23-1 computer network

Hw1 due 10.09 23:59

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1.

1-a. 50 users

1-b. 0.2

1-c.

1-d.

(if there are n user)
$$P(x>31) = \sum_{k=31}^{n} {}_{n}C_{k} \left(P^{k}_{x} \left(1-P^{k-1}\right)^{k}\right)$$

2.

$$\left(\frac{\mathcal{H}^{2}|}{313} = \frac{96 \text{ bir}}{5 \text{ mbyre/s}} = \frac{96.8 \text{ bir}}{5 \cdot 10^{6} \text{ bir}} = 0.0001536 \text{ s} = 0.1536 \text{ msec} + 6 \text{ msec} = 11.1536 \text{ msec}$$

11.1536 (msec)

3.

- 3-a. 200mesc, 6000msec
- 3-b. 2msec, 4msec
- 3-c. 204msec / if we don't use message segmentation, the transmission delay is N*P*(L/R). but when we use message segmentation, the transmission delay is (N+P-1) *(L/R) and as P increases, it becomes more time-efficient to use message segmentation. (N: number of links, P: number of packets, L: length of packet, R: bps of link)
- 3-d. using message segmentation is very useful when the switches use store-and forward packets switching. Each router should store all unit to send to next router, and the unit need to be stored became smaller when using message segmentation, it can prevent packet loss. And message

segmentation makes the users who want to be using the same link can using it fair. It prevents that user need to be waiting too much time for a single transfer.

4.

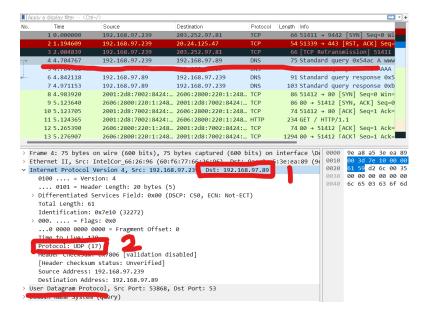
Non-persistence requires RTT time for each packet transmissions. So, we need handshaking 11 times. But even if we use parallel downloads, the total time is same as non-parallel downloads because each link transmit rate became 300/N bps when there are N parallel connections. So, I think this way is not efficient because cannot take the advantage of parallel connections.

If we consider persistent HTTP, the procedure of 10 handshaking is not needed. Still, we cannot take the advantage of parallel connection, but the absolute time taken might be better than nonpersistent way because its matter of amount of data needs to be delivered.

5.

No.	Time	Source	Destination	Protocol	Length	Info
	1 0.000000	192.168.97.239	203.252.97.81	TCP	66	51411 → 9442 [SYN] Seq=0 Win=642
	2 1.194609	192.168.97.239	20.24.125.47	ТСР	54	51339 → 443 [RST, ACK] Seq=1 Ack
	3 2.004839	192.168.97.239	203.252.97.81	TCP	66	[TCP Retransmission] 51411 → 944
	4 4.704767	192.168.97.239	192.168.97.89	DNS	75	Standard query 0x54ac A www.exam
	5 4.704981	192.168.97.239	192.168.97.89	DNS	75	Standard query 0xbf46 AAAA www.e
	6 4.842118	192.168.97.89	192.168.97.239	DNS	91	Standard query response 0x54ac A
	7 4.971153	192.168.97.89	192.168.97.239	DNS	103	Standard query response 0xbf46 A
	8 4.983920	2001:2d8:7002:8424:	2606:2800:220:1:248	TCP	86	$51412 \rightarrow 80$ [SYN] Seq=0 Win=64860
	9 5.123640	2606:2800:220:1:248	2001:2d8:7002:8424:	TCP	86	$80 \rightarrow 51412$ [SYN, ACK] Seq=0 Ack=
	10 5.123705	2001:2d8:7002:8424:	2606:2800:220:1:248	TCP	74	$51412 \rightarrow 80$ [ACK] Seq=1 Ack=1 Win
	11 5.124365	2001:2d8:7002:8424:	2606:2800:220:1:248	HTTP	234	GET / HTTP/1.1
	12 5.265390	2606:2800:220:1:248	2001:2d8:7002:8424:	TCP	74	$80 \rightarrow 51412$ [ACK] Seq=1 Ack=161 W
	13 5.276907	2606:2800:220:1:248	2001:2d8:7002:8424:	TCP	1294	80 \rightarrow 51412 [ACK] Seq=1 Ack=161 W
	14 5.276907	2606:2800:220:1:248	2001:2d8:7002:8424:	HTTP	445	HTTP/1.1 200 OK (text/html)
	15 5.276960	2001:2d8:7002:8424:	2606:2800:220:1:248	TCP	74	51412 → 80 [ACK] Seq=161 Ack=159
	16 5.808517	IntelCor_66:26:96	9e:a8:a5:3e:ea:89	ARP	42	Who has 192.168.97.89? Tell 192.
	17 5.812541	9e:a8:a5:3e:ea:89	IntelCor_66:26:96	ARP	42	192.168.97.89 is at 9e:a8:a5:3e:
	18 6.012045	192.168.97.239	203.252.97.81	TCP	66	[TCP Retransmission] 51411 → 944

