Lab 1 - Protocol Layers

Step 1: Capture a Trace

Proceed as follows to capture a trace of network traffic; alternatively, you may use a supplied trace. We want this trace to look at the protocol structure of packets. A simple Web fetch of a URL from a server of your choice to your computer, which is the client, will serve as traffic.

1. Pick a URL and fetch it with wget or curl. For example, "wget http://www.google.com" or "curl http://www.google.com". This will fetch the resource and either write it to a file (wget) or to the screen (curl). You are checking to see that the fetch works and retrieves some content. A successful example is shown below (with added highlighting) for wget. You want a single response with status code "200 OK". If the fetch does not work then try a different URL; if no URLs seem to work then debug your use of wget/curl or your Internet connectivity.

- 2. Close unnecessary browser tabs and windows. By minimizing browser activity you will stop your computer from fetching unnecessary web content, and avoid incidental traffic in the trace.
- 3. Launch Wireshark and start a capture with a filter of "tcp port 80" and check "enable net-work name resolution". This filter will record only standard web traffic and not other kinds of packets that your computer may send. The checking will translate the addresses of the computers sending and receiving packets into names, which should help you to recognize whether the packets are going to or from your computer.
- 4. When the capture is started, repeat the web fetch using wget/curl above. This time, the packets will be recorded by Wireshark as the content is transferred.

5. After the fetch is successful, return to Wireshark and use the menus or buttons to stop the trace. If you have succeeded, the upper Wireshark window will show multiple packets, and most likely it will be full. How many packets are captured will depend on the size of the web page, but there should be at least 8 packets in the trace, and typically 20-100, and many of these packets will be colored green. An example is shown below. Congratulations, you have captured a trace!

```
66 6494 + 80 [SYN] Seq=0 kin=64240 Len=0 MSS=1460 WS=256 SACK_PERM=1
66 80 + 6494 [SYN, ACK] Seq=0 Ack=1 kin=65535 Len=0 MSS=1430 SACK_PERM=1 WS=256
54 6494 + 80 [ACK] Seq=1 Ack=1 kin=65612 Len=0
191 GET / HTTP1.1
60 80 + 6494 [ACK] Seq=1 Ack=138 kin=66516 Len=0
522 HTTP1.1 301 Roved Permanently (Lett/Ital)
66 6495 + 80 [SYN] Seq=0 Min=64240 Len=0 MSS=1460 WS=256 SACK_PERM=1
66 6495 + 80 [SYN] Seq=0 Ack=1 kin=66720 Len=0 MSS=1380 SACK_PERM=1
66 6495 + 80 [SYN] Seq=0 Ack=1 kin=66720 Len=0 MSS=1380 SACK_PERM=1 WS=256
54 6495 + 80 [ACK] Seq=1 Ack=1 kin=60720 Len=0 MSS=1380 SACK_PERM=1 WS=256
54 6495 + 80 [ACK] Seq=1 Ack=1 kin=60720 Len=0 MSS=1380 SACK_PERM=1 WS=256
54 6495 + 80 [ACK] Seq=1 Ack=1 kin=60720 Len=0
150 GET / HTTP1.1
60 80 + 6495 [ACK] Seq=1 Ack=142 kin=61952 Len=1430 [TCP segment of a reassembled PDU]
1484 80 + 6495 [ACK] Seq=1431 Ack=142 kin=61952 Len=1430 [TCP segment of a reassembled PDU]
1484 80 + 6495 [ACK] Seq=261 Ack=142 kin=61952 Len=1430 [TCP segment of a reassembled PDU]
1484 80 + 6495 [ACK] Seq=261 Ack=142 kin=61952 Len=1430 [TCP segment of a reassembled PDU]
1484 80 + 6495 [ACK] Seq=271 Ack=142 kin=61952 Len=1430 [TCP segment of a reassembled PDU]
1484 80 + 6495 [ACK] Seq=271 Ack=142 kin=61952 Len=1430 [TCP segment of a reassembled PDU]
1484 80 + 6495 [ACK] Seq=281 Ack=142 kin=61952 Len=1430 [TCP segment of a reassembled PDU]
1484 80 + 6495 [ACK] Seq=281 Ack=142 kin=61952 Len=1430 [TCP segment of a reassembled PDU]
1484 80 + 6495 [ACK] Seq=281 Ack=142 kin=61952 Len=1430 [TCP segment of a reassembled PDU]
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1484 80 + 6495 [ACK] Seq=281 Ack=142 kin=61952 Len=1430 [TCP segment of a reassembled PDU]
1484 80 + 6495 [ACK] Seq=281 Ack=142 kin=61952 Len=1430 [TCP segment of a reassembled PDU]
1485 80 + 6495 [ACK] Seq=2814 Ack=142 k
  1 0.000000
2 0.005111
3 0.005212
4 0.025028
5 0.030344
6 0.039274
7 0.0661316
8 0.065974
9 0.066144
10 0.080132
11 0.085384
12 0.089871
13 0.142500
14 0.142500
15 0.142500
17 0.142500
17 0.142500
17 0.142500
18 0.142500
19 0.142500
20 0.142500
21 0.142500
22 0.142500
                                                                                                                                                                                                                                                                                    192.168.1.151
192.168.1.151
                                                                                                                                                                                                                                                                                    192.168.1.151
192.168.1.151
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         1116 HTTP/1.1 200 OK [TCP segment of a reassembled PDU]
54 6495 → 80 [ACK] Seq=142 Ack=13933 Win=262144 Len=0
  23 0.142766
                                                                                                                                                                                                                                                                                    172,217,10,36
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       54 6495 + 80 [ACK] Seq-142 Ack-13933 kin-262144 Len-9
156 HTTP-1.1 200 0X (text/html)
54 6494 + 80 [FIN, ACK] Seq-138 Ack-529 kin-262400 Len-9
54 6495 + 80 [FIN, ACK] Seq-142 Ack-14795 kin-262400 Len-0
68 80 + 6494 [FIN, ACK] Seq-152 Ack-139 kin-262400 Len-0
54 6494 + 80 [ACK] Seq-139 Ack-530 kin-262400 Len-0
68 80 + 6495 [FIN, ACK] Seq-14795 Ack-134 kin-65952 Len-0
54 6495 + 80 [ACK] Seq-14795 Ack-134 kin-65952 Len-0
54 6495 + 80 [ACK] Seq-14795 Ack-134 kin-65952 Len-0
  24 0.145744
                                                                                                                         172.217.10.3
  25 0.167897
                                                                                                                                                                                                                                                                                  172,217,6,206
  27 0.172374
                                                                                                                            172,217,6,206
  28 0.172660
                                                                                                                                                                                                                                                                                  172.217.6.206
                                                                                                                         172.217.10.36
                                                                                                                       192.168.1.151
                                                                                                                                                                                                                                                                               172.217.10.36
```

