00:57

QUESTION

Determine the maximum length of the cable (in km) for transmitting data at a rate of 500 Mbps in an Ethernet LAN with frames of size 10,000 bits. Assume the signal speed in the cable to be 2,00,000 km/s.

[GATE CS 2013]

(A) 1

(B) 2

(C) 2.5

(D) 5

NESO ACADEMY

01:39

SOLUTION

Given Data:

Rate of transmission = 500 Mbps

Size = 10^4 bits

Signal speed = 2×10^5 km/sec

Solution:

Transmission time $\geq$ round trip time of 1 bit

Transmission time $\geq 2 \times$ propagation time

NESO ACADEMY

02:36

SOLUTION

Transmission time $\geq$ 2 x propagation time

$$\text{Transmission time} = \frac{\text{Message Size}}{\text{Bandwidth}}$$

$$\text{Propagation time} = \frac{\text{Length}}{\text{Propagation Speed}}$$

$$\frac{\text{Message Size}}{\text{Bandwidth}} = \frac{2 \times \text{Length}}{\text{Propagation Speed}}$$

NESO ACADEMY

04:49

SOLUTION

$$\frac{10^4 \text{ bits}}{500 \text{ Mbps}} \geq \frac{2 \times L}{2 \times 10^5 \text{ Km/sec}}$$

$$\frac{10^4 \text{ bits}}{500 \text{ Mbps}} \geq \frac{L}{10^5 \text{ Km/sec}}$$

$$\frac{10^4 \text{ bits} \times 10^5 \text{ Km/sec}}{500 \text{ Mbps}} \geq L$$

$$\frac{10^4 \text{ bits} \times 10^5 \text{ Km/sec}}{500 \times 10^6 \text{ bps}} \geq L$$

$$\frac{10^4 \text{ Km/sec}}{500 \times 10} \geq L$$

$$2 \text{ Km} \geq L$$

$$\frac{10^4 \text{ bits} \times 10^5 \text{ Km/sec}}{500 \text{ Mbps}} \geq L$$

$$\frac{10^4 \text{ bits} \times 10^5 \text{ Km/sec}}{500 \times 10^6 \text{ bps}} \geq L$$