

CSc 450/550: Computer Networks (Summer 2006)

Assignment 2

To be handed in at the lecture on June 19, 2006

1. Computer A and Computer B are interconnected by a store-and-forward Router C and two 10 Mbps duplex communication links (i.e., AC and CB) of 1000 km length each. A binary file of 10 MB is to be transferred from A to B. Signal is propagated at 10^8 m per second in the communication channel.
 - (a) if the whole file is transferred as one big message (i.e., message switching), how long does it take for B to receive the entire file after A starts to send the file?
 - (b) if the file is transferred in a series of 10 KB packets (i.e., packet switching), how long does it take for B to receive the entire file after A starts to send the file?
 - (c) if it takes 10 ms for C to make the forward decision for a message or packet, please recalculate the time for B to receive the file with message or packet switching.
 - (d) please calculate the minimal buffer size required at C to support message or packet switching without or with the 10 ms processing time for each message or packet.
2. In a few sentences, please explain and compare frequency division multiplexing, wave-length division multiplexing, and time division multiplexing.
3. In a few sentences, please explain the scalability issue of the client-server model over the Internet and compare the different ways to improve it.
4. In a few sentences, please explain and compare recursive and iterative DNS query.
5. A client needs to send a 5-byte request message to a server over TCP, and the server will respond with a 10-byte reply message. Assume initial sequence number is 0. Please write down the sequence of packets exchanged between the client and the server, along with TCP flag(s), sequence number, and acknowledgment number in each TCP packet.
6. Please calculate the TCP/IP-style checksum for a 3-byte message in its hexadecimal representation: AB, CD, EF. Please also explain when the checksum would fail to detect possible packet errors.
7. Please calculate the TCP timeout value (RTO) for the following round-trip time (RTT) sequence: 1, 2, 3, 4, 1, 2, 3, 4. The initial SRTT is 1 and the initial RTTV is 0.5.

(continue on the next page)

8. For a simplified HTML document with URL `http://a.b.com/index.html`

```
<html>
<a href='image/fig1-big.jpg'><img src='image/fig1-small.jpg'></a>
<img src='http://x.y.com/image/fig2.gif'>
<img src='http://a.b.com/image/fig3.gif'>
</html>
```

and for a web browser that loads images (JPEG and GIF files) automatically, how long (in round-trip time) does it take to display this Web page properly (DNS overhead is omitted), if all files are small enough to be accommodated in one packet and:

- (a) non-persistent HTTP connections are used, or
- (b) persistent HTTP connections with non-pipelining are used, or
- (c) persistent HTTP connections with pipelining are used.

How about if at most two parallel TCP connections per server can be used by the browser with the above three scenarios?

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