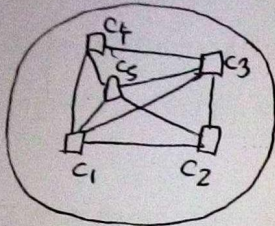


9/1 (1)

COMPUTER NETWORK

→ Data Communication & networking by Fraumen.



Network is an interconnection b/w autonomous machines (independent)

- Fully independent means no master-slave relationship or client-server one.
- All machines are sharing information only thus forming a network & they do not share peripheral devices or OS or memory or software or hardware whereas client-server relationship shares all.

COMMUNICATION

→ Sharing of information.

- TELE COMMUNICATION :- telephonic exchange of data (only voice info is shared)
- DATA " :- exchange of data (info. of all types - file, text, audio, video & other special files) info.
- LOCAL SHARING → face to face comm.
- REMOTE " → over the distance.

EFFECTIVENESS OF DATA COMMUNICATION :-

It is measured by following components :-

- 1) ACCURACY :- Accurate data should be delivered
- 2) CORRECT DELIVERY :- Delivery to correct destination
- 3) PROPER TIMING :- Delay should be minimum
- 4) JITTER :- No filtering of packets (the sequence in which data is send should be same when delivered).

A packet has a header & a trailer. The header contains the destination address & trailer contains the data about next packet id to be allocated, attached.

COMPONENTS OF DATA COMMUNICATION

- 1) Sender
- 2) Receiver
- 3) Message
- 4) Channel/Medium

Sender $\xrightarrow{\text{Message}}$ Receiver

Channel/Medium

- Wired (Visible) :- Using hardware components
- Wireless (Invisible) :- satellites, radio waves

IMP

PROTOCOLS :- Are the set of rules that govern the communication. They are the agreement made b/w sender & receiver.

PROTOCOL $\rightarrow$ what (sender receives message)
 $\rightarrow$ when (timing)
 $\rightarrow$ how (channel)

KEY ELEMENTS

- SYNTAX :- defines the format of data
- SEMANTICS :- Defines the method of decoding the pattern
- TIMING :- Defines when data should be sent & how fast.

H E L L O
1 2 3 4 5

Head $\leftarrow$ [H] $\rightarrow$ Trailer

SYNTAX OF
DATA

[O X]

Receiver
should know when
to terminate with
semantics.

$\rightarrow$ Rec Decoding required at receiver end (semantics)

When protocols are documented, they become a standard.

Standards

- **DEFACTO (By fact)** :- They are not governed by any gov. , Locally formed & used .
- **DEJURE (By law)** :- Defined by governing body & everybody is abide to follow the rules .

DATA FLOW B/W SENDER AND RECEIVER :-

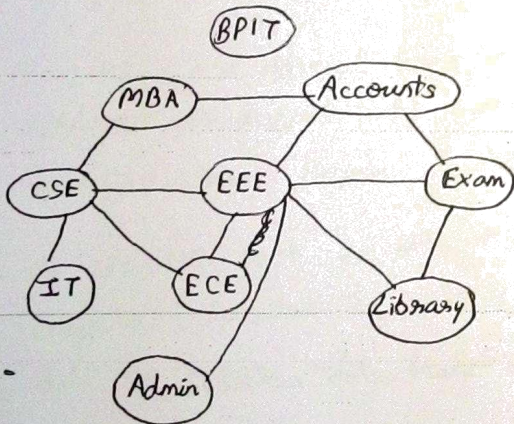
3 methods :-

- 1) SIMPLEX COMMUNICATION :- $A \rightarrow B$ A to B or B to A (single flow)
- 2) HALF DUPLEX " :- $A \rightleftarrows B$ A to B or B to A (one at a time)
- 3) FULL " :- $A \leftrightarrow B$ (simultaneously)

INTERNET :- It is a type of network which interconnects many computer networks, where only information is shared. The computers are autonomous in nature.

