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EECE2540 Fundamentals of Networks Sec 02

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1. The end-to-end delay of a packet includes processing delay, queuing delay, transmission delay, and propagation delay. Processing, propagation, and processing delay are constant. Queuing delay is variable.

2. Transmission delay = packet length/transmission rate = L/R

= 1000 bytes / 2 Mbps

= 8000 bits / 2000000 bps = 0.004 s

Propagation delay = distance/propagation speed = d/s

= 2500 km / 2.5 * 10^8 m/s

= 25 * 10^6 m / 25 * 10^7 m/s

= 0.1 s

The delay depends on packet length (L) and transmission rate (R) are a part of the transmission delay calculation L/R. Total delay is the sum of transmission delay and propagation delay.

3.

a.) the average throughput for the file transfer is constrained by the bottleneck of the capacity of the links, which is the minimum of the rates R1 = 500kbps.

b.) file size 4000000 bytes = 32000000 bits

time to transmit the file to host B

32000000 bits / 500000 bps = 64 seconds

4.

The end-to-end transmissions delay D of sending P packets back-to-back over N links

D = NL/R + (P-1)L/R

It is P-1 multiplied by the transmission delay because there can only be one packet on a link at a time.

5.

Time needed to request and receive the HTML file and all associated objects for

a.) Nonpersistent HTTP

2RTT0 + 2RTT0 x 10

22RTT0

Propagation delay 10000 m/1000 m/s = 10 s

RTT0 = 2 x propagation delay

22RRT0 = 22 (2 x 10 s) = 440 seconds

Transmission delay L/R = 10000 bits/1000 bps = 10 s

Total time = 440 + 10 = 450 seconds

b.) Persistent HTTP

RTT1 + RTT2 + RTT3 … RTT10 + 3RTT0

Propagation delay 10000 m/1000 m/s = 10 s

13(10 s) = 130 seconds

Transmission delay = L/R = 10000 bits/1000 bps = 10 s

Total time = 130 + 10 = 140 seconds

6.

Query sent to root server to find edu DNS server – top level domain (TDL) server

Query sent to edu DNS server to get mit.edu authoritative DNS server

Query sent to mit.edu DNS server to get IP address for www.mit.edu

Once the browser receives the IP address from DNS, it can initiate a TCP connection to the HTTP server process located at port 80 at that IP address

Query sent to www.mit.edu DNS server to get path name for www.mit.edu/research.html

7. The host uses IP addresses and port numbers to direct segments to appropriate sockets. There are four numbers in the connection, the source IP address and port number and destination IP address and port number. There are 16 bits that the port number can be, and they are randomly generated. When the connection setup, a port number is allocated to a certain connection. The destination IP address is fixed but there is also a port number for the connection between the source and destination so that if multiple people are trying to access a webpage at the same time, it is possible by accessing different port numbers.