GATE CSE NOTES

by

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CN Formulae.

* Flow Control.

$T_t = \frac{L}{B}$ | $T_p = \frac{d}{v}$ [$v = 2.1 \times 10^8$ m/s for optical fiber links]

$\eta = \frac{\text{Useful time}}{\text{Total time}}$ $\eta = \frac{T_t}{\text{Total time}}$

Throughput = ηB

$RTT = (T_t)_S + (T_p)_{pkt} + T_q + T_{proc} + (T_t)_R + (T_p)_{ack}$

When $T_q = T_{proc} = (T_t)_R = 0$,

$RTT = T_t + 2T_p$.

- **S&W / SAW / ARQ** $\eta = \frac{(T_t)_{pkt}}{(T_t)_{pkt} + 2T_p}$ | $a = \frac{T_p}{T_t}$

$\eta = \frac{1}{1+2a}$

for any SW protocol, (Sliding window)

avl seq. no. $\geq W_S + W_R$

$\eta = \frac{\text{Amount of data sent}}{\text{Max. data that could be sent.}}$

Capacity (half duplex) = $T_p B$

Capacity (full duplex) = $2T_p B$

$\eta = \frac{\#\text{frames sent in one window}}{\text{Total \#frames that can be sent in one window}} = \frac{*\ \text{sender window size in protocol}}{\text{optimal sender window size}}$ → $1+2a$

- **SWP** Optimal sender window size = $1 + 2a = \frac{T_t + 2T_p}{T_t}$ (for max η)

Max #frames that can be sent in a window = $1 + 2a$

Min # SN reqd = $1 + 2a$ | Min # bits reqd in SN field = $\lceil \log_2(1+2a) \rceil$

Sender window size = $\min(1+2a, 2^n)$, $n \rightarrow$ #bits in SN field

- **GBN** $\eta = N/1+2a$ $N \rightarrow W_S$ | #bits in SN field = $\lceil \log_2(N+1) \rceil$

$W_S = N$, $W_R = 1$

- **SR** $W_S = W_R = N = 2^{n-1}$ if n bits for SN field

$\eta = \frac{N}{1+2a}$

When p is error in packet (probability)

$\eta = \frac{N}{1+2a}(1-p)$

* Access Control.

TDM 1 time slot = $T_t + T_p$.

$\eta = \frac{T_t}{T_t + T_p}$

Max avl. effective BW = Total #stations × BW requirement of 1 station.

Polling $\eta = \frac{T_t}{T_{poll} + T_t + T_p}$

CSMA/CD.

Collision detⁿ condⁿ: $T_t \geq 2T_p$ | $L \geq \frac{2Bd}{v}$

$\eta_{CSMA/CD} = \frac{T_t}{c \times 2T_p + T_p + T_t}$ c = # contention slots / collision slots

$Pr(\text{succ. transmission of 1 station}) = {}^nC_1\, p(1-p)^{n-1}$ $p \rightarrow$ prob. of transmitting data

$Pr|_{max} = (1 - 1/n)^{n-1}$ @ $p = 1/n$ $n \rightarrow$ # stations

When $n \rightarrow \infty$, avg. # collisions that might occur before a successful transmission = e. $\Rightarrow \eta = \frac{T_t}{e \times 2T_p + T_t + T_p} = \frac{1}{1 + 6.44a}$

Binary exp. backoff. $[0, 2^n - 1]$ Backoff time = K x Time slot.

Token Passing. Ring latency = $\frac{d}{v} + \frac{Nb}{B}$ sec = $\frac{dB}{v} + Nb$ bits = 1 rtt.

Cycle time = $\frac{d}{v} + N \times$ (token holding time).

* $\eta = \frac{NT_t}{T_p + N \times THT}$

DTR] $THT = T_t + T_p + N \times \text{bit delay}^{0} = T_t + T_p$.

$\eta = \frac{NT_t}{T_p + N(T_t + T_p)} = \frac{1}{1 + \left(\frac{N+1}{N}\right)a}$

ETR] $THT = T_t$

$\eta = \frac{NT_t}{T_p + NT_t} = \frac{1}{1 + a/N}$ Use ETR when not said otherwise.

Aloha] Throughput, $S = Ge^{-2G}$ (Pure) $= Ge^{-G}$ (Slotted)

	P	S
S_{max}	18.4%	36.8%

Prob. that k frames are generated during a given frame time. $Pr[k] = \frac{G^k e^{-G}}{k!}$

* For Biphase Manchester & Diff. Manchester, Baud rate = 2 x Bit rate

For Biphase encoding, Clock rate = 2 x Data transfer rate

* Bit rate = Baud rate x (#bits/symbol)

* Circuit switching Time taken to send a message from S to R -

$T = T_t\,(\#\text{hops} + (\#\text{packets} - 1))$. (the msg is broken into as pipelining is used.)

Remember to subtract hdr. size from packet size to calculate # pkts reqd.

$T_t \rightarrow$ for 1 packet L/B

* Fragmentation overhead = (#fragments - 1) x size of IP hdr.

→ Efficiency = $\frac{\text{Useful}}{\text{Total}} = \frac{\text{Data w/out hdr}}{\text{Data w hdr}}$

* WAT = #SNs available / BW

#bits min reqd in SN field for satisfying WAT $\geq LT - \log_2(LT \times B)$

TCP