

**PRINCE OF SONGKLA UNIVERSITY****FACULTY OF ENGINEERING**

Mid-Term Examination: Semester I

Academic Year: 2004

Date: 5 August 2004

Time: 13.30 – 16.30 pm

Subject: 240-543 Broadband Integrated Networks

Room: R 200

ทฤษฎีในการสอบ โทษขั้นต่ำคือ ปรับตกลในรายวิชาที่ทฤษฎี และพักรการเรียน 1 ภาคการศึกษา

**Instructions**

- In this paper exam, there are FIVE questions. Answer ALL questions.
  - Calculators, Books, and notes are not allowed.
1. Answer the following questions (20 marks):
    - 1.1 The following technical terms are used in similar way. Please describe and make a distinction of (each group):
      - Bandwidth Enforcement, Bandwidth Regulation, Traffic shaping,
      - Flow Control, Congestion Control, Congestion Avoidance, Traffic Scheduling.
    - 1.2 Why does the distance used by Ethernet limited to 2 km?
    - 1.3 How many VC and VP can be carried on ATM network at UNI and NNI per a switch port? What is the maximum of connections can be happen in ATM switch (per port)?
    - 1.4 Why do we need VP switching and VC switching in ATM switch? What are their advantages?
    - 1.5 What are the differences of service quality between ABR (Available Bit Rate) and VBR (Variable Bit Rate) services (give a comparison in a table form)?
    - 1.6 Why does ATM can be used in LAN, MAN, and WAN?
  2. There are 4 nodes in the communication system as shown in Figure 1 (A). Node A and B transmit data by using router R to deliver traffic to their destination nodes C and D respectively. Only a single buffer is provided in R (traffic from A and B are stored into the

same buffer). The service discipline of R is first-come-first-serve. The link bandwidth, which is a normalised value and indicated by  $C$ , are 5, 2, 1, 2 for the link A-R, B-R, R-C, and R-D, respectively. Node B is a fixed transmission rate source while A is a variable rate source. Node A is able to vary its transmission rate,  $f$ , up to 5. Node B transmits data first until time zero then node A inserts its traffic. From the given graph in Figure 1 (B), answer the following questions (please explain clearly) (20 marks):

3.3.1. Explain what, why, and how (a),(b),(c) and (d) happen,

3.3.2. Give the normalised values in (e) and (f). Please show how you get such figures,

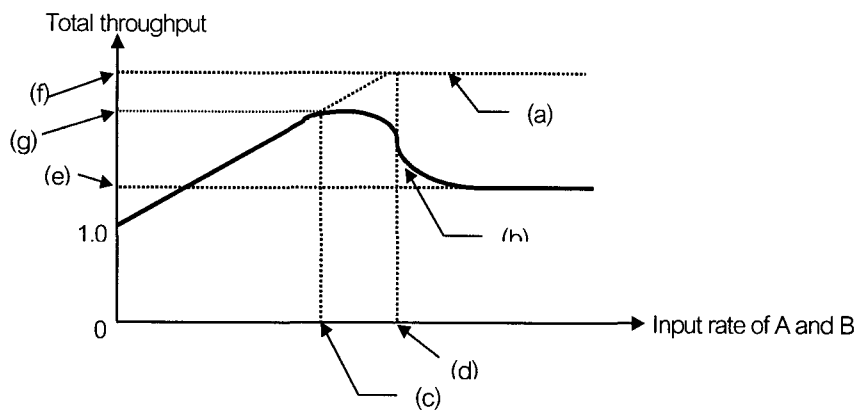
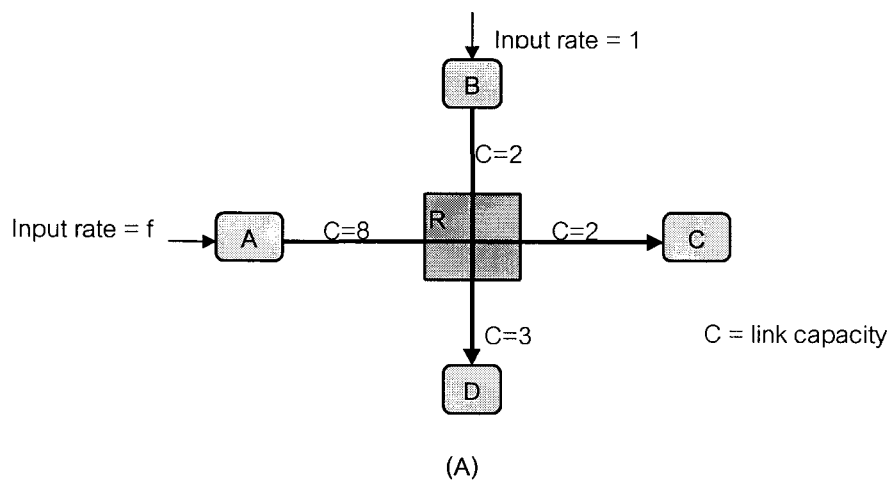


Figure 1 Figure (A) and (B) used for question 3.

