UNIVERSITI SAINS MALAYSIA

First Semester Examination
Academic Session 2003/2004

September/October 2003

CCS522 – Advanced Data Communication & Computer Network

Duration : 3 hours

INSTRUCTION TO CANDIDATE:

- Please ensure that this examination paper contains **SEVEN** questions in **FIVE** printed pages before you start the examination.
- Answer all **SEVEN (7)** questions.
- You can choose to answer either in Bahasa Malaysia or English.

ENGLISH VERSION OF THE QUESTION PAPER

1. You are looking at a system for possible use in a Voice over IP (VoIP) service for a corporate branch office. You are analyzing the outbound link which consists of the VoIP phones directly feeding a branch office router, which in turn is attached to corporate HQ by an 810 Kbps leased line. Tests have shown that to get good quality voice, the time lapse between your voice hitting a microphone and clearing the branch office router needs to be no greater than 75 msec. Assuming:

   - The VoIP phone codes voice at a fixed rate of 40 Kbps and generates one packet every 7 msec, leaving 18 msec of allowable delay at the router
   - Each packet contains 47 bytes of overhead (7B PPP, 20B IP, 8B UDP, and 12B RTP).
   - Propagation delay between the VoIP phones and branch office router can be ignored.

   (a) Compute the size of a VoIP packet, including the overhead.

   (3/100)

   (b) If there is no other traffic on the branch office system, once the leading edge of a VoIP packet hits the branch office router, how long will it take for the trailing edge to be completely cleared?

   (3/100)

   (c) Suppose there are N active VoIP phones on the branch office network, and no other traffic. Compute the largest value N can be such that all VoIP packets completely clear the router by <18 msec. Assume a worst-case situation, where all N active VoIP phones are somehow synchronized such that the leading edges of N VoIP packets hit the router simultaneously. How large can N be such that this group of N packets is completely transmitted by 18 msec?

   (6/100)

2. An unlimited supply of I-frames are generated by Node A and sent to Node C via Node B.

| A |----------| B |----------| C |

Given:

- Full duplex (FDX) communication channels between nodes A and B, and between nodes B and C.
- Data rate between Node A and Node B, R_{AB} = 1 Mbps.
- All I-frames are 2500 bits (flag to flag).
- All ACK frames (separate supervisory frames) are 100 bits (flag to flag).
- Propagation delay is 5 microseconds/kilometer.
- Distances: A to B = 5000 km; B to C = 250 km
- There are no errors.

Determine the minimum DataRate between Node B and Node C, that is, find R_{BC} such that the buffers of Node B are not flooded for the following condition.

- Condition

A-B	Sliding-window protocol, (Go-Back-N), between Node A and Node B with a 3-bit sequence field, max window = 7 frames.
B-C	Stop & Wait protocol between Node B and Node C with a 1-bit sequence field, max window = 1 frame.

(10/100)

3. The following questions pertain to routing in general:

(a) Give the names of **two (2)** routing ALGORITHMS and of **two (2)** ROUTING protocols that use the first two named routing algorithms.

(4/100)

(b) Explain how ARP (Address Resolution Protocol) works. Give **one (1)** example to help your explanation.

(5/100)

(c) When the IPv6 protocol is introduced, does the ARP protocol have to be changed? If so, are the changes conceptual or technical?

(5/100)

(d) Consider the network in Figure 1. ISP B provides national backbone service to regional ISP A. ISP C provides national backbone service to regional ISP D. B and C peer with each other in two places using BGP. Consider traffic going from A to D. B would prefer to hand that traffic over to C on the West Coast (so that C would have to absorb the cost of carrying the traffic cross-country), while C would prefer to get the traffic via its East Coast peering point with B (so that B would have carried the traffic cross-country). What BGP mechanism might C use, so that B would hand over A-to-D traffic at their East Coast peering point?

