Homework Assignment #2 - Due Oct 11 @ 3:50 PM

EE122: Introduction to Communication Networks

(Fall 2006)

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1. Peterson & Davie, Exercises 3.1, 3.6, 4.4.

2. **The Design of IP.**

   IP includes two options for including a "source route": that is, the sender of the datagram specifies a sequence of intermediary routers that the packet should traverse on its way to the destination. Both of these options have 3 bytes of meta-information (essentially an option "header") followed by a series of 4-byte IP addresses specifying the intermediary routers.

   Given the constraints imposed by the design of the IP header, what is the largest number of routers that such an option can include?

3. **Subnetting and Classless Interdomain-Routing (CIDR).**

   Your company, BearsEx, is assigned 4 blocks of 256 addresses from your ISP, 147.17.204.[0-255], 147.17.205.[0-255], 147.17.206.[0-255], and 147.17.207.[0-255].

   (a) If your ISP used class-A/B/C subnetting, what would be the subnet mask and the subnet number?

   (b) In this case, what corresponding network prefix(es) appear to routers *outside* of the ISP?

   (c) If instead your ISP uses classless interdomain-routing (CIDR) and assigns 197.17.204.[0-255], 197.17.205.[0-255], 197.17.206.[0-255], and 197.17.207.[0-255] to BearsEx, what are the corresponding network prefix(es) that appear to routers outside of the ISP?

4. **Comparison of Stop-and-Wait and Sliding Window.**

   You want to transfer a file from Berkeley to San Francisco. For this problem, assume the following:

   - The size of file is 90,000 bytes. It will be transferred in 1,500-byte data packets, for which 40 bytes are taken up with headers. The size of acknowledgement packets is 40 bytes including header. Every packet is acknowledged.
   - The communication is bidirectional and the bandwidth is 100 Mbps (megabits/sec) in each direction. Hosts can send and receive at the same time.
   - The latency from Berkeley to San Francisco is 5 ms, as is the latency in the opposite direction.
   - Assume that time to process a packet is very small, so the receiver can send an acknowledgement as soon as it receives a data packet, but not before it receives the entire data packet.
   - Likewise, for sliding window the sender can send packets back-to-back (to the degree that the window size permits).
   - Assume no packet loss.

   (a) With Stop-and-Wait, how long will it take to transfer the file?

   (b) What is the corresponding *throughput* (total amount of user data transferred [so 90,000 bytes] over the total time required to transfer it).

   (c) With Sliding Window with SWS=RWS=3, how long will it take to transfer the file. What is the throughput?

   (d) If SWS and RWS are set to the *bandwidth-delay product* (bandwidth of the path times the round-trip latency of the path), then how long does it take to transfer the file, and with what throughput?

   (e) Extra credit: if SWS and RWS are set to *twice* the bandwidth-delay product, how long does the transfer take, with what throughput, and why?

5. **DNS.**

   Repeatedly use the command "**dig +norecurse @*dns-server* c199.eecs.berkeley.edu**" to locate the IP address of **c199.eecs.berkeley.edu**, starting with **a.root-servers.net** as the first *dns-server*.

   (a) Which DNS servers do you visit in the process of finding the address?

   (b) What is the address?

   (c) What happens if instead you look up **c199.berkeley.edu** (i.e., you forget to include "**.eecs**")?

6. **Email.**

   In this problem, you will send an email, which looks like `http://inst.eecs.berkeley.edu/~ee122/fa06/hw/email_content.txt`. The file `http://inst.eecs.berkeley.edu/~ee122/fa06/hw/tracefile` contains a tcpdump trace showing an SMTP client connecting to an SMTP server to send an email.

   (a) Taking the actions of the client as a template, use the "**telnet**" tool to send an email to **binetude@calmail.berkeley.edu** (*not* binetude@eecs.berkeley.edu) with the subject "My Answer To Homework #2, Problem #4", and where your username is annotated in some obvious fashion, like "Golden Bear" in the example. When you do this, record your connection with *tcpdump*:

   ```
   tcpdump -s 0 -w tracefile host calmail.eecs.berkeley.edu and port 25
   ```

   and submit the trace as documentation, along with a transcript of the commands you used to send the email (including commands like HELO).

   IMPORTANT: You need to inspect *tracefile* to see whether it contains any activity other than your own (which can happen if someone else also sent email at the same time). If so, you need to filter the trace using your SMTP client's ephemeral port number

   It will be useful to use your calmail account when you testing so you can see the resulting email.

   (b) An *open relay* is an SMTP (email) server configured in such a way that it allows anyone on the Internet to relay email through it to a recipient who is not directly served by the server.

   Repeat the exercise but when connecting specify a recipient of **vern@icir.org** to the server. What response do you receive?

Submission Instructions:

1. Make sure you are registered with the EECS instructional account system (different from registration for the class). You would have been prompted to register the first time you logged in to your instructional account. You can check your registration status by running the command **check-register**. If you find yourself not registered, run the command **register**.
2. Log in to your instructional account.
3. Create a directory called "hw2" : **mkdir hw2**
4. Change to that directory: **cd hw2**
5. Copy all the files that you wish to submit to this directory.
6. Run the submit program: **submit hw2**
7. Make sure that no error messages are displayed. If some error occurs, retry. If it still occurs, contact the TAs.