CS 447: Networks and Data Communications
Homework #01

Assigned Date   : Thursday, September 18, 2014
Due Date   : Wednesday, October 01, 2014 @ 02:59:59 p.m.

Instructions

- This is an individual assignment. Do your own work.
- Your answers should be produced using a word processing application.
- Handover a printed, stapled copy of your solutions to the instructor at the beginning of class on due date. Make sure to include your name and the last 3 digits of your SIUE ID in the first page of your solutions sheet. **DO NOT** email your solutions to the instructor.
- Make proper arrangements, after consulting the instructor, to deliver your solutions **BEFORE** the due date, if you have a planned absence on the due date.
- Answer all questions
- Your assignment is due on **Wednesday, October 01, 2014 @ 02:59:59 p.m.**
- Total points: [**245 points**]

Questions

Q1. Suppose that all of the network sources send data at a constant bit rate. Would packet switching or circuit switching be more desirable in this case? Why? [**5 points**]

Q2. Suppose that all of the network sources bursty– they only occasionally have data to send. Would packet switching or circuit switching be more desirable in this case? Why? [**5 points**]

Q3. Suppose users share a 1 Mbps link. Also suppose each user requires 500 kbps when transmitting, but each user transmits only 10% of the time.

    a. When circuit switching is used, how many users can be supported? [**5 points**]

    b. When packet switching is used,

        i. What is the queuing delay when two users simultaneously transmit data? [**5 points**]

        ii. What is the queuing delay when three users simultaneously transmit data? [**5 points**]

        iii. Find the probability of three users transmitting simultaneously at any given time. Find the fraction of time during which the queue grows[**10 points**]

Q4. Suppose two hosts A and B, are separated by $20,000$ Kms and are connected by a direct link of $R = 2$ Mbps. Suppose the propagation speed over the link is $2.5 \cdot 10^8$ meters/sec.

    a. Calculate the bandwidth-delay product, $R \cdot d_{prop}$ [**5 points**]

    b. Consider sending a file of $800,000$ bits from Host_A to Host_B. Suppose the file is sent continuously as one large message. What is the maximum number of bits that will be in the link at any given time? [**5 points**]

    c. Provide an interpretation of the bandwidth-delay product[**10 points**]

    d. what is the width (in meters) of a bit in the link? Is it longer than a foot-ball field?[**10 points**]

    e. Derive a general expression for the width of a bit in terms of the propagation speed s, the transmission rate R, and the length of the link d[**5 points**]

Q5. Referring to Q4. suppose we can modify R. For what value of R is the width of a bit as long as the length of the link? [**10 points**]

Q6. What are the differences between a LAN and a WAN?[**10 points**]

Q7. Suppose $Host_A$ wants to send a large file to Host $_B$. The path from $Host_A$ to $Host_B$ has three links of rates $R_1 = 500$ kbps, $R_2 = 2$ Mbps, and $R_3 = 1$ Mbps.

    a. Assuming no other traffic in the network, what is the throughout for the file transfer?[**5 points**]

    b. Suppose the file is 4 million bytes. Dividing the file size by the throughout, roughly how long will it take to transfer the file to $Host_B$?[**5 points**]

    c. How long does it take the transmit the same file if R_2 is reduced to 100 kbps?[**5 points**]

Q8. Provide a brief history of the Internet describing when and how it was started [**15 points**]

Q9. List the layers of the TCP/IP model, and give a brief explanation of each. Explain how headers are added and removed as data passes through each layer of the protocol stack[**25 points**]

Q10. Explain e-mail delivery. Be descriptive, i.e., types of protocols used, entities involved, etc. [**10 points**]

Q11. What is MIME? Why is it important?[**10 points**]

Q12. Assume we add a new protocol to the application layer. What changes do we need to make to other layers?[**10 points**]

Q13. Can a program written to use the services of UDP be run on a computer that has installed TCP as the only transport-layer protocol? Explain[**15 points**]

Q14. Assume there is a server with the domain name *www.cs447.com*

    a. Show an HTTP request that needs to retrieve the document **/2014/assigns/project**. The client accepts MIME version 1, GIF or JPEG images, but the document should not be more than 4 days old [**25 points**]

    b. Show the HTTP response to part (a) for a successful request [**10 points**]

Q15. What is the difference between **MAIL FROM**: in SMTP and **From**: in the mail message itself? [**20 points**]