Homework 1

Due: 17 February 2012, 4pm

Problem 1 - Switching

a. Explain why using circuit switching on a network such as the Internet would lead to a waste of resources.

b. Explain how routing is different in circuit and packet switched networks: When is the route established and what overhead is required? What happens in case of a failure of a switch in the middle of a route?

c. Congestion happens on both packet and circuit switched networks. How does this impact the end-users on each of the networks? What can a sender in either case do to decrease the congestion?

Problem 2 - Modulation and Encoding

a. For each of the encoding schemes below, determine the minimum bandwidth needed to transmit at a rate of B bits/sec. Explain your reasoning for each.

- NRZ
- NRZI
- Manchester

b. As discussed in the lecture DC balancing is an important goal for any encoding scheme. Show that in 4B/5B encoding, a signal transition will occur *at least* every 4 bits, no matter the message being transmitted. (Note: enumerating all possible encoded messages would not be a good proof strategy here). Why is the combination of 4B/5B with NRZI advantageous?

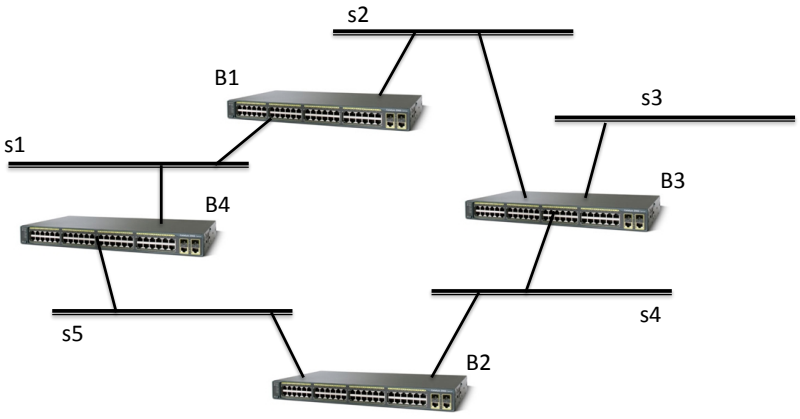
Problem 3 - Bandwidth, Delay and Windows

a. A channel has a bit rate of 5kbps (assume $5 \times 10^3 bps$) and a propagation delay of 10msec. What is the range of frame sizes for which a stop-and-go protocol gives an efficiency of at least 50%? Assume the acknowledgment frames have negligible length. Can you reach 100% efficiency?

b. Newt Gingrich is president and has delivered on his promise of a lunar base. You are in charge of establishing a link for efficient communication. A sliding window protocol is in place for frame transmission on a 64 Mbps point-to-point link. For what send window size will the link utilization be 100%? Assume the distance to the moon is

$3.6 \times 10^8 m$ and that the speed of light is $3 \times 10^8 m/s$. You may ignore any processing times at the sender/receiver.

Problem 4 - Spanning Tree Algorithm



The spanning tree algorithm in a switched Ethernet eliminates loops in the network. Based on the description in the slides (lecture 5), and in the book (Section 3.1), determine which bridge ports will be disabled after the spanning tree algorithm converges. Assume the bridges to be ordered B1, B2, B3, B4. For each LAN segment, list the designated bridge, and for each bridge, the port with the path closest to the root. If you want to show configuration messages, list them as (Bi, d, Bj), meaning bridge Bj claims it is at distance d from root bridge Bi. Show your work.