172.22.2.120/CSE

CN.

26/12/16.

Interconnection between nodes - network.
Processing of data.
Network of computing devices.
- Communication
- Information sharing. (data).
- Distributed computing
- Resources sharing. (H/W).
- Software resources sharing. (application)
- Remote computing. FD.

Security → disadvantage of CN.

Data communication:
- Receiver and sender. (destination and source)
- Message
- Transmission medium.
- Set of rules agreeable by both the nodes.

Protocol has three components
- Syntax.
- Semantics.
- Timing.

} everything is explicitly defined

Network provides the infrastructure for communic^n. Processing between different nodes but two nodes are necessarily not interacting.

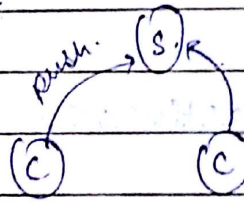
Characteristic requirements of data communic^n -
- Delivery
- Accuracy.

- Timing.
- Jitter. → message does not go as a single entity! (packets).
Message should have even delay b/w two packets.

Data flow → in which direction data is flowing

Simplex. → fixed rec. and sender.
Half duplex → at a time one, can change.
Full duplex → simultaneously rec. and sender.

Email.



Failed mail → error, not reply.
gets information only when it fetches for it.

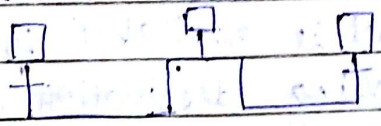
DB. Query. HD. Web - HD.
Connection - multipoint.
- point to point

28/12/16

Network Infrastructure → enables communication
Network services → application purpose. (both s/w and h/w.)

Intermediate nodes needn't follow protocol.
Protocol requires agreement of source and destination only.
Point to point - both parties are connected directly.

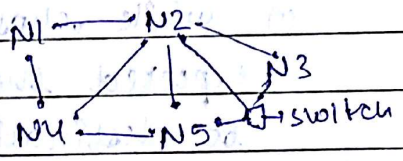
Type of connection:
- Point to point → are directly connected.
- Multipoint
Two network cards can be connected by point to point with two devices.



Topology → organisation of node.
- Star topology
- Bus topology
- Ring topology.
- Tree topology
- Mesh topology. →

all devices are connected directly

Type of network.
- LAN. → Geographically within a certain area. (Belongs to one network.) eg Wifi.
- WAN. → Connection of two different networks. (only connection part, not the whole thing). (mainly service providers).
  (a) Point to point.
  (b) Switch.



- MAN → Network spread over entire city.
- PAN. eg Bluetooth.
- Storage Area Network (SAN). → different servers are connected.
- Inter Network → Network of networks. (Internet)

Internet vs Internet. → The " ", web services we use.
↳ can be created by companies.

Extranet

DMZ → De militarized zone.

This particular network is isolated, only [illegible] can interact, authorized access.

Physical circuit → Dedicated channel is available for connection.

Online call → Regardless of reaching destination, it is send.

Circuit Switching → circuit is established
communication (data transfer)
termination

Internet works on → Packet Switching → packets are pushed based on availability reply. (communication needn't follows same path).

Message Switching → not dividing in multiple packets, entire message is pushed no source or path specified.

30/12/16

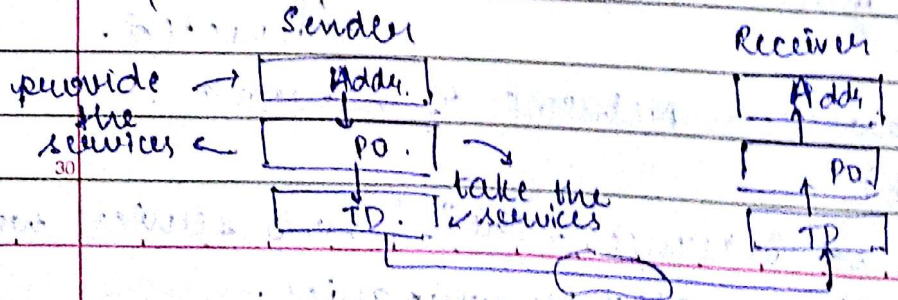
Types of communication.

