

CN

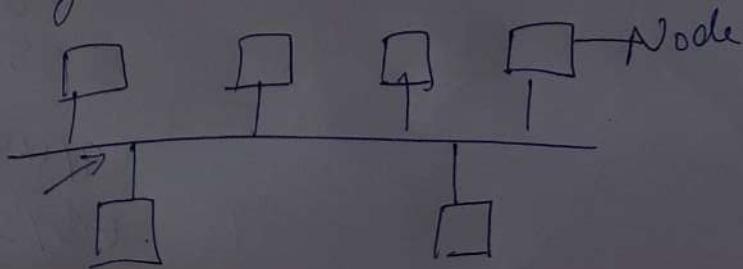
Network Topology hardware

Objectives: Describe the backbone structure that form the foundation for most LAN.

Physical Topology: Physical layout of nodes on n/w.

a) Bus Topology

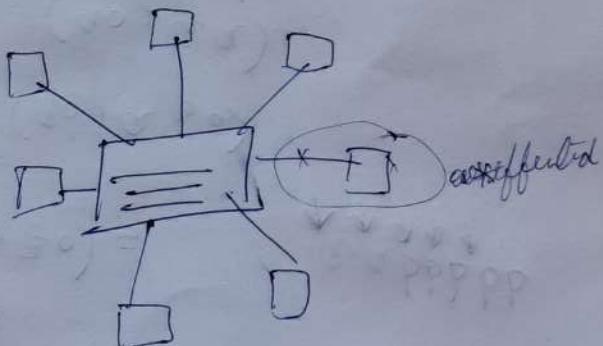
- * In this config, every computer shares n/w total bus capacities
- * By adding more computers, will reduce the access speed on n/w
- * Devices share responsibility for getting data from one pt to another



- * All computers are connected to a long cable called bus.
- * In this topology, any computer can send data over the bus at any time.
- * Terminator stops signals after reaching end of wire (to avoid signal bounce).
- * peer to peer n/w.

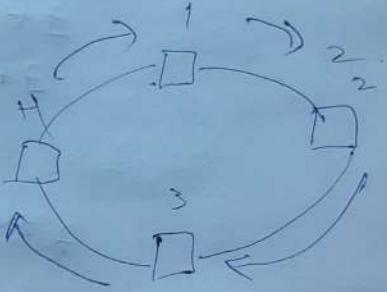
Star topology

- * Every node on n/w is connected through a central device like hub, switch, router.



