

Part 1

1.

a. Emission time = $\text{Frame_length} / \text{emission_rate}$

b. Propagation time = $\text{Diameter} / S$

The condition for CSMA/CD to work properly : $T_e \geq 2T_p$ (any machine in the network needs to detect an incoming signal while sending to detect the collision)

$$\Rightarrow ((\text{Frame_length} / \text{emission_rate}) / 2) * S \geq \text{Diameter}$$

c. Rule of three to compute the new diameter based on the rate

10 -> D

100 -> ? $10 * D$

d. If we maintain the same diameter and increase the emission rate we need then to adjust the minimum frame length

2.

a. $P_t = \text{Diameter} / S$

b. $E_t = \text{Frame_length} / \text{emission_rate}$

c. $E_{t_ack} = 80 / \text{emission_rate}$

$$T_t = E_t * 4 + P_t * 2 + 2 * 1\text{ms} + E_{t_ack} * 4 + P_t * 2$$

//the transfer time T_t = the emission time of a frame from the client + the propagation time to the switch + the reception time of the frame on the switch + the switching process time + the emission time of the frame from the switch + the propagation time to the server + the reception time of a frame on the server + the emission time of a acknowledgement from the server + the propagation time to the switch + the reception time of the acknowledgement on the switch + the emission time of the acknowledgement from the switch + the propagation time to the client + the reception time of the acknowledgement on the client

d. How many frame for a message of 15Kbits $Nb_frames = \text{message_length} / (\text{frame_length} - 80)$

$$T_{total} = T_t * Nb_frames$$

e. We send 1000 – 80 bits (data without headers) in T_t

$$\Rightarrow \text{the useful rate } U_r = 1000 - 80 / T_t$$

f. The latency of clients

Part 2

a.

Destination Mac address	Source Mac address	Protocol type : IP	Other bytes are Data : layer 3 packet
FF FF FF FF FF FF	08 00 20 02 45 9E	08 00	00 01 08 00 06 04 00 01 08 00 20 02 45 9E 81 68 FE 06 00 00 00 00 00 00 81 68 FE 05 08 00 20 02 45 9E 08 00 20 07 0B 94 08 06 00 01 08 00 06 04 00 02 08 00 20 07 0B 94 81 68 FE 05 08 00 20 02 45 9E 81 68 FE 06

b. The server sends the message because it is a broadcast address