ECE361 Homework 2

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R24. What is an application-layer message? A transport-layer segment? A network-layer datagram? A link-layer frame?

*The **application-layer message** refers to the packet of information at the application layer, which is exchanged between applications in two different end system using an application-layer protocol. (1.5)*

*The **transport-layer segment** is a transport-layer packet which is transported between transport layers of the two end system. (1.5)*

*The **network-layer datagram** is the type of network-layer packets delivered from one host to another in the network-layer. The datagram includes a transport-layer segment and a destination address to the network layer. (1.5)*

*The **link-layer frame** is the type of packets transmitted in link-layer through a series of routers between the source and destination. (1.5)*

R25. Which layers in the Internet protocol stack does a router process? Which layers does link-layer switch process? Which layers does s a host process?

Router processes network, link, physical layers.

Link-layer switch processes link, physical layers.

Host processes all layers including Application, transport, network, link, physical layers.

R27. Describe how a botnet can be created and how it can be used for a DDoS attack.

For a distributed DoS (DDoS), we can create a worm and let it infect thousands of end devices by spreading it out on the Internet. By doing this, our botnet has control of thousands of host system and is able to blast traffic at the target, and the aggregate traffic rate are fairly large and is able to cripple the service at the target server.

P31. (a)

$$d = \frac{10^6}{5 \cdot 10^6} = 0.2 \ s$$

$$d_{total} = 0.2 \cdot 3 = 0.6 \ s$$

P31. (b)

$$d = \frac{10^4}{5 \cdot 10^6} = 0.002 \ s$$

$$d_{2_{nd} to 1_{st} switch} = 0.002 \cdot 2 = 0.004 \ s$$

P31. (c)

$$d_{segmentation} = (100 - 1) \cdot 0.002 + 0.002 \cdot 3 = 0.204 \ s$$

Comparing the result with and without message segmentation, it is clearly shows that the segmented data have improved the transmission efficiency by approximately 3 times.

P33

$$d_{1link} = \frac{80 + S}{R}$$

$$d_{total} = \frac{80 + S}{R} \cdot \left(3 + \frac{F}{S} - 1\right)$$

$$= \frac{80 + S}{R} \cdot \left(2 + \frac{F}{S}\right)$$

To find the minimized delay, we can construct the following inequality:

$$3\frac{F}{R} > \frac{80 + S}{R} \cdot \left(2 + \frac{F}{S}\right)$$

$$3F > (80 + S) \cdot \left(2 + \frac{F}{S}\right)$$

$$3FS > (80 + S) \cdot (2S + F)$$

$$0 > S^2 + (80 - F)S + 40F$$

$$S = \frac{160F - (80 - F)^2}{4}$$

R3. For a communication session between a pair of processes, which process is the client and which is the server?

(2.1.1) In a client-server architecture, the always-on host is called server, which services requests from other hosts, namely clients. (2.1.2) Generally, in the context of a communication session between a pair of processes, the process that initiates the communication is labeled as the client, and the process that waits to be contacted to begin the session is the server.

R5. What information is used by a process running on one host to identify a process running on another host?

Two pieces of information need to be specified:

1. *The address of the host (IP)*
2. *An identifier that specifies the receiving process in the destination host (port number)*

R7. Referring to Figure 2.4, we see that none of the applications listed in Figure 2.4 requires both no data loss and timing. Can you conceive of an application that requires no data loss and that is also highly time-sensitive?

An application that requires no data loss and is also highly time-sensitive must have high data security while providing a timely service. Therefore, an example is a online chatting agent provided by TD bank, such services would require live text messages transmission (live chatting is highly time-sensitive) and would require no data loss in the chatting process (data must be protected as client privacy is a priority and we need continuous chatting data for chatting context).

R8. List the four broad classes of services that a transport protocol can provide. For each of the service classes, indicate if either UDP or TCP provides such a service.

Reliable Data Transfer: TCP provides such a service

Throughput: neither UDP/TCP provides such a service

Timing: neither UDP/TCP provides such a service

Security: neither UDP/TCP provides such a service