國 立 臺 北 科 技 大 學

九十九學年第二學期電機系博士班資格考試

網際網路工程 試題

注意事項：

1. 本試題共【10】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. (10 points) Suppose we send into the Internet two IP datagrams, each carrying a different UDP segment. The first datagram has source IP address A1, destination IP address B, source port P1, and destination port T. The second datagram has source IP address A2, destination IP address B, source port P2, and destination port T. Suppose that A1 is different from A2 and that P1 is different from P2. Assuming that both datagrams reach their final destination, will the two UDP datagrams be received by the same socket? Why or why not?

2. (10 points) Suppose Alice, Bob, and Claire want to have an audio conference call using SIP and RTP. For Alice to send and receive RTP packets to and from Bob and Claire, is only one UDP socket sufficient? If yes, then how does Alice's SIP client distinguish between the RTP packets received from Bob and Claire?

3. (10 points) Recall the two FEC schemes for Internet phone. Suppose the first scheme generates a redundant chunk for every four original chunks. Suppose the second scheme uses a low-bit rate encoding whose transmission rate is 25 percent of the transmission rate of the nominal stream. How much additional bandwidth does each scheme require? How much playback delay does each scheme add?

4. (10 points) Consider the topology shown in Figure 1. (R_i, i=1,2,3, are Routers. S_i, i=1,..,5, are Ethernet Switches. H_i, i=1,…,7, are Hosts. If_i, i=1, …, 4, are interfaces)

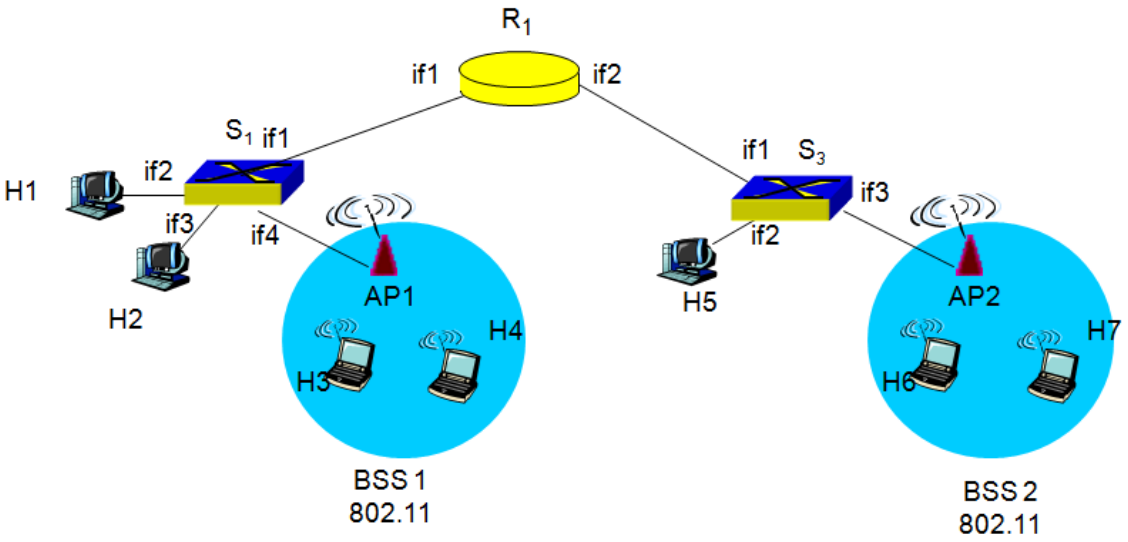

Figure 1.

Consider sending an IP datagram from host H3 to Host H6. Suppose the ARP table in the sending host is empty and the other tables are up to date. The switch table is initially empty. The forwarding table of router has ready. Enumerate all the steps and shown the switch tables in S1 and S3 for every steps. (You must Assign MAC address to each interface network address to each of the subnets and communication equipment)

5. (10 points) Host A and B are directly connected with a 100 Mbps link. There is one TCP connection between the two hosts, and Host A is sending to Host B an enormous file over this connection. Host A can send application data into link at 50 Mbps but Host B can read out of its TCP receive buffer at a maximum rate of 20 Mbps. Describe the effect of TCP flow control.

6. (10 points) Consider distributing a file of F bits to N peers using a P2P architecture shown in Fig. 2. Assume a fluid model. Let d_{min} denote the download rate of the peer with the lowest download rate. Assumes that d_{min} is very large, so that peer download bandwidth is never a bottleneck. Suppose that $u_s \leq (u_s+u_1+\ldots+u_N)/N$. Specify a distribution scheme that has a distribution time of $NF/(u_s+u_1+\ldots+u_N)$

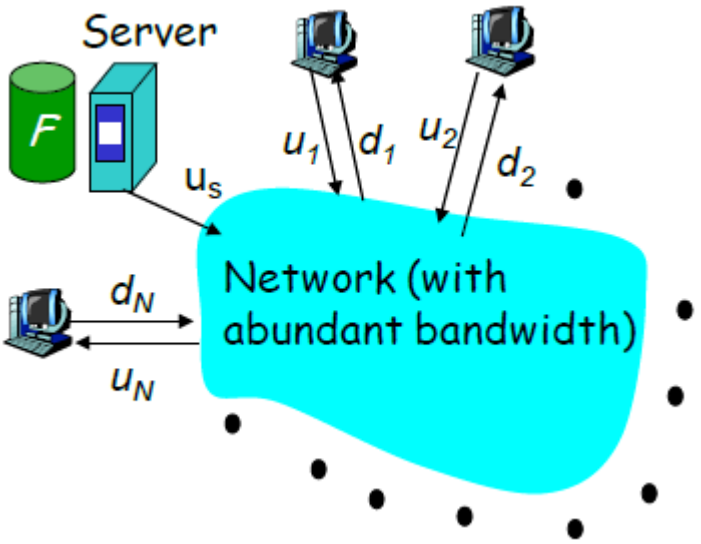

Figure 2

7. (10 points)In this problem we explore designing a hierarchical overlay that has ordinary peers, super peers, and super-duper peers.
   (a) Suppose each super-duper peer is roughly responsible for 100 super peers, and each super peer is roughly responsible for 100 ordinary peers. How many super-duper peers would be necessary for a network of one million peers?
   (b) What information might each super peer store? What information might each super-duper peer store? How might searches be performed in such a three-tier design?

8. (10 points) Consider an HTTP client that wants to retrieve a Web document at a given URL. The IP address of the HTTP server is initially unknown. What transport and application-layer protocols are need in this scenario?

9. (10 points) Consider sending a large file from a host to another over a TCP connection that has no loss.
   (a) Suppose TCP uses AIMD for its congestion control without slow start. Assume CongWin increases by 1 MSS every time a batch of ACKs is received and assuming approximately constant round-trip times, how long does it take for CongWin to increase from 1 MSS to 6 MSS
   (b) What is the average throughput (in terms of MSS and RTT) for this connection up through time = 5 RTT?

10. (10 points) Suppose datagrams are limited to 1500 bytes (include header) between source Host A and destination Host B. Assuming a 20-byte IP header, how many datagrams would be required to send an MP3 consisting of 2 million bytes?