(i) One to one → Both reside at same place.

(ii) while chosing intermediate person; it is expected that same message is delivered at destination.

(iii) very far, can use Postal services
Source and destination addresses vary at each st

(iv) Telecommunication



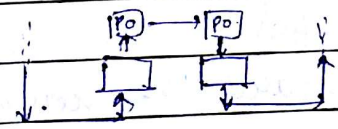
Network model. defines the concept of.
- Layer → Interface → Protocol.

Layer provides some sort of functionalities / primitives for the whole communication.

For file transfer, communication module is required to interpret correctly and then do the actual transfer. Communication takes place between two layers. The peer layers must've same set of rules being followed, i.e. protocol. → always between two peer layers.

Interface is a specified format of particular services.

1) Actual communication. → directly.
2) Virtual communication. → when lower layers helps in moving message from one point to another.

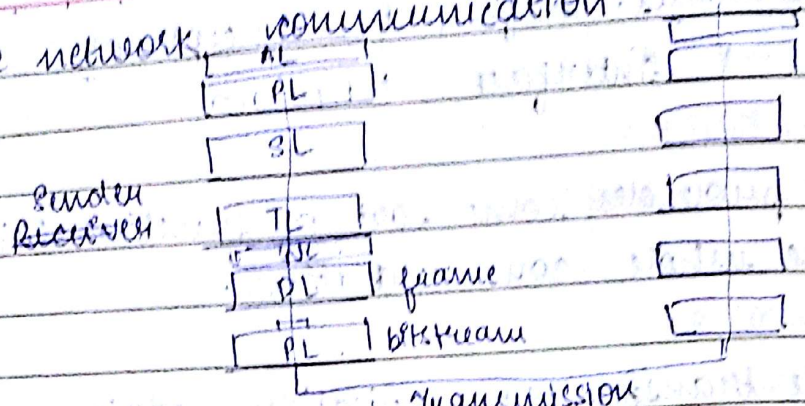


Protocol conversion.
→ only a specific layer converts the protocol.

02/01/17 (V) Human interaction.
Communication part is controlled by
→ Message.
→ Accuracy (its timing).
Vocal system is controlled and directed by mind.

Objective is defined, the way of implementation might vary. (technique).
ISO (International Standard Org) has defined.
OSI (Open System Interconnect) network model for

the network communication



AL → Application layer
PL → Presentation layer
SL → Session layer
TL → Transportation layer
NL → Network layer
DL → Data layer
PL → Physical layer

↳ communication is done by the signals.

Physical layer → electrical, magnetic, interface properties are defined so that there is a concept of interoperability. Converts the "bit into signals", "Synchronization" also, topics (vice versa). ⇒ transfers the bits.

Hello Protocol → Person starts the communication only when HELLO is said. Identification of communication been started. Process of synchron

Data link layer →

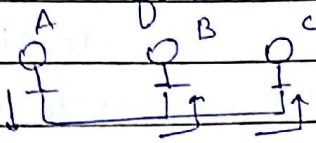
(i) Logical link control layer (LLC)
(ii) Media Access control layer (MAC).

(i) Various mechanism to identify different streams of data is "framing"
Multiple sized frames might exist.
Errors → some bits are corrupted
entire frame is not received

"Error Detection and correction" concept.

(frame level) "Flow control" occurs only when there is mismatch of speed i.e. sender is fast and receiver is slow.

(ii) Defining the "Physical Address" it is identified that message is for the particular address.

(iii) 

(Hard coded device address)

(iv) Define who has the access to transmission medium. (like Master Slave Model).

Cloud is not a communication model because it does not satisfy char. of data communic". (accuracy and delivery are breached). → from network pt. of view.

"Access Control" is defined.

PL needs the data in specific manner, only then it can be processed → Interface.

DL requires frame and address → Interface.

Network layer → provides Internetworking.

Boundary can be identified. ↓ communication b/w different networks.

04/01/17

PL → transfers bitstreams to all the layers.

DLL → checks whether that particular bitstream is for the layer or not.

PL → point to point communication.

DLL → node to node communication (very specific).