Step 2: Inspect the Trace

Select a packet for which the Protocol column is "HTTP" and the Info column says it is a GET. It is the packet that carries the web (HTTP) request sent from your computer to the server. (You can click the column headings to sort by that value, though it should not be difficult to find an HTTP packet by inspection.) Let's have a closer look to see how the packet structure reflects the protocols that are in use.

```
1 0.000000
                        192.168.1.151
                                               172.217.9.238
                                                                                   66 50359 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM=1
                                               192.168.1.151
172.217.9.238
                                                                                   66 80 \rightarrow 50359 [SYN, ACK] Seq=0 Ack=1 Win=60720 Len=0 MSS=1380 SACK_PERM=1 WS=256 54 50359 \rightarrow 80 [ACK] Seq=1 Ack=1 Win=262144 Len=0
       2 0.004604
                        172.217.9.238
                                                                      TCP
                                                                      TCP
       3 0.004883
                        192.168.1.151
                        192.168.1.151
                                                                                 191 GET / HTTP/1.1
       5 0.035254
                        172.217.9.238
                                               192.168.1.151
                                                                       TCP
                                                                                   60 80 → 50359 [ACK] Seq=1 Ack=138 Win=61952 Len=0
                                                                      HTTP
                        172.217.9.238
       6 0.044222
                                               192.168.1.151
                                                                                 582 HTTP/1.1 301 Moved Permanently (text/html)
                                               172.217.3.100
                                                                                   66 50360 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM=1
       7 0.073539
                        192.168.1.151
       8 0.077854
                        172.217.3.100
                                                                                 66 80 → 50360 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1430 SACK_PERM=1 WS=256
                                               192.168.1.151
wget "google.com"
```

Since we are fetching a web page, we know that the protocol layers being used are as shown below. That is, HTTP is the application layer web protocol used to fetch URLs. Like many Internet applications, it runs on top of the TCP/IP transport and network layer protocols. The link and physical layer protocols

depend on your network, but are typically combined in the form of Ethernet (shown) if your computer is wired, or 802.11 (not shown) if your computer is wireless.

With the HTTP GET packet selected, look closely to see the similarities and differences between it and our protocol stack as described next. The protocol blocks are listed in the middle panel. You can expand each block (by clicking on the "+" expander or icon) to see its details.

• The first Wireshark block is "Frame". This is not a protocol, it is a record that describes overall information about the packet, including when it was captured and how many bits long it is.

```
✓ Frame 4: 191 bytes on wire (1528 bits), 191 bytes captured (1528 bits) on interface \Device\NPF_{FRBDE0E-2083-4888-BFC9-2460E1FE7C6F}, id 0
   > Interface id: 0 (\Device\NPF_{FF8BDE0E-2083-4888-BFC9-2460E1FE7C6F})
    Encapsulation type: Ethernet (1)
    Arrival Time: Sep 30, 2020 16:33:02.722608000 Eastern Summer Time
    [Time shift for this packet: 0.000000000 seconds]
     Epoch Time: 1601497982.722608000 seconds
     [Time delta from previous captured frame: 0.025241000 seconds]
     [Time delta from previous displayed frame: 0.025241000 seconds]
     [Time since reference or first frame: 0.030124000 seconds]
     Frame Number: 4
    Frame Length: 191 bytes (1528 bits)
    Capture Length: 191 bytes (1528 bits)
    [Frame is marked: False]
     [Frame is ignored: False]
     [Protocols in frame: eth:ethertype:ip:tcp:http]
     [Coloring Rule Name: HTTP]
     [Coloring Rule String: http || tcp.port == 80 || http2]
```

• The second block is "Ethernet". This matches our diagram! Note that you may have taken a trace on a computer using 802.11 yet still see an Ethernet block instead of an 802.11 block. Why? It happens because we asked Wireshark to capture traffic in Ethernet format on the cap-ture options, so it converted the real 802.11 header into a pseudo-Ethernet header.