Ring Topology

* Used for LAN, WAN in which every system has 2 neighbours for comm pur

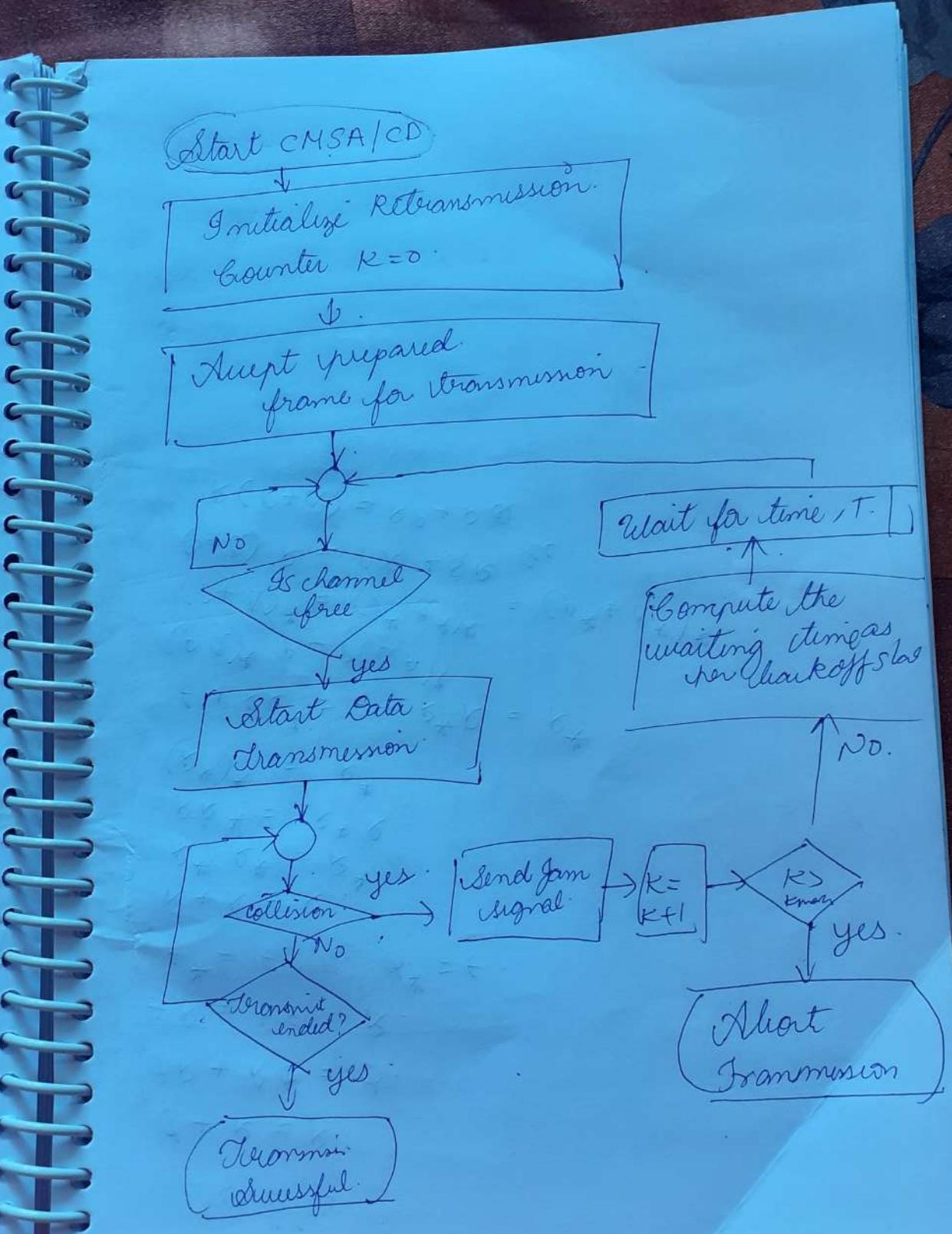


* One direction

CSMA/CD

Theory: In this a station monitors the medium before it sends the frame to see if the transmission was successful. If so, the station is finished more; else if there is a collision, the frame is sent again.

Flow diagram



DNS

- * Domain Name System
- * Directory service that provides mapping b/w name of host on the network & numerical address
- * DNS is a service that translates the domain name into IP address.
- * This allows the users of networks to utilize user-friendly names when looking for other hosts instead of remembering IP address.
- * Eg:- FTP site at EduSoft had an IP of 132.142.165.50, most people would reach out to this site by specifying `ftp.EduSoft.com`.
- * Domain name is more flexible than IP address.
- * DNS is TCP/IP protocol.
- * Domain name space is divided into generic domains, country domains, misc. domains

Generic:

biz - business, com - commercial,
edu - educational, gov - govt, info -
information service providers, mil -
military groups, org - non profit organisat

Country

In - India, uk - UK,

Reverse

- * The reverse domain is used for mapping an address to a name.
- * When the server has received a request from the client, the server has files only of authorized clients.
- * To determine whether the client is authorized or not, it sends a query to the DNS server, & ask for mapping an address to name.

Application Layer

protocols

used by
users

eg : email.

which help
to support
the protocols
eg : DNS

DNS Working

- * works on client server model
- * translates DN into IP address
- * eg : domain name www.shreya.com
 ↓
 198.105.137.55

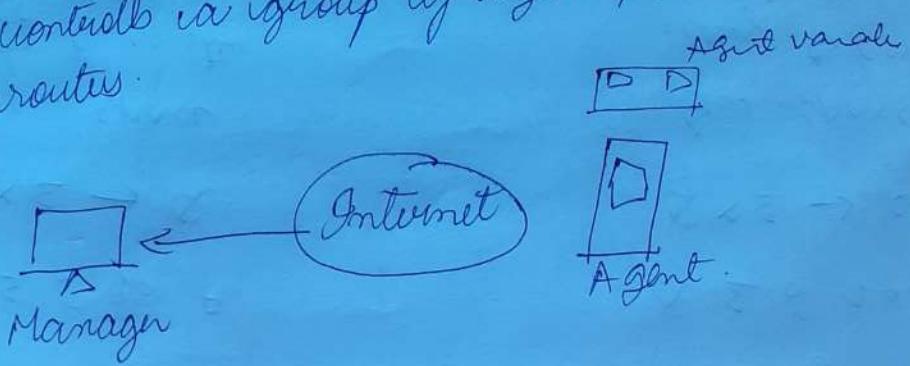
SMTP

- * Simple Mail Transport Protocol.
- * Internet standard for e-mail transmission
- * SMTP connections are secured with SSL
- * In SMTP, (the messages are stored)
are then forwarded to the destination

- * SMTP uses a port no 25 of TCP
- * The concept of SW

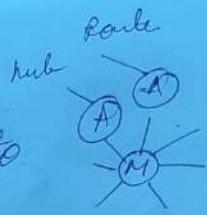
SNMP

- * SNMP calls Simple Network Management Protocol defined by IETF.
- * It is used to manage the network.
- * It is an internet standard protocol that monitors devices in IP networks.
- * SNMP is supported by most of network devices such as hub, switch, router, bridge, modem & printer.
- * The concept of SNMP is based on manager & agent.
- * The manager is like a host that controls a group of agents, such as routers.



Components

① Manager - Centralized system to monitor n/w



② Agent - It is a software program that is located in the network
* It collects real-time info from the device & passes this info to SNMP manager

Management Components

① SMI:

- * Structure of Management Info:
- * It is a network management comp.
- * It defines rules for naming object & object type.

② MIB:

- * Management Information Base.
- * Second comp of network management.
- * Virtual Info storage where management is stored.

SNMP basic Operation

o get Req



determine one
or more
values.

$M \rightarrow A$

o get nextReq

↓
next value

$M \rightarrow A$

o SetRequest



setting value

$M \rightarrow A$

o Trap



send acknowledgement
messages

$A \rightarrow M$

o Get Bulk Request



retrieve large
data

$M \rightarrow A$

HTTP

* Hypertext

* hypertext transfer protocol

* Transfer data

* good efficiency

* similar to FTP

- coz - transfers files from 1 host to other

- but - HTTP better coz only information.

