1\

```
▼ User Datagram Protocol, Src Port: 53 (53), Dst Port: 60263 (60263)
    Source Port: 53
    Destination Port: 60263
    Length: 56
  ▶ Checksum: 0x9881 [validation disabled]
    [Stream index: 212]
```

there are five headers: source port; destination port, length and checksum.

2\

```
▼ User Datagram Protocol, Src Port: 53 (53), Dst Port: 60263 (60263)
    Source Port: 53
    Destination Port: 60263
    Length: 56
  ▶ Checksum: 0x9881 [validation disabled]
    [Stream index: 212]
▶ Domain Name System (response)
```

```
0000  ac bc 32 b8 45 d1 00 90  0b 27 0e f5 08 00 45 00   ..2.E... .'....E.
0010  00 4c fe 67 00 00 35 11  dd b1 08 08 08 08 64 41   .L.g..5. ......dA
0020  35 37 00 35 eb 67 00 38  98 81 53 9d 81 80 00 01   57.5.g.8 ..S.....
0030  00 01 00 00 00 00 03 77  77 77 06 67 6f 6f 67 6c   .......w ww.googl
0040  65 03 63 6f 6d 00 00 01  00 01 c0 0c 00 01 00 01   e.com... ........
0050  00 00 00 c1 00 04 ac d9  01 64                     ........ .d
```

the length of each of the UDP header is 2 bytes long.

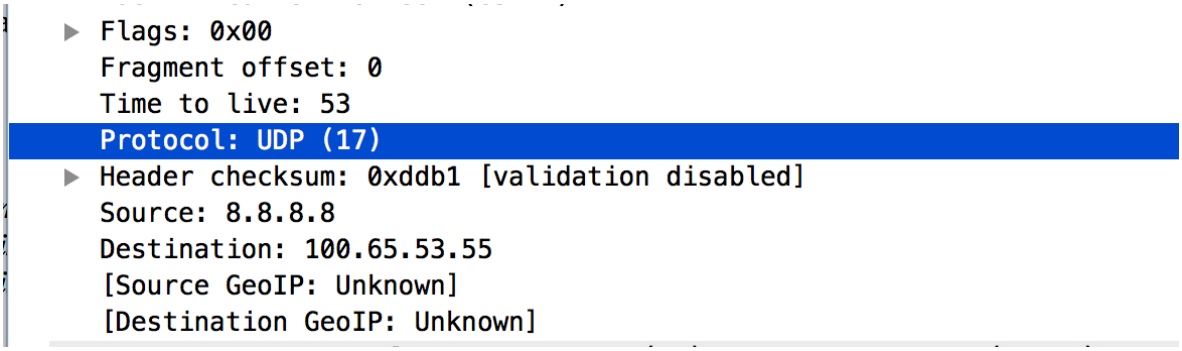
3\ the value in the length field is the sum of the 8 header bytes, plus 48 encapsulated data bytes.

```
▼ User Datagram Protocol, Src Port: 53 (53), Dst Port: 60263 (60263)
    Source Port: 53
    Destination Port: 60263
    Length: 56
  ▶ Checksum: 0x9881 [validation disabled]
    [Stream index: 212]
```

4\ The maximum number of bytes that can be included in UDP payload is 2^16 - 1 less the header bytes. This gives 65535 - 8 = 65527 bytes.

