國立臺北科技大學

九十六學年第二學期電機系博士班資格考試

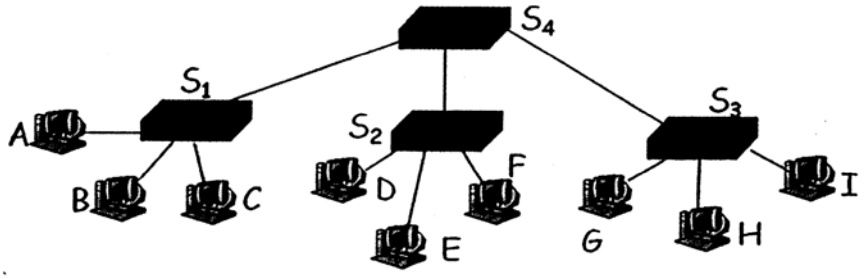
網際網路工程試題

填學生證號碼　　第一頁　共一頁

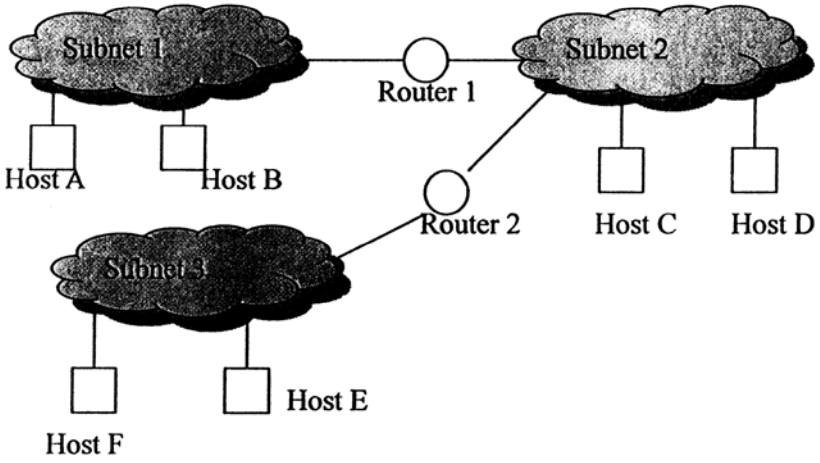
注意事項：

1. 本試題共 [7] 題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在試卷答案欄內，否則不予計分。
4. 考試時間:二小時。

1. (15 points) Let's consider the operation of a learning switch in the context of the following figure. Suppose that (1) A sends a frame to C, (2) C replies with s frame to A, (3) A sends a frame to D, (4) D replies with s frame to A, (5) A sends a frame to G, (6) G replies with s frame to A, (7) B sends a frame to D, (8) D replies with s frame to B, (9) E sends a frame to G, (10) G replies with s frame to E. The switch table is initially empty. Show the state of the switch table before and after each of these events. For each of these events, identify the link(s) on which the transmitted frame will be forwarded.



2. (15 points) Provide MAC addresses and IP addresses for the interfaces at Host A, Router 1, Router 2, and Host F. Suppose Host A sends a datagram to Host F. Give the source and destination MAC address in the frame encapsulation this IP datagram as the frame is transmitted (1) from A to Router 1, (2) from Router 1 to Router 2, (3) from Router 2 to F. Also give the source and destination IP addresses in the IP datagram encapsulated within the frame at each of these points in time.



3. (15 points) Consider distributing a file of $F = 10$ Gbits to N peers. The server has an upload rate of $u_s = 20$ Mbps, and each peer has a download rate of $d_i = 1$ Mbps and an upload rate of u. For $N = 10$, 100, and 1000 and $u = 200$ Kbps, 600 Kbps, and 1 Mbps, prepare a chart giving the minimum distribution time for each of the combination of N and u for both client-server distribution and P2P distribution.

4. (10 points) Suppose the correspondent in the following figure were mobile. Sketch the additional network-layer infrastructure that would be needed to route the datagram from the original mobile user to the (now mobile) correspondent. Show the structure of the datagram(s) between the original mobile user and the (now mobile) correspondent, as show in the following figure.

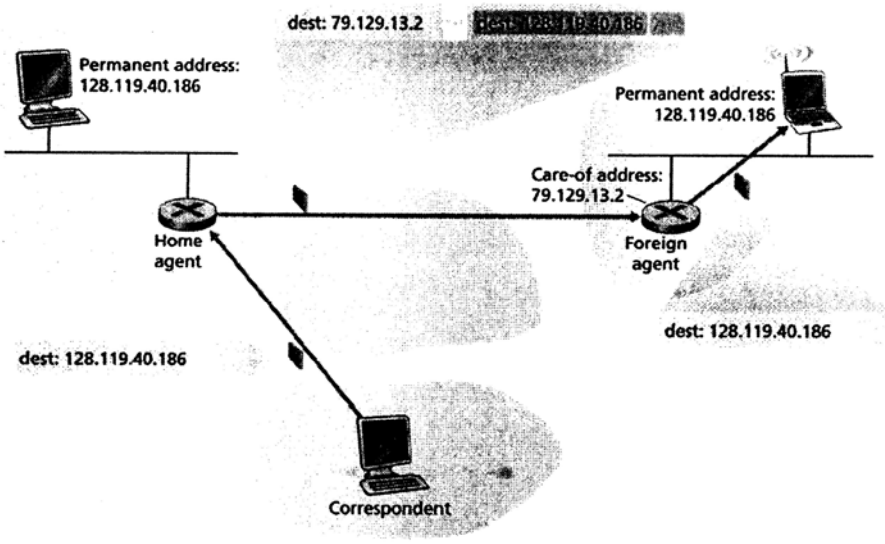


Figure 6.23 ♦ Encapsulation and decapsulation

5. (10 points) What are three approaches that can be taken to avoid having a single wireless link degrade the performance of an end-to-end transport-layer TCP connection??

6. (20 points) Answer the following problems.

(a) What is meant by "opportunistic scheduling" in WiMAX?

(b) What are the roles played by the IGMP protocol and a wide-area multicast routing protocol?

(c) Suppose two TCP connections are present over some bottleneck link of rate R bps. Both connections have a huge file to send. The transmissions of the files start at the same time. What transmission rate would TCP like to give to each of the connections?

(d) List at least four different applications that are naturally suitable for P2P architectures.

7. (15 points) Consider the following notation:
   a. assume one link between client and server of rate R
   b. S: MSS (bits)
   c. O: object size (bits)
   d. No retransmissions (no loss, no corruption)

Now suppose window grows according to slow start. Please show that the delay for one object is:

$$\boxed{Latency = 2RTT + \frac{O}{R} + P\left[RTT + \frac{S}{R}\right] - (2^P - 1)\frac{S}{R}}$$

where P is the number of times TCP idles at server.