3. Below is the demonstration diagram of window flow control. Given a window size,  $W$  (the time to transmit data) as shown in Figure 2, the maximum transmission rate of the source is determined by the value of  $W$  in relation to the round-trip time delay  $D$ . If the service rate of the source is  $1/R$ . Please, answer the following questions (20 marks):

- 3.1 What is the maximum rate of information transmission of the source?
- 3.2 What is the minimum rate of the source (in relation of  $1/R$ ,  $W$ , and  $D$ )?
- 3.3 From 3.2, what is the maximum rate of the source if  $W$  is larger than  $D$ ?
- 3.4 What is the optimal value of  $W$ ?
- 3.5 Assuming that the time-out mechanism is activated after  $T$ . If the acknowledgement signal from downstream is missing. What is the system throughput (in relation of  $1/R$ ,  $W$ ,  $D$ , and  $T$ )?

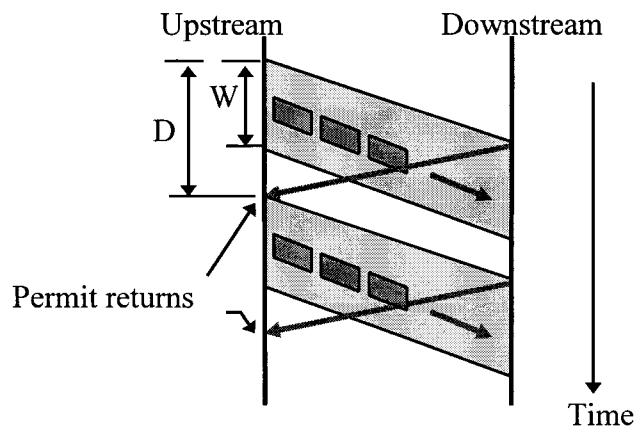


Figure 2 Windows flow control demonstration diagram used for question 2

- 4 4.1 In ATM networks, any VCI from a source to a destination may change when it passes any ATM switch in the network. Explain why and how this scenario happens. You should give an example to amplify your answer (10 marks).
- 4.2 Picture shown below is the main working steps of CLIP (Classical IP over ATM)

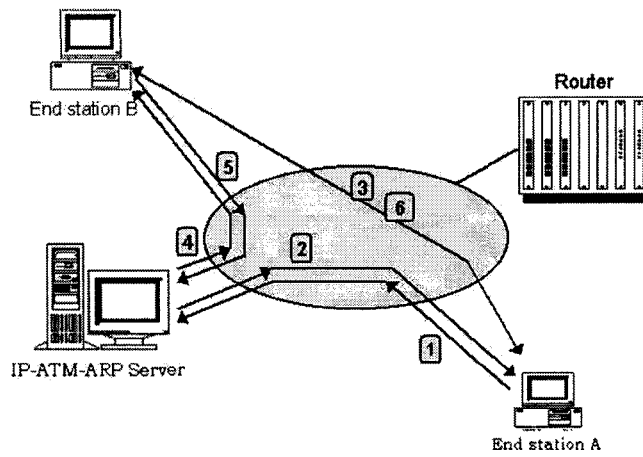


Figure 3 Working steps of classical IP over ATM

Please describe each step in Figure 3, how it works (10 marks).

- The following are flow control schemes of ATM. Please explain each scheme clearly, how it works, what are the main advantages and drawbacks (20 marks).