5\ The largest possible source port number is 2^16 - 1 = 65535

6\

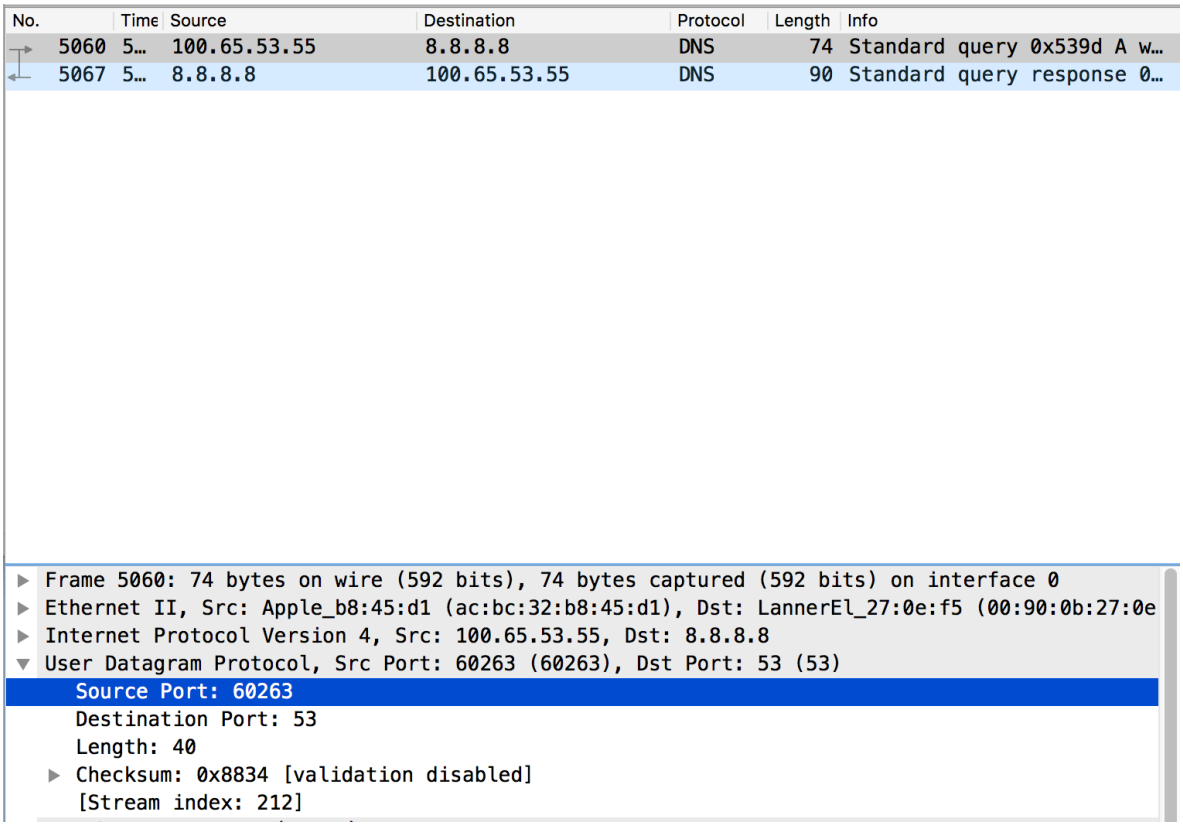


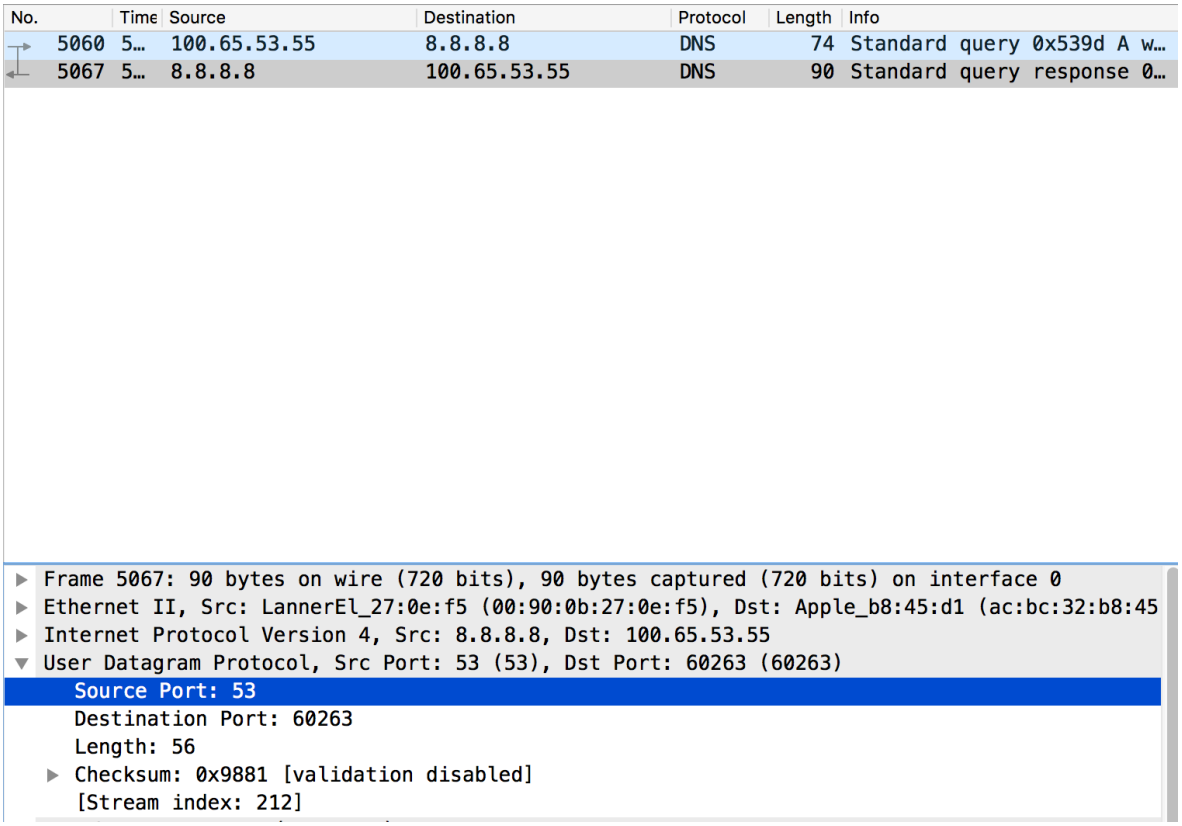
The IP protocol number for UDP is 0x11 hex, which is 17 in decimal value.

