CNS TUT-4

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B11

Q1)

a,b)

* M1.a.com needs to resolve the name www.b.com to an IP address so it sends a DNS REQUEST message to its local DNS resolver (this takes no time given the assumptions below)
* Local DNS server does not have any information so it contacts a root DNS server with a REQUEST message (this take 500 ms given the assumptions below)
* Root DNS server returns name of DNS Top Level Domain server for .com (this takes 500 ms given the assumptions below)
* Local DNS server contacts .com TLD (this take 500 ms given the assumptions below)
* TLD .com server returns authoritative name server for b.com (this takes 500 ms given the assumptions below)
* Local DNS server contacts authoritative name server for b.com (this takes 100 ms given the assumptions below)
* Authoritative name server for b.com returns IP address of www.b1.com. (this takes 100 ms given the assumptions below)
* HTTP client sends HTTP GET message to www.b1.com, which it sends to the HTTP cache in the a.com network (this takes no time given the assumptions).
* The HTTP cache does not find the requested document in its cache, so it sends the GET request to www.b.com. (this takes 100 ms given the assumptions below)
* www.b.com receives the GE request. There is a 1 sec transmission delay to send the 1Gbps file from www.b.com to R2. If we assume that as soon as the first few bits of the file arrive at R1, that they are forwarded on the 1Mbps R2-to-R1 link, then this delay can be ignored.
* The 1 Gbit file (in smaller packets or in a big chunk, that’s not important here) is transmitted over the 1 Mbps link between R2 and R1. This takes 1000 seconds. There is an additional 100 ms propagation delay.
* There is a 1 sec delay to send the 1Gbps file from R1 to the HTTP cache. If we assume that as soon as the first few bits of the file arrive at the cache, that they are forwarded to the cache, then this delay can be ignored.
* There is a 1 sec delay to send the 1Gbps file from the HTTP cache to m1.a.com. If we assume that as soon as the first few bits of the file arrive at the cache, that they are forwarded to the cache, then this delay can be ignored. The total delay is thus: .5 + .5 + .5 +.5 +.1 + .1 + 1 + 1000 +1+1 = 1105.2 secs (1002.2 is also an OK answer)

C,d)

* m2.a.com needs to resolve the name www.b.com to an IP address so it sends a DNS REQUEST message to its local DNS resolver (this takes no time given the assumptions above)
* The local DNS server looks in its cache and finds the IP address for www.b.com, since m1.a.com had just requested that that name be resolved, and returns the IP address to m2.b.com. (this takes no time given the assumptions above)
* HTTP client at m2.a.com sends HTTP GET message to www.b1.com, which it sends to the HTTP cache in the a.com network (this takes no time given the assumptions).
* The HTTP cache finds the requested document in its cache, so it sends a GET request with an If-Modified-Since to www.b.com. (this takes 100 ms given the assumptions)
* www.b.com receives the GET request. The document has not changed, so www.b.com sends a short HTTP REPLY message to the HTTP cache in a.com indicating that the cached copy is valid. (this takes 100 ms given the assumptions)
* There is a 1 sec delay to send the 1Gbps file from the HTTP cache to m2.a.com.
* The total delay is thus: .1 + .1 + 1 = 1.2 secs

e) Since it takes 1000 secs to send the file from R2 to R1, the maximum rate at which requests to send the file from b.com to a.com is 1 request every 1000 seconds, or an arrival rate of .001 requests/sec.

Q2)

1. False.  
   There are four connections since each connection transports exactly one request message and one response message. So, each object will have its one request message instead of there being only one request message.
2. True.  
   It is because both of these web pages are on the same physical server
3. False.  
    In a non-persistent connection, the connection closes after each connection. In this case, the connection will close once the first message is received, and there will be a new connection opened to send the second message.
4. False.  
    The “Date:” is the time at which the request was created and not when the object was last modified.
5. False.  
   Some HTTP response messages have an empty message body. For example, HTTP Status-Code of 204 and 304 MUST NOT include a message body.

Q3)

11 server-side sockets are used. One socket is used for listening on port 80. The other 10 sockets are created for each coming connection. Only one port number (80) is used.

Q4)

a) For the Internet access link: λ=14/sec, μ=1.5Mbps/100,000bit = 15/sec. So the response time on the access link is: E[Taccess] = 1/(μ-λ) = 1 second

For the local LAN: λ=14/sec, μ=10Mbps/100,000bit = 100/sec. So the response time on LAN is:

E[TLAN] = 1/(μ-λ) = 0.0116 second

Thus the total average response time is:

E[T] = E[Taccess] + Internet delay + LAN delay = 1 + 2+0.0116 = 3.0116 seconds

b)

For the Internet access link: λ=14/sec, μ=1.5Mbps/100,000bit = 15/sec. So the response time on the access link is: E[Taccess] = 1/(μ-λ) = 1 second

For the local LAN: λ=14/sec, μ=10Mbps/100,000bit = 100/sec. So the response time on LAN is:

E[TLAN] = 1/(μ-λ) = 0.0116 second

Thus the total average response time is:

E[T] = E[Taccess] + Internet delay + LAN delay = 1 + 2+0.0116 = 3.0116 seconds

Q5)

Once the IP address is known, RTT0 elapses to set up a TCP connection and another RTT0 elapses to request and receive the small object from S0. The time needed to bring an object of size 1000bits is 0.1s. For get object i it is necessary to use 2RTT\_i (seeting up the connection) + transmission time for the object. So, the total response time is therefore; 2\*RTT0 + 2RTT1 + 0.1 + 2RTT2 + 0.1 + 2RTT3+ 0.1 + 2RTT4+ 0.1