

Assignment #4: Networking and Internetworking

1) A client sends a 200-byte request message to a service, which produces a response containing 5000 bytes. Estimate the total time required to complete the request in each of the following cases, with the performance assumptions listed below:

- Using connectionless (datagram) communication (for example, UDP)
 - Understand that everything needs to be in the same units. Most of the units are in bytes, so all my units are going to be byte values.
 - Convert Mbps to MBps
 - $10 \text{ Mbps} * \frac{1 \text{ Megabyte}}{8 \text{ Megabits}} = \frac{5}{4} \text{ MBps}$
 - $\frac{5}{4} \text{ MBps} * \frac{10^6 \text{ bytes}}{1 \text{ Megabyte}} = \frac{1250000 \text{ bytes}}{\text{sec}}$
 - How many packets are sent and received
 - Sent: 200 bytes = 1 packet
 - Received: 5000 bytes = 5 packets
 - Add all of the timings
 - UDP has no connection setup time
 - Latency on the Client sent packet = 5ms/packet = 5ms
 - Transfer time for Client sent packet = $200 \text{ bytes} * \frac{1 \text{ sec}}{1250000 \text{ bytes}} = 0.16 \text{ ms}$
 - Latency on the Server received packet = 5ms
 - Server processing time = 2ms
 - Latency on the Server sent packets = 5ms/packet = 25ms
 - Transfer time for Server sent packets = $5000 \text{ bytes} * \frac{1 \text{ sec}}{1250000 \text{ bytes}} = 4 \text{ ms}$
 - Latency on the Client received packets = 5ms/packet = 25ms
 - **Total time = 66.16ms**
- Using connection-oriented communication (for example, TCP)
 - Do all the same calculations for UDP, but add a connection time = +5ms
 - **Total time = 71.16ms**

2) For large networks, such as the internet, there needs to be a organized scheme that allows for extensibility and scalability to accommodate larger numbers of electronic devices. To manage this structure, the Internet community agreed on using the Route Information Protocol (RIP) to keep routers consistent and Topological default router numbers that describe where the router is located.

- RIP: Each router maintains a list of its neighbor's route and cost to traverse to a local router.
- Default router numbers: Each country has a unique range of network bits. As you enter specific geographical locations (state, county, city) the network IDs get more specific.

3) The route for transmitting a packet in a wide area network is determined dynamically for each packet. Not all packets addressed to the same destination will follow the same route or will need the same amount of time to reach the destination. It cannot happen in LANs because there is only a single communication wire; the messages are transmitted sequentially. Connection-oriented protocols TCP add sequence numbers to the packets and organize them at the receiving host. The data transmission in ATM networks is connection-oriented; the communication is always through virtual circuits and these assure the order preservation.

4) Show the sequence of changes to the routing tables in Figure 3.8 that will occur (according to the RIP algorithm given in Figure 3.9) after the link labelled 3 in Figure 3.7 is broken.

First Pass:

- Routings from A:
 - To D cost = ∞
- Routings from B:
 - To D cost = ∞
- Routings from D:
 - To A cost = ∞
 - To B cost = ∞

Second Pass:

- Routings from A:
 - To D cost = ∞
- Routings from B:
 - To D cost = 2
 - To D link = 6
- Routings from D:
 - To A cost = 3
 - To A link = 6
 - To B cost = 2
 - To B link = 6

Third Pass:

- Routings from A:
 - To D cost = 3
 - To D link = 1

5) Assuming each of our networks took a maximum of 1024 hosts (typical of a VLAN), then we would need 18 x 1024 hosts to shape our subnet mask.

- i. $1024 \times 18 = 18432$
- ii. $\log_2(18432) = 14.17$
- iii. Round up to 15 bits to account for all of the networks and their hosts.
- iv. $32 \text{ (Network bits)} - 15 \text{ (host bits)} = 17 \text{ (mask bits)}$
- v. Subnet mask = 255.255.128.0/17