7\

The UDP checksum is calculated as the 16-bits one's complement of the one's complement sum of a pseudo header of information from the IP header, the UDP header, and the data. This is padded as needed with zero bytes at the end to make a multiple of two bytes. If the checksum is computed to be 0, it must be set to 0xFFFF

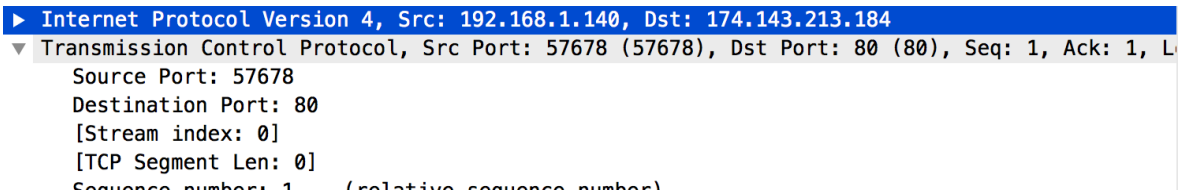
8\





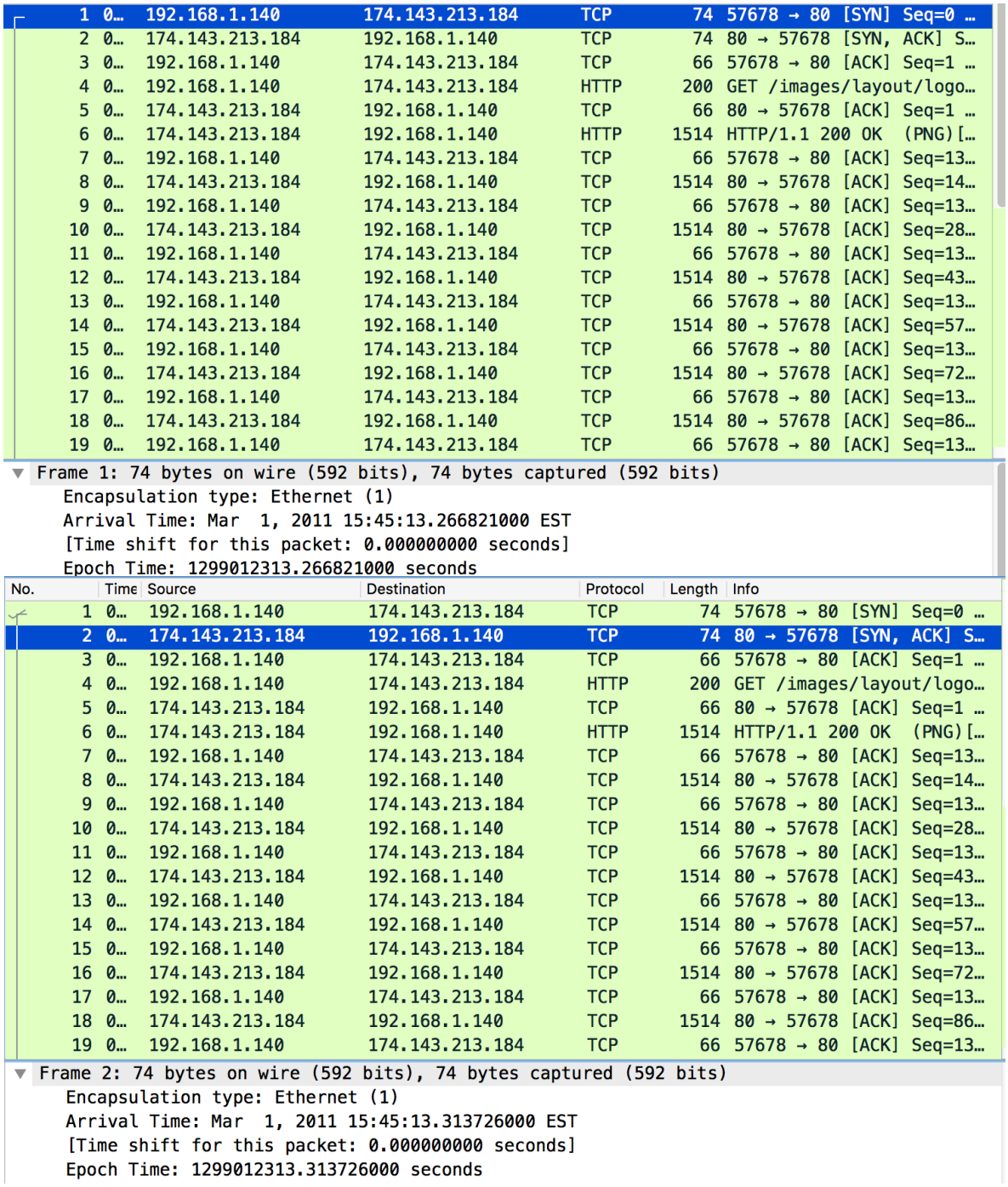
2.

1\



IP address of the client, 192.168.1.140; server IP address, 174.143.213.184
src port number 57678; destination port number: 80

2\



No.	Time	Source	Destination	Protocol	Length	Info
1	0…	192.168.1.140	174.143.213.184	TCP	74	57678 → 80 [SYN] Seq=0 …
2	0…	174.143.213.184	192.168.1.140	TCP	74	80 → 57678 [SYN, ACK] S…
3	0…	192.168.1.140	174.143.213.184	TCP	66	57678 → 80 [ACK] Seq=1 …
4	0…	192.168.1.140	174.143.213.184	HTTP	200	GET /images/layout/logo…
5	0…	174.143.213.184	192.168.1.140	TCP	66	80 → 57678 [ACK] Seq=1 …
6	0…	174.143.213.184	192.168.1.140	HTTP	1514	HTTP/1.1 200 OK (PNG)[…
7	0…	192.168.1.140	174.143.213.184	TCP	66	57678 → 80 [ACK] Seq=13…
8	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=14…
9	0…	192.168.1.140	174.143.213.184	TCP	66	57678 → 80 [ACK] Seq=13…
10	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=28…
11	0…	192.168.1.140	174.143.213.184	TCP	66	57678 → 80 [ACK] Seq=13…
12	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=43…
13	0…	192.168.1.140	174.143.213.184	TCP	66	57678 → 80 [ACK] Seq=13…
14	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=57…
15	0…	192.168.1.140	174.143.213.184	TCP	66	57678 → 80 [ACK] Seq=13…
16	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=72…
17	0…	192.168.1.140	174.143.213.184	TCP	66	57678 → 80 [ACK] Seq=13…
18	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=86…
19	0…	192.168.1.140	174.143.213.184	TCP	66	57678 → 80 [ACK] Seq=13…

```
▼ Frame 1: 74 bytes on wire (592 bits), 74 bytes captured (592 bits)
    Encapsulation type: Ethernet (1)
    Arrival Time: Mar  1, 2011 15:45:13.266821000 EST
    [Time shift for this packet: 0.000000000 seconds]
    Epoch Time: 1299012313.266821000 seconds
```