• Then come IP, TCP, and HTTP, which are just as we wanted. Note that the order is from the bot-tom of the protocol stack upwards. This is because as packets are passed down the stack, the header information of the lower layer protocol is added to the front of the information from the higher layer protocol, as in Fig. 1-15 of your text. That is, the lower layer protocols come first in the packet "on the wire".

```
> Internet Protocol Version 4, Src: 192.168.1.151, Dst: 172.217.9.238
> Transmission Control Protocol, Src Port: 50359, Dst Port: 80, Seq: 1, Ack: 1, Len: 137
> Hypertext Transfer Protocol
```

Now find another HTTP packet, the response from the server to your computer, and look at the structure of this packet for the differences compared to the HTTP GET packet. This packet should have "200 OK" in the Info field, denoting a successful fetch. In our trace, there are two extra blocks in the detail panel as seen in the next figure.

```
- 24 0.168786 172.217.3.100 192.168.1.151 HTTP 493 HTTP/1.1 200 OK (text/html)
```

• The first extra block says "[11 reassembled TCP segments ...]".

```
[11 Reassembled TCP Segments (14737 bytes): #13(1430), #14(1430), #15(1430), #16(1430), #17(1430), #18(1430), #19(
```

• The second extra block says "Line-based text data ...".

[truncated](function(){google.jl={dw:false,em:[],emw:false,lls:'default',pdt:0,snet:true,uwp:true};})();(function(){var pmc='{\x22d\x22:{},\x22sb_he\x22:{\x22agen\x22:true}}}

Step 3: Packet Structure

function _F_installCss(c){}\n

To show your understanding of packet structure, draw a figure of an HTTP GET packet that shows the position and size in bytes of the TCP, IP and Ethernet protocol headers. Your figure can simply show the overall packet as a long, thin rectangle. Leftmost elements are the first sent on the wire. On this drawing, show the range of the Ethernet header and the Ethernet payload that IP passed to Ethernet to send over the network. To show the nesting structure of protocol layers, note the range of the IP header and the IP

payload. You may have questions about the fields in each protocol as you look at them. We will explore these protocols and fields in detail in future labs.

Turn-in: Hand in your packet drawing.

НТТР	ТСР	IP	Ethernet	
191	20	20	14	Get Packet
bytes	bytes	bytes	bytes	

Step 4: Protocol Overhead

Estimate the download protocol overhead, or percentage of the download bytes taken up by protocol overhead. To do this, consider HTTP data (headers and message) to be useful data for the network to carry, and lower layer headers (TCP, IP, and Ethernet) to be the overhead. We would like this overhead to be small, so that most bits are used to carry content that applications care about. To work this out, first look at only the packets in the download direction for a single web fetch. You might sort on the Destination column to find them. The packets should start with a short TCP packet described as a SYN ACK, which is the beginning of a connection. They will be followed by mostly longer packets in the middle (of roughly 1 to 1.5KB), of which the last one is an HTTP packet. This is the main portion of the download. And they will likely end with a short TCP packet that is part of ending the connection. For each packet, you can inspect how much overhead it has in the form of Ethernet / IP / TCP headers, and how much useful HTTP data it carries in the TCP payload. You may also look at the HTTP packet in Wireshark to learn how much data is in the TCP payloads over all download packets.

Turn-in: Your estimate of download protocol overhead as defined above. Tell us whether you find this overhead to be significant.

Estimation:

