

# 國立臺北科技大學

一百零三學年第二學期電機系博士班資格考試

## 網際網路工程 試題

第一頁 共三頁

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### 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) Explain the following items.

- (a) Consider an e-commerce site that wants to keep a purchase record for each of its customers. Describe how this can be done.
- (b) Describe how Web caching can reduce the delay in receiving a requested object. Will Web caching reduce the delay for all objects requested by a user or for only some of the objects? Why?.
- (c) If the TCP server were to support  $n$  simultaneous connection, each from a different client host, how many sockets would the TCP server need? If the UDP server were to support  $n$  simultaneous different client hosts, how many sockets would the UDP server need?

2. (15 points) Suppose a peer with username Alice discovers through querying that a peer with user Bob has a file it want to download. Also suppose that Alice and Bob are both behind a NAT. Try to devise a technique that will allow Alice to establish a TCP connection with Bob without application-specific NAT configuration. If you have difficulty devising such a technique, discuss why.

3. (15 points) Suppose within your Web browser you click on a link to obtain a Web page. The IP address for the associated URL is not cached in your local host, so a DNS look-up is necessary to obtain the IP address. Suppose that  $n$  DNS servers are visited before your host receives the IP address from DNS; the successive visits incur an RTT of  $RTT_1, \dots, RTT_n$ . Let  $RTT_0$  denote the RTT between the local host and the server containing the object. Suppose the HTML file references three very small objects on the same server. Neglecting transmission times, how much time elapses with
- Nonpersistent HTTP with no parallel TCP connections?
  - Nonpersistent HTTP with parallel connections?
  - Persistent HTTP with pipelining?
4. (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.

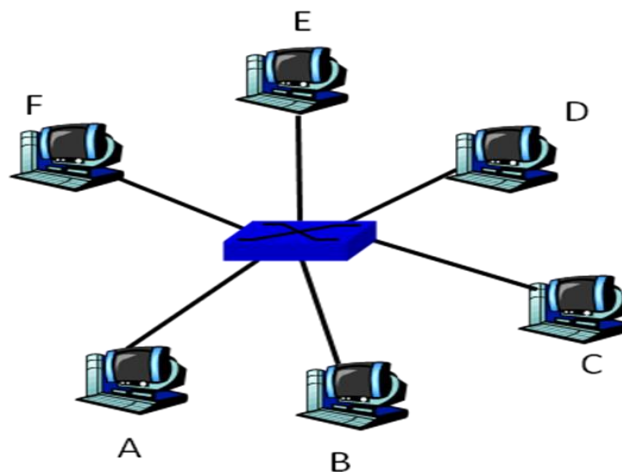


Figure 1 A link-layer switch inter-connecting six nodes

5. (15 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 (in addition to the socket needed for the SIP message)? If yes, then how does Alice's SIP client distinguish between the RTP packets received from Bob and Claire?

6. (15 points) Consider distributing a file of  $F$  bits to  $N$  peers using a P2P architecture shown in Figure 2. Denote the upload rate of server's access link by  $u_s$ , and the upload rate of the  $i$ th peer's access link by  $u_i$ , and the download rate of the  $i$ th peer's access link by  $d_i$ . Let  $d_{min}$  denote the download rate of the peer with the lowest download rate. Assume a fluid model. Assume that  $d_{min}$  is very large, so that peer download bandwidth is never a bottleneck. Suppose that  $u_s \leq (u_s + u_1 + \dots + u_N)/N$ . Specify a distribution scheme that has a distribution time of  $NF/(u_s + u_1 + \dots + u_N)$ .

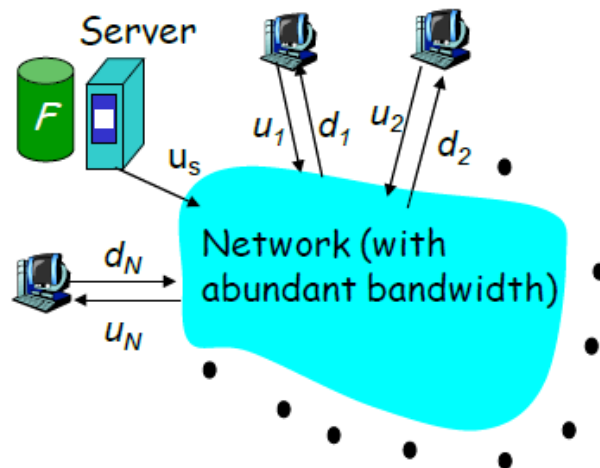


Figure 2

7. (10 points) What information is needed to dimension a network so that a given quality of service is achieved?