Virginia Tech - ECE 5484 - Summer 2020

Homework 7

Before starting this homework assignment, please be sure that you have completed all of the following activities.

- View the relevant online lectures and read associated sections in the textbook before or while you work on this homework assignment.
- Review the course syllabus. Note the grading policies, including policies for submitting assignments.
- Review the course schedule. Note the due dates for course assignments, including this one.
- Review the Graduate Honor System at https://graduateschool.vt.edu/academics/expectations/graduate-honor-system.html. Review the Graduate Honor System Constitution, especially Articles I (Sections 1, 2, and 3), V, VI, VII, VIII, and IX.

Please note the following.

- Solutions must be clear and presented in the order assigned. Solutions must show work needed, as appropriate, to derive your answers. Written answers should be concise, but sufficiently complete to answer the question. Neat hand drawings, where needed, are acceptable. Your final solution for each problem must be easily identified.
- At the top of the first page, include: your name (as recorded by the university); your email address; and the assignment name ("ECE 5484, Homework 7"). Do *not* include your Virginia Tech ID number or your social security number.
- Homework must be submitted as a PDF (.pdf) file with the file name *lastname_firstname*_HW7.pdf, where *lastname* is your last or family name and *firstname* is your first or given name. Submit a single file.
- Submit your assignment using the Assignments area of the class website. You must submit your assignment by 11:55 p.m. on the due date.

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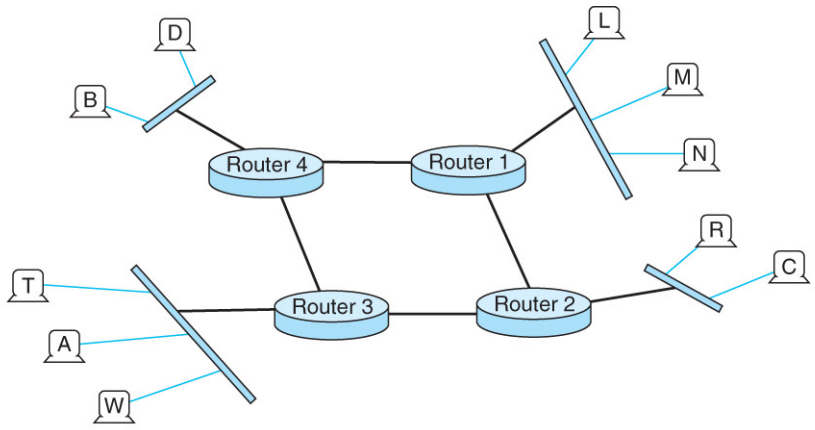
1. Why is the length of a TCP segment limited to 65,536 bytes?
2. A station running TCP/IP needs to transfer a file to a host. The file contains 2048 bytes. Assume a payload size of 512 bytes would be sent per packet and both systems are running IPv4. Also assume that the three-way handshake and window size negotiation have been completed and that no errors occur during transmission.
    a. What is the protocol overhead (stated as a percentage)?
    b. Perform the same calculation if both clients are using IPv6.
3. Two stations running TCP/IP are engaged in transferring a file. This file is 10K long, the payload size is 100 bytes, and the negotiated window size is 2000 bytes. The sender receives an ACK 1000 from the receiver.
    a. Which bytes will be sent next?
    b. What is the last byte number that can be sent without an ACK being sent by the receiver?
4. With reference to the figure below, suppose Router 4 derives its routing table from the routing tables of Router 1 and Router 3. Complete the routing table for Router 4 using the same format as the routing table of the other three routers.

a)



b)

Router 3

Dest	Next Hop	Hop Count
A	--	0
B	R4	1
C	R2	1
D	R4	1
L	R4	2
M	R4	2
N	R4	2
R	R2	1
T	--	0
W	--	0

Router 2

Dest	Next Hop	Hop Count
A	R3	1
B	R3	2
C	--	0
D	R3	2
L	R1	1
M	R1	1
N	R1	1
R	--	0
T	R3	1
W	R3	1

Router 1

Dest	Next Hop	Hop Count
A	R2	2
B	R4	1
C	R2	1
D	R4	1
L	--	0
M	--	0
N	--	0
R	R2	1
T	R4	2
W	R4	2

5. Hosts A and B are communicating over a TCP connection, and Host B has already received from Host A all bytes up through (and including) byte 248. Suppose Host A then sends two back-to-back segments to Host B. The first and second segments contain 40 and 60 bytes of data, respectively. In the first segment, the sequence number is 249, the source port number is 503, and the destination port number is 80. Host B sends an acknowledgment (ACK) whenever it receives a segment from Host A.
   a. In the second segment sent from Host A to Host B, what are the sequence number, source port number, and destination port number?
   b. Assume that the first segment arrives before the second segment. In the acknowledgement of the first *arriving* segment, what are the acknowledgement sequence number, the source port number, and the destination port number?
   c. Assume that the second segment arrives before the first segment. In the acknowledgement of the first *arriving* segment what is the acknowledgement sequence number?
6. An organization is granted the block of IP addresses 129.57.0.0/16. The administrator wants to create 1024 subnets of equal size within this block.
   a. What is the subnet mask for these subnets?
   b. What is the maximum number of addresses in each subnet?
   c. What are the first and last IP addresses in subnet 1 (assuming we start counting the subnets with subnet 0)?
7. Write the following subnet masks in "slash" notation (/n).

   a. 255.255.255.0
   b. 255.255.240.0

8. Find the range of addresses in the following blocks.

   a. 123.56.77.32/29
   b. 17.34.16.0/23

9. Use of IPv6 requires capabilities in the client, server, and network. Use the https://test-ipv6.com/ website to check the readiness of your computer for IPv6.

   a. What is your "readiness score" (out of 10 points)? (include screenshot)
   b. If your score is not 10/10, what capabilities are missing to allow use of IPv6?
   c. Should you be worried? Check against https://ipv6test.google.com/ (include screenshot)

10. **Scavenger Hunt:** What is the subject of RFC 7511? When was this RFC issued?