

PRINCE OF SONGKLA UNIVERSITY
FACULTY OF ENGINEERING

Mid-Term Examination: Semester I

Academic Year: 2005

Date: 04 August 2005

Time: 13.30-16.30

Subject: 240-543 Broadband Integrated Networks

Room: A201

ทฤษฎีในการสอบ โทษขั้นต่ำคือ ปรับตกในรายวิชาที่ทฤษฎี และพักการเรียน 1 ภาคการศึกษา

Instructions

- In this paper exam, there are FIVE questions, 5 pages, out of 100 marks. Answer ALL questions.
- Calculators, books, and notes are NOT allowed.

1. Answer the following questions (20 marks):

1.1 The following technical terms of each group 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 What are the difference between

- (a) open loop and closed loop flow controls
- (b) preventive and reactive flow controls

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 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 can ATM 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 10, 1, 2, 1 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 8, where f is a linear increment function. 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):

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

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

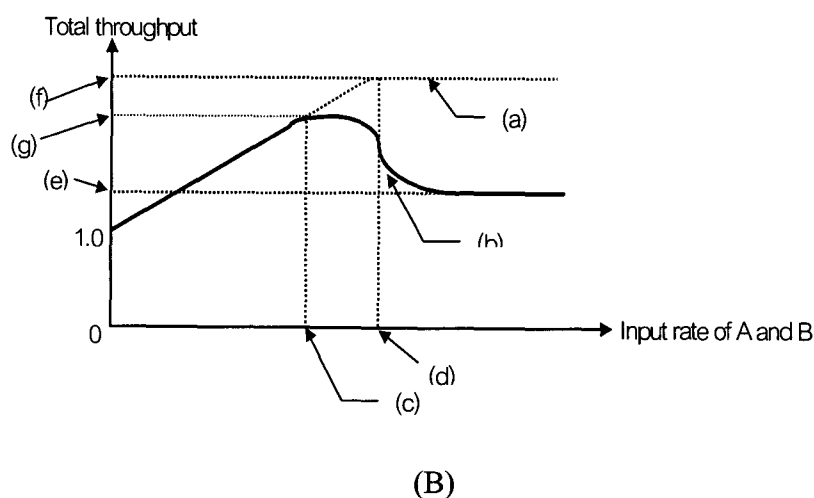
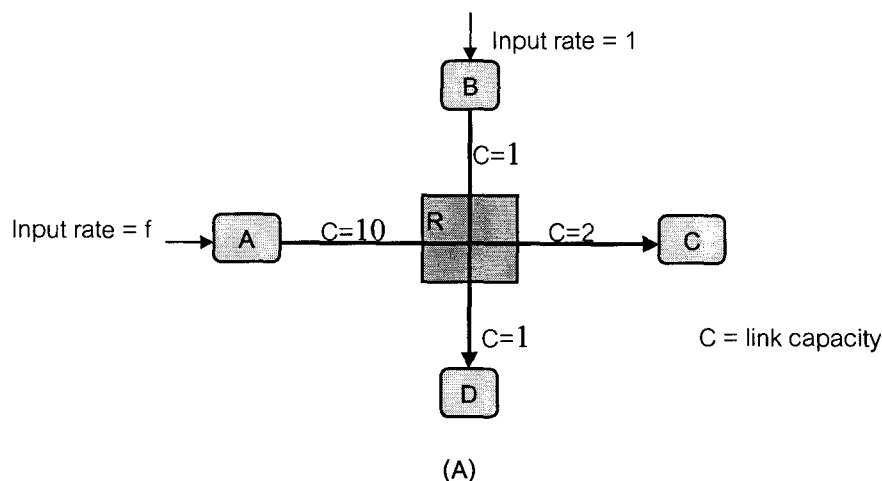


Figure 1 Figure (A) and (B) used for question 2.

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)?

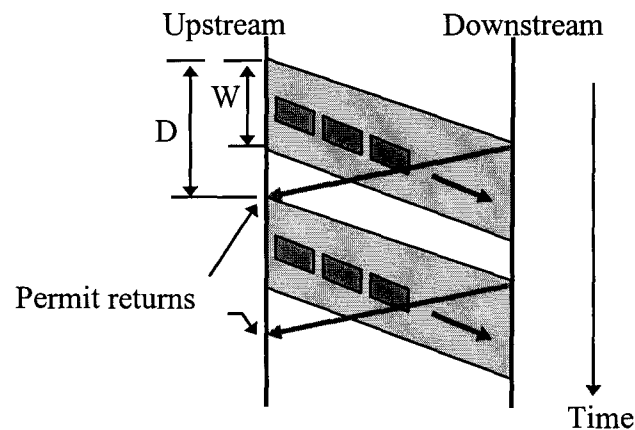


Figure 2 Windows flow control demonstration diagram used for question 2

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)

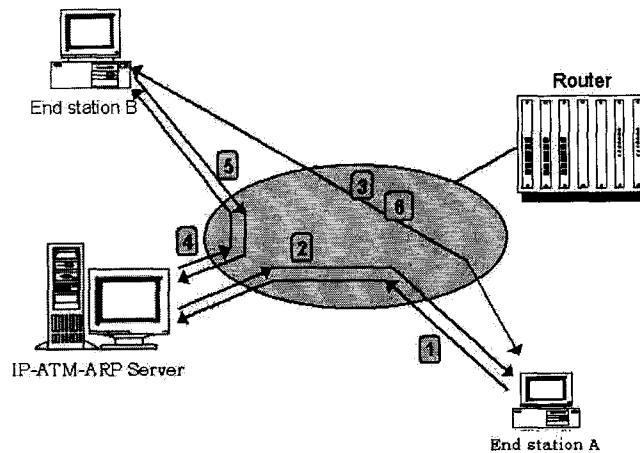


Figure 3 Working steps of classical IP over ATM

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

- The following are flow control schemes of ATM (figure 4 to 6). Please explain each scheme clearly, how it works, what the main advantages and drawbacks are (20 marks).

