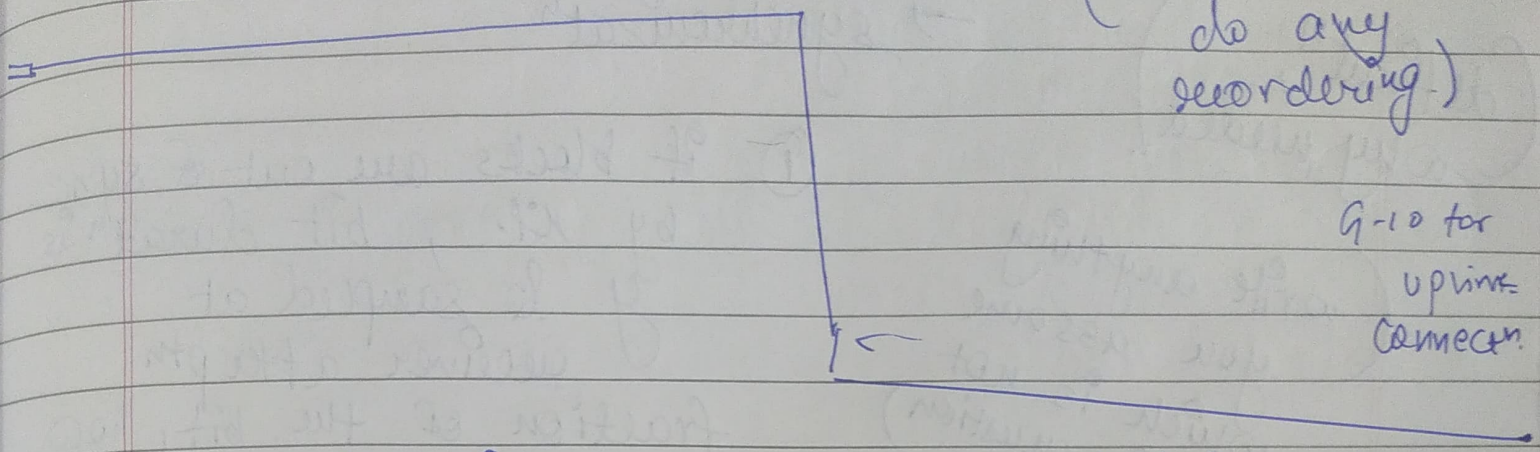
connection oriented ⇒ TCP/IP

connectionless ⇒ UDP. (router doesn't do any reordering)



Transmission basis: spectrum → actual freq range
bandwidth → a diff b/w highest & lowest
effective bandwidth.

when I have continuous signal, I can't send it directly, I sample it. if freq f then sample it 2f.

Nyquist → sampling rate
↳ channel capacity.

shannon capacity

dB, SNR, attenuation

Media: twisted pair & OFC (types)
range, comparison
(practical advantage)
(distance constraints / interference).

Direct communicatn b/w 2 machine on Single link

→ synchronizatn

(defintn, why needed)

(write anything you assume which is not in question)

① If blocks are out of sync by x%, bit durath is y & sampled at receiver after pth fraction of the bit, how many bits before you lose a bit?

② ~~What~~ is given y, p & size of one frame, what is the max difference between the clocks you can tolerate?

Bit stuffing (work out simple examples)

Encodings : desirable qualities (transition more bandwidth use data rate)

→ given bit streams, show ~~ex~~ encoding

→ given the encoding find bit stream.

→ given bit stream & encoding, how many transitions will occur?

ASK, FSK, PSK/DPSK : definatn with/ diagram only.

Error detection : parity
CRC
Checksum
} work out examples.

if size of length k chosen, burst error of length k can be detected.

what errors CRC/Checksum can tolerate? no need to remember for exam.

① Given bit stream, generate CRC/Checksum

② Given CRC scheme, find bit stream received, see if it correct.

flow control

Stop & wait (different variatn of link efficiency)

- Practice with non negligible ack size, processing delays. at receiver, repeater with specified delays in between etc
→ principle is same

ARQ : practice some scenarios.

stop & wait : what if bit error rate is 0.1? (t)

frame size given, what is the expected time efficiency.

↳ calc prob of successful transmission

↳ calc expected no. of transmission before the message success.

if chance of success $\frac{1}{2}$

∴ you need to send twice to guarantee success

∴ expected time b/w two successive send (twice original)

prob that transmission fails = frame damaged + ack damaged

$= 1 - \left(\frac{1}{2}\right)^{\text{frame size}} + 1 - (p)^{\text{ack.}}$

$\left(\frac{1}{2}\right)$ → no error

(p) → no error

window size ⇒ what & why ? (max).

Medium sharing :

FDM – given n signals each with bandwidth requirements & given guard band size, what is the bandwidth of the link needed?

$(n-1)$ guard band

TDM : given no. of senders with data rate, given frame format what minimum data rate to be supported.

CSMA : basic definat^n

given n senders

if $p \geq 0.5$ in p-persistent, what is the prob that at least one will transmit successfully at $t = 0$.

CSMA/CD : slot time definat^n. (time to transmit min size frame)

minimum frame length computat^n. (one bit to travel, one to track). $2D/V \times R$.

(doesn't matter)

add processing delays, repeaters with delays & so on.

(time for one bit to go & one bit to come) × R.

Given slot time & the fact that a station/node suffers 3 collision before it is transmitted successfully, what is the min & max time it would have waited

first coll^n 0-1 time slot

second coll^n 0-3 time slot (binary ~~expo~~ exponential backoff)

third coll^n 0-7 time slot.

min = 0 max = 11

Hidden terminal: why doesn't RTS / CTS solve it fully?

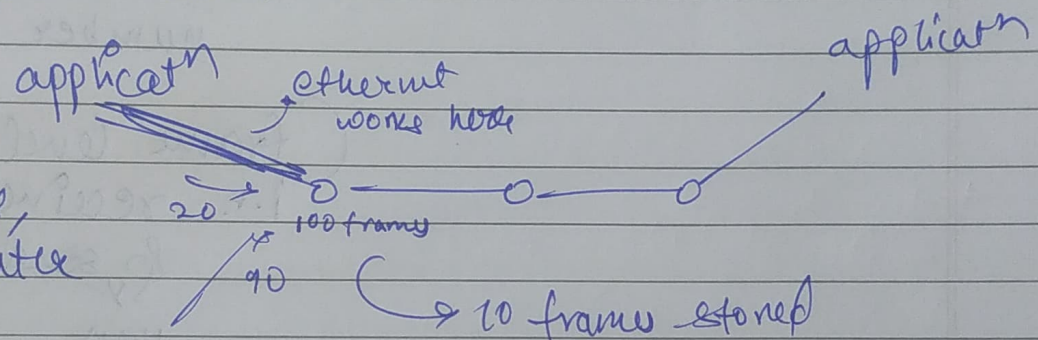
(CTS might get lost)

LAN:

① Why no flow control & error control in ethernet?

↳ data link layer

↳ error control



(not little issue, issue with router i.e. router can still drop packets)

↳ 10 frames stored initially in buffer.

for every incoming connection, we need to maintain window for flow & error control

② Minimum how many ~~switches~~ switches will be needed to connect n machines.

what if we say delay per switch (processing) delay at switch is p & total delay can't be more than T.?

How end of frame is detected.

Layering : name

packet switching : practice last picture.

(frame size,
header,
number of links)

(frame level pipeling
i.e. receive full frame
& send
then)