Cairo University
Faculty of Engineering
Electronics and Communications Department

Fouth Year
Computer Networks
2011-2012

Sheet 1

Review Questions:

1- What advantages does a circuit-switched network has over a packet-switched network?
2- Why is it said that packet switching employes statistical multiplexing?
3- What are the pros and cons of VCs when used for packet-switching?
4- Consider sending a packet from a sending host to a receiving host over a fixed route. List the delay components in the end-to-end delay. Which of these delays are constants and which are variable?
5- What are the five layers in the internet protocol stack? What are the principle responsibilites of each of these layers?

Problems:

1- You are required to reduce the delay for certain application. The options under consideration are listed below. For each option, explain whether the decision will increase or decrease the packet delay. Moreover, which component of the delay (transmission or propagation) will be affected?

a) Increasing the packet size.
b) Increasing the bit rate of the transmission system from R bits/second to 2R bits/second?
c) Moving the two end points physically closer (for example Cairo to Giza rather then Cairo to Alex)?

2- A standard analog broadcast television channel is 6MHz wide.

a) How many bits/sec can be transmitted using (256-QAM) signal? Assume that the bandwidth efficient pulse shapes are used so that the baud rate $6*10^6$ QAM symbol/sec can be achieved.
b) What is the SNR required to support communication at the data rate you found in part(a)?
c) How much smaller could the transmit power S be to send at the same data rate in (b), but using twice the bandwidth (i.e., 12MHz)?

3- A telephone line is known to have loss of 15 dB. The input signal power is measured as 0.7 watt and the output noise is measured as 5 uwatt.

a) Calculate the output signal-to-noise ratio in dB.
b) What is the capacity of this phone line with a frequency range 300Hz-3300Hz?
c) If the attenuation rate of this phone line is 4dB/Km, and the minimum output signal is 0.001 watt, how long can the phone line be before requiring a repeater?

4- Ten 9600-bps lines are to be multiplexed using TDM. Ignoring overhead bits in the TDM frame, what is the total capacity required for synchronous TDM? Assuming that we wish to limit average TDM link utilization to 0.8, and assuming that each TDM link is busy 50% of the time, what is the capacity required for statistical TDM?

5- A 5000-byte file is to be transmitted along a path composed of the source, destination, 6 point-to-point links, and 5 switches. Suppose each link has a propagation delay of 2ms, bit rate of 4 Mbps, and the switching. Thus you can either break the file up to into 1KB packets, or set up a circuit through the switches and send the file as one contiguous bit stream. Suppose that packets have 24 bytes of packet header information and 1000 bytes of payload, that store and forward packet processing at each switch incurs a 1ms delay after the packet has been completely received. What is the time needed to transfer the whole file if:

a) Circiut switching is used, Circuit setup requires a 1 KB message to make one round trip incurring 1 ms delay at the switches after the message has been completely received.
b) Packet switching is used. What is the link utilization?
c) Packet switching with acknowledgement is used such that the following packet is not transmitted until an ACK for the current packet has been received. Assume the acknowledgement packet size is 1 byte length. What is the link utilization?

6- Suppose users share a 5 Mbps link and each user requires 500 Kbps when it is active. Also, each user is inactive 75% of the time and transmits only 25% of the time.

a) With circuit switching, how many users can be supported?

b) Now consider packet switching with 50 users. What is the probability that **exactly** 10 users are active?
c) What is the probability that **at least** 10 users are active?
d) What is the maximum number of users that can be supported on the link with packet switching assuming we do not want the probability that 10 or more users are active to be greater than 0.05?

7- Consider the following parameters for a switching network:

N = number of hops between two given end systems

L = message length in bits

B = data rate, in bits per second (bps), on all links

P = fixed packet size, in bits

H = overhead (header) bits per packet

S = call setup time (circuit switching or virtual circuit) in seconds

D = propagation delay per hop in seconds

a) For ***N = 4, L = 3200, B = 9600, P = 1024, H = 16, S = 0.2, D = 0.001*** compute the end-to-end delays for circuit switching, virtual circuit packet switching, and datagram packet switching. Assume that there are no acknowledgments. Ignore processing delay at the nodes.
b) Derive general expressions for the end-to-end delay in the three techniques of part (a). Taking two techniques at a time, show the conditions under which the delays are equal.