EXERCISES

3.1 A client sends a 200 byte request message to a service, which produces a response containing 5000 bytes. Estimate the total time required to complete the request in each of the following cases, with the performance assumptions listed below:

i) using connectionless (datagram) communication (for example, UDP);

ii) using connection-oriented communication (for example, TCP);

iii) when the server process is in the same machine as the client.

[Latency per packet (local or remote,
incurred on both send and receive): 5 ms
Connection setup time (TCP only): 5 ms
Data transfer rate: 10 Mbps
MTU: 1000 bytes
Server request processing time: 2 ms
Assume that the network is lightly loaded.]

pages 82, 122

3.2 The Internet is far too large for any router to hold routing information for all destinations. How does the Internet routing scheme deal with this issue? *pages 98, 114*

3.3 What is the task of an Ethernet switch? What tables does it maintain? *pages 105, 130*

3.4 Make a table similar to Figure 3.5 describing the work done by the software in each protocol layer when Internet applications and the TCP/IP suite are implemented over an Ethernet. *pages 94, 122, 130*

3.5 How has the end-to-end argument [Saltzer *et al.* 1984] been applied to the design of the Internet? Consider how the use of a virtual circuit network protocol in place of IP would impact the feasibility of the World Wide Web. *pages 61, 96, 106,* [www.reed.com]

3.6 Can we be sure that no two computers in the Internet have the same IP address? *page 108*

3.7 Compare connectionless (UDP) and connection-oriented (TCP) communication for the implementation of each of the following application-level or presentation-level protocols:

i) virtual terminal access (for example, Telnet);

ii) file transfer (for example, FTP);

iii) user location (for example, rwho, finger);

iv) information browsing (for example, HTTP);

v) remote procedure call.

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3.8 Explain how it is possible for a sequence of packets transmitted through a wide area network to arrive at their destination in an order that differs from that in which they were sent. Why can't this happen in a local network?

pages 97, 131

3.9 A specific problem that must be solved in remote terminal access protocols such as Telnet is the need to transmit exceptional events such as 'kill signals' from the 'terminal' to the host in advance of previousl transmitted data. Kill signals should reach their destination ahead of any other ongoing transmissions. Discuss the solution of this problem with connection-oriented and connectionless protocols. *page 122*

3.10 What are the disadvantages of using network-level broadcasting to locate resources:

i) in a single Ethernet?

ii) in an intranet?

To what extent is Ethernet multicast an improvement on broadcasting? *page 130*

3.11 Suggest a scheme that improves on MobileIP for providing access to a web server on a mobile device that is sometimes connected to the Internet by the mobile phone network and at other times has a wired connection to the Internet at one of several locations. *page 120*

3.12 Show the sequence of changes to the routing tables in Figure 3.8 that will occur (according to the RIP algorithm given in Figure 3.9) after the link labelled 3 in Figure 3.7 is broken. *pages 98–101*

3.13 Use the diagram in Figure 3.13 as a basis for an illustration showing the segmentation and encapsulation of an HTTP request to a server and the resulting reply. Assume that the request is a short HTTP message, but the reply includes at least 2000 bytes of HTML. *page 93, 107*

3.14 Consider the use of TCP in a Telnet remote terminal client. How should the keyboard input be buffered at the client? Investigate Nagle's and Clark's algorithms [Nagle 1984, Clark 1982] for flow control and compare them with the simple algorithm described on page 103 when TCP is used by:

a) a web server,

b) a Telnet application,

c) a remote graphical application with continuous mouse input. *pages 102, 123*

3.15 Construct a network diagram similar to Figure 3.10 for the local network at your institution or company. *page 104*

3.16 Describe how you would configure a firewall to protect the local network at your institution or company. What incoming and outgoing requests should it intercept? *page 125*

3.17 How does a newly installed personal computer connected to an Ethernet discover the IP addresses of local servers? How does it translate them to Ethernet addresses? *page 111*

3.18 Can firewalls prevent denial of service attacks such as the one described on page 112? What other methods are available to deal with such attacks? *page 112, 125*