1 0.000000 192.168.1.151 172.217.9.238 TCP 66 50359 + 30 [SVN] Seq-0 Win-66240 Len-0 MSS-1260 MS-256 SACK_PERN-1 2 0.004604 172.217.9.238 192.168.1.151 172.217.9.238 TCP 68 09 + 50330 [SVN, Seq-0 Ack-1 Win-66261 Len-0 MSS-1380 SACK_PERN-1 MS-256 3 0.004883 192.168.1.151 172.217.9.238 TCP 54 50359 + 80 [ACK] Seq-1 Ack-1 Win-262144 Len-0 4 0.030124 192.168.1.151 172.217.9.238 TCP 68 09 + 50350 [SVN, Seq-0 Ack-1 Win-262144 Len-0 4 0.030124 192.168.1.151 172.217.9.238 TCP 68 09 + 50350 [ACK] Seq-1 Ack-138 Win-61952 Len-0 6 0.04222 172.217.9.238 192.168.1.151 TCP 66 80 + 50350 [ACK] Seq-1 Ack-138 Win-61952 Len-0 6 0.04222 172.217.9.238 192.168.1.151 TCP 66 80 + 50350 [SVN, ACK] Seq-0 Ack-1 Win-65635 Len-0 MSS-1460 WS-256 SACK_PERN-1 WS-256 9 0.077916 192.168.1.151 172.217.3.100 TCP 54 50350 + 80 [SVN] ACK] Seq-0 Ack-1 Win-65535 Len-0 MSS-1430 SACK_PERN-1 WS-256 9 0.077916 192.168.1.151 172.217.3.100 TCP 54 50359 + 80 [ACK] Seq-1 Ack-142 Win-656316 Len-0 1 1 0.00188 172.217.3.100 TCP 10.00188					
3 0.04883 192.168.1.151 172.217.9.238 TCP 54 50359 + 80 [ACK] Seq=1 Ack=1 Win=262144 Len=0 4 0.030124 192.168.1.151 172.217.9.238 HTTP 191 GET / HTTP/1.1 5 0.035254 172.217.9.238 192.168.1.151 TCP 60 80 + 50359 [ACK] Seq=1 Ack=138 Win=61952 Len=0 6 0.044222 172.217.9.238 192.168.1.151 TCP 60 80 + 50359 [ACK] Seq=1 Ack=138 Win=61952 Len=0 7 0.073539 192.168.1.151 172.217.3.100 TCP 65 69360 + 30 [SV], ACK] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM=1 8 0.077854 172.217.3.100 192.168.1.151 TCP 66 80 + 50360 [SV], ACK] Seq=0 Ack=1 Win=262912 Len=0 10 0.099184 192.168.1.151 172.217.3.100 TCP 54 50360 + 80 [ACK] Seq=1 Ack=1 Win=262912 Len=0 11 0.101689 192.168.1.151 172.217.3.100 HTTP 195 GET / HTTP/1.1 12 0.1016188 172.217.3.100 192.168.1.151 TCP 60 80 + 50360 [ACK] Seq=1 Ack=142 Win=66816 Len=0 13 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=1 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 14 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=130 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 15 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=130 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 16 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=2801 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 16 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=2801 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 17 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=2801 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 18 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=2801 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 18 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=3801 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 19 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=3801 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 19 0.163518	1 0.000000	192.168.1.151	172.217.9.238	TCP	66 50359 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM=1
4 0.030124 192.168.1.151 172.217.9.238 HTTP 191 GET / HTTP/1.1 5 0.033524 172.217.9.238 192.168.1.151 TCP 60 80 + 50359 [ACK] Seq=1 Ack=138 Win=61952 Len=0 6 0.044222 172.217.9.238 192.168.1.151 TCP 65 80 + 50359 [ACK] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM=1 7 0.073539 192.168.1.151 172.217.3.100 TCP 66 50360 + 80 [SVN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM=1 8 0.077816 192.168.1.151 172.217.3.100 TCP 54 50360 + 80 [ACK] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM=1 WS=256 9 0.077916 192.168.1.151 172.217.3.100 TCP 54 50360 + 80 [ACK] Seq=1 Ack=1 Win=265912 Len=0 10 0.099184 192.168.1.151 172.217.3.100 TCP 54 50360 + 80 [ACK] Seq=138 Ack=529 Win=261632 Len=0 11 0.101699 192.168.1.151 172.217.3.100 HTTP 156 GET / HTTP1.1 12 0.106188 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=1 Ack=142 Win=66816 Len=0 13 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=1 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 15 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=2861 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 16 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=2861 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 17 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=2861 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 18 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=27861 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 18 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=27861 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 18 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=1801 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 18 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=1801 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 20 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=1801 Ack=142 Win=66816 Len=143	2 0.004604	172.217.9.238	192.168.1.151	TCP	66 80 → 50359 [SYN, ACK] Seq=0 Ack=1 Win=60720 Len=0 MSS=1380 SACK_PERM=1 WS=256
5 0.035254 172,217.9,238 192,168.1.151 TCP 60 80 → 50350 [ACK] Seq=1 Ack=138 Win=61952 Len=0 6 0.044222 172,217.9,238 192,168.1.151 TCP 66 98 0→ 50350 [ACK] Seq=1 Ack=138 Win=61952 Len=0 7 0.075359 192,168.1.151 172,217.3,100 TCP 66 98 0→ 50360 [SVN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM=1 8 0.077854 172,217.3,100 192,168.1.151 TCP 66 80 → 50360 [SVN] ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1430 SACK_PERM=1 WS=256 9 0.077916 192,168.1.151 172,217.3,100 TCP 54 50360 9 ACK] Seq=1 Ack=134 Win=65535 Len=0 MSS=1430 SACK_PERM=1 WS=256 10 0.099184 192,168.1,151 172,217.9,238 TCP 54 50350 9 & 80 [ACK] Seq=1 Ack=1348 Ack=529 Win=261632 Len=0 11 0.101699 192,168.1,151 172,217.3,100 HTTP 195 GET / HTTP/1.1 12 0.106188 172,217.3,100 192,168.1,151 TCP 1484 80 → 50360 [ACK] Seq=1 Ack=142 Win=66816 Len=0 13 0.163518 172,217.3,100 192,168.1,151 TCP 1484 80 → 50360 [ACK] Seq=2 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 15 0.163518 172,217.3,100 192,168.1,151 TCP 1484 80 → 50360 [ACK] Seq=281 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 16 0.163518 172,217.3,100 192,168.1,151 TCP 1484 80 → 50360 [ACK] Seq=2921 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 16 0.163518 172,217.3,100 192,168.1,151 TCP 1484 80 → 50360 [ACK] Seq=2921 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 18 0.163518 172,217.3,100 192,168.1,151 TCP 1484 80 → 50360 [ACK] Seq=2921 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 18 0.163518 172,217.3,100 192,168.1,151 TCP 1484 80 → 50360 [ACK] Seq=2921 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 19 0.163518 172,217.3,100 192,168.1,151 TCP 1484 80 → 50360 [ACK] Seq=2921 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 20 0.163518 172,217.3,100 192,168.1,151 TCP 1484 80 → 50360 [ACK] Seq=2181 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 21 0.163518 172,217.3,100 192,168.1,151 TCP 1484 80 → 50360 [ACK] Seq=1414 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 21 0.163	3 0.004883	192.168.1.151	172.217.9.238	TCP	54 50359 → 80 [ACK] Seq=1 Ack=1 Win=262144 Len=0
