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Lab02

Question 1) 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? (10 marks)

SSL Operates at the application layer. To enhance TCP with SSL, a developer needs to include SSL code or API on both client and server sides of Application.

Question 2) R18. From a user's perspective, what is the difference between the download-and-delete mode and the download-and-keep mode in POP3? (10 marks)

Download-and-delete mode means that if a user reads a message on a device, they will not be able to view that same message again on a different device. Download-and-keep mode means that messages are stored on a mail server so users can access their messages no matter what device they are using.

Question 3) R26. In Section 2.7, the UDP server described needed only one socket, whereas the TCP server needed two sockets. Why? If the TCP server were to support n simultaneous connections, each from a different client host, how many sockets would the TCP server need? (10 marks)

The TCP server needs 2 sockets because one end needs to connect to the client socket and the other end needs to connect to the server socket so that when one side wants to send data it cand just send it by putting it into the TCP connection. The TCP server would need n+1 sockets.

Question 4) 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 $\Delta/(1 - \Delta\beta)$, where Δ is the average time required to send an object over the access link and β is the

arrival rate of objects to the access link. (15 marks)

a) Find the total average response time.
   Δ = 850,000/(15*10^6) = .056 seconds
   β = 16 rps
   Total average response time = 3 + 0.056/(1- 0.056 * 16)=**3.53846**

b) Now suppose a cache is installed in the institutional LAN. Suppose the miss rate is 0.4. Find the total response time.
   Total response time = (0.6*0)+(0.4*(3+.056/(1-0.4*.056*16)))=
   3.087281

Question 5) P22. Consider distributing a file of F = 15 Gbits to N peers. The server has an upload rate of us = 30 Mbps, and each peer has a download rate of di = 2 Mbps and an upload rate of u. For N = 10 and 1,000 and u = 300 Kbps and 2 Mbps, prepare a chart giving the minimum distribution time for each of the combinations of N and u for both client-server distribution and P2P distribution. (15 marks)

F = 15 Gbits

us = 30 Mbps

di = 2 Mbps

Dcs=max{NF/us, F/di}

DP2P=max{F/us, F/di, NF/(us +∑i=1Nui)}

Client-Server Distribution	N=10	N=1,000
	max{10*(15E9/30E6),15E9/2E6} =max{500, 7,500} =**7,500s**	max{1000*(15E9/30E6),15E9/2E6}= **500,000s**
	U value unapplicable	U value unapplicable

P2P Distribution	N=10	N=1,000

u=300kbps	max{15E9/30E6,15E9/2E6,10*(15E9/(30E6+300E3+3E6))}=**7,500s**	max{15E9/30E6, 15E9/2E6, 1,000*(15E9/(30E6+300E3+2E6))}=**464,396.3s**
u=2Mbps	Same	Same

TCP vs UDP (12 marks)

Question 6) Indicate if TCP, UDP, or neither should be used given the following transmission requirements:

a) Reliable data transfer
   TCP
b) Minimum transmission overhead
   UDP
c) Guaranteed transmission rate
   TCP
d) Bounded limits on packet delay
   TCP
e) Guarantee in-order delivery of data
   TCP
f) No transmission setup time
   UDP

HTTP Request and Response (8 marks)

Question 7) Given the following HTTP request, answer the following questions:

GET /index.html HTTP/1.1

Accept: */*

Accept-Language: en-ca

User-Agent: Mozilla/5.0 (Windows NT 6.1; rv:2.0.1) Gecko/20100101 Firefox/4.0.1

CLR 2.0.50727; InfoPath.1)

Host: localhost:6789

Connection: Keep-Alive

a) What is the full URL of the requested page?
   https:// localhost:6789/index.html HTTP/1.1
b) Is the browser requesting a persistent or non-persistent connection? How do you know?

The browser is requesting a persistent connection because the Connection attribute has the value “Keep-Alive”

Persistent versus non-Persistent Connections (10 marks)

Question 8) Assume you have a HTML file of size 10,000 bits. The HTML file has 4 linked images each of size 50,000 bits. One of the linked images is on a different server machine. To simplify the discussion, assume that the round trip time (RTT) from your browser to either server is 100 ms, and the "link" between browser and server is a 10 Mbps link. Answer these questions:

a) What is the total time to receive the HTML file and all images using non-persistent connections?
   non-persistent HTTP response time = 2RTT+ file transmission time
   file transmission time = 60,000/10MBPS = 0.006s
   non-persistent HTTP response time = 2(.001s) + .006s
   = .008s
b) What is the total time using non-persistent connections but the browser can open up any number of parallel connections?
   It would be shorter, but I don’t know how to calculate parallel connections.

Caching (10 marks)

Question 9) Given the network diagram below, answer the following questions. Assume that the transmission delay for HTTP GET/RESPONSE and DNS REQUEST/RESPONSE messages is so small that it can be ignored. Transmission delays are only calculated when sending the data file. Both routers, R1 and R2, use store and forward. The transmission delays on the LANs must be calculated, but propagation delays are ignored. The round-trip time from any machine in a.com to b.com is 50 ms. The round-trip time from any machine in a.com to the Internet is 100 ms. Answer these questions:

LAN transmission delay = 150ms

a) Give the sequence and timing of messages sent when m1.a.com requests a 1 Mbit file from www.b.com. Assume the DNS record and the HTTP file are not cached locally. Also assume that the top-level domain is not cached.

Time (ms)	Message	Description
0	HTTP GET	m1a.com sends HTTP GET for b.com file

~0	DNS Request	local HTTP cache is missing specified document; needs to find it with DNS on b.com; DNS Request message is sent to local DNS server
~0	DNS Request	local DNS server is missing the file; a request is now sent to root level DNS
50	DNS Response	root level server receives DNS request; sends DNS response with TLD
100	DNS Request	root level DNS response arrives at local DNS; DNS Request is sent to TLD DNS
~100	DNS Response	TLD receives DNS Request; sent to authoritative domain
150	HTTP GET	Authoritative DNS sends file to client

b) Give the sequence and timing of messages sent when m2.a.com requests the same 1 Mbit file assuming the DNS records and file have been cached locally.

Time (ms)	Message	Description
0	HTTP GET	m2a.com sends HTTP GET for b.com file
~0	HTTP Response	local HTTP cache contains specified document
50	HTTP Fetch	file is sent from cache to client device