Network layer → source to destination delivery of message.

Source Destination

"Forwarding capability" and "routing"

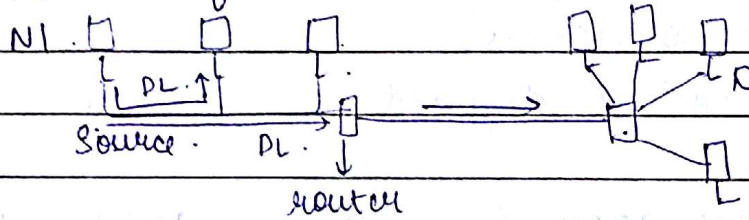
↓ ↓

moving forward from each intermediate step between source and destination in a particular route.

identifying the route

"Logical addressing" for identification of network. Duplicacy in address is possible only when it is specified to different networks.

Exit point of the network is router.



↓

routing occurs for path identification

accepted only by DLL destination address.

N1 checks if physical address belongs to the same network or not. → this becomes logical addressing.

If not deliver / transfer to router and further identify the path for the packet.

Transport layer → Delivery made to the system. In that system which process is determined. End to end delivery. "Port address / service point address is requi

Source process to end process delivery.

"Segmentation" and "Reassembling" always in ordered format

Segment the message and transfer it to next layer. ("flow control" and "Error control" (message level))

Session Layer → Very specific part of communication.

N.L. → Connection oriented → circuit switching.
Connection less → just push the message regardless of availability at destination.

"Dialog control" - establishment
data transfer
termination.

"Synchronization" - identification of starting boundary of the communication. Clock should be same.

Presentation Layer → Message is delivered, we need to know the format of the received message.
"Encryption, compression, translation."
"Data representation" in which format.

Application Layer → What type of network services we have to use? Eg. file service, mail service etc. ↳ will be enabled.

06/01/17

TCP/IP MODEL (OSI → reference model. model done in previous lecture).
- Network at software level.
- Protocol stack.
- TCP → Analogy to Transport Layer.
(Transmission Control Protocol)
- Move data from one point to another (inter).
- NL provides networking.

TCP / IP		OSI
User interface (Appl^n layer)		
TCP	CO, CL	CO
IP	CL	CO, CL

(Internet protocol)

Network interface (like a physical layer)

IP, ICMP, IGMP - Protocols all in Present^n layer
RIP, OSPF

Transport layer - end to end connectivity.

RIP for routing, protocol to distinguish logical addr from physical address.

OSI vs TCP/IP

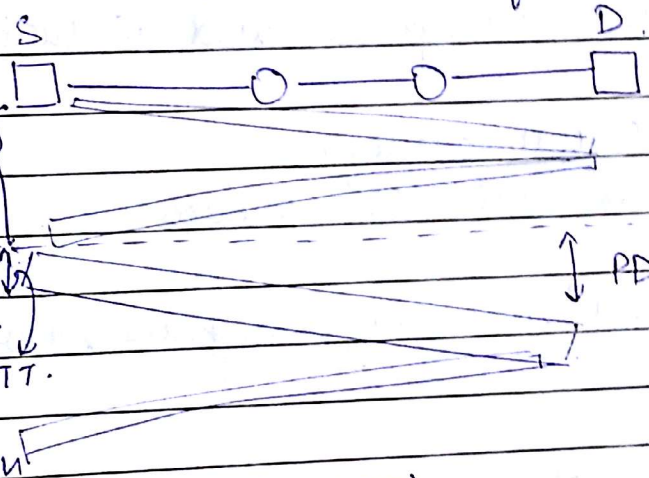
- In IP, CL (connection less service) is like postal w/o knowing whether destination is ready to get service or not.
- TCP layer has both "connection oriented" and "CL service"
  - ↓
  - first establish connection then transfer data.
- Packet comes from upper layer establishment request, data requests, termination requests etc, all come in form of packets.
- There is no need to make connection from one point to another point. No need to identify the type of data.

SWITCHING

3 types ← Circuit switching (CS)
Packet switching (PS)
Message switching (MS).