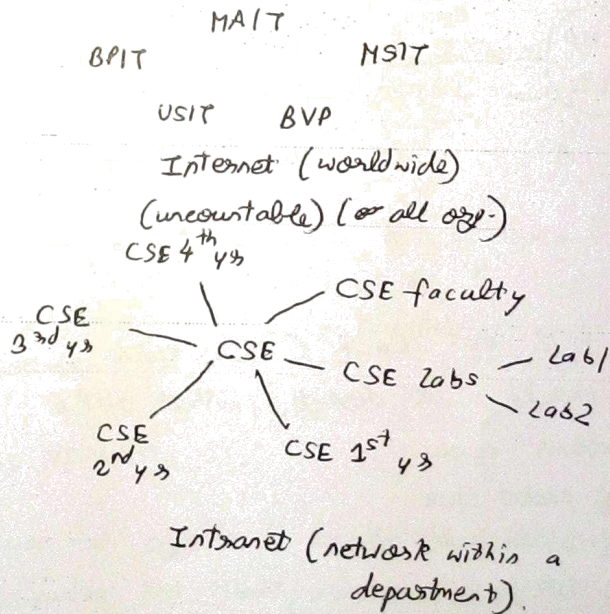
Interconnection of uncountable no. of autonomous machines.

Internet :- Interconnection of countable no. of autonomous machines.



internet
(countable)

(network within organization)



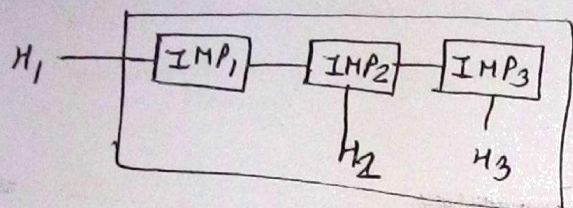
HISTORY OF INTERNET :-

→ In mid 1960's, there were standalone labs. There were no sharing of information or no network.

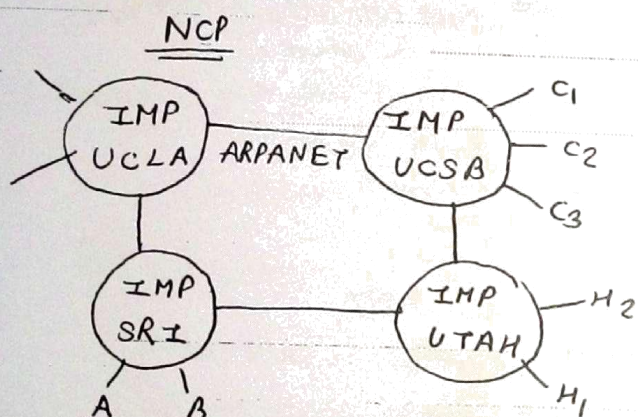
ARPA $\rightarrow$ Advanced research project Agency

→ Department of Defence of ARPA → in 1967 organised a meeting of ACM presented an idea of small network called ARPANET. Idea was

"each host computer will be connected with special computers, — IMP (Interface Message processor, serves for searching message) & all the IMPs should be interconnected. The interconnection of small IMPs will form ARPANET."



In 1969, ARPANET became a reality in which 4 universities (University of California & Los Angeles, University of California at Santa Barbara, University of Utah & Stanford research institute.) The 4 universities were connected to each other forming ARPANET & the protocol followed was NCP (Network Control Protocol).



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In 1972, Vint Cerf & Bob Kahn presented idea that inter connections b/w host should be direct without IMPs.

Some problems occurs :-

- 1) Diff. packet size
- 2) Diff. transmission rate
- 3) Diff. interface
- 4) Diff. reliability requirements

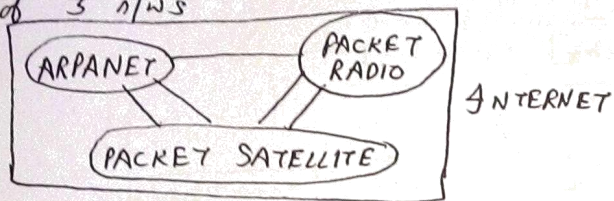
So to overcome these problems, GATEWAY was designed & its purpose was synchronization.

gateway is
and main p

gateway is a device that is used to connect two networks and its main purpose is synchronization.

In 1973, NCP was replaced by TCP (Transmission Control Protocol) where it is responsible for error handling & correction. ARPANET was handed over to DCA (Defense communication agency).

In 1977, TCP was replaced by TCP/IP. TCP can't handle packets. IP handles datagrams (packets). So first internet was formed that consists of 3 n/w's



In 1980, a new OS UNIX came in the market.