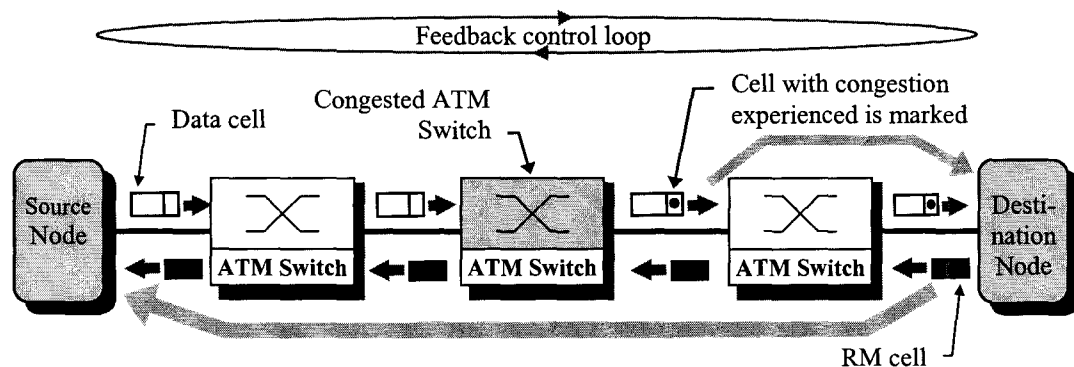


Figure 4 Forward Explicit Congestion Notification (FECN) Scheme

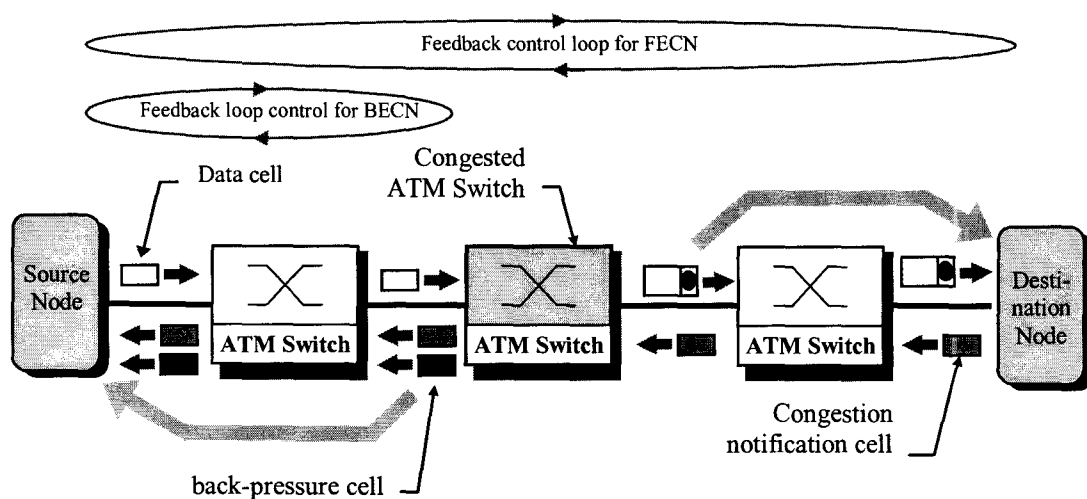


Figure 5 FECN with link-by-link back-pressure per virtual channel rate-based flow control

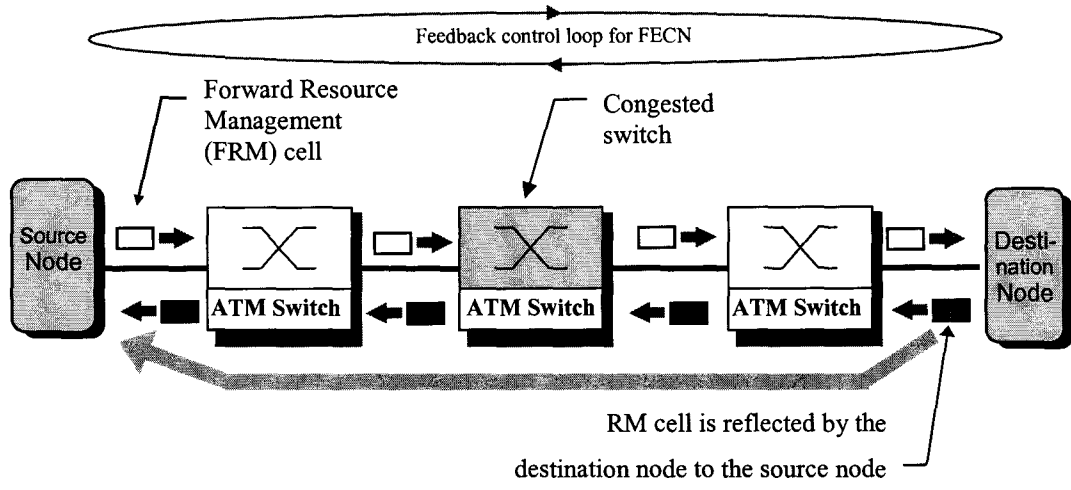


Figure 6 Explicit rate (ER) scheme