# Segunda Lista de exercícios

R9. Recall that TCP can be enhanced with SSL to provide process-to-process security services, including encryption. Does SSL operate at the transport layer or the application layer? If the application developer wants TCP to be enhanced with SSL, what does the developer have to do?

R10. What is meant by a handshaking protocol?

R12. Consider an e-commerce site that wants to keep a purchase record for each of its customers. Describe how this can be done with cookies.

R13. 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?

R15. Why is it said that FTP sends control information "out-of-band"?

R18. From a user's perspective, what is the difference between the download-anddelete mode and the download-and-keep mode in POP3?

R21. In BitTorrent, suppose Alice provides chunks to Bob throughout a 30-second interval. Will Bob necessarily return the favor and provide chunks to Alice in this same interval? Why or why not?

R22. Consider a new peer Alice that joins BitTorrent without possessing any chunks. Without any chunks, she cannot become a top-four uploader for any of the other peers, since she has nothing to upload. How then will Alice get her first chunk?

R23. What is an overlay network? Does it include routers? What are the edges in the overlay network?

P3. 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 besides HTTP are needed in this scenario?

P7. 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 lookup 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 $RTT_1, \ldots, RTT_n$. Further suppose that the Web page associated with the link contains exactly one object, consisting of a small amount of HTML text. Let $RTT_0$ denote the RTT between the local host and the server containing the object. Assuming zero transmission time of the object, how much time elapses from when the client clicks on the link until the client receives the object?

P8. Referring to Problem P7, suppose the HTML file references eight very small objects on the same server. Neglecting transmission times, how much time elapses with

a. Non-persistent HTTP with no parallel TCP connections?
b. Non-persistent HTTP with the browser configured for 5 parallel connections?
c. Persistent HTTP?

P9. Consider Figure 2.12, for which there is an institutional network connected to the Internet. Suppose that the average object size is 850,000 bits and that the average request rate from the institution's browsers to the origin servers is 16 requests per second. Also suppose that the amount of time it takes from when the router on the Internet side of the access link forwards an HTTP request until it receives the response is three seconds on average (see Section 2.2.5). Model the total average response time as the sum of the average access delay (that is, the delay from Internet router to institution router) and the average Internet delay. For the average access delay, use ⊗/(1 – ⊗_), where ⊗ is the average time required to send an object over the access link and _ is the arrival rate of objects to the access link.

a. Find the total average response time.
b. Now suppose a cache is installed in the institutional LAN. Suppose the miss rate is 0.4. Find the total response time.

P13. What is the difference between MAIL FROM: in SMTP and From: in the mail message itself?

P20. Suppose you can access the caches in the local DNS servers of your department. Can you propose a way to roughly determine the Web servers (outside your department) that are most popular among the users in your department? Explain.

P21. Suppose that your department has a local DNS server for all computers in the department. You are an ordinary user (i.e., not a network/system administrator). Can you determine if an external Web site was likely accessed from a computer in your department a couple of seconds ago? Explain.

P23. Consider distributing a file of $F$ bits to $N$ peers using a client-server architecture. Assume a fluid model where the server can simultaneously transmit to multiple peers, transmitting to each peer at different rates, as long as the combined rate does not exceed $u_s$.

a. Suppose that $u_s/N$ δ $d_{min}$. Specify a distribution scheme that has a distribution time of $NF/u_s$.
b. Suppose that $u_s/N$ ε $d_{min}$. Specify a distribution scheme that has a distribution time of $F/d_{min}$.
c. Conclude that the minimum distribution time is in general given by $\max\{NF/u_s, F/d_{min}\}$.

P24. Consider distributing a file of $F$ bits to $N$ peers using a P2P architecture. Assume a fluid model. For simplicity assume that $d_{min}$ is very large, so that peer download bandwidth is never a bottleneck.

a. Suppose that $u_s$ δ $(u_s + u_1 + ... + u_N)/N$. Specify a distribution scheme that has a distribution time of $F/u_s$.
b. Suppose that $u_s$ ε $(u_s + u_1 + ... + u_N)/N$. Specify a distribution scheme that has a distribution time of $NF/(u_s + u_1 + ... + u_N)$.
c. Conclude that the minimum distribution time is in general given by $\max\{F/u_s, NF/(u_s + u_1 + ... + u_N)$