6 0.044222 172.217.9.238 192.168.1.151 HTTP 582 HTTP/1.1 301 Moved Permanently (text/html) 7 0.073559 192.168.1.151 172.217.3.100 TCP 66 9360-9 80 [SVN], ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1460 WS=256 SACK_PERM=1 WS=256 9 0.077916 192.168.1.151 172.217.3.100 TCP 54 9360 SVN, ACK] Seq=1 Ack=1 Win=65535 Len=0 MSS=1430 SACK_PERM=1 WS=256 10 0.099184 192.168.1.151 172.217.3.100 TCP 54 9360 SVN, ACK] Seq=1 Ack=1 Win=262912 Len=0 11 0.101689 192.168.1.151 172.217.3.100 HTTP 195 GET / HTTP/1.1 12 0.106188 172.217.3.100 192.168.1.151 TCP 60 80 + 50360 [ACK] Seq=1 Ack=142 Win=66816 Len=0 13 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=1 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 14 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=2 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 15 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=2 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 16 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=2 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 17 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=292 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 18 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=2921 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 18 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=2581 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 19 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=26581 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 19 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=26581 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 20 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=1001 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 21 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=1001 Ack=142 Win=66816 Len=14	4 0.030124	192.168.1.151	172.217.9.238	HTTP	191 GET / HTTP/1.1
7 0.073539 192.168.1.151 172.217.3.100 TCP 66 50360 + 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM=1 8 0.077854 172.217.3.100 192.168.1.151 TCP 66 80 + 50360 [SYN], ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1430 SACK_PERM=1 WS=256 9 0.077916 192.168.1.151 172.217.3.100 TCP 54 50360 FAW, ACK] Seq=1 Ack=1 Win=65816 Len=0 10 0.099184 192.168.1.151 172.217.3.100 TCP 54 50360 FAW, Seq=1 Ack=1 Win=66816 Len=0 11 0.101689 192.168.1.151 172.217.3.100 HTTP 195 GET / HTTP/1.1 190 GET /	5 0.035254	172.217.9.238	192.168.1.151	TCP	60 80 → 50359 [ACK] Seq=1 Ack=138 Win=61952 Len=0
8 0.077854 172.217.3.100 192.168.1.151 TCP 66 80 + 50360 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1430 SACK_PERM=1 WS=256 9 0.07916 192.168.1.151 172.217.3.100 TCP 54 50360 → 80 [ACK] Seq=1 Ack=1 Win=652912 Len=0 10 0.099184 192.168.1.151 172.217.3.100 HTTP 54 50360 → 80 [ACK] Seq=1 Ack=120 Win=261632 Len=0 11 0.101689 192.168.1.151 172.217.3.100 HTTP 195 GET / HTTP/1.1 12 0.106188 172.217.3.100 192.168.1.151 TCP 60 80 + 50360 [ACK] Seq=1 Ack=142 Win=66816 Len=0 13 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=1 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 14 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=2861 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 15 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=2861 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 16 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=2861 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 17 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=4291 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 17 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=7571 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 19 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=7571 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 19 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=7571 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 20 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=1141A Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 21 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=1141A Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 22 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=1141A Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 22 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [FIN, ACK	6 0.044222	172.217.9.238	192.168.1.151	HTTP	582 HTTP/1.1 301 Moved Permanently (text/html)
9 0.077916 192.168.1.151 172.217.3.100 TCP 54 50360 + 80 [ACK] Seq=1 Ack=1 Win=262912 Len=0 10 0.099184 192.168.1.151 172.217.3.100 HTTP 54 50359 + 80 [ACK] Seq=138 Ack=529 Win=261632 Len=0 11 0.101689 192.168.1.151 172.217.3.100 HTTP 195 GET / HTTP/1.1 12 0.106188 172.217.3.100 192.168.1.151 TCP 60 80 + 50360 [ACK] Seq=1 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 13 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=1 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 15 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=1 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 16 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=2861 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 16 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=2861 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 18 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=27521 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 18 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=7521 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 19 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=7521 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 19 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=1851 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 21 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=1851 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 21 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=11441 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 21 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=11441 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 22 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=11441 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 23 0.163972 192.16	7 0.073539	192.168.1.151	172.217.3.100	TCP	66 50360 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM=1