In 1981, OS was changed to UNIX for networking coz UNIX was open source OS. CCNET sponsored by National Science Foundation was created less expensive & its transmission rate is low.

In 1983, a new official name was assigned to ARPANET, that was Internet. ARPANET was divided into 2 groups: MILNET & ARPANET where MILNET was used for military purpose & ARPANET for non-military users.

In 1986, NSF came up with NSFNET, was a interconnection of 5 super computers located in centres of US. Data transmission rate of 1.544 mbps.
 thinking capability.

In 1990, ARPANET was totally replaced by NSFNET.

In 1991, US govt. decided that NSFNET was not capable to handle the increasing traffic so came up with ANSNET. 3 companies IBM, Merit, MSI created a new high speed Internet using advanced network service known as ANSNET.

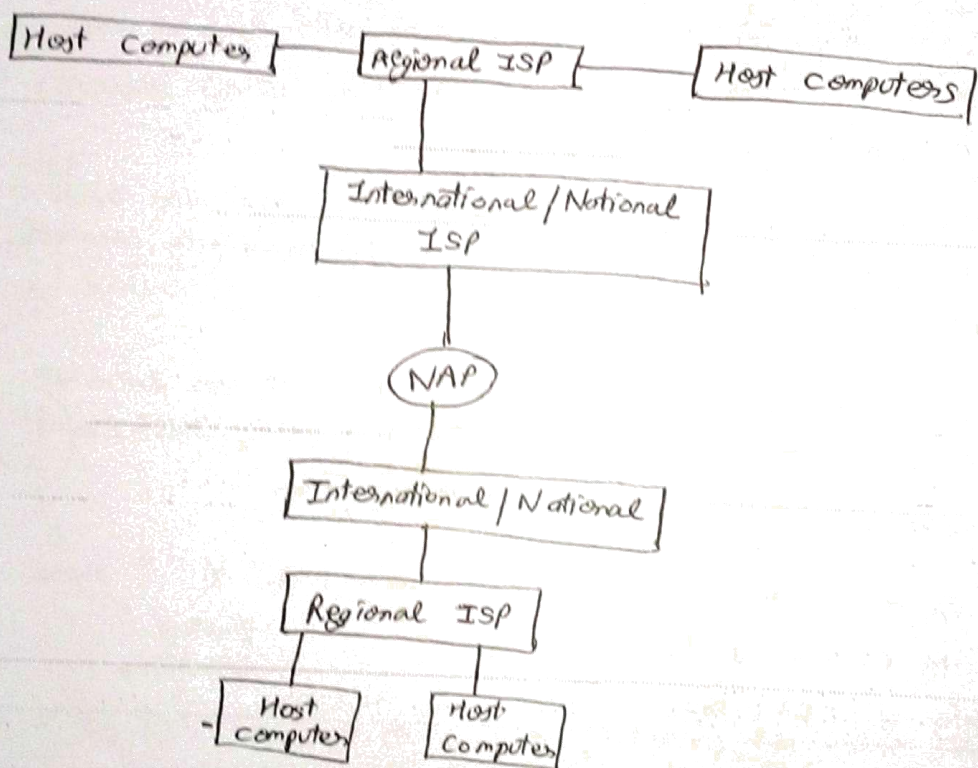
Internet used today is enhanced version of ANSNET.

In 1995, NSFNET was converted to research projects.

- 1967 - Idea of Arpanet
- 1969 - Ap. Market
- 1972 - Gateway
- 1973 - NCP → TCP
- 1977 - TCP → TCP/IP
- 1980 → UNIX
- 1981 → UNIX with TCP/IP, CSNET
- 1983 → ~~A~~ ARPANET → INTERNET.

