Disciplina de Redes de Computadores (CK0061 / CK0249)
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Lista de Exercícios da Unidade 2
Camada de Aplicação

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1.
a) A circuit-switched network would be well suited to the application described, because the application involves long sessions with predictable smooth bandwidth requirements. Since the transmission rate is known and not bursty, bandwidth can be reserved for each application session circuit with no significant waste. In addition, we need not worry greatly about the overhead costs of setting up and tearing down a circuit connection, which are amortized over the lengthy duration of a typical application session.

2.

First link transmit packet
= L/R1 = (1500 * 8) / 2 * 10^6 =0.006 s
First propagates of link is d1/s1 = 5000 * 10^3 / 2.5 * 10^8 = 0.02 s
Delay time dprocessing = 3 mllsec

Second link transmit packet = L/R2 = (1500 * 8) / 2 * 10^6 = 0.006sec
Second propagates of link is d2/s2 = 4000 * 10^3 / 2.5 * 10^8 = 0.016sec
3º link transmit packet = L/R3 = 1500 * 8 / 2 * 10^6 = 0.006 sec
The last propagates in d3/s3 = 1000 * 10^3 / 2.5 * 10^8 = 0.004 sec
End-to- end delay = L/R1 + L/R2 + L/R3 +d1/s1 + d2/s2 + d2/s3 + dprocessing + dprocessing
= 0.006 + 0.006 + 0.006 + 0.02 + 0.016 + 0.004 + 0.003 + 0.003 = 0.064sec

4.
a) The transmission time of the 100kbits page
= L/R = 100 * 10^3 / 100 * 10^6 = 10^{-3} = 1ms
The transmission time of each 100 kbits image
= 100 * 10^3 / 100 * 10^6 = 10^{-3} = 1ms
The delays associated with this scenarios are:
= 2 * RTT * 6 + transmission time for file and images
= 2 * 300 * 6 + 1ms (1 *1) = 3.60s

b) The delays associated with this scenario are:
2 RTT for first object +
2 RTT for all images(parallel) +
transmission time for file +
transmission time for images

= 600ms + 600ms + 1ms + 1ms = 1210 ms = 1.215s

c) Now, we have 2 RTT for base file + RTT * 5 (for the 5 images) + transmission time for file + transmission time for images
= 600 + (300 * 5) + 10 images + 1ms = 2.111s

d) 2 RTT for the base file + RTT for all images(parallel) + transmission time for file + transmission time for iamges
= 600 + 300 + 1 + 1 = 902 ms = 9.02s

5.

a) 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) 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

d) 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