10 0.099184 192.168.1.151 172.217.9.238 TCP 54 50359 + 80 [ACK] Seq=138 Ack=529 Win=261632 Len=0 11 0.101689 192.168.1.151 172.217.3.100 HTTP 195 GET / HTTP/1.1 20.106188 172.217.3.100 192.168.1.151 TCP 68 89 + 50360 [ACK] Seq=1 Ack=142 Win=66816 Len=430 [TCP segment of a reassembled PDU] 14 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=1 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 15 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=2861 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 16 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=2861 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 17 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=2861 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 17 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=7151 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 18 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=7151 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 19 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=7151 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 19 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=7151 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 19 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=11441 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 20 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=10011 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 21 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=11441 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 21 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=11441 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 22 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=1142 Ack=142 Win=66816 Len=1430 [TCP segm	8 0.077854	172.217.3.100	192.168.1.151	TCP	66 80 → 50360 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1430 SACK_PERM=1 WS=256
11 0.101689 192.168.1.151 172.217.3.100 HTTP 195 GET / HTTP/1.1 1 12 0.106188 172.217.3.100 192.168.1.151 TCP 60 80 + 50360 [ACK] Seq=1 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 14 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=1 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 15 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=2861 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 16 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=2861 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 17 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=2961 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 18 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=2721 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 18 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=7521 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 19 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=8581 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 19 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=10011 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 21 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=10011 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 21 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=10011 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 22 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=10011 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 21 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=10011 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 23 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=1287 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 24 0.16378 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK]	9 0.077916	192.168.1.151	172.217.3.100	TCP	54 50360 → 80 [ACK] Seq=1 Ack=1 Win=262912 Len=0
12 0.106188 172.217.3.100 192.168.1.151 TCP 60 80 + 50360 [ACK] Seq=1 Ack=142 Win=66816 Len=0 13 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=1 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 15 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=2431 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 15 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=2861 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 16 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=2861 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 18 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=5721 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 18 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=7521 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 19 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=7521 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 19 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=7851 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 21 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=1801 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 21 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=1801 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 22 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=1801 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 22 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=1801 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 24 0.168786 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=1801 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 25 0.2082990 192.168.1.151 172.217.3.100 TCP 54 50360 + 80 [ACK] Seq=12871 Ack=142 Win=66816 Len=1428 [TCP segment of a reassembled PDU] 26 0.225233 172.217.9.238 192.168.1.1	10 0.099184	192.168.1.151	172.217.9.238	TCP	54 50359 → 80 [ACK] Seq=138 Ack=529 Win=261632 Len=0
13 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=1 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 14 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=2861 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 15 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=2861 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 16 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=2921 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 17 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=27151 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 19 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=7151 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 19 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=7151 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 20 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=10011 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 21 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=10011 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 22 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=11441 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 22 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=11441 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 23 0.163972 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=11441 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 24 0.168786 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=12871 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 25 0.268890 192.168.1.151 172.217.3.100 TCP 54 50360 P80 [ACK] Seq=12871 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 25 0.268890 192.168.1.151 172.217.3.100 TCP 54 50360 P80 [ACK] Seq=1287 Ack=14738 Win=266556 Len=0 26 0.221061 192.168.1.151 172.217.3.100 T	11 0.101689	192.168.1.151	172.217.3.100	HTTP	195 GET / HTTP/1.1
