnetwork address.
3. For other bytes, use bit-wise AND operator.

Example							
IP address	**45**	**.**	**23**	**.**	**21**	**.**	**8**
Mask	**255**	**.**	**192**	**.**	**0**	**.**	**0**
Subnetwork address	**45**	**.**	**64**	**.**	**0**	**.**	**0**

Example							
IP address	**213**	**.**	**23**	**.**	**47**	**.**	**37**
Mask	**255**	**.**	**255**	**.**	**255**	**.**	**240**
Subnetwork address	**213**	**.**	**23**	**.**	**47**	**.**	**32**

TCP/IP Protocol Suite

TCP/IP Suite consists of Four layer



1. **Network Interface layer**:
   - It include the function of physical layer and data link layer
   - It is the bottom layer of TCP/IP Model lies below the Internet Layer.
   - Function of this layer is to connect the Host To Network & inform the upperlayers so that they could start sending the data packets.
   - This layer varies from network to network.
   - Host To Network Layer protocols
     - SLIP(Serial Line IP)
     - PPP(Point To Point Protocol)

2. **Internet Layer :**
   - The internet layer is exactly same to the network layer of OSI model
   - IP is the primary protocol operating at this layer and it provides data encapsulation routing, addressing and fragmentation services to the protocols atthe transport layer above it.
   - The fives network layer protocol are as follows:-
   - The fives network layer protocol are as follows:-

1. ARP
2. RARP
3. IP
4. ICMP
5. IGMP

- IP is an Important protocol in this layer.

ARP (Address resolution protocol)

- Every machine on internet has one address, these address cannot actually be used for sendingpackets data because data link layer does not understand the internet address.
- ARP Provides an essential services when TCP/IP is running in LAN.

RARP (Reverse Address Resolution Protocol)

- The Reverse Address Resolution Protocol is used to obtain the IP address of a Host basedon Its physical address. That is , it preform a job that is exactly opposite to that of ARP.
- RARP works in a very similar way to ARP. but in the exactly opposite direction , as shown inthe side figure.

Internet Protocol (IP)

- Internet Protocol is very important protocol present in this network layer.
- IP is the protocol responsible for carrying data, generated by nearly all the other TCP/IP protocol,from the source system to its destination .
- IP Features : -
  - Unreliable : IP is unreliable , it means that it does not provide a guarantee that adatagram send from a source computer definitely will arrive at the destination.
  - Connectionless : IP services is similar to the postal service.
- It is possible that the order in which the message are sent and the order in which they arereceived is different**.**

3. Transport Layer

- The transport layer runs on the top of internet layer and is mainly concerned with transport ofpackets from the source to the destination.

- The main function of transport layer is to deliver packets between the end points.

- In TCP/IP, the transport layer include to protocols : TCP

  and UDP.Comparison between TCP And UDP

Parameter	UDP	TCP
Data Transfer	Data is sent in discrete packages by theapplication.	Data is sent by the application with no particular structure.
Transmissio nspeed	Very High	High but not as high sUDP
Protocol connection setup	Connectionless	Connection oriented
Used	UDP is useful when speedof delivery is critical	TCP is useful for transmission of datawithout error.

4. Application Layer

- The TCP/IP Model Does Not have Session or presentation layer on the top of the transport layer.
- It is just has the application layer. It contains all higher level protocols.
- Higher Level Protocols Used in application layer are as Follows:
- TELNET: - the virtual terminal protocol allows a user on one machine to log onto a distantmachine and work there.
- FTP: - File Transfer protocol provides a way to move data efficiently from one machine toanother.
- SMTP: - Simple mail transfer protocol developed for email transfer.
- DNS: -Domain Name System Protocol is used for mapping the host names onto their networkaddress.
- HTTP: -hyper Text transfer Protocol is used for fetching pages on the world wide web (WWW)and many others.

TCP/IP	OSI
Implementation of OSI model	Reference model
Model around which Internet is developed	This is a theoretical model
Has only 4 layers	Has 7 layers
Considered more reliable	Considered a reference tool
Protocols are not strictly defined	Stricter boundaries for the protocols
Horizontal approach	Vertical approach
Combines the session and presentation layer in the application layer	Has separate session and presentation layer
Protocols were developed first and then the model was developed	Model was developed before the development of protocols
Supports only connectionless communication in the network layer	Supports connectionless and connection-oriented communication in the network layer
Protocol dependent standard	Protocol independent standard

Comparison Between OSI and TCP/IP

Digi{Coders}