* Similar to SNTP:

- coz - Client Server.

- but - HTTP better coz SNTP - stored as forwarded
HTTP - delivered directly

HTTP features

① Connectionless :

* client sends req, waits for res.

* server gets req, processes the req, sends res after which client disconnects connection.

② Media Independent

* data can be sent as long as both CS know to handle data content

* Requirement : ~~144~~ Content type in MIME header

③ Stateless :

CS know each other only during current req

URL:

Method : // Host : Port / Path

http://www. ————— portnumber / pattern

E-Mail

- * transmission of messages on Internet.
- * most common command.
- * Info stored in one PC is sent through net to an individual.
- * It uses multiple protocols within TCP/IP.
- * Uses SMTP to send msgs.
- * IMAP or POP to retrieve msgs.
- * login, email, passwd.
- * webmail servers automatically config email.
- * Manual config for - Outlook, Apple Mail.
- * Email msg - 3 components
 - msg envelope
 - msg header
 - msg body
- * Org emails supports plain text - modern, HTML, CSS.
- * send attachments with msgs.
- * 1971, Ray Tomlinson, sent to himself - QWERTYUIOP, transmitted - ARPANET
- * MAILBOX - MIT, first email system
- * Advantages - cost effective, access from anywhere, better communication, speed, simplicity, mass sends.

Streaming

- * hours websites - text, vis.
- * Today - HD movies, music calls
- * Streaming is continuous transmission of audio or video files from server to client.
- * AV broken into data packets

WWW

- * collection of websites
- * stored in web servers.
- * connected to local comp thru Internet
- * Websites contain
- * Users can access from any part of the world.
- * BB of website \rightarrow HTML $\xrightarrow{\text{connected by links}}$ Hyperlinks $\xrightarrow{\text{accessed by}}$ HTTP
- * www \rightarrow storage e-book whose pages are stored on multiple servers.
- * Book - one page to other;
www - hyperlinks to more
- * Need a browser, to access web.

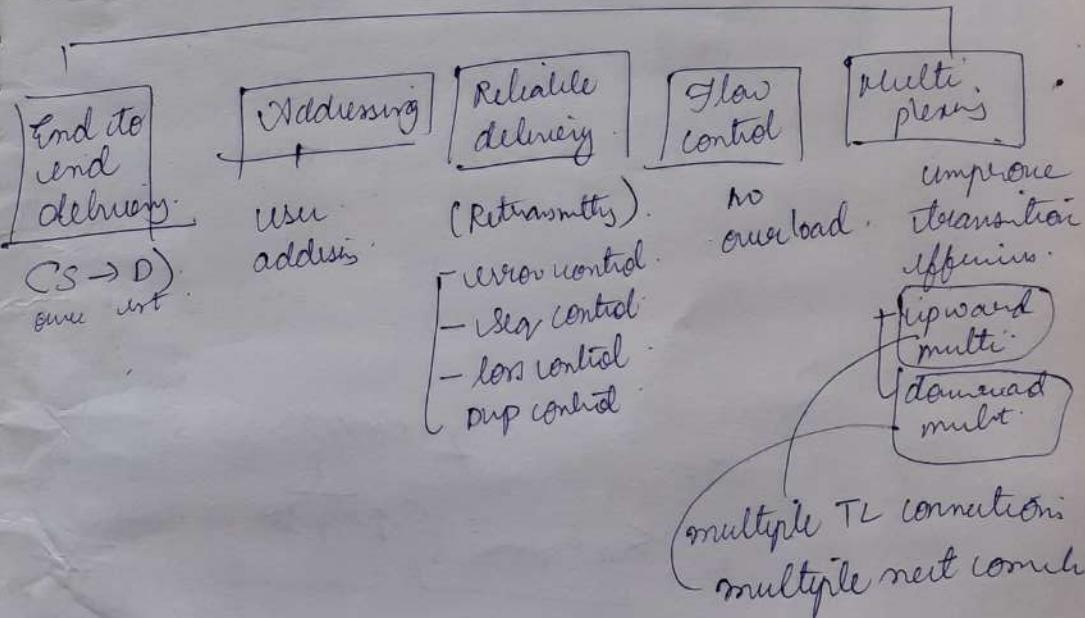
UNIT - 4

Transport Layer

Services provided by TL

- * Similar to DLL.
- * but TL provides services across an internetwork made up of many networks
- * Controls all the lower layers

TL Services



Elements of TP

- ① Addressing
- ② Connection establishment
- ③ Connection Release
- ④ Error control, flow control
- ⑤ Multiplexing

① \Rightarrow user wishes to set

- * When low layer application process initiates application to remote application via connection it must satisfy which one to connect to process, it must satisfy which one to define process.
- * The method normally used is to define endpoint address
- * In internet, these endpoints are called ports

Ports

- * TSAP: Transport Service Access point to
- * TSAP: Transport Service Access point to transport layer
- * Many a specific endpoint in transport layer
- * IP address are examples of ports

