PRINCE OF SONGKLA UNIVERSITY

FACULTY OF ENGINEERING

Midterm Examination Semester I : Academic Year : 2006

Date : 31 July 2006 Time : 9.00 – 12.00 Room : A401

Subject : 240 – 641 Differentiated Services in the Internet

Instruction:

- Make sure that there are 5 problems (100 points) in your exam paper.
- This is closed book exam and you have 3 hours to complete it.
- All of your answers can be written either in Thai or English.
- Dictionary and calculator are allowed, but computer is not.

Problem 1 Fundamentals of the Internet

1.1 Explain how the end-to-end principle has led to an opposite design of the Internet as compared to the telephone system. (10 points)

1.2 Routing is a fairly complex function placed inside the network and not in end-systems. Explain why it is still consistent with end-to-end principle. (10 points)

Problem 2 QoS and Congestion Control in the Internet

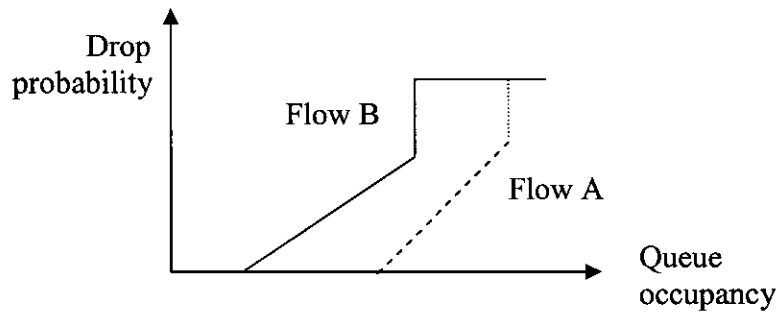
2.1 TCP congestion control has two key pieces: slow start phase and congestion avoidance phase. Explain what the role of each piece is, and how they are complementary to each other in terms of functionality. (10 points)

2.2 What does the word "Early" in the acronym RED (Random Early Detection) refer to? (5 points)

2.3 Why is the assumption of a transport protocol such as TCP important for RED to achieve its desired result of preventive congestion control? (5 points)

2.4 Why the average queue size is used instead of actual queue size in RED? (5 points)

2.5 In RED scheme, suppose that two flows share the same queue. Flow 'A' is given a higher drop preference than flow 'B', as indicated in the figure below. Can we claim that flow 'A' is protected from flow 'B'? Why or why not? (10 points)



Problem 3 QoS Architecture

3.1 Describe four main principles (as shown in Figure 1) that allow the Internet to provide QoS Guarantee for network applications. (10 points)

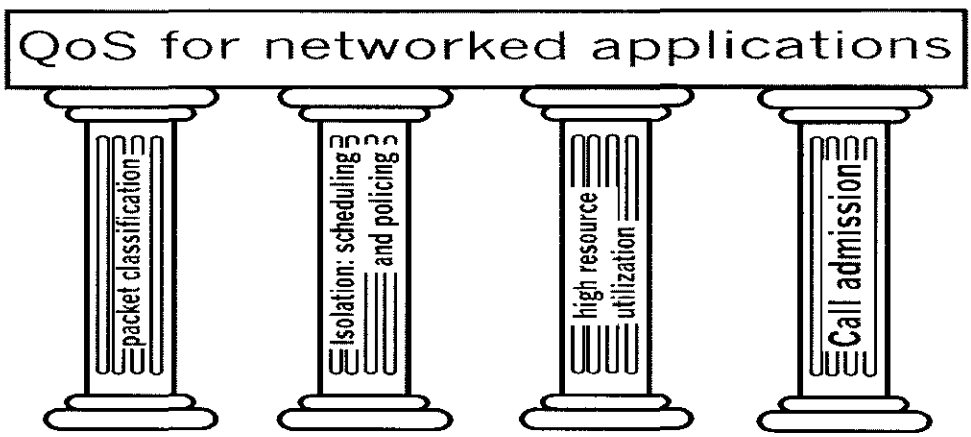


Figure 1

3.2 What are the differences between traffic shaper and traffic policer? (5 points)

Problem 4 Traffic Shaping

4.1 From the Figure 2 below, describe a (r, b) curve of token bucket descriptors for a source, and how does it help in selecting a traffic descriptor? (10 points)

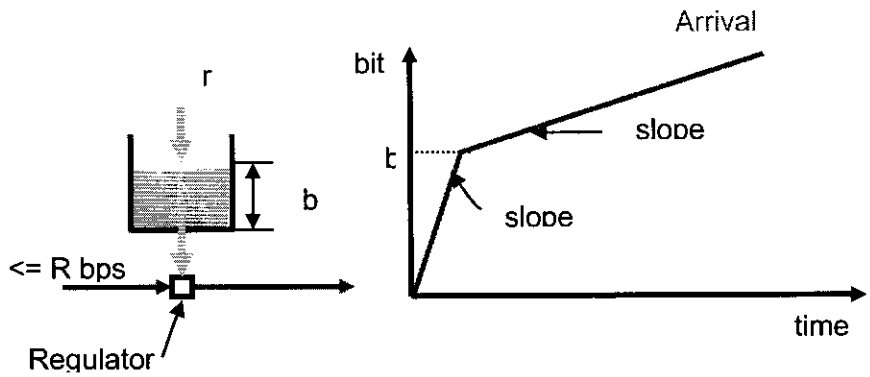


Figure 2

4.2 Explain why token bucket is more suitable for packet transmission in the Internet than leaky bucket? (5 points)

Problem 5 Fair Queueing

5.1 What is the main problem when emulating GPS (General Processor Sharing) with (unweighted) round-robin? (5 points)

5.2 What problem does Fair Queueing address? (5 points)

5.3 Four sources wish to transmit data at rates $R_1 = 4$ Mb/s, $R_2 = 13$ Mb/s, $R_3 = 2$ Mb/s and $R_4 = 2$ Mb/s, where R_i is the desired rate of source i. All four flows share a link with data rate 10Mb/s. All four flows contain TCP traffic and we'll assume here that the congestion control mechanism of TCP adapts each flow so that its average rate is equal to the max-min fairness allocation. What average rate (in Mb/s) does each flow actually operate at? (5 points)