

Ch-1

* **CN** :- Multiple PC connected to each other to share info. & resources. Pros :- file sharing, flexible access, Internet, resource sharing.

* **Internet** :- World-wide computer nw.

- network of networks.

* **Protocol** :- Set of rules that governs data communications.

- Elements :
 - 1.) Syntax : format / structure of data
 - 2.) Semantics : each section of bits.
 - 3.) Timing : what time & how fast data can be sent.

Data Communication :- 2 types :

- 1.) De facto : facts / by convention [not officially approved but widely used - Many factors]
- 2.) De jure : law / by regulation [officially approved]

* **Types of nw** :-

1.) **LAN (Local Area N/w)** :- single building / campus)

- composed of comp. hw & transmission media & sw (1 to 10 km)

- Transmission capacity = ($> 1 \text{ Mbps}$)

- Properties = low delay, low error rate, limited no. of

stations, broadcast, peer relationship btwn stations.

- LAN's can be differentiated by
 - = Protocols: rules for sending data
 - = Media: connection medium (twisted cable, optic cable)
 - = Topology: arrangement of devices

2.) MAN (Metropolitan Area Network): - city/group of offices

- Transmission rates = 34 - 150 mbps
- Properties: 2 unidirectional buses, fibre optic transmission
- (10 to 100 km)

3.) WAN (wide area network): - state, country / world

- connects diff. nw including LAN & MAN
- (Beyond 100 km)

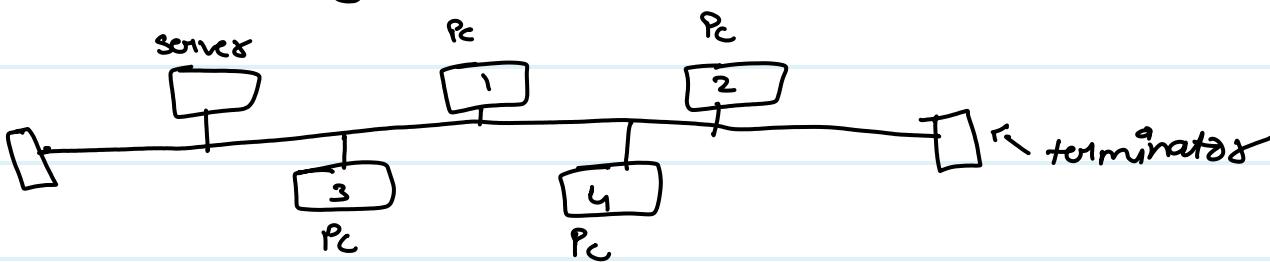
* NW Topologies: - Manner in which nodes / pc are arranged & connected.

- features: - flexible to accomodate changes in physical loc., cost should be min., no single point of complete failure

Types of topologies: - bus, star, mesh, ring & hybrid.

1.) Bus Topology :- Horizontal topology

- nodes are connected 'by' by drop cables at connectors
- When 1 pc sends signal, all pc on the nw receive the signal, but only one pc accept it using add. matching
- passive topology: requires termination cable



Pros :- low cost

- easy to use
- fewer phy. connectivity devices

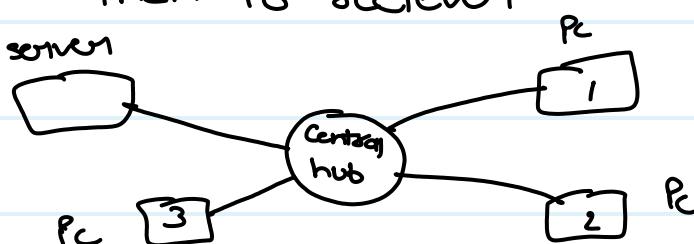
Cons :- Heavy traffic can slow a bus

- difficult to troubleshoot
- failure of cable affects all devices
- difficult to add new node

2.) Star topology :- all nodes connected to a central hub

- Data travels from node to central hub &

then to receiver



Pros :- easy to control

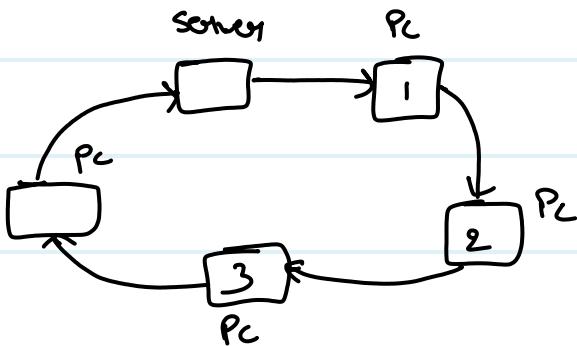
- troubleshooting is easy
- failure of any node won't lead to complete failure
- less wire required.