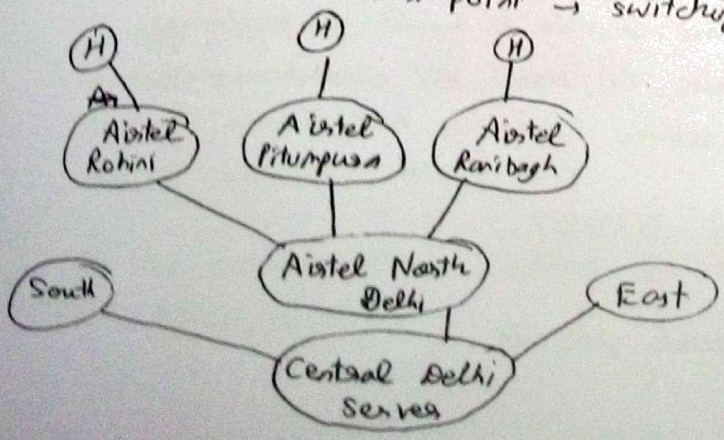
7/2

STRUCTURE OF INTERNET :-



ISP - Internet Service Provider

NAP - Network access point → switching stations (similar to gateway)



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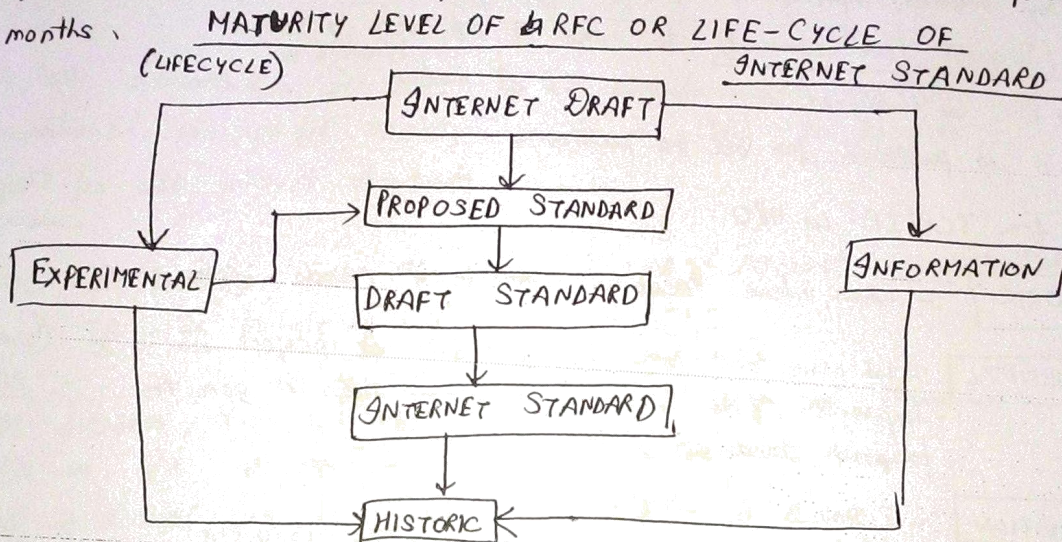
COMPUTER NETWORKS

INTERNET STANDARD

→ Thoroughly tested specifications which everyone who uses internet has to follow them strictly.

→ FIRST we propose a problem statement by ^{draft} group for 6 months (MINIMUM PERIOD).

→ Draft is a document that defines the rules which is studied for 6 months.



→ Idea to change existing methodology & tells diff ways to do it.

INTERNET DRAFT :- Problems fetched in currently executing rules & regulations of the idea that comes that it can be better one. When such ideas are noted on a paper is called INTERNET DRAFT. (THIS CAN BE A BETTER WAY).

PROPOSED STANDARD :- When we try to calculate solution of the ideas in draft & we start working for the solutions.

→ It is stable specification on which the research has started from draft & it is of interest on internet society.

→ It gives solution of the problem.

→ It is worked on for minimum 6 MONTHS & is to be implemented by several groups.

→ If atleast 2 groups says that it is successful then we go to next stage i.e. draft standard otherwise it goes to HISTORIC ~~for also it didn't work~~

DRAFT STANDARD :- More refined ~~specification~~ solution to the problem. - Period of 4 months. with stress testing (to test the specifications beyond limits).

- If 2 group gives positive feedback then it gets official name & it becomes INTERNET STANDARD. It means that it had become thoroughly tested specification of ~~now every~~

INTERNET STANDARD

- stable, thoroughly tested specification.
- Now it has to be published.
- Every internet standard is published then & known as RFC (Request For comment). to make it available globally.
- Every RFC is assigned a unique ID & number.
- Now it is published for all the parties.

RFC for TCP/IP is 1180.

HISTORIC :- When ideas becomes obsolete & needs improvement.