OCI → Just a difference model.
TCP/IP → Not a model but a protocol stack.
(say arranged in layered architecture)

If only 2 nodes, move node from one pt to another pt

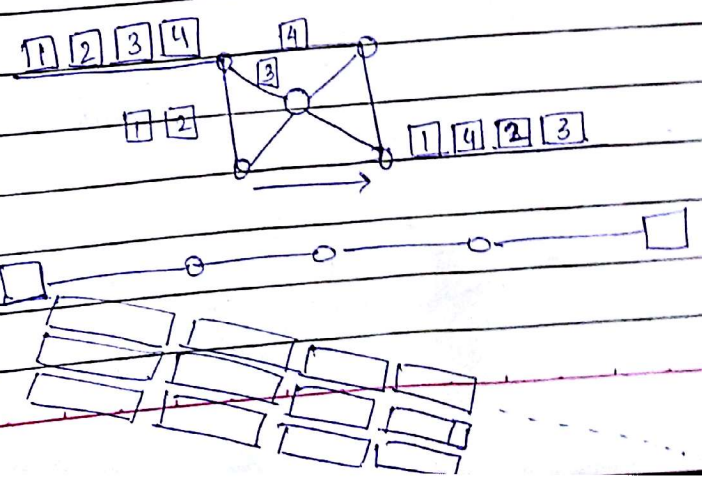


S: source
D: destination
O: service.

Transmission time (TT).
Propogation Delay (PD).

Transport layer: responsive for ordered delivery of data.

Packet switching → Datagram technique.
(1).



Layer pt. of view switching.

- CS is taken care by physical layer. No control of other layers in CS.
- DLL and upper are responsible for packet switching
- VCS: DLL in some approach and network layer in some other layer.

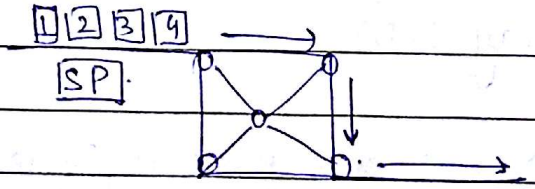
TCP/IP : only datagram service.
↓
CC.

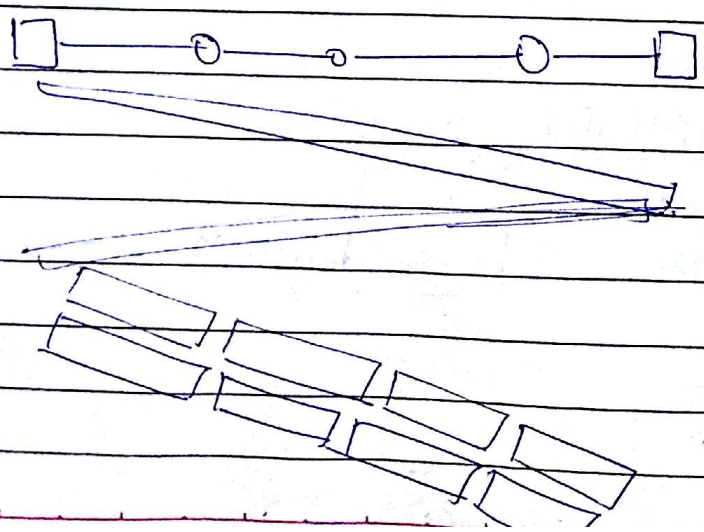
OCP : both datagram and virtual circuit service
↓ CL. ↓ CO.

Virtual circuit Identifier
To maintain CS approach.

"The Internet" has only datagram service not VC.

(ii) - Virtual circuit Service (VCS)



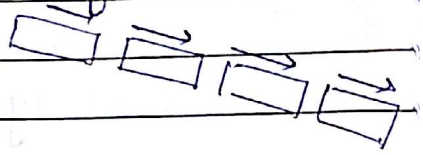


In CS, resources are received.

Min delay in which technique?
- No waiting time in node if resources are reserved
- CS is best in terms of delay point of view: only 1 packet is required

Better efficiency?
- CS is not efficient (more time to reserve resources but if reserved then min time to transfer data)

Datagram switching
- Multiple transmission time by 3 if



09/01/17

Layer is always asking service from the lower layer. Service'll be accessed by interface.
- Protocol data unit. (PDU)
- Service data unit. (SDU).