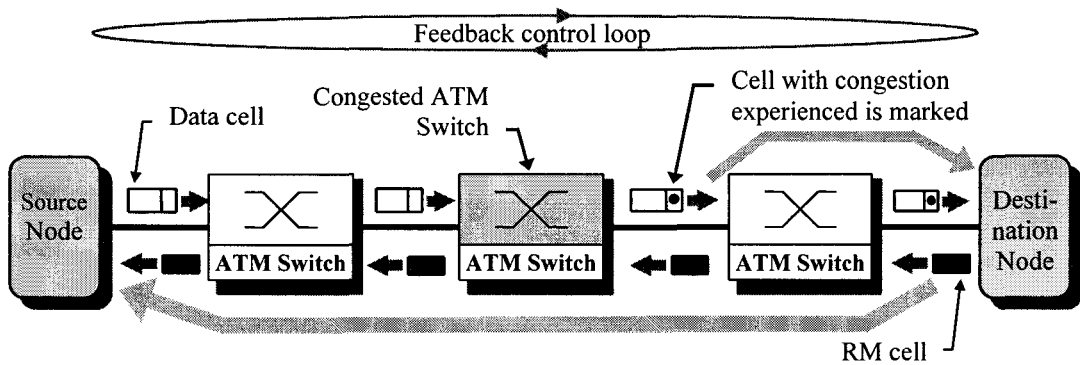


Figure 4 Forward Explicit Congestion Notification (FECN) Scheme

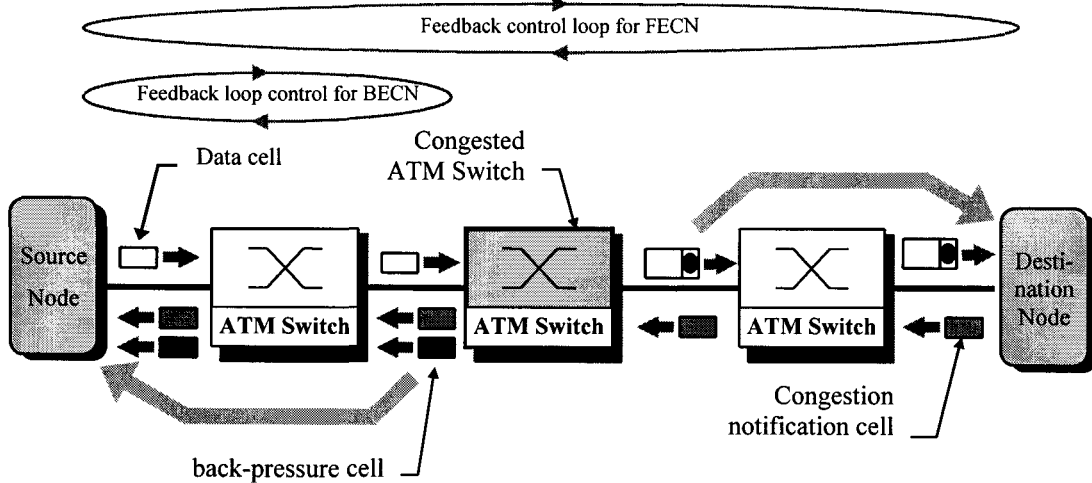


Figure 5 FECN with link-by-link back-pressure per virtual channel rate-based flow control

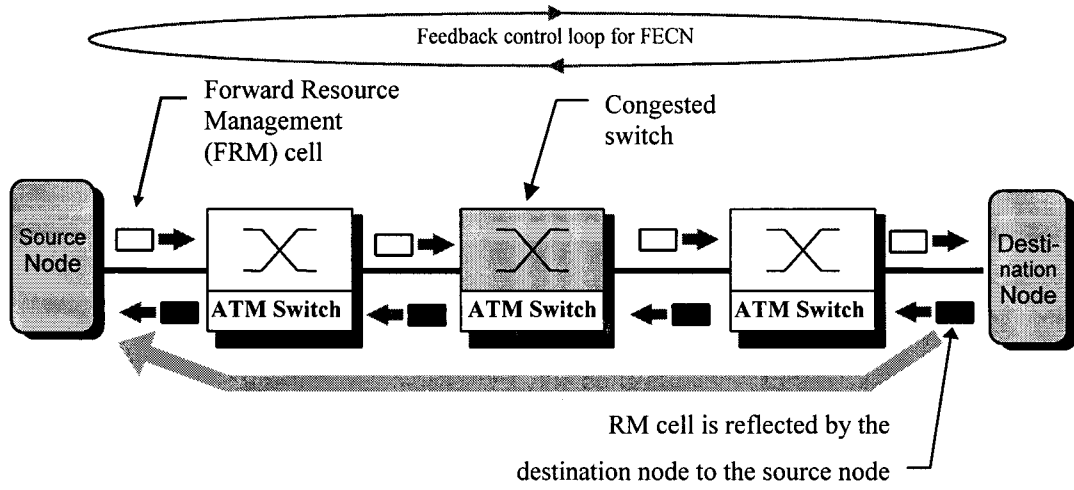


Figure 6 Explicit rate scheme