Cons :- If central hub fails, whole n/w fails

- each device req. its own cable
- Installation is difficult.

3.) Ring topology :- each node connected to next node, & last node connects to first node.

- unidirectional data flow.



- Active topology: no termination required.

- each node transmits data received

Pros:- cable failure can be easily found.

- no monopolized n/w

Cons:- adding / removing nodes

disrupts the n/w

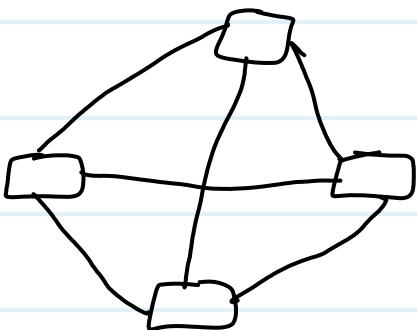
- difficult to troubleshoot.

- one node failure, leads to ring failure.

- cost of cable is more

4) Mesh topology :- each & every node is connected to each other

- Much bandwidth available.



Pros:- troubleshooting is easy
- isolation of link failure is easy

Cons:- difficult installation
- costly
- difficult to reconfigure

5) Hybrid Topology :- combination of 2 or more topology

* Types of services :-

Connection-Oriented

- path established btwn source & destination

- Telephone System

Connection less

- it goes directly from idle TO data transfer mode & then again to idle
- email systems

* New Cox :- Mesh of routers that interconnect the Internet's end system.

3 types of switching technique :-

1) Circuit switching :- It reqd. to establish connection initially

- Inorder connection $[s = a, b \rightarrow d = a, b]$

- Steps :- establish connection

 - communicate

 - end connection

- works on physical layer

- fixed path for all

- reserved bandwidth

$$\begin{array}{c} \text{Setup time} \\ \uparrow \\ \text{Total time} = ST + T_f + T_p \\ \downarrow \text{transmission} \\ + T_{teardown} \end{array}$$

- Better for large data

- low propagation delay

2) Packet switching :- data / msg split into small parts = packets

- works on store & forward transmission.

- packets can take different path

- Out of order transmission $[s = a, b \rightarrow d = b, a]$

- Total Time = $\underbrace{x \cdot \frac{l}{B}}_{\tau_t} + \underbrace{x \cdot \frac{d}{v}}_{T_p}$

- header required.

- better for small sized data

2 types of packet switching: Virtual & datagram

Virtual

- fixed path
- in-order
- connection oriented
- no header required
- Costly
- reservation of CPU, bandwidth & buffer
- reliable

Datagram

- path may vary
- out-of-order
- connection less
- header required
- cheaper than virtual
- no reservation
- Not reliable

* Types of delays:-

1.) Processing delay :- Time req. examining the packet header & determining where to direct the packet. $[d_{proc}]$

2.) Queuing delay :- Time spent by packet in the queue before sending for execution.
- $[d_{queue}]$

3.) Transmission delay :- Time taken to transmit all packets over the link
- also called Store-&-forward delay $[d_{trans}]$

- Transmission delay = $\frac{\text{Packet length}}{\text{Trans. rate}}$

4.) Propogational delay - time req. by packet to travel from transmitting node to receiving node. $[d_{\text{prop.}}]$

- Propogation delay = $\frac{\text{distance}}{\text{trans. speed}}$

5.) Total Nodal delay = $d_{\text{proc}} + d_{\text{queue}} + d_{\text{trans}} + d_{\text{prop.}}$

*Protocol layers & their service modes:-

- OSI Model

* OSI Model :- Open System Interconnection.

- 7 layers : Physical layer

Data layer

NW layer

Transport layer

Session layer

Presentation layer

Application layer

i.) Physical layer :- deals with functional, procedural, electrical, mechanical characteristics & topologies

functional :- Types of transmission :

- Simplex - unidirectional ($S \rightarrow R$)

- duplex - bidirectional ($S \leftrightarrow R$)

- half duplex - bidirectional, one at a time ($S \nleftrightarrow R$)

- lowest layer

- Functions :-

- Representation of bits : encodes the bit stream into electric or optical signal

- Data rate : defines duration of a bit

- Synchronization of bits : transmission & receiving rates must be same, by synchronizing clocks at both ends.

2.) Data link layer :- transmitting frames from one node to next node.

- flow control (Go Back N), error control (CRC), framing, physical addressing

- 2 sublayers :- LLC (Logical Link Control) =

flow control

MAC (Media Access Control) : framing, physical addressing.

