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Quiz 1
CSE232 Computer Networks
Duration-30min, Full marks-12

September 29, 2022

Q.1.

Three routers are connected via a store-and-forward packet switch with **1 Gbps** links. Each link is **100 km** long and supports **signal speed of 2x10^8** meters per second. The size of a packet is **1000 bits**. Assume the router requires **0.1 ms to process each packet**; **ignore host processing delays.**

(a) What is the time elapsed between the transmission of the first bit of the packet and the reception of the last bit of the packet, between S and D? **[2]**

(b) We want to send 1000 packets. What is the time elapsed between the transmission of the first bit of the first packet and the reception of the last bit of the last packet, between S and D? **[2]**

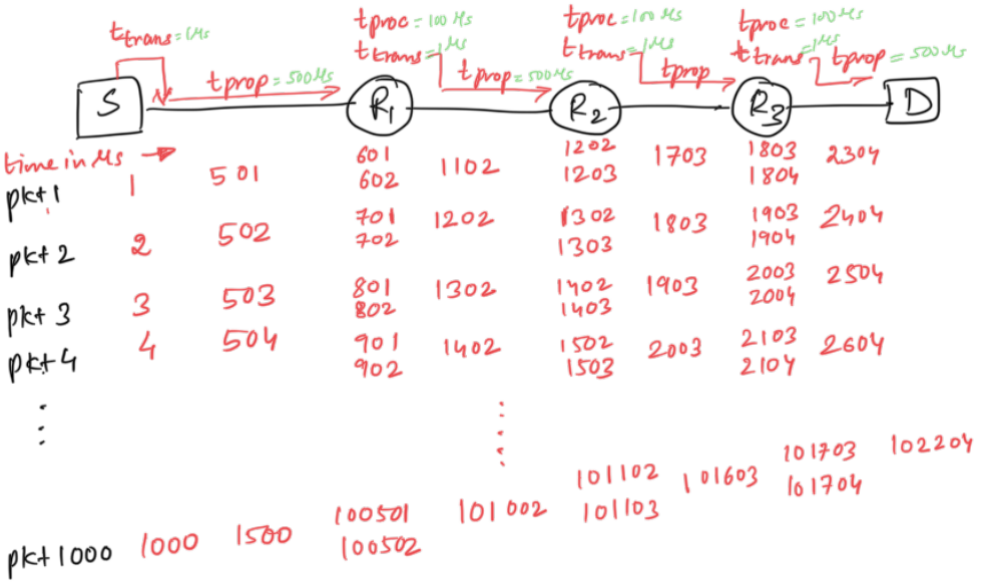
(c) If the processing delay at each router was 5 ms, what can you say about the router queueing delays under high traffic loads? Justify. **[1+1]**

[Solution: t_trans (1000 bit packet) = 1 us = 0.001 ms; t_prop=0.5 ms;

(a) t(S to D) = (t_trans+t_prop) + (t_proc+t_trans+t_prop)* 3 = 0.501+0.601*3 = 2.304 ms

(b) Since t_trans < t_proc; therefore the packets would be queued at the router.

The calculations are complex and not doable within the time limit, so we will award 2marks to everyone who attempted this question.



t(S to D) = 102204 us = 102.204 ms

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(c) Packet arrival rate at the router = 1/(0.001ms) = 10^6 packets per sec; router processing delay = 5ms; Service rate at the router = 1/5ms = 200 packets per sec;
Arrival rate >> service rate => router queueing delay = infinity

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Q.2. Suppose a webpage has **10 objects** namely object 1,....object 10. There is a dependency amongst objects, i.e., the dependent object can not be downloaded till the point the object on which it depends is not downloaded. For example, say if object 2 is dependent on object 1, object 2 can be downloaded only after object 1 has been downloaded.
The dependency for the webpage is as follows: object 2=>object 1, object 4=>object 3, object 6=>object 5, object 8=>object 7, object 10=>object 9.
Suppose, each object is of size **10KB** and the bandwidth is **1Mbps**. Also, assume the **RTT is 10ms**. The client browser supports **parallelism of 10** for non-persistent HTTP.
Suppose that the HTTP connection is **non persistent**. Compute the time required for the entire page to be downloaded. **Ignore the time required to fetch the main object. [1+1+2]**

[Solution: Object download time = 10*8Kb/1Mbps=80ms; RTT = 10 ms
As 5 objects depend on 5 other objects; even if the parallelism level supported is 10, we can only have 5 parallel connections. Each pair of dependent objects have to be downloaded sequentially.
HTTP non persistent: Object download time= 2*RTT + object download time = 2*10+80=100ms
The browser supports pipelining of 10. However, these 10 request cannot be sent in parallel as there is dependency. Hence, first the 5 requests (for objects 1,3,5,7,9) will be sent in parallel and then the next 5 requests .
Total page download time (ignoring the time required to download the main object)= 2*100ms = 200ms
Some students might have added 2RTT for TCP connection & HTTP connection of main object and they would have got the answer as 200+20 = 220ms. Please give them full marks if they have justified this correctly.
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Q.3. Mark the one(s) that is(are) TRUE. **[1]**

(a) HTTP is a stateless protocol, and it uses UDP for transport.
(b) HTTP is a stateless protocol, and it uses TCP for transport.
(c) In case of TCP, there exist no packet errors and packet losses.
(d) In case of UDP, there can be packet errors and packet losses.

[Solution: b, d]

Q.4. Consider the following network S->R->D that uses circuit switching. The bandwidth of S->R is 100Mbps, R->D is 10Mbps. Consider each circuit requires 1Mbps. What will be the queue size at R? Assume maximum number of circuits possible. **[1]**

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a. 90Mb
b. 100Mb
c. 10Mb
d. None of the above

[Solution: d (None of the above).
In case of packet switching, the routers/switches provide store& forward switching. However, in the case of circuit switching, the required bandwidth is reserved before the start of the connection. Therefore, there will be no queueing even with the maximum possible circuits.
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