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Question 1

Consider building a CSMA/CD network running at 1 Gbps over a 1 km cable with no repeaters. The signal speed in the cable is 200000km/sec. What is the minimum frame size?

Answer

We must keep in mind that in CSMA/CD, for a station to get some surety of successful transmission the contention interval (time during which the station is transmitting) should have at least 2τ slot width where τ is time for signal to propagate between two farthest stations ie there must be enough time for the front of the frame to reach the end of the cable and then for an error message to be sent back to the start before the entire frame is transmitted.

As a result for a 1 km cable the one way propagation time = $1/200000$

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

so for both ways it would be = $2 \times 5 \mu\text{sec} = 10 \mu\text{sec}$

To make CSMA/CD work, it must be impossible to transmit an entire frame in this interval. At 1 Gbps, all frames shorter than 10,000 bits can be completely transmitted in under 10 μsec , so the minimum frame is **10,000 bits** or **1250 bytes**.

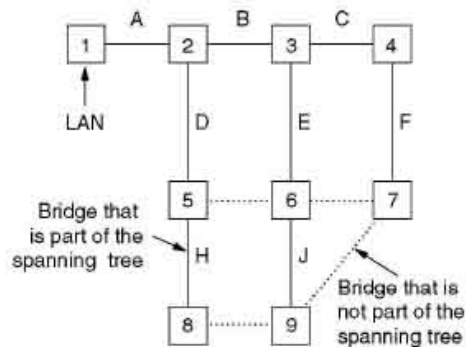
$$\text{ie } 10^9 \text{ bps} \times 10 \times 10^{-6} \text{ sec} = 10^4 \text{ bits}$$

$$10^4 \text{ bits} / 8 = 1250 \text{ bytes}$$

Question 2

Consider the interconnected LANS shown in fig 4-44. Assume that the hosts a and b are on LAN1, c is on LAN 2, and d is on LAN 8. Initially , hash tables in all bridges are empty and the spanning trees is used(fig 4-44b). Show how the hash tables of different bridges change after each of the following events happen in sequence.

- a sends to d.
- c sends to a
- d sends to c.
- d moves to LAN 6.
- d sends to a



(b)

Answer

a) When a sends to d: whole network is flooded

A	B	C	D	E	F	H	J
a,1	a,2	a,3	a,2	a,3	a,4	a,5	a,6

i.e. bridge A gets to know that it can get to 'a' on LAN 1, bridge B gets to know it can get to 'a' through LAN 2 etc.

b) When c sends to a

A	B	C	D	E	F	H	J
c,2	c,2		c,2				
a,1	a,2	a,3	a,2	a,3	a,4	a,5	a,6

Here when 'c' on LAN 2 transmits so it will send frame to bridges B, D and A. Because B and D know that they can get to 'a' through LAN 2 they don't forward

the frames to the rest of the LAN's. In the process they also learn about host 'c' location.

c) When d sends to c

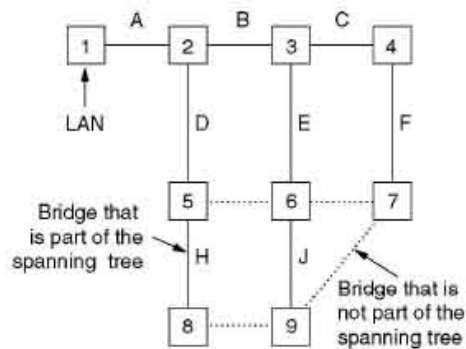
A	B	C	D	E	F	H	J
d,2	d,2		d,5			d,8	
c,2	c,2		c,2				
a,1	a,2	a,3	a,2	a,3	a,4	a,5	a,6

d) When d moves to LAN 6

A	B	C	D	E	F	H	J
d,2	d,2		d,5			d,8	
c,2	c,2		c,2				
a,1	a,2	a,3	a,2	a,3	a,4	a,5	a,6

e) When d sends to a

A	B	C	D	E	F	H	J
d,2	d,3	d,3	d,2	d,6		d,8	d,6
c,2	c,2		c,2				
a,1	a,2	a,3	a,2	a,3	a,4	a,5	a,6



(b)

Question 3

Imagine that a switch has line cards for four input lines. It frequently happens that a frame arriving on one of the lines has to exit on another line on the same card. What choices is the switch designer faced with as a result of this situation ?

Answer

First the designer would need to decide on the type of switch to use. That implies whether to use a crossbar switch, space division switch or to use a time division switch. The crossbar switch has n input lines and n output lines (in our case n is 4). However with this switch number of crossbars grow as the square of number of lines into the switch. The space division switch splits the crossbar into small chunks and interconnects them making it possible to build multistage switch with fewer cross points. The third that is time division switches the n input lines are scanned in sequence to build an input frame with n slots.

Once the switch type is decided, the designer would need to decide whether the switch uses circuit switching or packet switching. In other words should the input port be buffered or not. In circuit switching there is a need to set up end-to-end path before any data can be sent. In other words this technique reserves required bandwidth in advance, which is not the case with packet switching. With packet switching there is an upper limit to block size, which allows packets to be buffered at the input port. This rules out wastage of bandwidth because circuits are never dedicated as in case of circuit switching.

Finally it should be decided whether there would be any error handling in the switch. This would be necessary in case of packet switching because packets may be delivered in the wrong order to the destination. Moreover what would be done with garbled packets (cases where the destination address gets garbled or does not exist).