- functions :- framing : frames from nw layer divided
flow control : data flow is controlled

error control : detect, retransmit lost frames.

physical addressing: adds headers to frames

3.) Network layer:- delivering packets from source to destination

- host to host connectivity , routing , logical addressing , switching , fragmentation .
- functions :- • Routing : route packet to its final destination .
- logical addressing: adds header to packet

Note :- Physical add : locally unique add.
logical add : Globally unique add.

4.) Transport layer : - delivery of whole msg. intact & in order .

- functions :-

Connection control : provides connection less or oriented service with destination machine

- Flow control : end to end flow control . (SR)
- Error Control : error free transmission (checksum)
- Segmentation & reassembly : - msg divided into

segments, each segment has sequence no.,

so this layer can assemble at destination.

Port addressing:- nw layer delivers packets to desired pc, transport layer gets message to correct process on the pc.

5.) Session layer:- checkpointing, connection between 2 process is established, used, maintained & terminated = dialog control

- functions:

- Synchronization:- synchronization points into stream of data.
- Eg:- audio → syn. ← video

• dialog control

6.) Presentation layer:- syntax & semantics of info. being exchanged

- Functions:-

- Translation:- interoperability b/w 2 pc.
- Encryption & decryption:- ensure privacy while transmission
- Compression:- reducing no. of bits req. to represent data

7.) Application layer :- provides UI & services.

- functions :-

Nlw Virtual terminal :- slow version of phy. terminal that allow user to log onto a remote host.

FTAM :- access, transfer & manage file in remote host.

- Mail Services
- Directory Services

* TCP / IP :- Transmission control protocol / Internet protocol.

- consists of 4 layers :- Application layer
[session & presentation layer]
- Transport layer
[nlw layer]
- Internet layer
[Physical & data link layer]
- Host-Nlw layer

Host-Nlw layer :- Also called physical & data link layer.

- responsible for accepting & transmitting IP

datagram

- It can't define any protocol.
- Consists of device drivers in OS & nlw interface card in machine.

- 2.) Internet layer :- also known as nlw layer.
- handles communication btwn machines & routing of packets.
 - IP provides = addressing : determine route to deliver data
 - = fragmentation : breaking msg into small part.
 - Connectionless method.

- 3.) Transport layer :- 2 protocols : TCP
: UDP (User Datagram Protocol)

- TCP → connection oriented protocol, allows byte stream
- UDP → connection less protocol, reliable delivery

- 4.) Application layer :- combination of session & presentation layer.

- all process & services that use transport layer to deliver data
- TELNET, FTP, SMTP, SNMP .. etc.

* Types of address :-

1.) Physical :- link add. , defined by LAN or WAN ,
included in frame by data link layer. in header part , changes hop to hop.

2.) logical :- 32-bit , uniquely defines host connected

to internet.

3.) Port :- label assigned to a process in TCP/IP architecture, 16-bits.

* DOS :- attacker prevents legitimate user from accessing info.

- Types : • Penetration : attacker gets inside your machine
 - Man in Middle : attacker listens & controls it.
 - Eavesdropping : attacker gains access to same hw.
 - Flooding : attacker sends huge no. of msgs to create congestion.

Transmission Media :- anything that can carry info. from source to destination

- 2 types :- Guided (Physical) :- twisted pair, coaxial, fibre optic

Unguided (Wireless) :- microwave, radio wave, infrared wave.

1.) Guided media :- provide channel from one point to other

⇒ twisted pair :- 2 insulated copper wires

1 mm thick are twisted in helical form.

2 types of twisted pair:

Unshielded

category 3

loosely twisted
Bandwidth: 16 MHz



Shielded

twists per cm
Bandwidth: 100 MHz

has metal foil or braided mesh



⇒ Coaxial Cable:- stiff copper wire as a core surrounded

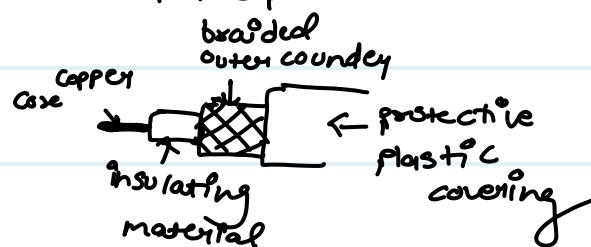
by insulating material

2 types

50 ohm
↓
digital transmission

75 ohm
↓
analog transmission

Used in telephones



⇒ fiber optic:- made of glass or plastic & transmits

signals in form of light.

:- same as coax w/o braided layer

2.) Unguided (waveless) :-

Radio wave

micro wave

infrared wave

- long distance

- short distance

- shorter range
- can't pass through solid objects

- penetrate through building

- can't penetrate well through building

- TV remote

- frequency dependent
- omnidirectional

- travel in a straight line.

- better security

Ch-2

