1. Increasing the router memory to infinite cannot control the congestion. Agree or disagree? Elaborate briefly (60-100 words)

It has been suggested that congestion can be mitigated by giving routers infinite memory, but this is a myth (Ingoley & Nashipudi, 2012). Congestion cannot be fixed with a static solution because it is a dynamic problem. Specifically, the memory demands on a network cannot be predicted: the packet arrival rates can vary wildly and the amount of time needed to hold resources for incoming data cannot be predetermined. Regardless of how much memory is allocated, there may still be congestion issues.

2. Compare the following:

* Flow Control vs Congestion Control

Flow Control tries to prevent congestion by ensuring that a sender does not send more data packets than a receiver can acquire. Congestion control attempts to fix congestion problems once they have already happened. Another way to distinguish these is to view congestion control as effecting the entire network’s ability to handle traffic, whereas flow control handles the transmission between sender and receiver (Indika, 2011).

* Open loop congestion control methods vs Closed Loop congestion control

Open Loop prevents congestion from happening by determining when packets will be transferred, accepted, or discarded. Closed Loop eliminates congestion that has already occurred by identifying congested areas of the network and making adjustments to the network to correct the congestion (Thakur, n.d.).

* Leaky Bucket Algorithm vs Token Bucket Algorithm

Leaky Bucket Algorithm provides a constant service rate through a single server queue by using an input buffer. This will smooth out bursts in flow. All data is queued and eventually is transmitted. Token Bucket Algorithm is a method to time data transmissions so that the bandwidth and burstiness requirements of the network are complied with. Each data packet requires a token and there are only so many tokens available in a period of time. Any traffic in excess of the specified burst size or rate can be queued, marked, or simply dropped (Ghosh, 2005).

* Warning Bit Method vs Random Early Detection Method

The Warning Bit Method includes a special warning bit in the packet header which a receiver can then copy and send back to the sender on the ACK packet if the packet rate is getting too high. The sender must monitor the number of ACKs it receives with the warning bit included and then adjust its transmission of packets accordingly. In the Random Early Discard Method, every time a packet arrives the average queue length is calculated. If the average is below a certain threshold, then the packet will be queued, otherwise the packet is discarded (“Congestion Control”, n.d.).

3. What do you mean by Load Shedding in congestion control?

When networks are congested by too many data packets, a last resort mechanism for handling the congestion is Load Shedding. This simply means dropping or “shedding” the excess packets (Clayton, 2012).

4. Transport protocols resemble those you studied in Data Link Layer since both will have to deal with error control, sequencing, flow control etc. Still the two differ significantly. How? elaborate with at least 4 differences.

There are four differences between Transportation Protocols and Data Link Layer. The Transportation Protocols do the following (Conte, 2008):

1. It uses explicit addresses
2. It establishes, maintains and releases connections
3. It resolves connections in multiple ways, like different pathways or latencies.
4. It handles the effects of subnet storage capabilities.

5. What is a 3 way hand shake? Is it better than 2 way hand shake?

A 3 way hand shake establishes a connection between two computers. This is how a 3 way hand shake works: Computer A sends a SYN message to computer B. Then computer B sends an SYN-ACK back to computer A. Then computer A sends an ACK to computer B and the connection is established (InetDaemon, 2013).

A 3 way hand shake is better than a 2 way hand shake because any delayed duplicate SYNs from A will cause B to send an ACK again, which will in turn cause Computer A to transmit the data again.

6. When do we use Upward Multiplexing and Downward Multiplexing?

Upward Multiplexing is used when several transport connections are going to the same destination. It is a means by which users can mitigate the cost of having several devices connected by sharing the cost of a single transport connection.

Downward Multiplexing happens when one session connection parses data to multiple network connections into packets, which then need to be re-sequenced and re-assembled. This may be necessary if the session layer requests a larger throughput than the virtual connection on a network allows (Tront, n.d.)

7. Suppose we design a reliable transport protocol that use only NAKs as feedback from receiver to sender:

* If the data rate is low (sender sends packets infrequently),is a NAK-only protocol better than a ACK-based protocol? Why?