Data unit (DU).

PDU. Packet. [NL] → [H|SDU] (Encapsulation occurs)

frames [DL] [DL] [DL] → different DLs, as per requirements.

Two types of communication -
(i) Physical
(ii) Virtual. ↳ b/w same layers.

PDU = SDU + H + T(O)
(H: Header; T(O): only for DL.)

Very specific format is required. which has to be understood by both ⇒ PDU. and this process is v/a encapsulation.

DNS (Domain Name Service)
↳ converts applica address to logical address.

Message and required service parameters are passed from one layer to another.
For transport layer, segment, source logical addr. and destin^{n} LA is transferred. → Interface.

Delivery → transferring data from one layer to another..

eg only PL → telephone network.
if no TL → only one system/process.
upto 3 layer → IP telephone.

Presentation and session is dependent on Application, hence these two layers are not present in TCP/IP model.

If interoperability is req., then a layer is added.

Multiplexing and Demultiplexing.
output is one; multiple i/ps.
NL will not distinguish, all in one packet.

TCP/IP Model → Physical layer. (Phy + data link layer)
Network Layer

15/9 = 135

140/26.

11/01/17 All nodes in a particular n/w need to have unique identification code → MAC address / Physical address.

↓

Network address / Logical address.

why does not the router not have single PA?

Router is layer free device.

Data Link Layer

Network layer.

↓ gives.

Media access control.

↑ receives.

Physical Layer.

13/01/17-

Broadcasting - use address diff. then PA of the respective nodes.

Addressing consists of -

- Unicast
- Multicast
- Broadcast.

Frame - beginning / end of something meaningful

- Fixed size.
- Variable size.

Message is a sequence of bytes.

→ Flow control.

→ Error control.

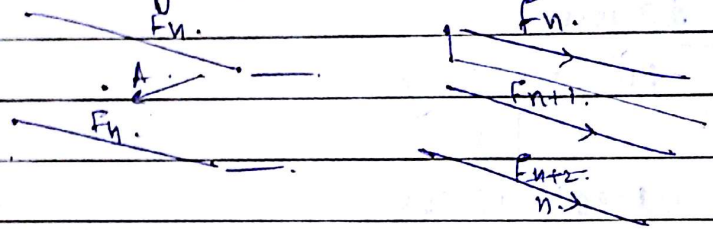
16/01/17

Data link Protocols.
- for noiseless channels.
- for noisy channels.

Stop and wait : ARQ.

→ Automatic Repeat Request.
- Acknowledgement may get lost
- frame'll be sent once again.

(content might be same, but frames are actually different).



(Buffer) Extra part to be included is a single bit space which will either be 0 or 1.

0 to 2^m. → frame sequence number.