TSAP

: by

TSAP

TSAP

IP port

② → Connection establishment

Mr. M. * 21/08/14

Connection Management

Connection establishment Connection Termination

(2)

Sequence no, syn = 1
MSS = 1460B, WS = 1460B

syn = 1
Request

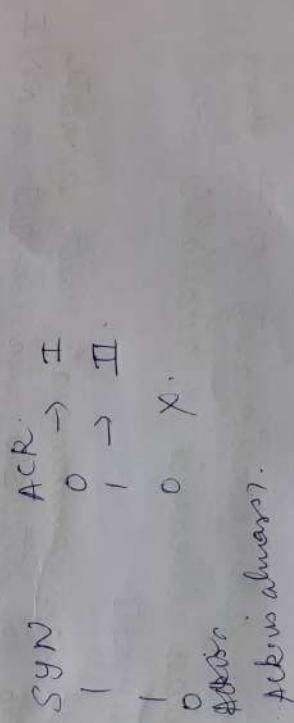
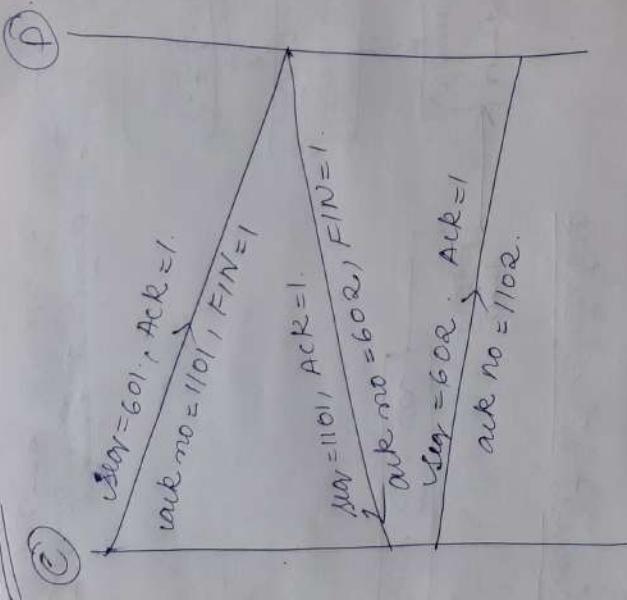
seq no = 10001
syn = 100000B
ACK = 501
WS = 10000B
MSS = 600B
RCR = 1

Reply
ACK no = 501
Ack no = 1001

ACK no = 1001
Ack no = 501

Two way handshake
Request, Reply & Acknowledgment

Terminate



ACK is always
ACK is always

UNIT - 3

Network Layer Design Issues

- * ① Stateless forward packet switching.
- * ② Always provided its Transport layer.
- * ③ Implementation of connectionless services.
- * ④ Implementation of connection oriented services.

- * ⑤ Routing
- * ⑥ Congestion Control

- ⑦ The node which has packet to send, delivers it to the nearest node i.e. router.
- * The packet is stored in the router until it has fully arrived at its destination. When it is verified for error detection once this is done, the packet is transmitted to the next router.
- * The same process is continued.

each router until the packet reaches
destination

② Services provided by transport layer.

goal to keep in mind:

- * Offering services must not depend on router tech
- * The transport layer needs to be protocol independent
- * The topology available from the me as topology available

~~OSI~~ *
~~ref~~

OSI Reference Model

An, CN, RM gives conceptual framework
that standardizes comm b/w 2 heterogeneous
machines.

2 hop - OSI / TCP/IP

~~working~~

~~types~~

OSI

- * Open System Interconnection
- * developed by ISO
- * gives layered Networking framework
- * gives layers
- * Conceptualistic
- * 7 interconnected layers
- * 2 interconnection - value performs -
 - * each layer - self contained
 - * looks independent

~~fun~~ *

(m)

