

Course name: Network I  
 Course Code: CNExxx  
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Exam number: Quiz 02  
 Exam Date: 15/11/2011  
 Time Allowed: 45 minutes

1. Consider two hosts, *A* and *B*, connected by a single link of rate *R* (measured in kbps). Suppose that the two hosts are separated by *m* meters, and the propagation speed along the link is *Sp* meters per second. Host *A* is to send a packet of size *L* bits to host *B*.

- Express the propagation delay *Dp* in terms of *m* and *Sp*.
- Express the transmission delay *Dt* in terms of *L* and *R*.
- What will be the total end-to-end delay?
- Suppose  $Sp = 2.5 \times 10^8$  m/s, *L* = 100 bits, and *R* = 28 kbps.

Find the distance *m* such that  $Dp = Dt$ .

$$\begin{aligned}
 &\text{Propagation speed} = Sp \\
 &\text{Distance} = m \quad \rightarrow \quad Dp = m/Sp \\
 &\text{Data Rate (bandwidth)} = R \\
 &\text{Packet size} = L \quad \rightarrow \quad Dt = L/R \\
 &\rightarrow \quad \text{delay} = Dp + Dt \\
 &\rightarrow \quad m/2.5 \times 10^8 = 100/28 \times 1024 \quad \rightarrow \quad m = 87193.8 \text{m}
 \end{aligned}$$

2. Consider a point-to-point link *l* = 100,000 km in length. The propagation speed *Sp* of bits in this link is  $2 \times 10^8$  m/s. At what bandwidth *B* will propagation delay *Dp* equal transmission delay *Dt* for a 1 Kbyte packets?

$$\begin{aligned}
 &100000 \times 10^3 / 2 \times 10^8 = 1 \times 1024 \times 8 / R \\
 &R = 2048 \text{ bps}
 \end{aligned}$$

3. A system has an n-layer protocol hierarchy including the physical layer. Applications generate messages of length M bytes. At each of the layers an h-byte header is added. What is the percentage of channel Band Width occupied with protocol headers ?

$$\text{Total amount of data with header} = M + (n-2) \times h$$
$$\text{Fraction} = ((n-2) \times h) / (M + (n-2) \times h) = ((n-2) \times h / M) + 1$$