國 立 臺 北 科 技 大 學

九十八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【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) Consider an RTP session consisting of 4 users, all of which are sending and receiving RTP packets into the same multicast address. Each user sends video at 100 kbps.

   (a) RTCP will limit its traffic to what rate?
   (b) A particular receiver will be allocated how much RTCP bandwidth?
   (c) A particular sender will be allocated how much RTCP bandwidth?

2. (10 points) In the Internet phone, let h be the total number of header bytes added to each chunk, including UDP and IP header.
   (a) What is a typical value of h when RTP is used?
   (b) Assuming an IP datagram is emitted every 20 *msecs*, find the transmission rate in bits per second for the datagrams generated by one side of this application.

3. (15 points) Suppose an 802.11b station is configured to always reserve the channel with the RTS/CTS sequence. Suppose this station suddenly wants to transmit 1000 bytes of data, and all other stations are idle at this time. As a function of SIFS and DIFS, and ignoring propagation delay and assuming no bit errors, calculate the time required to transmit the frame and receive the acknowledgment

4. (15 points) Consider distributing a file of F bits to N peers using a P2P architecture. Assume a fluid model. Denote the upload rate of the server's access link by u_s, the upload rate of the ith peer's access link by u_i, and the download rate of the ith peer's access link by d_i. For simplicity assume that d_{min} ($d_{min}=min\{d_1,...,d_N\}$) is very large, so that peer download bandwidth is never a bottleneck. Suppose that $u_s <= (u_s+u_1+...+u_N)/N$. Specify a distribution scheme that has a distribution time of $NF/(u_s+u_1+...+u_N)$.

5. (15 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 term of MSS and RTT) for this connection up through time = 5 RTT?

6. (15 points) Suppose a peer with username Arnold discovers through querying that a peer with username Bernard has a file it wants to download. Also suppose that Bernard and Arnold are both behind a NAT. Try to devise a technique that will allow Arnold to establish a TCP connection with Bernard without application-specific NAT configuration.

7. (15 points) Let's consider the operation of a learning switch in the context of Figure 1. Suppose that (*i*) A send a frame to D, (*ii*) D replies with a frame to A, (*iii*) C sends a frame to D, (*iv*) D replies with a frame to C. 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.
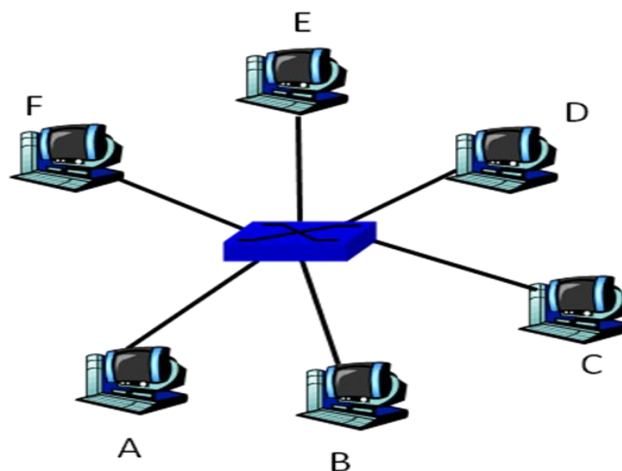

Figure 1 A link-layer switch inter-connecting six nodes