m

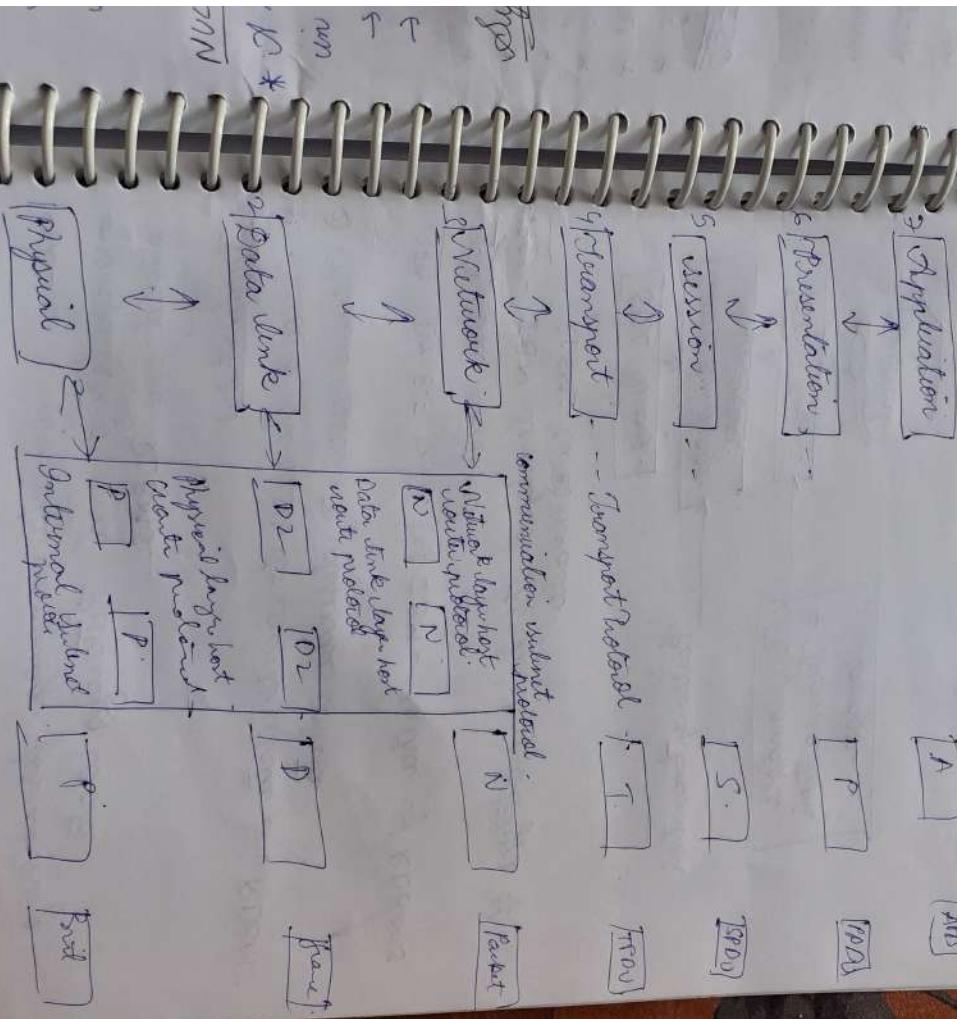
m *

m

m *

Note A

Note B
Name
Grade



source
from

=

PL

- Physical Medium - bits transmitted
- lowest layer.
- establishes, maintains, deactivates physical connection.

from
from

tos

- DL
- * error free transfer of datagrams.
 - * reliable, asymmetrical. com b/w 2 devices.
 - * 2 sub layers
 - ① logical link
 - ② media access

I - 9861

DL

- * large 3. address addressing
- * message a) device addressing
b) tracks location

MAC

MAC

Medium: best path to move data from -
destination host path to move data from -
source

S-D

factors : include cond.
 amounts of usage

parties: Network traffic protocols or called

now

now

e.g.: IP vs IPv6.

85

Transport

- v.
- no duplication of data
- main res - transfers data complete.
- 2 main protocols
 - * TCP, UDP

Session

- establish, maintain & synchronize interaction b/w comm dev

Presentation

- 6 contexts concerned with:
 - Syntax & semantics of info exchange b/w 2 sys.
 - P also called Syntax layer

App Layer

- * Windows for user or app processes.
- * Provides info to end-users.

TCP/IP

INDIA

- | ALU | ADD | DE |
|----------|----------|----------|
| 11111111 | 00000000 | 11111111 |
| 11111111 | 00000000 | 11111111 |
| 11111111 | 00000000 | 11111111 |
| 11111111 | 00000000 | 11111111 |

TCP/IP

of now by OSI
4 layers

 - * Application layer
 - * Transport layer
 - * Network layer
 - * Data link layer

① Network Layer

- * comme of Protocol: Token ring, FDDI, Ethernet, Frame relay
 - * Protocols :

② Introducing

- ~~It is~~ 2nd.
known as melville layer.

a market, here TCP/IP

- (3) DL
* Identify the restored parks, were they +
* proposed : now restored.
* proposed : now restored.
for San.

⑤ The TELCO is responsible for
* Establishing the connection.
Reliability flow control over the network
data which is being sent over the network.

S
op

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S

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(Q)