Whole packets



5-a. first destination might be the IP of my default DNS.

Dst: 192.168.97.89

5-b. UDP protocol

5-c.

response filed is 0 and it means this is query packet. Opcode is type of query, and the value is 0000 in common case. Truncation is 0 and it means that all the contents is delivered. Recursion is 1 and it means this packet is using recursion. Reserved bit is reserved, so it is cleared to 0. Question means the number of questions. In these cases, only one question is delivered. Other fields are number of each session.

Queries are consisting of some fields. Name filed contains name of domain that required, and name of host. Type means type of query. In the cases, A mean the address of host and AAAA means address of Ipv6. Class filed is type of network class. The case is IN, means Internet.

```
.... .... 0 .... = Non-authenticated data: Unacceptable
                                                                                                 .... 0000 = Reply code: No error (0)
  Questions: 1
  Answer RRs: 1
                                                                                          Answer RRs: 1
  Authority RRs: 0
Additional RRs: 0
                                                                                          Authority RRs: 0
                                                                                         Additional RRs: 0
∨ Oueries
                                                                                       v Oueries
   www.example.com: type A, class IN
Name: www.example.com
[Name Length: 15]
                                                                                          ∨ www.example.com: type AAAA, class IN
                                                                                              Name: www.example.com
[Name Length: 15]
       [Label Count: 3]
      Type: A (Host Address) (1)
Class: IN (0x0001)
                                                                                               [Label Count: 3]
                                                                                                Type: AAAA (IPv6 Address) (28)
                                                                                               Class: IN (0x0001)
   www.example.com: type A, class IN, addr 93.184.216.34
      Name: www.example.com
Type: A (Host Address) (1)
Class: IN (0x0001)
                                                                                          www.example.com: type AAAA, class IN, addr 2606:2800:220:1:248:1893:25c8
                                                                                               Name: www.example.com
                                                                                               Type: AAAA (IPv6 Address) (28)
       Time to live: 49492 (13 hours, 44 minutes, 52 seconds)
                                                                                               Class: IN (0x0001)
  Data length: 4
Address: 93.184.216.34
[Request In: 4]
                                                                                               Time to live: 1800 (30 minutes)
                                                                                               Data length: 16
                                                                                               AAAA Address: 2606:2800:220:1:248:1893:25c8:1946
  [Time: 0.137351000 seconds]
                                                                                          [Time: 0.266172000 seconds]
```

5-d.

Answers section is about the response of queries and consist of some fields. Name filed indicates name of domain, type and class filed are same as above answer. Time to live means the time DNS server saved the data as cache. Data length is length of data, and Address is actual data they tried to deliver.