No.	Time	Source	Destination	Protocol	Length	Info
1	0…	192.168.1.140	174.143.213.184	TCP	74	57678 → 80 [SYN] Seq=0 …
2	0…	174.143.213.184	192.168.1.140	TCP	74	80 → 57678 [SYN, ACK] S…
3	0…	192.168.1.140	174.143.213.184	TCP	66	57678 → 80 [ACK] Seq=1 …
4	0…	192.168.1.140	174.143.213.184	HTTP	200	GET /images/layout/logo…
5	0…	174.143.213.184	192.168.1.140	TCP	66	80 → 57678 [ACK] Seq=1 …
6	0…	174.143.213.184	192.168.1.140	HTTP	1514	HTTP/1.1 200 OK (PNG)[…
7	0…	192.168.1.140	174.143.213.184	TCP	66	57678 → 80 [ACK] Seq=13…
8	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=14…
9	0…	192.168.1.140	174.143.213.184	TCP	66	57678 → 80 [ACK] Seq=13…
10	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=28…
11	0…	192.168.1.140	174.143.213.184	TCP	66	57678 → 80 [ACK] Seq=13…
12	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=43…
13	0…	192.168.1.140	174.143.213.184	TCP	66	57678 → 80 [ACK] Seq=13…
14	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=57…
15	0…	192.168.1.140	174.143.213.184	TCP	66	57678 → 80 [ACK] Seq=13…
16	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=72…
17	0…	192.168.1.140	174.143.213.184	TCP	66	57678 → 80 [ACK] Seq=13…
18	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=86…
19	0…	192.168.1.140	174.143.213.184	TCP	66	57678 → 80 [ACK] Seq=13…

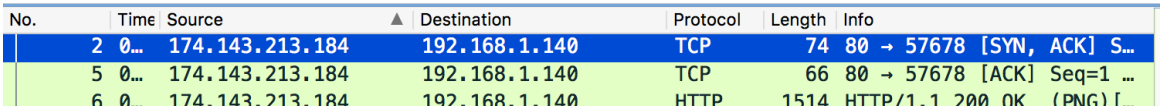
```
▼ Frame 2: 74 bytes on wire (592 bits), 74 bytes captured (592 bits)
    Encapsulation type: Ethernet (1)
    Arrival Time: Mar  1, 2011 15:45:13.313726000 EST
    [Time shift for this packet: 0.000000000 seconds]
    Epoch Time: 1299012313.313726000 seconds
```

A rough estimate for RTT is the time when SYN-ACK arrived the sender minus the time for SYN arriving the receiver. The rough time is 13.313726000 – 13.266821000 = 0.05 second

2	0…	174.143.213.184	192.168.1.140	TCP	74	80 → 57678 [SYN, ACK] S…
5	0…	174.143.213.184	192.168.1.140	TCP	66	80 → 57678 [ACK] Seq=1 …
6	0…	174.143.213.184	192.168.1.140	HTTP	1514	HTTP/1.1 200 OK (PNG)[…
8	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=14…
10	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=28…
12	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=43…
14	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=57…
16	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=72…
18	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=86…
20	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=10…
22	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=11…
24	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=13…
26	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [PSH, ACK] S…
28	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=15…
30	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=17…
32	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=18…
34	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=20…
36	0…	174.143.213.184	192.168.1.140	TCP	391	80 → 57678 [PSH, ACK] S…
39	0…	174.143.213.184	192.168.1.140	TCP	66	80 → 57678 [FIN, ACK] S…

roughly 20 RTTs are needed to finished this connection.