*

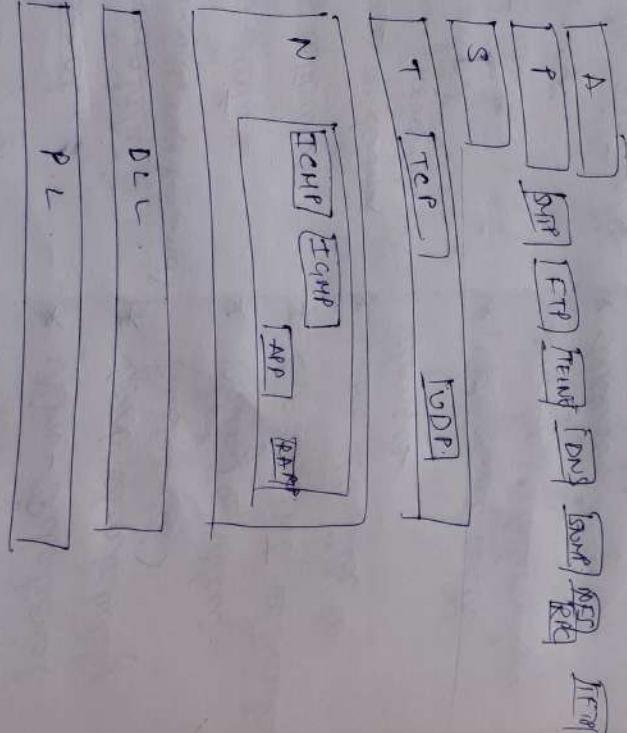
N
m
T
G

Application

* Common -

* User interact with commercial
* responsible for high level protocol conversion

of app



CRC

- * cyclic red check
- * general arithmetic

Steps

- * os is appended to Data unit i.e. in problem.
- * n mod 16 is less than no of divisor units $n+1$ bits are known as divisor units. Divisor
- * Secondly: the newly extended data is divided by a divisor — gives —餘数 divisor remainder generated — CRC remainder
- * Thirdly : The CRC remainder replaces the check : The CRC remainder replaces the appended 0's at the end of our data.
- * This results you in sent to the receiver
- * receiver receives the data followed by ccc
- * demands.
- * Receiving treat the whole as single units
- * Then divides the it is divided by the divisor

Error detection
method

VRC

CRC

Checksum

FEC

CRC

CRC generation at sender side

- ① find the 2^k of divisor r .
- ② append $2^k - 1$ bits to long msg.
- ③ perform binary operation
- ④ remainder division = CRC.
- ⑤ remainder division = CRC.

A	R	XOR
0	0	0
0	1	1
1	0	1
1	1	0

Note: CRC must be 2^k bits.

msg. 1101
100100

$L = 4, L-1 = 3$
so 3 zeroes
are appended
to msg.

$$\begin{array}{r} 1101 \\ \hline 100100000 \\ -1101 \\ \hline 1000 \\ -1101 \\ \hline 1010 \\ -1101 \\ \hline 1101 \\ -1101 \\ \hline 0 \end{array}$$

appending 001 to
the org msg.

i.e. 100100001

$$\begin{array}{r} 1101 \\ \hline 1000 \\ -1101 \\ \hline 1000 \\ -1101 \\ \hline 0000 \\ -1101 \\ \hline 1001 \end{array}$$

Parikh

is
may
no OF

AT

Protocol

Neuriles
channels

Nervous
channels

Simplest
stop & wait.

Stop & wait

Stop & wait ARA.
Go Back N ARA.
Selective Repeat ARA

- * Stop & wait
- * PDR protocol over neuriles channels
- * Used for transmission of frames.
- * Provides undivisional, with flow control
- * no error control facility.
- * One frame $\xrightarrow{\text{trans}}$
Send counts for each byte transmitted
next frame.
- * flow control ✓ error control ✗

PRIMITIVES.

K
d
d
d
d
d

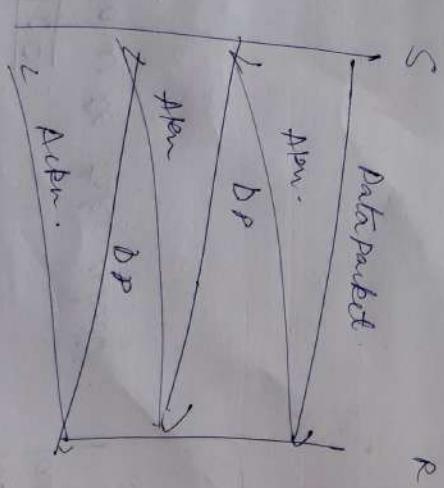
Sender
rule 1: Send one packet at a time -
rule 2: Insert next packet after receiving
ack for the previous.

ref
hgo
B
B

ref
hgo
B
B

Receiver

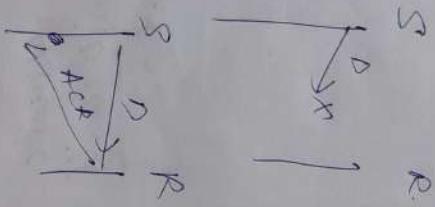
rule 1: Receive the consumed data packet.
rule 2: After consuming the packet, ACK
needs to be sent.



Problems

Problems due to lost data

- * Sender waits for ACK for a go.
- * Receiver waits for data.
- * delayed ACK / data.
- * idle due to ACK / data.
- * After timeout on sender.

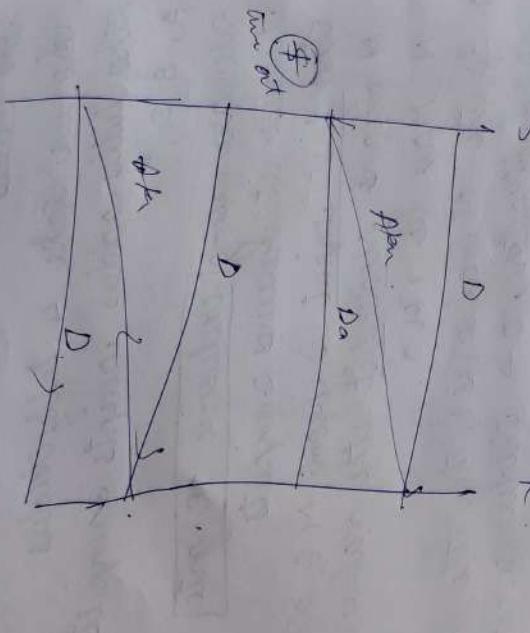


Sliding Window Protocol

Repeat ARQ.

Up-Link ARQ in selective repeat mode.
is called Sliding window protocol.