14 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=1431 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 15 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=2861 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 17 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=2861 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 17 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=7571 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 18 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=7571 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 19 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=8581 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 10 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=8581 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 12 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=10011 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 12 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=10011 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 12 0.163518 172.217.3.100 192.168.1.151 TCP 1482 80 + 50360 [ACK] Seq=12871 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 12 0.163518 172.217.3.100 192.168.1.151 TCP 1482 80 + 50360 [ACK] Seq=12871 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 12 0.163972 192.168.1.151 172.217.3.100 TCP 54 50360 + 80 [ACK] Seq=12871 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 1482 80 + 50360 + 80 [ACK] Seq=12871 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 1482 80 + 50360 + 80 [ACK] Seq=12871 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 1482 80 + 50360 + 80 [ACK] Seq=12871 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 1482 80 + 50360 + 80 [ACK] Seq=12871 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 148	12 0.106188	172.217.3.100	192.168.1.151	TCP	60 80 → 50360 [ACK] Seq=1 Ack=142 Win=66816 Len=0
15 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=2861 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 16 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=24291 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 18 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=7521 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 18 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=7521 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 19 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=7511 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 19 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=1081 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 10 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=1081 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 10 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=1081 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 10 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=11441 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 10 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=12871 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 10 0.163518 172.217.3.100 TCP 1484 80 + 50360 [ACK] Seq=12871 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 10 0.163518 172.217.3.100 TCP 1484 80 + 50360 [ACK] Seq=12871 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 11 0.163518 172.17.3.100 TCP 1484 80 + 50360 [ACK] Seq=12871 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 11 0.163518 172.17.3.100 TCP 1484 80 + 50360 [ACK] Seq=12871 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 12 0.1681.151 T72.217.3.100 TCP 1484 80 + 50360 [ACK] Seq=12871 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 12 0.1681.151 TCP 1484 80 + 50360 [ACK] Seq=12871 Ack	13 0.163518	172.217.3.100	192.168.1.151	TCP	1484 80 → 50360 [ACK] Seq=1 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU]
16 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=4291 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 17 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=7512 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 19 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=7151 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 19 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=7151 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 10 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=10011 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 10 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=10011 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 10 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=11441 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 10 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=11441 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 10 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=11441 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 10 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=12871 Ack=142 Win=66816 Len=1428 [TCP segment of a reassembled PDU] 10 0.163518 172.217.3.100 192.168.1.151 TCP 1482 80 + 50360 [ACK] Seq=142 Ack=14290 Win=266912 Len=0 1484 80 + 50360 [ACK] Seq=142 Ack=14290 Win=266912 Len=0 1484 80 + 50360 [ACK] Seq=142 Ack=14290 Win=266912 Len=0 1484 80 + 50360 [ACK] Seq=142 Ack=14290 Win=266912 Len=0 1484 80 + 50360 [ACK] Seq=142 Ack=14290 Win=266912 Len=0 1484 80 + 50360 [ACK] Seq=142 Ack=14290 Win=266912 Len=0 1484 80 + 50360 [ACK] Seq=142 Ack=14290 Win=266912 Len=0 1484 80 + 50360 [ACK] Seq=142 Ack=14290 Win=266912 Len=0 1484 80 + 50360 [ACK] Seq=142 Ack=14290 Win=266912 Len=0 1484 80 + 50360 [ACK] Seq=142 Ack=14290 Win=266912 Len=0 1484 80 + 50360 [ACK] Seq=142 Ack=14290 Win=266912 Len=0	14 0.163518	172.217.3.100	192.168.1.151	TCP	1484 80 → 50360 [ACK] Seq=1431 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU]
17 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=7721 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 18 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=7151 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 19 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=881 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 10 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=10011 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 11 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=10011 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 12 0.163518 172.217.3.100 192.168.1.151 TCP 1482 80 + 50360 [ACK] Seq=10011 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 12 0.163518 172.217.3.100 192.168.1.151 TCP 1482 80 + 50360 [ACK] Seq=1041 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 12 0.163518 172.217.3.100 TCP 54 50360 [ACK] Seq=1041 Ack=104 [TCP segment of a reassembled PDU] 12 0.163972 192.168.1.151 172.217.3.100 TCP 54 50360 A 80 [ACK] Seq=1042 Ack=10429 Win=26912 Len=0 [TCP segment of a reassembled PDU] 12 0.1638.1.151 TCP 10 0.1638 [TCP segment of a reassembled PDU] 12 0.1638.1.151 TCP 10 0.1638 [TCP segment of a reassembled PDU] 12 0.1638.1.151 TCP 10 0.1638 [TCP segment of a reassembled PDU] 12 0.1638.1.151 TCP 10 0.1638 [TCP segment of a reassembled PDU] 12 0.1638.1.151 TCP 10 0.1638 [TCP segment of a reassembled PDU] 12 0.1638.1.151 TCP 10 0.1638 [TCP segment of a reassembled PDU] 12 0.1638.1.151 TCP 10 0.1638 [TCP segment of a reassembled PDU] 12 0.1638.1.151 TCP 10 0.1638 [TCP segment of a reassembled PDU] 12 0.1638.1.151 TCP 10 0.1638 [TCP segment of a reassembled PDU] 12 0.1638.1.151 TCP 10 0.1638 [TCP segment of a reassembled PDU] 12 0.1638.1.151 TCP 10 0.1638 [TCP segment of a reassembled PDU] 12 0.1638.1.151 TCP 10 0.1638 [TCP segment of a reassembled PDU] 12 0.1638.1.151 TCP 10 0.1638 [TCP seq=10011 Ack=142 Win=66816 Len=1430 [T	15 0.163518	172.217.3.100	192.168.1.151	TCP	1484 80 → 50360 [ACK] Seq=2861 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU]
