Exam - Midterm

Due: 7:00pm, 24 Oct 2016

Closed Book. Maximum points: 100

NAME:

1. Flying high [25 pts]

Did you write your name above? Please do! Now we can start:

You are designing the network for a company that wants to use satellites to provide Internet access.

These satellites will be initially at an altitude of 750km. Packets in your protocol are 1250 bytes in size, and the bandwidth you can get out of your equipment 100Mpbs, or 10^8 bits/s. (Make sure you don't mix bits with bytes).

a. **What is the two-way propagation delay in this link**, considering the speed of light to be 3×10^8 m/s? [4 pts]

b. If you use a stop-and-wait protocol, **what would be the average throughput you get**? (You can express it as a fraction of the link bandwidth). [5 pts]

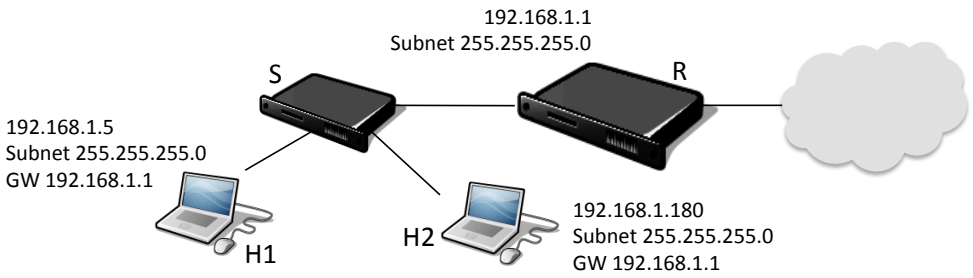
c. You quickly realize that this is terrible, and decide to use a sliding window. **What is the best size of the sending window, *in packets*, to maximally utilize the link?**[5 pts]

d. When you are ready to do a git commit of your calculations, Sam and Xueyang from the orbital calculation department come to you and say that you will only have authorization to have the satellites orbiting at 2× the original distance. You immediately realize that your window calculations will have to change.

You were very proud of your modulation. You had used Shannon/Hartley's law to compute how many levels of modulation you could use ($M \leq \sqrt{1 + S/N}$), and sized your antenna to get $S/N = 1024$. It is too bad that the signal strength will reduce proportionally to the square of the distance. Given that you will likely have to adjust your modulation (and thus the bandwidth), and that the latency is also changing, **what is the new size of the window to fully utilize this new link?** [6 pts]

2. MAC Unlearning [25 pts]

Conside the following network.



a. Suppose H2 wants to snoop on all communications between H1 and some other host S, without disrupting the communication. H2 sets its interface to promiscuous mode, but, alas, gets at most one packet. **Why**? [6 pts]

b. **Describe what H2 can do** (an attack) to force its way into getting most packets from H1 to S, again without preventing S from getting its packets. [6 pts]

c. **Cite two differences** between this switched network and an old-fashioned Ethernet in which the switch S is replaced by a wire. [6 pts]

d. If the network mask of H1 is accidentally changed to 255.255.255.128, **does the way in which it sends packets to H2's IP address change? If yes, how does it change? If not, why not?** [7 pts]

3. Intra-domain Routing [25 pts]

a. In a network with Distance Vector routing, if the diameter (the length of the longest shortest path among any pair of nodes) of the network increases to large values, you have to adjust the protocol so that it keeps working. **What is this adjustment, and what is a bad side effect of this adjustment**? [5 pts]

b. In DV routing, **can count-to-infinity happen when a link is added to the network? Why or why not?** (Assume nothing else changes in the network during this time.)[5 pts]

c. **Mention one advantage** of Link State routing over Distance Vector. [5 pts]

d. **Mention one advantage** of Distance Vector routing over Link State. [5 pts]

e. One way to scale Link State is to use a hierarchical set of zones. If this solves scaling to large networks, **why is this not a good solution for the global Internet?** [5 pts]

4. IP Routing Tables [25 pts]

Having gotten tired of satellite links from question 1, you are now working with a Tier-1 ISP, and are constantly monitoring the size of the core BGP tables.

a. As a Tier-1 ISP, **why can't you have a default route in your routing tables?** [5 pts]

b. For each of the items below, **say if it increases, decreases, or doesn't affect the number of entries in your routing tables, and briefly explain why:** (Assume that any announcements generated will eventually be reflected in your routing table.) [5 pts each]

   (a) An organization with a spare /8 address allocation decides to sell blocks of this space to anyone that wants IP addresses.

   (b) An organization that was a leaf in the BGP graph becomes multi-homed.

   (c) An organization defending against a BGP prefix hijacking announces the same set of addresses as it had before, but using more specific prefixes.

   (d) An organization which had already had IP prefix 15.81.128/17 manages to buy 15.81.0/17.