

PRINCE OF SONGKLA UNIVERSITY
FACULTY OF ENGINEERING

Final Examination Semester II : Academic Year : 2003
Date : 9 October 2003 Time : 9.00 – 12.00 Room : R300
Subject : 240 – 575 Special Topics in Information Network Engineering II
(Differentiated Services in the Internet)

Instruction:

- Make sure that there are 5 problems (100 points) in your exam paper.
- This exam is **OPEN BOOK** and you have 3 hours to complete your exam.
- All of your answers can be written either in Thai or English.
- Dictionary and Calculator are allowed.
- No palm pilots or other hand held computers are allowed.

Problem 1 (5 points) True or False

- In MPLS, label swapping occurs only at the edges of the network, *i.e.*, in the Label Edge Routers (LERs).
- LDP uses UDP for reliable transmission of signaling information between LSRs.
- The Expedited Forwarding (EF) PHB implies some form of isolation among service classes, since this guarantee is made independently of the traffic intensity of any arriving flows with other DSCPs.
- The effectiveness of congestion control in Random Exponential Marking (REM) routers do not rely on cooperation of users.
- Random Exponential Marking (REM) mechanism in routers can be set to drop packets, instead of marking packets, during congestion.

Problem 2 Multi Protocol Label Switching (MPLS) (20 points)

- 2.1 What is a Label Switch Path used in Multi Protocol Label Switching (MPLS)? (5 points)
- 2.2 Why is MPLS suitable to support Quality of Service (QoS) provisioning for adaptive real-time multimedia applications in the Internet? (5 points)
- 2.3 Describe benefits of DiffServ and MPLS integration, and explain a possible approach that can be generally used to solve the problem of insufficient class representation between DiffServ and MPLS when they are operated in the same network. (10 points)

Problem 3 Optimization Flow Control (20 points)

3.1 Compare packet marking (or dropping) policy for congestion control used in Random Early Detection (RED) and Random Exponential Marking (REM) router mechanisms. (5 points)

3.2 Regarding the global optimization problem for solving the congestion control problem in the Internet as shown in Figure 1 below,

- Explain why this problem is not practicable to use in the real networks,
- Explain how this problem is modified in such a way that the source and link models of Random Exponential Marking (REM) mechanism are developed.
- Explain how the REM algorithms in both link (router) and users can work cooperatively towards achieving the optimal fair of bandwidth sharing among contending users after several iterations.

(15 points)

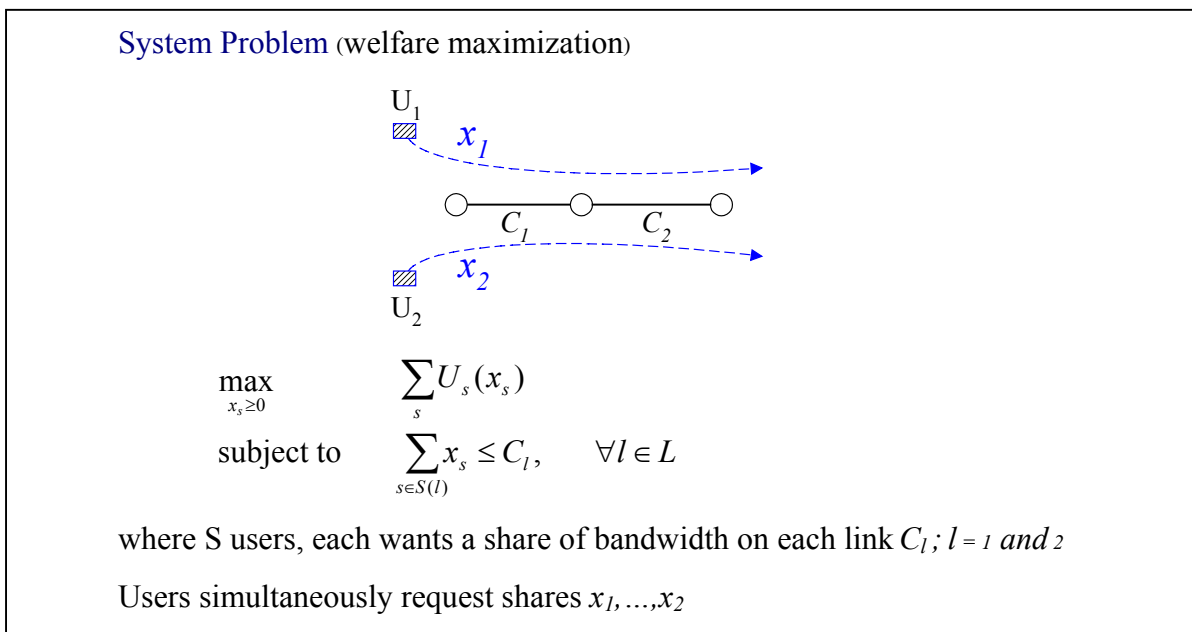


Figure 1 Global Optimization problem for solving congestion in the Internet

Problem 4 Relative Service Differentiation (20 points)

4.1 What's the fundamental problem that most of relative differentiated mechanisms studied in the classroom aim to solve? When can the situation be occurred? (10 points)

4.2 Regarding the general forwarding mechanism shown in Figure 2 below, explain its principle for achieving the proportional differentiation, and also explain why this mechanism is fundamentally different from the other scheduling approaches such as Weighted Fair Queue (WFQ) and Class Based Queueing (CBQ) schedulers. (10 points)

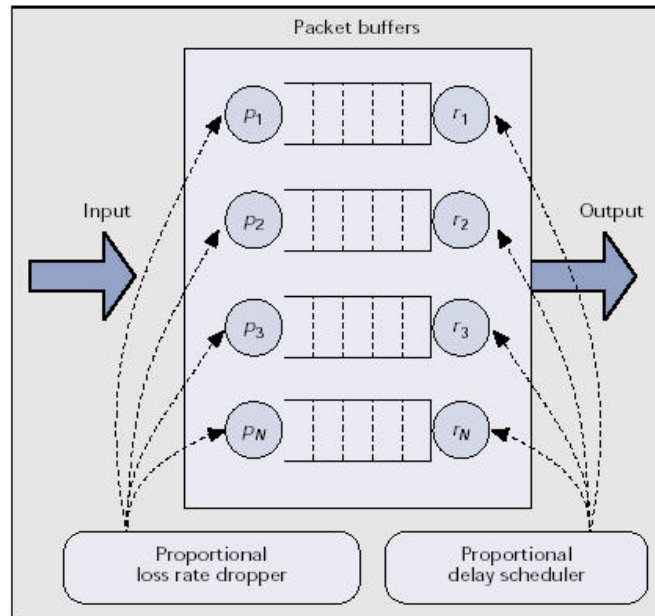


Figure 2 Forwarding engine in the context of relative differentiation model

Problem 5 Unfairness Problem within Differentiated Services Internet (35 points)

- 5.1 Why can the basic of Differentiated Services Internet (DiffServ) architecture cause the problem of fair resource sharing among individual flows within the same class? (5 points)
- 5.2 Give two possible scenarios that can cause this unfairness problem and suggest some possible markers proposed in the literature that are capable of handling this problem in each scenario. Also, explain clearly why and in what ways that these markers can handle this problem in a given scenario. (20 points)
- 5.3 In your opinion, is it possible to find a marking mechanism that can effectively handle two key weaknesses of the DiffServ architecture? Give reasons to support your opinion. (10 points)

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September 2003