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IIT2022155 (MAC Layer)

① For a station to get some surety of successful transmission the contention interval should have atleast 2t slot width where t is time for signal to propogate between 2 farthest station

→ For a 1km cable, one way prog time = $\frac{1}{200,000}$

$= 5 \times 10^{-6} = 5\mu sec$

for both ways = $2 \times 5\mu s = 10\mu s$

At 1 Gbps all frames shorter than 10,000 bits can be completely transmitted in under 10μs, so minimum frame is 10,000 bits or 1250 bytes

$= 10^9 bps \times 10 \times 10^{-6} s = 10^4 bits = 1250 bytes$

③ (17, 19, 23, 29, 31) prime numbered Stations

Tree-spling algorithms start from root (24). Contention will occur at root

Root (24) get contention & gets channel

(17, 19, 23, 29, 31) will detect collision and back off

Result : 24 succesfully transmits station (7, 19, 23, 29, 31) experience collisions

→ Contention occurs at left child of root
Station 20 successfully transmit, stations 17, 19 experience Collisions

→ Contention occurs at left child of 20 (18) station 18 successfully transmits

→ Contention occurs at right child of 20 (22). station 22 successfully transmits.

→ Contention occurs at left child of 22 (21). station 21 successfully transmits.

→ Contention occurs at right child of 22 (23), station 23 transmit successfully

→ Contention occurs at 24 (28), station 28 transmits successfully.

→ Contention occurs at left child of 28 (26), station 26 transmit successfully.

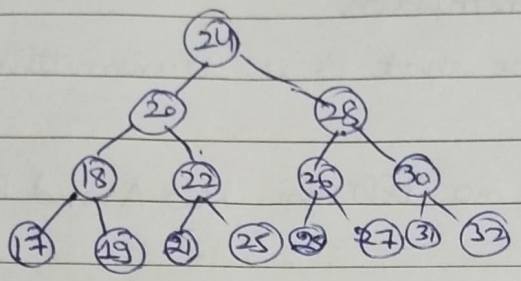
→ Contention occurs at left child of 26 (25), station 25 transmits successfully

→ Contention occurs at ~~right~~ left child of 25 (29), station 29 transmits successfully

→ Contention occurs at right child of 29 (32), station 32 transmit successfully.

All stations transmit successful

11 slots needed to resolve contention



(2) B: initiates transmission to C.

A: If A has to transmit to F, it should sense medium before B starts transmitting. If medium is busy (B is transmitting), A should defer its transmission until the medium become idle.

F: AS F wants to receive data from A, it should also sense medium. If its busy, F should defer its transmission.

C: If C has to transmit data to any of its connected stations (B, D, or E), it should also sense medium. If its busy, C should defer its transmission.

D & E - Not involved in transmission from B→C so they should should sense medium and defer their transmission if its busy.

B→C

A→F

C→B/D/E

D/E→C

If A want to have simultaneous data transmission with F while B transmits to C, restriction are :

1) A must be able to sense that B is transmitting before A starts its transmission
2) F must also sense that B is transmitting before F starts transmission
3) There should be no collision b/w A and F

A and F both should sense medium and after transmission if B is transmitting
A and F constant their transmissions once medium become idle after B's transmission finishes.

(3) In 1000 ms, no of frames = 50

No of frames in 40 ms = $\frac{50 \times 40}{1000} = 2$

a) P(success at 1st attempt) = P(0) = Poisson distribution
$= e^{-G}$
$= e^{-2}$

b) P(success after k collision) = (P(failure))^k P(success)
$= (1 - e^{-G})^k (e^{-G})$
$= (1 - e^{-2})^k e^{-2}$

c) Expected no. of attempts
$= 1 P(1) + 2 \cdot P(2) + 3P(3) - \ldots - \infty$
$= \sum k P(k)$
$= \sum k e^{-G} \cdot (1 - e^{-G})^{k-1}$
$= e^{G}$
$= e^{2} = 7.39 \simeq 8$

⑤ $T_{Propagation} = \frac{2km}{2\times10^8} = 10\mu s$

$T_{transmission} = \frac{256\ bits}{20\ mbps} = 12.8\ \mu s$

Transmission delay = 12.8 μs
Propagation delay = 10μs × 2 = 20μs

Wait till time channel has been free = 10 μs

Ack transmission Delay = $\frac{32\ bit}{20\ mbps} = 1.6\mu s$

Propagation delay (receiver to sender) = 20 μs
Wait till time has been free = 10μs

Sum = 74.4 μs
20 mbps ⟹ 20 mb is 1 s
$74.4\times10^{-6}\times20\times10^6 = 74.4\ \mu s = 1488$ bits

Efficiency = $\frac{\text{Actual amount of data can be sent}}{\text{Capacity of channel for given period}}$

$= \frac{256-32}{1488} = 0.1505$

⑥

	Hidden Station	Exposed station
F → A	B	F
A → B	F, C	A
B → C	A	B
C → D	B, E	C

(7) a) 20% of slots idle → frame will be successfully transmitted if sent in those 20% of slots = P(success) = 0.2

a) $P(\text{success}) = e^{-G} = G = -\ln(P(\text{success}))$
$= -\ln(0.2)$
$= 1.609$

b) $S = P(\text{success}) \times G = Ge^{-G}$
$= 1.609 \times 0.2$
$= 0.32$

c) $G > 1$ Channel is overlooded