STOP and WAIT ARQ



DR AWBACRS

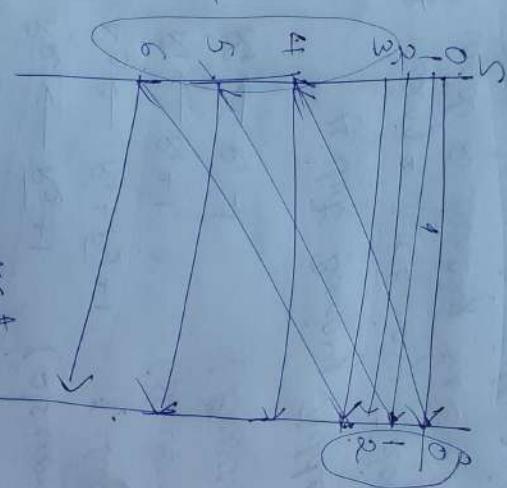
only one frame polluted
poor utilization of BW
Poor performance

SWP

- * Number of frames to be sent is based on No. of frames.
- * Window size.
- * Each frame is numbered called sequence number.



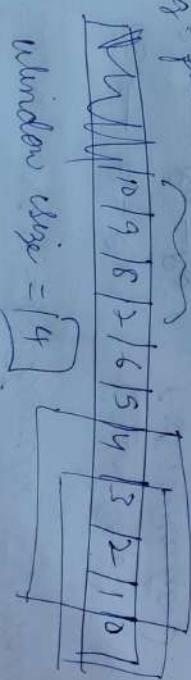
seq no available
not yet sent



not yet sent

available
new seq.

seq no



window size = 4

Re Bank NARO

fixed window size
Automatic
Reps API
etc
etc

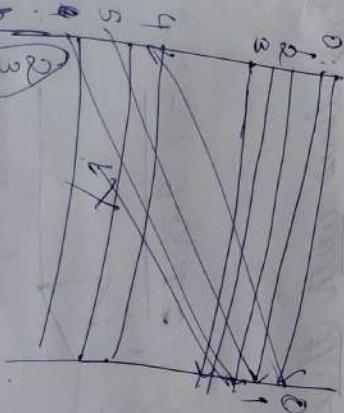
If $n \rightarrow \infty$
 n frames can be sent

- * concept : protocol synchronizing news flow
- * sends multiple frames at once from first frame
- * how seq nos.
- * no of frame = window
- * If after w frame is not received important

$$\text{window size} = \frac{w}{2} = (2^2)$$

$$\begin{array}{c} 1/9/8/7/6/5/4/3/2/1/0 \\ \hline 0123 012301 \dots \\ w=4 \end{array}$$

R



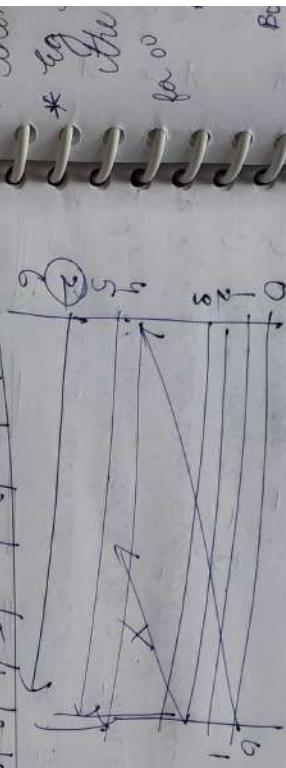
F₁
F₂

Solution Repeat

Only last frame are released initially

- * Pincer - we action

R



$$\left[\begin{array}{cccccc} 1 & 0 & 1 & 9 & 1 & 8 & 1 & 2 & 1 & 6 & 1 & 5 & 1 & 4 & 1 & 3 & 1 & 2 & 1 & 1 & 0 \end{array} \right]$$

