

CSC4200 – Homework 2 (Total 100 points)

Due – Sep 26th 2022, 11:59 PM CST

1. Give some (4-5) key differences between circuit switching and packet switching? 10 points

Circuit Switching

Dedicated resource divided among participants

Requires setup, guaranteed performance (unless the link breaks)

Packet Switching

Shared resource

Use small chunks of data (packets), send as soon as possible

Store-and-forward packets

2. What are the different layers in today's Internet? Why do we create layers? 10 points

The different layers in today's internet are Use Services: FTP, HTTP, NV, TFTP, TCP, UDP, IP and Export Services: Application, TCP, UDP, IP, Subnetwork.

We create layers to break problems down into smaller problems.

3. Suppose there is a 10 Mbps microwave link between a geostationary satellite and its base station on Earth that are 36 thousand KM apart. Every minute the satellite takes a digital photo and sends it to the base station. Assume speed of light in the link is 2.4×10^8 meters/sec. - 25

- a. What is the propagation delay of the link? – 10 points
- b. What is the bandwidth-delay product, $R \cdot d_{\text{prop}}$? – 5 points
- c. Let x denote the size of the photo. What is the minimum value of x for the microwave link to be continuously transmitting? - 10 points

3. 10 Mbps 2.4×10^8 m/s
36,000 km
1 min

- a. What is the ~~prop~~ propagation delay of the link?

$$\text{propagation} = \frac{36,000,000 \text{ m}}{2.4 \times 10^8 \text{ m/s}} = 0.15 \text{ s} = 150 \text{ ms}$$

- b. What is the ~~band~~ bandwidth-delay product, $R \cdot d_{\text{prop}}$?

$$B \times D = 10 \cdot 10^6 \cdot 150 \cdot 10^{-3} = 15 \times 10^6 \text{ bits} = 1875 \text{ kilobytes}$$

- c. Let x denote the size of the photo. What is minimum value of x for the microwave link to be continuously transmitting?

$$\text{Transmission rate} = 10 \text{ Mbps} = 10 \times 10^6 = 10^7 \text{ bits/s}$$

$$x_{\text{min}} = 10^7 \text{ bits} \cdot 60 \text{ s} = 600,000,000 \text{ bits} = 75000 \text{ KB}$$

4. Calculate the total time required to transfer a 1000-KB file in the following cases, assuming an RTT of 50 ms, a packet size of 1 KB data, and an initial $2 \times \text{RTT}$ of “handshaking” before data is sent: - 25 points

Hint: Speed of light is not given but RTT is given as 50ms, Propagation delay = Half of RTT

- (a) The bandwidth is 1.5 Mbps, and data packets can be sent continuously. – 10 points
- (b) The bandwidth is 1.5 Mbps, but after we finish sending each data packet, we must wait one RTT before sending the next. – 10 points
- (c) The bandwidth is “infinite,” meaning that we take transmit time to be zero, and up to 20 packets can be sent per RTT. – 5 points

4. 1000 KB File 1 KB packet size
RTT 50ms

a.) $\frac{50\text{ms}}{2} + \frac{1000\text{KB}}{1.5\text{Mbps}} + 50\text{ms} \cdot 2 = 5.33\text{s} = 5.333\text{s}$

b.) ~~5.333s~~ $5.333\text{s} + 50\text{ms} \cdot 999 = 55.283\text{s}$

c.) $\frac{50\text{ms}}{2} + 50\text{ms} \cdot 2 + 50\text{ms} \cdot 49 = 2.575\text{s}$

5. Assuming a framing protocol that uses bit stuffing, show the bit sequence transmitted over the link when the frame contains the following bit sequence: - 10 points

10011111**0**101011111**0**10111111**0**

Mark the stuffed bits.

6. How can a wireless node interfere with the communications of another node when the two nodes are separated by a distance greater than the transmission range of either node? – 10 points

The node that is in range of both of the other nodes has signal interference from the other nodes.

7. What kind of problems can arise when two hosts on the same Ethernet share the same hardware address? Describe what happens and why that behavior is a problem. – 10 points

Being on the same ethernet and having the same hardware address could result in getting wrong packets which can be harmful to the host.