Mid-term examination on Introduction to the Internet

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1 Review questions

1. What advantage does a circuit-switched network have over a packet-switched network? What advantage does TDM have over FDM in a circuit-switched network?

2. Why is it that packet switching is said to employ statistical multiplexing? Contrast statistical multiplexing with the multiplexing that takes place in TDM.

3. What is meant by connection state information in a virtual circuit network?

4. Suppose you are developing a standard for a new type of network. You need to decide whether your network will use VCs or datagram routing. What are the pros and cons for using VCs?

5. What are the advantages of message segmentation in packet-switched networks? What are the disadvantages?

6. What is the key distinguishing difference between a tier-1 ISP (backbone) and a tier-2 ISP?

7. Is HFC bandwidth dedicated or shared among users? Are collisions possible in a downstream HFC channel?

8. Consider sending a series of packets from a sending host to a receiving host over a fixed route. List the delay components in the end-to-end delay for a single packet. Which of these delays are constant and which are variable?

9. List five tasks that a protocol layer can perform. Is it possible that one (or more) of these tasks could be performed by two (or more) layers?

10. What are the five layers in the Internet protocol stack? What are the principal responsibilities of each of these layers?

11. What information is used by a process running on one host to identify a process running on another host?

12. What is the difference between persistent HTTP with pipelining and persistent HTTP without pipelining?

2 Problems

1. True or false?

   (a) Suppose a user requests a Web page that consists of some text and two images. For this page the client will send one request and receive three response messages.

   (b) Two distinct Web pages can be sent over the same persistent connection.

   (c) With non-persistent connections between browser and origin server, it is possible for a single TCP segment to carry two distinct HTTP request messages.

   (d) The `Date:` header in the HTTP response message indicates when the object in the response was last modified.

2. Consider sending a file of $M \times L$ bits over a path of Q links. Each link transmits at R bits per second. The network is lightly loaded so that there are no queuing delays. When a form of packet switching is used, the $M \times L$ bits are broken up into M packets, each packet with L bits. Propagation delay is negligible.

   (a) Suppose the network is a packet-switched virtual circuit network. Denote the VC set-up time by t_s seconds. Suppose the sending layers add a total of h bits of header to each packet. How long does it take to send the file from source to destination?

   (b) Suppose the network is a packet-switched datagram network and a connectionless service is used. Now suppose each packet has $2h$ bits of header. How long does it take to send the file?

(c) Repeat case 2b but assume message switching is used (that is, $2h$ bits are added to the message, and the message is not segmented).

(d) Finally, suppose that the network is a circuit-switched network. Further suppose that the transmission rate of the circuit between source and destination is R bit/s. Assuming t_s seconds of set-up and h bits of header appended to the entire file, how long does it take to send the file?

3. Consider sending a large file of F bits from host A to host B. There are two links (and one switch) between them and the links are uncongested (that is, no queuing delays). Host A segments the file into segments of S bits each and adds 40 bits of header to each segment, forming packets of $L = 40+S$ bits. Each link has a transmission rate of R bit/s. Assuming that F/S is an integer, find the value of S that minimises the delay of moving the file from host A to host B. Disregard propagation delay.