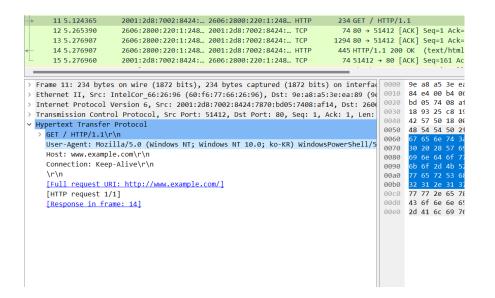
5-e.

In the final response packet, AAAA Address might be the IP address.

AAAA Address: 2606:2800:220:1:248:1893:25c8:1946

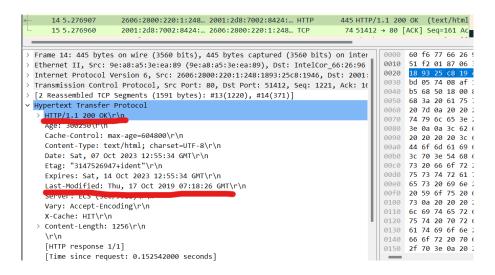
```
11 5.124365
                       2001:2d8:7002:8424:... 2606:2800:220:1:248... HTTP
                                                                            234 GET / HTTP/1.1
      12 5.265390
                       2606:2800:220:1:248... 2001:2d8:7002:8424:... TCP
                                                                             74 80 → 51412 [ACK] Seq=1 Ack=
> Frame 11: 234 bytes on wire (1872 bits), 234 bytes captured (1872 bits) on inter-
                                                                                             9e a8 a5 3e ea
> Ethernet II, Src: IntelCor 66:26:96 (60:f6:77:66:26:96), Dst: 9e:a8:a5:3e:ea:89
                                                                                       0020
                                                                                             bd 05 74 08 af
∨ Internet Protocol Version 6, Src: 2001:2d8:7002:8424:7870:bd05:7408:af14, Dst: 20
                                                                                             18 93 25 c8 19
    0110 .... = Version: 6
                                                                                       0040
                                                                                             42 57 50 18 00
48 54 54 50 2f
  > .... 0000 0000 .... ....
                              .... = Traffic Class: 0x00 (DSCP: CS0, ECN:
                                                                                       0050
     .... 0010 1000 0100 1110 0100 = Flow Label: 0x284e4
    Payload Length: 180
                                                                                       0070
                                                                                             30 20 28 57 69
    Next Header: TCP (6)
                                                                                       9999
                                                                                             6b 6f 2d 4b 52
    Source Address: 2001:2d8:7002:8424:7870:bd05:7408:af14
                                                                                             77 65 72 53 68
    Destination Address: 2606:2800:220:1:248:1893:25c8:1946
                                                                                       00b0
                                                                                             32 31 2e 31 37
Transmission Control Protocol, Src Port: 51412, Dst Port: 80, Seq: 1, Ack: 1, Ler
                                                                                       00c0
                                                                                             77 77 2e 65 78
    Destination Port: 80
                                                                                       00e0
                                                                                             2d 41 6c 69 76
    [Stream index: 2]
     [Conversation completeness: Incomplete, DATA (15)]
    [TCP Segment Len: 160]
                          (relative sequence number)
    Sequence Number: 1
    Sequence Number (raw): 1024046280
    [Next Sequence Number: 161
                                  (relative sequence number)]
    Acknowledgment Number: 1
                                (relative ack number)
```

5-f. TCP protocol



5-g. User-Agent means OS information of client's application. In this case, User-agent is like that.

User-Agent: Mozilla/5.0 (Windows NT; Windows NT 10.0; ko-KR) WindowsPowerShell/



- 5-h HTTP/1.1 version
- 5-i. status code returned from the server is 200 OK
- 5-j last modified time is like that.

Last-Modified: Thu, 17 Oct 2019 07:18:26 GMT\r\n



5-k. bytes of contents are 1256 in this case.