Spring 22 Solutions Sample MIDTERM EXAM I CS:352 Internet Technology

1. Quickies (20 points)

1. What is the difference between packet loss and packet corruption? How are they detected?

Packet loss occurs when a packet is dropped due to buffer overflow. It is detected by a time out or receipt of a NACK. Packet corruption occurs when bits of a packet are in error and is detected by using a checksum in the packet.

2. Compare push vs pull mode of server operation. Explain why http operates in a pull whereas SMTP operates in a push mode.

A server is in push mode, when it sends content to a client (either gratuitously or on an event such as receiving a message). SMTP is a push server, as a server needs to send a message only when a mail is received. A server is in pull mode when a client requests contents from a server. A http server stores content and responds only to specific content requests and is normally implemented as a pull server.

3. Differentiate between packet switching and message switching.

In packet switching, message is broken into smaller units called packets and each packet is independently routed to the destination. Each packet has to have a header for routing. Has better tolerance to loss as only those packets that are lost needs to be retransmitted and not the entire message. In message switching, entire message is sent hop-to-hop. Less header overhead. Susceptible to loss as the entire message has to be retransmitted in case of errors.

4. Differentiate between active FTP connection and passive FTP connection.

In active FTP connection, the data connection is made by the server to the client on a predefined port communicated by the client. In a passive FTP connection, the data connection is made by the client to the server on a port. The server port number is communicated by the server over the control connection in response to a PASV command.

5. What are advantages and disadvantages of persistent and non-persistent http connections?

Persistent connection keeps the connection open over successive requests. More efficient, as there is no overhead on opening connection for each request. However, server needs to have all connection open until the session ends. In a Non-persistent connection, the server closes the connection after every request. There is less load on the server but every request has an overhead of opening a connection.

2. Sliding Window (20 points).

1. A sender needs to send 5 packets (P0,…,P4, packet size is 100 B) over a link with infinite bandwidth and RTT of 100 milli seconds. Time out value for each packet is set as send_time + RTT. The receivers flow control window size is 5. What is the total time required to receive all 5 packets if packet P2 is lost once and no other packet is lost under the two following schemes?
    i. Go Back N
    infinite bandwidth, all packets except P2 will arrive at 50 msec. P2, P3, P4 will all be retransmitted at 100 msec and will all arrive at 150 msec
    ii. Selective repeat
    infinite bandwidth, all packets except P2 will arrive at 50 msec. P2 will be retransmitted at 100 msec and will all arrive at 150 msec

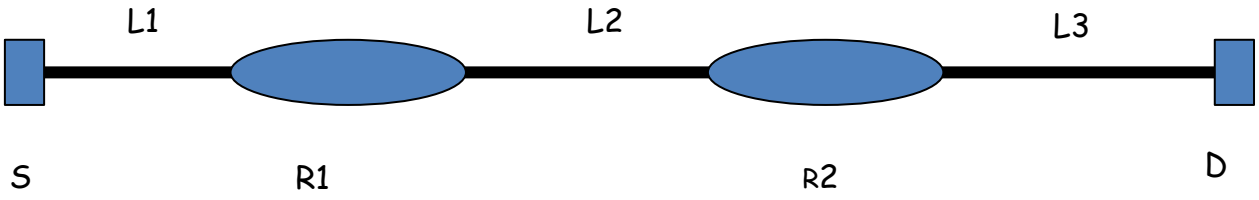
2. A sender needs to send 5 packets (P0,…,P4, packet size is 100 B) over a 100 MB/sec link and RTT of 100 milli seconds. Time out value for each packet is set as send_time + RTT. The receivers flow control window size is 5. What is the total time required to receive all 5 packets if packet P2 is lost once and no other packet is lost under the two following schemes?
    i. Go Back N
    Receive times for packets: 0, 1, 3, 4 are 50.001, 50.002, 50.004, 50.005 milli secs. Receive time for retransmitted packets 2,3,4 are 150.003, 150.004 and **150.005** msecs
    ii. Selective repeat
    Receive times for packets: 0, 1, 3, 4 are 50.001, 50.002, 50.004, 50.005 milli secs. Receive time for retransmitted packet 2 is **150.003** msecs.

3. Performance (20 Points)

3. A sender and a receiver are connected by two routers as shown. The bandwidth of each link is 100,000 Bytes/sec. A file size of 1000 bytes needs to be transferred from source to destination. Ignore propagation delay and assume no packets are lost. Calculate the total time taken to transfer the file under the following two switching schemes
    i. Message switching

Transfer time for each link = 1000/100,000 = 0.01 sec, three links= 0.03 seconds or 30 msecs.

ii. Packet switching, and the packet size is 100 Bytes
Transfer Time for first packet over 3 links : 100/100,000= 1 msec *3 = 3 msec, after that the remaining packets arrive every 1 msec, so time = 9 msec. Total time = 12 msecs



4. RTT (20 points)

4. How does TCP estimate Round Trip Time?

   For each packet sent TCP calculates time elapsed between send and an ack that covers the packet. Then TCP averages the RTT estimate as SRTT = alpha*SRTT + (1-alpha)*RTT. More weight is given to the average as opposed to the current measurement.

5. What happens if the estimate is greater than true RTT?

   If the estimate RTT is greater, then the TCP will wait longer than needed to retransmit. **This results in lower throughput**.

6. What happens if the estimate is less than true RTT time?

   If the estimate RTT is less than true RTT, then the TCP will timeout prematurely and results in unnecessary retransmit. Hence **resulting in lower efficiency or utilization .**

7. Why does TCP increase Time out value when there is a time out?
   TCP only updates RTT estimate on a successful packet transmission. If a longer link becomes the chosen path, then the SRTT will be lower than the True RTT, resulting in timeout and **retransmission and no**

update of SRTT resulting in every packet being retransmitted. Hence, TCP increases timeout value to accommodate a new larger RTT.