ELEC3500 TELECOMMUNICATIONS NETWORKS

Question Set – 5

5-0. Under what circumstances is file downloading through P2P much faster than through a centralized client-server approach? Justify your answer using following equation.

$$D_{P2P} \geq max\left\{\frac{F}{u_s}, \frac{F}{d_{min}}, \frac{NF}{u_s+\sum_{i=1}^{N} u_i}\right\}$$

5-1. Consider a DASH (Dynamic Adaptive Streaming HTTP) for which there are *N* video versions (at *N* different rates and qualities) and *N* audio versions (at *N* different rates and qualities). Suppose we want to allow the player to choose at any time any of the *N* video versions and any of the *N* audio versions.

a. If we create files so that the audio is mixed in with the video, so server sends only one media stream at given time, how many files will the server need to store (each a different URL)?

b. If the server instead sends the audio and video streams separately and has the client synchronize the streams, how many files will the server need to store?

5-2. Can you configure your browser to open multiple simultaneous connections to a Web site? What are the advantages and disadvantages of having a large number of simultaneous TCP connections?

5-3. Suppose the network layer provides the following service. The network layer in the source has accepts a segment of maximum size 1,200 bytes and a destination host address from the transport layer. The network layer then guarantee to deliver the segment to the transport layer at the destination host. Suppose many network application processes can be running at the destination host.

a. Design the simplest possible transport layer protocol that will get application data to the desired process at the destination host. Assume the operating system in the destination has assigned a 2-byte port number to each running application process.

b. Modify this protocol that it provides a *return address* to the destination process.

c. In your protocols, does the transport layer *have to do anything* in the core of the computer network?

5-4. Describe why an application developer might choose to run an application over UDP rather than TCP.

5-5. Why is it that voice and video traffic is often sent over TCP rather than UDP in today's Internet?

5-6. Is it possible for application to enjoy reliable data transfer even when the application runs over UDP? If so, how?

5-7. Suppose a process in Host C has a UDP socket with port number 6789. Suppose both host A and host B each send a UDP segment to host C with destination port number 6789. Will both of these segments be directed to the same socket at host C? If so, will process at host C know that these segments originated from two different hosts?

5-8. Suppose host A sends two TCP segments back to back to host B over a TCP connection. The first segment has sequence number 90; the second has sequence number 110.

a. How much data is in the first segment?

b. Suppose that the first segment is lost but the second segment arrives at B. In the acknowledgement that host B sends to host A, what will be the acknowledgement number?

5-9. UDP and TCP use 1s complement for their checksums. Suppose you have the following three byte data: 01010011, 01100110, 01110100. What is the 1s complement of the sum of these

bytes (although UDP and TCP use 16-bits words in computing the checksum, we use 8 bits to understand the process). Show how the checksum technique work. Why is it that UDP takes the 1s complement of the sum, why not just use the sum? Show how the 1s complement detect errors? Is it possible that 1-bit error will go undetected? How about a 2-bit error?

5-10. Assume that a host receives a UDP segment with 01011101 11110010 as the checksum. The host adds the 16-bit words over all necessary fields excluding the checksum and obtains the value 00110010 00001101. Is the segment considered correctly received or not? What does the receiver the do?

5-11. Give a trace of the operation of protocol `rtd3.0` when data packets and acknowledgement packets are corrupted. Show a trace similar trace to the figure 3.16 in text book or slide 11 of Lecture-12 slide set.

5-12. Consider a channel that can lose packets but has but has a maximum delay that is known. Modify protocol `rtd2.1` to include sender timeout and retransmit. Explain why the protocol can communicate correctly over this channel.

****