Computer Networking

Assignment 1 Solutions

Solutions 1:

1) Time to send message from source host to first packet switch = $\frac{1\times10^6}{5\times10^6}$sec = 0.2sec. With store-and-forward switching, the total time to move message from source host to destination host = $0.2\text{sec}\times 3\ hops = 0.6\text{sec}$.

2) Time to send 1st packet from source host to first packet switch = $\frac{1\times10^4}{5\times10^6}$sec = $2m$ sec. Time at which 2nd packet is received at the first switch = time at which 1st packet is received at the second switch
= $2 \times 2m$ sec = $4\ m$ sec

3) Time at which 1st packet is received at the destination host = $2\ m$ sec$\times$ $3\ hops = 6\ m$ sec. After this, every 2msec one packet will be received; thus, time at which last (100th) packet is received
= $6\ m$ sec+ 99 *$2m$ sec = 0.204sec

It can be seen that delay in using message segmentation is significantly less (almost 1/3rd).

Solutions 2:

1) The total amount of time to get the IP address is: $RTT_1 + RTT_2 + \Lambda + RTT_n$. Once the IP address is known, RTT_O elapses to set up the TCP connection and another $RTTO$ elapses to request and receive the small object. The total response time is $2RTTo + RTT1 + RTT2 + \Lambda + RTTn$

2) a) $RTT1 + \Lambda + RTTn + 2RTTo + 8\cdot 2RTTo = 18RTTo + RTT1 + \Lambda + RTTn$

   b) $RTT1 + \Lambda + RTTn + 2RTTo + 2\cdot 2RTTo = 6RTTo + RTT1 + \Lambda + RTTn$

   c) Persistent connection with pipelining. This is the default mode of HTTP

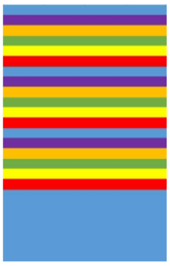
   $RTT1 + \Lambda + RTTn + 2RTTo + RTTo = 3RTTo + RTT1 + \Lambda + RTTn$.

   Persistent connection without pipelining, without parallel connections.

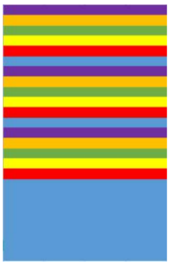
   $RTT1 + \Lambda + RTTn + 2RTTo + 8RTTo = 10RTTo + RTT1 + \Lambda + RTTn$.

Solutions 3:

Sol:After interleaving, the video clip is divided into 2000 frames (blue section) and each image is divided into three frames (purple, orange, green, yellow, red respective) .



(figure 1)



(figure 2)

Situation one (figure 1) : If the first sent frame belongs to video clip, it needs 6×3=18 frame times until all five images are sent.

Situation two (figure 2) : If the first sent frame is one of frame belonging to five images and the last sent frame belongs to video clip, it needs 6×3-1=17 frame times until all five images are sent.

Solutions 4:

1) The time to transmit an object of size L over a link or rate R is L/R. The average time is the average size of the object divided by R:
   a = (850,000 bits)/(15,000,000 bits/sec) = 0.0567 sec
   The traffic intensity on the link is given by ab=(16 requests/sec)(0.0567 sec/request) = 0.907. Thus, the average access delay is (0.0567 sec)/(1 - 0.907) ≈ 0.6 seconds. The total average response time is therefore 0.6 sec + 3 sec = 3.6 sec.

2) The traffic intensity on the access link is reduced by 60% since the 60% of the requests are satisfied within the institutional network. Thus the average access delay is (0.0567 sec)/[1 – (0.4)(0.907)] = 0.089 seconds. The response time is approximately zero if the request is satisfied by the cache (which happens with probability 0.6); the average response time is 0.089 sec + 3 sec = 3.089 sec for cache misses (which happens 40% of the time). So the average response time is (0.6)(0 sec) + (0.4)(3.089 sec) = 1.24 seconds. Thus the average response time is reduced from 3.6 sec to 1.24 sec.

Solutions 5:

1) Yes. His first claim is possible, as long as there are enough peers staying in the swarm for a long enough time. Bob can always receive data through optimistic unchoking by other peers.
2) His second claim is also true. He can run a client on each host, let each client “free-ride,” and combine the collected chunks from the different hosts into a single file. He can even write a small scheduling program to make the different hosts ask for different chunks of the file. This is actually a kind of Sybil attack in P2P networks.