$$\omega = 4$$

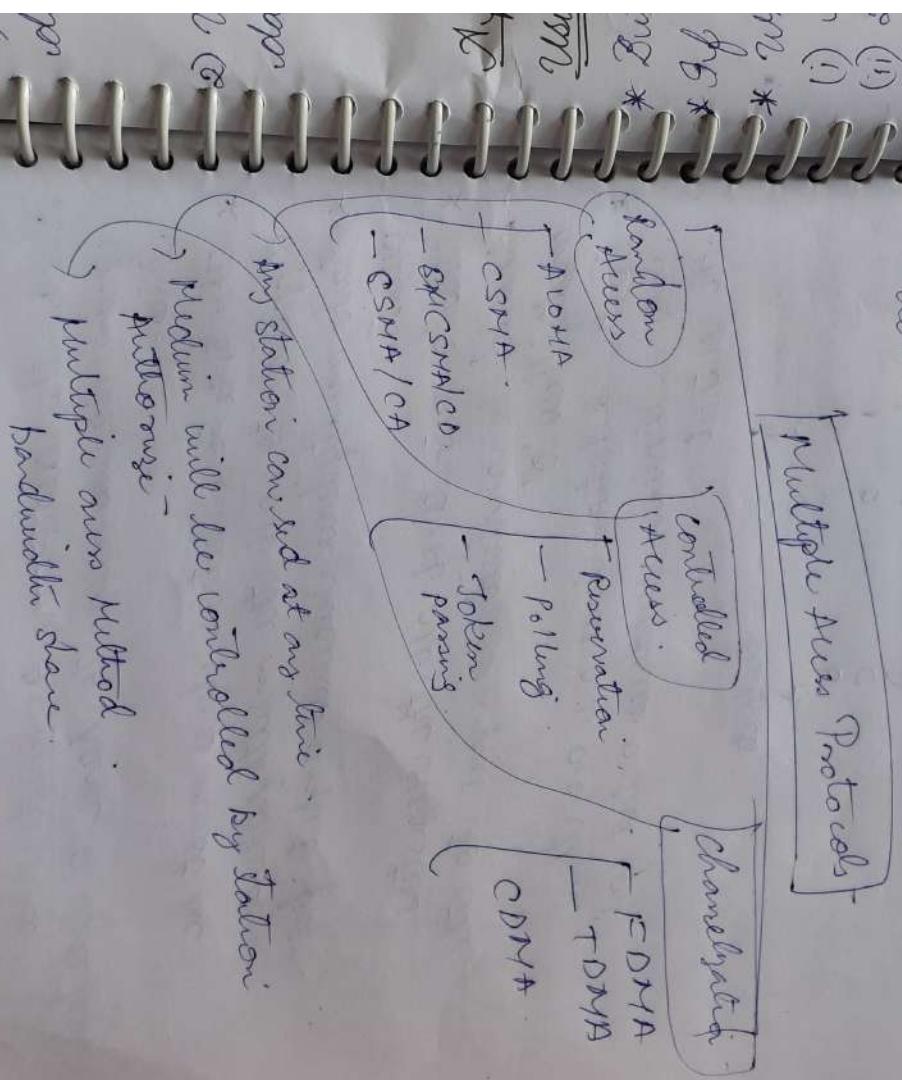
Bus

* all
* the
* It.
* We
* the
* for
* 0°

Multiplex Access Protocols

11

pollution. It is used if it is wet in the area.



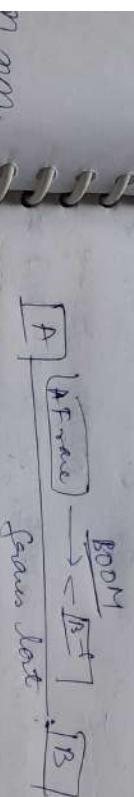
✓ my station caused at my time
medium will be controlled by station
authorise -
Multiple ones will be
handled share.

AUOMA

* RA Prototol

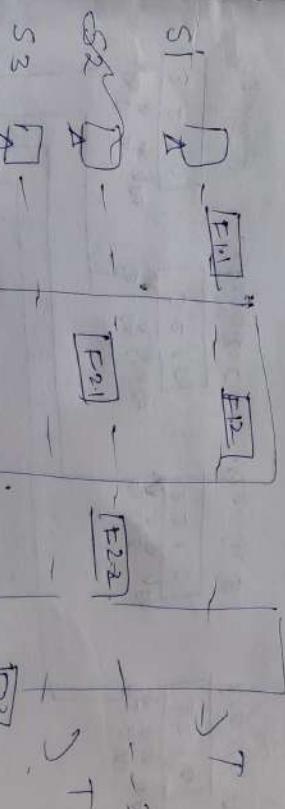
* WMAN & Slotted Medium

* collision avoidance



pure Aloha
slotted Aloha

more



collisions due to other nodes

Collaborative Protocols

- ① Bit Map
 - ② Binary Count Down
 - ③ Limited Contention
 - ④ Adaptive Tree Walk

for Xerox®
problems. ① * Specified in MAC layer
as noted.

- * 20 Notes

* Total status - same median

- John Staub - some
of shot 1 is to sub. others want
to want to

Register

$$\begin{array}{r} \overset{D_2}{D_3} \\ \downarrow \\ \boxed{3 \quad 2} \end{array}$$

Jan 1

Sets Bit Value to 1
done by slot no's

$$D. \quad \begin{array}{c} 2 \\ 2 \\ 2 \\ 2 \\ 2 \\ 2 \\ 2 \end{array}$$

Net min
wages

c or L :

prova
mber
re (c-
g)

$\rightarrow \alpha$

$$\alpha = \beta \div \gamma$$

own smg

roads

low Bandwidth
National websites

Utilities LAN's

very flexible.
Adha now do not need plan.

no wins difficult
more robust.

Design
global
use more for battery use
patient to test -

PTL:

Adv

flexible
user
bus
well
letter
own

plan
dust
pollution
cost
done by me

Own

Bau

Switzerland

→ Computer Networks



At the
shorter
wings

all we
n bits

三

→ home config X.

bit hard on Mac adren

\rightarrow Sonnenblatt /
 \rightarrow Duplex node

\rightarrow Smaller in size
by collision.

in ~~near~~ ~~near~~

Badrudhi

lock

Quintus

Jesu

Hierarchical Routing Protocols

Benefits

Reduction in the size of routes

- better Scalability

Multi clustering - to enhance resource allocation & management.

At every level A leader is elected.

Each cluster one leader

Path b/w 2 cluster heads involving multipath links need virtual ip