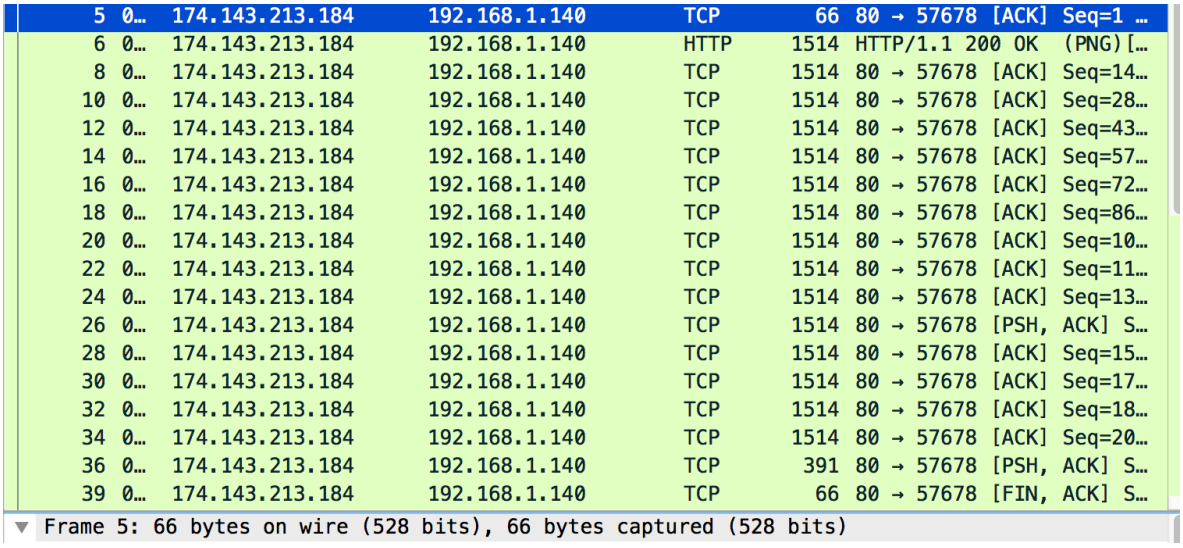
3\



No.	Time	Source	Destination	Protocol	Length	Info
2	0…	174.143.213.184	192.168.1.140	TCP	74	80 → 57678 [SYN, ACK] S…
5	0…	174.143.213.184	192.168.1.140	TCP	66	80 → 57678 [ACK] Seq=1 …
6	0…	174.143.213.184	192.168.1.140	HTTP	1514	HTTP/1.1 200 OK (PNG)[…

the length of the header is 74.

5\



5	0…	174.143.213.184	192.168.1.140	TCP	66	80 → 57678 [ACK] Seq=1 …
6	0…	174.143.213.184	192.168.1.140	HTTP	1514	HTTP/1.1 200 OK (PNG)[…
8	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=14…
10	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=28…
12	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=43…
14	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=57…
16	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=72…
18	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=86…
20	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=10…
22	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=11…
24	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=13…
26	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [PSH, ACK] S…
28	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=15…
30	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=17…
32	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=18…
34	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=20…
36	0…	174.143.213.184	192.168.1.140	TCP	391	80 → 57678 [PSH, ACK] S…
39	0…	174.143.213.184	192.168.1.140	TCP	66	80 → 57678 [FIN, ACK] S…

▼ Frame 5: 66 bytes on wire (528 bits), 66 bytes captured (528 bits)

the 2nd RTT contains 66 bytes, 3rd RTT contains 66 bytes, 4th RTT contains 1514 bytes.

6\

2	0…	174.143.213.184	192.168.1.140	TCP	74	80 → 57678 [SYN, ACK] Seq=0 Ack=1 W…
5	0…	174.143.213.184	192.168.1.140	TCP	66	80 → 57678 [ACK] Seq=1 Ack=135 Win=…
6	0…	174.143.213.184	192.168.1.140	HTTP	1514	HTTP/1.1 200 OK (PNG)[Malformed Pa…
8	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=1449 Ack=135 W…
10	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=2897 Ack=135 W…
12	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=4345 Ack=135 W…
14	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=5793 Ack=135 W…
16	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=7241 Ack=135 W…
18	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=8689 Ack=135 W…
20	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=10137 Ack=135 …
22	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=11585 Ack=135 …
24	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=13033 Ack=135 …
26	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [PSH, ACK] Seq=14481 Ack…
28	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=15929 Ack=135 …
30	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=17377 Ack=135 …
32	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=18825 Ack=135 …
34	0…	174.143.213.184	192.168.1.140	TCP	1514	80 → 57678 [ACK] Seq=20273 Ack=135 …
36	0…	174.143.213.184	192.168.1.140	TCP	391	80 → 57678 [PSH, ACK] Seq=21721 Ack…
39	0…	174.143.213.184	192.168.1.140	TCP	66	80 → 57678 [FIN, ACK] Seq=22046 Ack…

```
▼ Transmission Control Protocol, Src Port: 80 (80), Dst Port: 57678 (57678), Seq: 0, Ack: 1, Len: 0
    Source Port: 80
    Destination Port: 57678
    [Stream index: 0]
    [TCP Segment Len: 0]
    Sequence number: 0    (relative sequence number)
    Acknowledgment number: 1    (relative ack number)
    Header Length: 40 bytes
  ▶ Flags: 0x012 (SYN, ACK)
    Window size value: 5792
    [Calculated window size: 5792]
```

window size is 5792, as you can see from the graph below:

No.	Time	Source	Destination	Protocol	Length	Info
4	0…	192.168.1.140	174.143.213.184	HTTP	200	GET /images/layout/logo.png HTTP/1.0
7	0…	192.168.1.140	174.143.213.184	TCP	66	57678 → 80 [ACK] Seq=135 Ack=1449 Win=8832 Len=0 TSval=2216548 TSecr=…
9	0…	192.168.1.140	174.143.213.184	TCP	66	57678 → 80 [ACK] Seq=135 Ack=2897 Win=11648 Len=0 TSval=2216548 TSecr…
11	0…	192.168.1.140	174.143.213.184	TCP	66	57678 → 80 [ACK] Seq=135 Ack=4345 Win=14592 Len=0 TSval=2216548 TSecr…
13	0…	192.168.1.140	174.143.213.184	TCP	66	57678 → 80 [ACK] Seq=135 Ack=5793 Win=17536 Len=0 TSval=2216553 TSecr…
15	0…	192.168.1.140	174.143.213.184	TCP	66	57678 → 80 [ACK] Seq=135 Ack=7241 Win=20352 Len=0 TSval=2216553 TSecr…
17	0…	192.168.1.140	174.143.213.184	TCP	66	57678 → 80 [ACK] Seq=135 Ack=8689 Win=23296 Len=0 TSval=2216553 TSecr…
19	0…	192.168.1.140	174.143.213.184	TCP	66	57678 → 80 [ACK] Seq=135 Ack=10137 Win=26112 Len=0 TSval=2216553 TSec…
21	0…	192.168.1.140	174.143.213.184	TCP	66	57678 → 80 [ACK] Seq=135 Ack=11585 Win=29056 Len=0 TSval=2216553 TSec…
23	0…	192.168.1.140	174.143.213.184	TCP	66	57678 → 80 [ACK] Seq=135 Ack=13033 Win=32000 Len=0 TSval=2216553 TSec…
25	0…	192.168.1.140	174.143.213.184	TCP	66	57678 → 80 [ACK] Seq=135 Ack=14481 Win=34816 Len=0 TSval=2216557 TSec…
27	0…	192.168.1.140	174.143.213.184	TCP	66	57678 → 80 [ACK] Seq=135 Ack=15929 Win=37760 Len=0 TSval=2216558 TSec…
29	0…	192.168.1.140	174.143.213.184	TCP	66	57678 → 80 [ACK] Seq=135 Ack=17377 Win=40704 Len=0 TSval=2216558 TSec…
31	0…	192.168.1.140	174.143.213.184	TCP	66	57678 → 80 [ACK] Seq=135 Ack=18825 Win=43520 Len=0 TSval=2216558 TSec…
33	0…	192.168.1.140	174.143.213.184	TCP	66	57678 → 80 [ACK] Seq=135 Ack=20273 Win=46464 Len=0 TSval=2216558 TSec…
35	0…	192.168.1.140	174.143.213.184	TCP	66	57678 → 80 [ACK] Seq=135 Ack=21721 Win=49280 Len=0 TSval=2216558 TSec…
37	0…	192.168.1.140	174.143.213.184	TCP	66	57678 → 80 [ACK] Seq=135 Ack=22046 Win=52224 Len=0 TSval=2216558 TSec…
38	0…	192.168.1.140	174.143.213.184	TCP	66	57678 → 80 [FIN, ACK] Seq=135 Ack=22046 Win=52224 Len=0 TSval=2216558…
40	0…	192.168.1.140	174.143.213.184	TCP	66	57678 → 80 [ACK] Seq=136 Ack=22047 Win=52224 Len=0 TSval=2216563 TSec…

the window size grow steadily to 52224, which means that the sender is never throttled due to lacking of receiver buffer space by inspecting this trace.