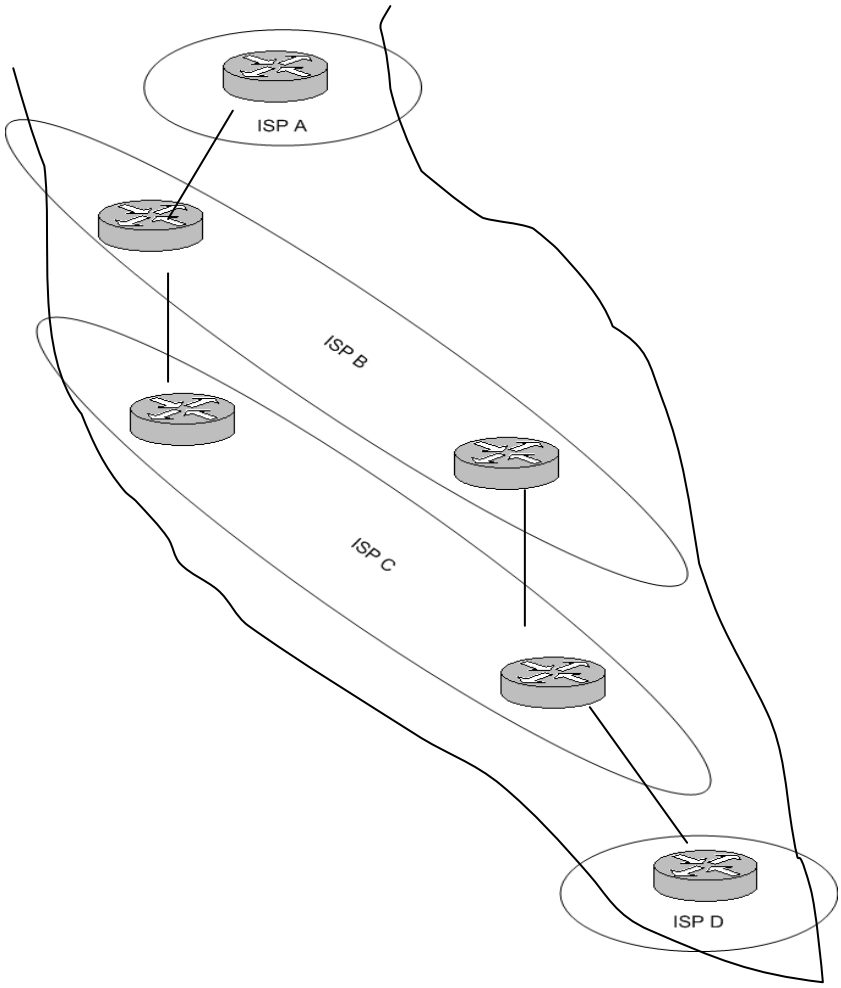

Figure 1

(6/100)

4. Answer the following questions on the IPv6.

   (a) Sketch the IPv6 segment structure and describe briefly, the header fields.

   (6/100)

   (b) List **three (3)** IPv4 problems and describe how IPv6 overcomes the problems.

   (5/100)

   (c) How will the public Internet, which is based on IPv4, be transitioned to IPv6?

   (5/100)

5. Describe using diagrams and words why Ethernet packets have a minimum packet size of 64 Bytes. The explanation should include how a system knows that a collision belongs to its packet and not other packets.

   (15/100)

6. Draw the packet structure of the following items and label each of the fields:

   (a) Ethernet (802.3)

   (5/100)

   (b) IP

   (5/100)

   (c) TCP

   (5/100)

7. (a) Briefly describe what a proxy server is and at what layer/layers of the OSI 7 layer model does a proxy server work? If more than one local client tries to connect to the same web server outside the LAN in the Internet, how does the proxy handle this? Explain using ports and IP addresses. Also, use diagrams to help explain your answer.

   (6/100)

   (b) What is the basic difference between a switch and a hub?

   (6/100)

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