EXPERIMENTAL :- When we think idea is good but not perfect so it is improved. If it becomes beneficial then it goes to proposed standards otherwise rejected.

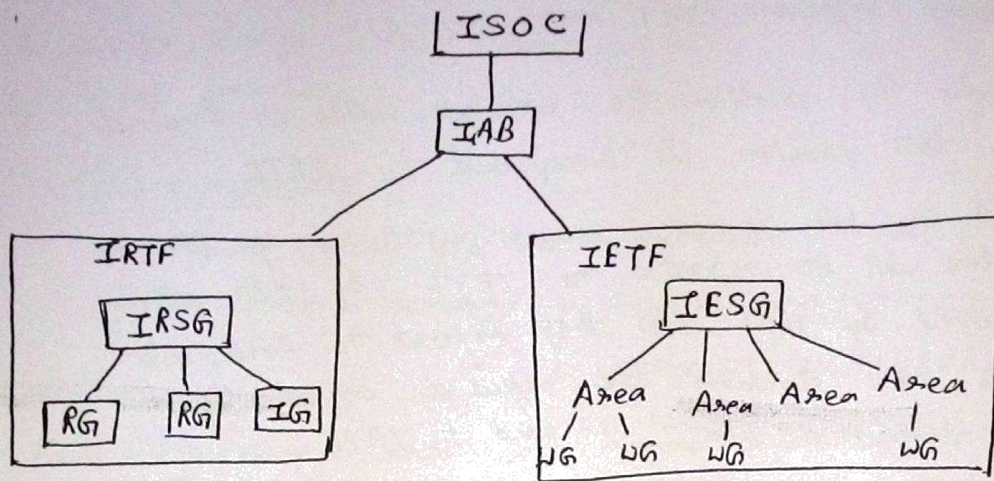
INFORMATION :- Tutorials of drafts.
- When information gets old it is send to HISTORIC.

REQUIREMENT LEVEL OF RFC

5 requirement level :-

- 1) REQUIRED (Mandatory) :- Must for internet communication. Ex:- TCP/IP.
- 2) RECOMMENDED :- Not mandatory but useful. Ex- FTP
- 3) ELECTIVE :- Depended on user's use. Ex:- Encryption.
- 4) LIMITED USE :- RFC that are used in limited situations - Ex. Research
- 5) NOT REQUIRED :- Ex:- Historic

INTERNET ADMINISTRATION :-



- The basic administration of internet is done by ISOC (Internet Society). It is international non-profit society found in 1992 to provide support for all internet standards.

- ISOC is working with the help of IAB (Internet Administrative Board). IAB is technical advisor to ISOC.

IAB :-

- IAB oversees the continuous development of all the standards & acts as the advisor to all the committees.

IAB is divided into 2 groups:-

- Internet Research task force (IRTF)
- Internet Engineering task force (IETF).

IESG

IESG → Internet Engineering Steering Group.

It deals with all the operational problem of internet & proposes solution to the problem.

- They are further divided in working groups known as AREAS.
- Each area concentrate on a specific topic. Currently there are

9 areas-

- Applications
- 2) Internet Protocols
- 3) Routing
- 4) Operations
- 5) User services
- 6) Network Management
- 7) Transport
- 8) Internet Protocol next generation
- 9) Security.

Area further contains appointed WG (Working group).

If the problem to solve the problem the existing rules or standards are not good then that problem is transferred to IRTF.

Users are present in WG. If WG arrives with any problem then first that problem will be reported to IETF. If that problem is not being diagnosed by them then they report to IAB.

IAB checks whether new standards are required or not. If new standards are required then it is sent to IRTF.

After problem is solved.

1912 IRTF → IAB → IETF → IESG → Area → WG.

USES OF COMPUTER NETWORK

used to establish computer network:-

- 1) Resource Sharing : Sharing of device.
- 2) Database Sharing
- 3) Communication among computer/systems :- Chatting
- 4) Sharing of information : File transfer.
- 5) To connect systems/computer in a building
- 6) For education purpose.

Use

- 1) In Business application
 - Sharing of data, database, information, resources
 - Communicating with clients.
- 2) Desktop sharing
 - Telnet - Remote sharing.
- 3) E-commerce.
- 4) Virtual Private Network :- It helps to perform WORK FROM HOME in MNCs.
 - They are connected only to a small group.
- 5) Social Media
- 6) Smart home :- When using all appliances using a remote.
- 7) Globally connecting everyone :- Aadhar Card.