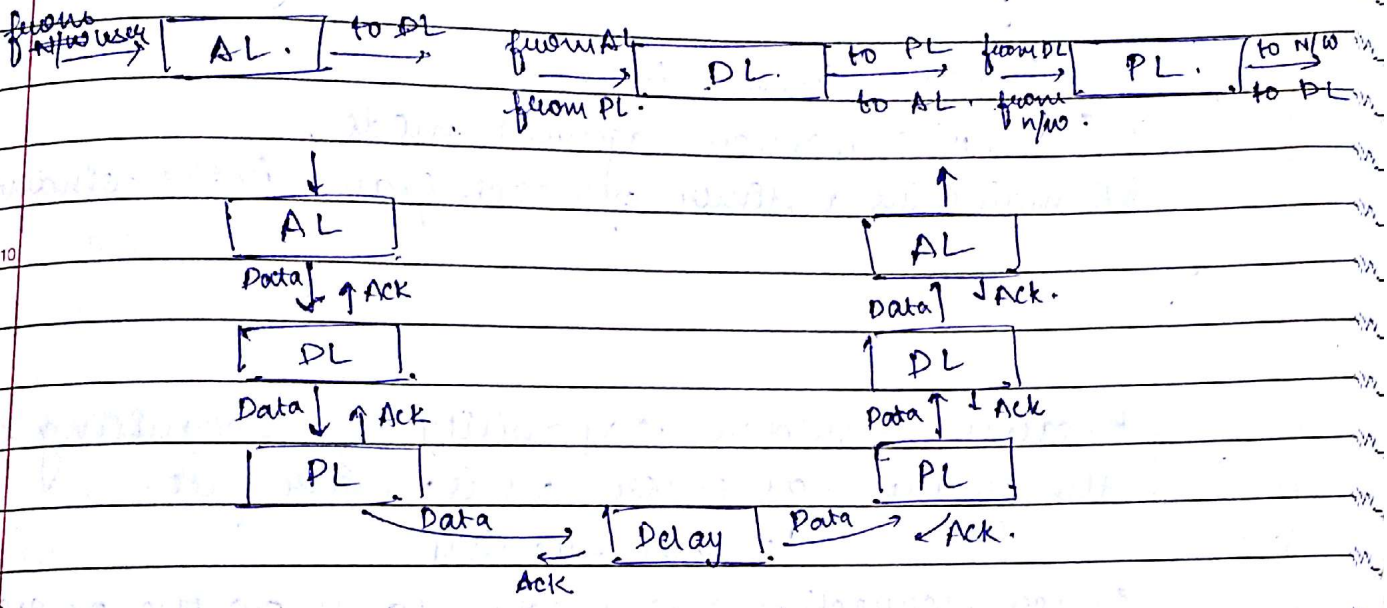
PDU :-

msg → Application layer
segment → Transport layer
packet → Network layer
frames → Data link layer.

AL-PDU.
DL-PDU [ ]
PL-PDU [ ]

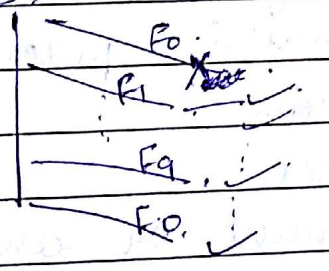
```
if(msg → getArrivalGate() == fromDL)
    create P-PDU p.
    p→Encapsulate( ).
    send to Network.
```

elseif (msg → getArrivalGate() == from N/w) ...
create and cast P-PDU.
decapsulate().
send to DLL.



5/01/17

Selective Repeat ARQ → Receiver can receive ~~data~~ frames even if it is out of order. → not all frames're retransmitted. Reducing retransmissions to a great extent.



	S	R
Go back N.	$2^m - 1$	1
Selective Repeat	2^{m-1}	2^{m-1}

Window → buffer space in DLL to store frame.

only when first frame is received, window'll slide further.

If frame received is not the first frame in the window, then -ve acknowledgement is sent (NAK)

ACK3 → received frame 3.
NAK3 → something is received after frame no. 3. (frame3 is yet to be received).

Camlin Page No. Date

~~Again if~~ more than one -ve acknowledgements should not be send for a particular position of the window.

Having sequence of frames from beginning of the window → send +ve acknowledgement.

↓

Window will then slide.

Cumulative acknowledgement mode.

SR. maintains a timer for each frame in the window.

Receiver should've capability of recognising if the frame has error or is error free.

↳ Error detection.

Error correction also needs to know the position of the bits where the error has occured.

(corrupted bits)

→ Single bit - easy to detect

→ Burst error - dependent on bandwidth of transmitted medium.

(when error is at multiple places).

Detection is primary objective.

↳ disgarding the packet

↳ send -ve acknowledgement or remain silent.

Redundant bits have some relationship with the data (message). $[K+R]$.

Assuming data is not corrupted, it'll be accepted by receivers side.

Block coding

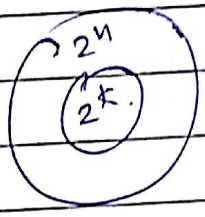
blocks of equal size (let k bits).

each block has some redundant bits. then n = k + r.

2^k datawords → data block.

2^n codewords → data + red. bits.

(2^k valid out of them)



$2^n - 2^k$ → invalid codewords.

valid → accepted.

invalid → rejected.

Parity Check
Cyclic Redundancy check.
Check Sum.

} Technique to check.