When the data rate is low, it will take more time to detect a loss of data when using a NAK-only protocol because the receiver will have to wait for a later packet to show that a previous packet was skipped (Grossglauser, n.d.).

* if the data rate is high and the network drops only a small number of packets is a NAK-only protocol better than a ACK-based protocol? Why?

In this case the NAK-only protocol is better. If the losses are seldom, then NAKs only need to be sent seldomly. On the other hand, ACK need to be sent after each packet (Grossglauser, n.d.).

8. What are the 3 transport layer servcies?

According to OSILayers.org (n.d.), the 3 transport layer services are:

* Flow Control
* Reliable Delivery
* Same Order Delivery

9. Compare the design issues of Transport Layer with those of Network Layer

Design issues for Network Layer:

* Connectionless or Connection Oriented
* Virtual Circuits or Datagrams

Design issues for Transport Layer (Conte, 2008):

* Addressing
* Multiplexing
* Flow Control

10. What is fragmentation? Why is fragmentation important in Transport Layer?

When data is too large, it may been to be divided up into smaller chunks. This splitting of data is called fragmentation. Some routers and destination devices may put a cap on the size of data packets. If this is the case, then packets that are too big will be dropped. The Transport Layer can work around these criteria by fragmenting packets that are too big into smaller packets (Jakma, 2011).

References

Clayton, R. (2012). Computer Networking Lecture Notes. “Network Congestion Control.” Retrieved from <http://bluehawk.monmouth.edu/rclayton/web-pages/f12-514/netcqs.html>

“Congestion Control.” (n.d.) Retrieved from <https://view.officeapps.live.com/op/view.aspx?src=http%3A%2F%2Fftp.utcluj.ro%2Fpub%2Fusers%2Fcemil%2Fprc%2FCONGESTION%2520CONTROL.ppt>

Conte, P. (2008). “Computer Networks: Transport Layer.” Retrieved from <http://www.doc.ic.ac.uk/~costa/cn_slides/cn_06.pdf>

Ghosh, S. (2005). Computer Networks. “Lecture#35: Congestion Control.” Retrieved from <http://www.bing.com/videos/search?q=leaky+bucket+vs+token+bucket&FORM=VIRE3#view=detail&mid=6DFDB8A3C386751EE7706DFDB8A3C386751EE770>

Grossglauser, M. (n.d.). “Transport Layer Principles: Excercises.” Retrieved from <http://icawww1.epfl.ch/sc250_2004/lecture_notes/sc250_04_6.exos.pdf>

Indika (2011). “Difference Between Flow Control and Congestion Control.” Retrieved from <http://www.differencebetween.com/difference-between-flow-control-and-vs-congestion-control/>

InetDaemon (2013). “TCT 3-Way Handshake (SYN, SYN-ACK, ACK).” Retrieved from <http://www.inetdaemon.com/tutorials/internet/tcp/3-way_handshake.shtml>

Ingoley, S. N. & Nashipudi, M. (2012). “A Review: Fuzzy Logic in Congestion Control of Computer Network.” International Conference in Recent Trends in Information Technology and Computer Science. Retrieved from <http://research.ijcaonline.org/icrtitcs2012/number12/icrtitcs1443.pdf>

Jakma, P. (2011). “Cerf and Kahn on why you want to keep IP fragmentation.” Retrieved from <http://paul.jakma.org/2011/06/28/cerf-and-kahn-on-why-you-want-to-keep-ip-fragmentation/>

OSILayers.org (2014). “OSI Transport Layer.” Retrieved from <http://osilayers.org/osi-transport-layer.html>

Thakur, D. (n.d.). “What is congestion control?” Retrieved from <http://ecomputernotes.com/computernetworkingnotes/communication-networks/what-is-congestion-control-describe-the-congestion-control-algorithm-commonly-used>

Tront, R. (n.d.). “Lecture 5. The Transport Layer - Layer 4.”

Retrieved from <http://www.cs.sfu.ca/CourseCentral/371/tront/lectureNotes/371s5.991.4up.pdf>