DISADVANTAGE :-

- 1) Personal information is easily available.
 - ↓
 - Security concern.
- 2) Leading to lot of distraction
- 3) Malware

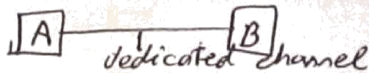
- 4) Unwanted sharing :- Virus, cookies.
- 5) Illegal behaviour

NETWORK HARDWARE

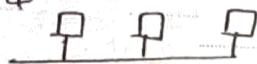
- It deals with how to establish network.
- Transmission Technology
 - Point to point / UNICAST
 - Multipoint / MULTIDROP / BROADCAST
 - Scale.

POINT-TO-POINT :- When some communication channel is shared b/w sender & receiver & this channel is dedicated channel.

[i.e. only sender & receiver can use it no one else can interfere with that link].



MULTI-POINT :- A channel is shared by ~~an~~ 1 sender & many receivers & vice-versa.



SCALE :-

On the basis of scale, network can be of 4 types :-

- PAN
- LAN
- MAN
- WAN

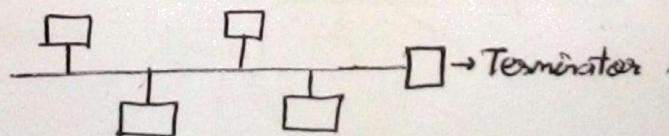
NETWORK TOPOLOGIES :-

It is a geometric representation of the relationship of all the links in the network. Network Topology describes the layout or the appearance of network i.e. how computers, cables & other components are interconnected both physically & logically.

(how systems are kept?) (how data will flow).

TYPES :-

1) BUS TOPOLOGY :-



- Multidrop connection but communication is point to point (channel capacity is shared b/w multiple users).

- Scenario :- PUSH & PULL to send & receive message. Source will push the message to channel capacity, then all b/w systems will check pull it, if its not of itself then it will push it otherwise will pull it.

terminator will tell that bus topology is completed.

Messages are always transmitted in forward direction.

If message reaches to terminator, it means that is not of any previous systems. Now terminator will send the information to the starting system in bus topology.

If any information is not pulled by any system & then that message reaches to sender. At that time, sender will only pull the message & will discard it.

→ It is applied in single room.

It is of 2 TYPES :-

- REGULAR BUS :- All machines are fixed at starting point only. So no new machines can be arranged without re-installing it. FIXED NUMBER OF CONNECTION.
- LOCAL BUS



ADHOC TECHNOLOGY :- Here temporary topology is arranged b/w machines. Now when desired information is transferred that topology is discarded.

→ CONNECTIONS CAN VARY

FEATURES OF BUS TOPOLOGY :-

- ∴ Signal circuit to which all the devices are connected.
- ∴ Multi-drop connection.

ADVANTAGES :-

- ∴ Easy to understand & easy to install.
- ∴ It requires less wire for connection.
- ∴ No central point.
- ∴ Easy to expand.
- ∴ Signal strength is maintained.
- ∴ Fault isolation is easy.

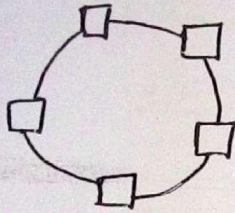
DISADVANTAGES :-

- ∴ If any problem in main wire, complete system will shut down.
- ∴ Speed is very slow.

... Main
RING

∴ Maintenance cost is high. [It is difficult to diagnose fault].

RING TOPOLOGY :-



- Multi-drop connection in which ^{message} communication is broadcasted.
- Pull & ignore.
- Used where high performance is required.
- Here whenever an information is sent it is sent with a time interval, if it is fetched in that particular time interval then info is fetched otherwise it is discarded.

FEATURES :-

- * Direct transmission of message
- * Only the receiver receives rest ignores message.

ADVANTAGES:-

- * System growth is easy
- * All system have equal access.
- * Data packet travel at greater speed.
- * Congestion

DISADVANTAGES

- * Congestion is high.
- * If 2 machines want to traffic at same time, it will cause congestion.

TREE TOPOLOGY :-

→ parent-child relationship