18 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=7151 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 190.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=8581 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 190.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=10011 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 190.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=11441 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 192.168.1.151 TCP 1482 80 + 50360 [ACK] Seq=11441 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 192.168.1.151 TCP 1482 80 + 50360 [PS] Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 192.168.1.151 TCP 1482 80 + 50360 [PS] Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 192.168.1.151 TCP 1482 80 + 50360 [PS] Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 192.168.1.151 TCP 1482 80 + 50360 [PS] Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 192.168.1.151 TCP 1482 80 + 50360 [PS] Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 192.168.1.151 TCP 1482 80 + 50360 [PS] Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 192.168.1.151 TCP 1482 80 + 50360 [ACK] Seq=1287 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 192.168.1.151 TCP 1482 80 + 50360 [ACK] Seq=1287 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 192.168.1.151 TCP 1482 80 + 50360 [ACK] Seq=128 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 192.168.1.151 TCP 1482 80 + 50360 [ACK] Seq=1287 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 192.168.1.151 TCP 1482 80 + 50360 [ACK] Seq=1287 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 192.168.1.151 TCP 1482 80 + 50360 [ACK] Seq=1287 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 192.168.1.151 TCP 1482 80 + 50360 [ACK] Seq=1287 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 192.1	16 0.163518	172.217.3.100	192.168.1.151	TCP	1484 80 → 50360 [ACK] Seq=4291 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU]
19 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=8581 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 20 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=10011 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 22 0.163518 172.217.3.100 192.168.1.151 TCP 1484 80 + 50360 [ACK] Seq=10011 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 22 0.163518 172.217.3.100 192.168.1.151 TCP 1482 80 + 50360 [PSH, ACK] Seq=12871 Ack=142 Win=66816 Len=1428 [TCP segment of a reassembled PDU] 23 0.163972 192.168.1.151 T72.217.3.100 TCP 54 50360 + 30 [ACK] Seq=1242 Ack=14299 Win=262912 Len=0 40.168786 172.217.3.100 192.168.1.151 HTTP 493 HTTP/1.1 200 OK (text/html) 25 0.208890 192.168.1.151 172.217.3.100 TCP 54 50360 + 80 [ACK] Seq=142 Ack=14738 Win=26256 Len=0 26 0.221061 192.168.1.151 172.217.3.100 TCP 54 50360 + 80 [ACK] Seq=142 Ack=14738 Win=262653 Len=0 27 0.225233 172.217.9.238 192.168.1.151 TCP 60 80 + 50350 [FIN, ACK] Seq=139 Ack=139 Win=61952 Len=0 29 0.225537 192.168.1.151 172.217.3.100 TCP 54 50360 + 80 [ACK] Seq=142 Ack=1478 Win=262656 Len=0 30 0.230040 172.217.3.100 192.168.1.151 TCP 60 80 + 50360 [FIN, ACK] Seq=142 Ack=1478 Win=262656 Len=0 30 0.230040 172.217.3.100 192.168.1.151 TCP 60 80 + 50360 [FIN, ACK] Seq=142 Ack=1478 Win=261632 Len=0 30 0.230040 172.217.3.100 192.168.1.151 TCP 60 80 + 50360 [FIN, ACK] Seq=142 Ack=1478 Win=261632 Len=0 30 0.230040 172.217.3.100 192.168.1.151 TCP 60 80 + 50360 [FIN, ACK] Seq=142 Ack=1478 Win=261632 Len=0 30 0.230040 172.217.3.100 192.168.1.151 TCP 60 80 + 50360 [FIN, ACK] Seq=142 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 1484 80 + 50360 [FIN, ACK] Seq=142 Ack=142 Win=66816 Len=1430 [TCP segment of a reassembled PDU] 1210 [TCP segment of a reassemb	17 0.163518		192.168.1.151	TCP	
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22 0.163518 172.217.3.100 192.168.1.151 TCP 1482 80 + 50360 [PSH, ACK] Seq=12871 Ack=142 Win=66816 Len=1428 [TCP segment of a reassembled PDU] 23 0.163972 192.168.1.151 172.217.3.100 TCP 54 50360 + 80 [ACK] Seq=142 Ack=14299 Win=262912 Len=0 24 0.168786 172.217.3.100 192.168.1.151 HTTP 493 HTTPL 200 KC (text/html) 25 0.208890 192.168.1.151 172.217.3.100 TCP 54 50360 + 80 [ACK] Seq=142 Ack=14738 Win=26256 Len=0 26 0.221061 192.168.1.151 172.217.3.100 TCP 54 50350 + 80 [ACK] Seq=338 Ack=529 Win=261632 Len=0 27 0.225233 172.217.9.238 192.168.1.151 TCP 54 50350 + 80 [FIN, ACK] Seq=329 Ack=139 Win=61952 Len=0 28 0.225236 192.168.1.151 172.217.3.100 TCP 54 50360 + 80 [FIN, ACK] Seq=142 Ack=14738 Win=262656 Len=0 29 0.225537 192.168.1.151 172.217.3.208 TCP 54 50350 + 80 [ACK] Seq=142 Ack=14738 Win=262656 Len=0 30 0.2390040 172.217.3.100 192.168.1.151 TCP 60 80 + 50360 [FIN, ACK] Seq=142 Ack=14738 Win=261632 Len=0 30 0.2390040 172.217.3.100 192.168.1.151 TCP 60 80 + 50360 [FIN, ACK] Seq=142 Ack=14738 Win=261632 Len=0 30 0.2390040 172.217.3.100 192.168.1.151 TCP 60 80 + 50360 [FIN, ACK] Seq=1439 Ack=30 Win=261632 Len=0	20 0.163518	172.217.3.100			
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24 0.168786 172.217.3.100 192.168.1.151 HTTP 493 HTTP/1.1 200 OK (text/html) 25 0.208890 192.168.1.151 172.217.3.100 TCP 54 59360 → 80 [ACK] Seq=142 Ack=14738 Win=262656 Len=0 26 0.22161 192.168.1.151 172.217.9.238 TCP 54 59359 → 80 [FIN, ACK] Seq=138 Ack=529 Win=261632 Len=0 27 0.225233 172.217.9.238 192.168.1.151 TCP 60 80 → 50359 [FIN, ACK] Seq=529 Ack=139 Win=61952 Len=0 28 0.225236 192.168.1.151 172.217.3.100 TCP 54 59360 → 80 [FIN, ACK] Seq=142 Ack=14738 Win=262656 Len=0 29 0.225537 192.168.1.151 172.217.9.238 TCP 54 59360 → 80 [ACK] Seq=142 Ack=30 Win=261632 Len=0 30 0.2390440 172.217.3.100 192.168.1.151 TCP 60 80 → 50360 [FIN, ACK] Seq=1439 Ack=30 Win=6816 Len=0					
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31 0.230396 192.168.1.151 172.217.3.100 TCP 54 50360 → 80 [ACK] Seq=143 Ack=14739 Win=262656 Len=0					
	31 0.230396	192.168.1.151	172.217.3.100	TCP	54 50360 → 80 [ACK] Seq=143 Ack=14739 Win=262656 Len=0

Frame #:	TCP IP Ethernet (Overhead) bytes	HTTP Data (Useful) bytes
2	66	0
3	54	0
4	40	191
5	60	0
8	66	0
9	54	0
10	54	0
11	40	195
12	60	0
13	1484	0
14	1484	0
15	1484	0
16	1484	0
17	1484	0
18	1484	0
19	1484	0

20	1484	0
21	1484	0
22	1482	0
23	54	0
24	40	493
25	54	0

Total Overhead: <u>15480 bytes</u>

Useful data: 879 bytes

15480 bytes + 879 bytes = 16719 bytes

15480/16719 ***100** = **94.74%**

The overhead is significant as ~95% of the byte data consists of overhead. 5% is relevant (http) data.

Step 5: Demultiplexing Keys

When an Ethernet frame arrives at a computer, the Ethernet layer must hand the packet that it contains to the next higher layer to be processed. The act of finding the right higher layer to process received packets is called demultiplexing. We know that in our case the higher layer is IP. But how does the Ethernet protocol know this? After all, the higher-layer could have been another protocol entirely (such as ARP). We have the same issue at the IP layer – IP must be able to determine that the contents of IP message is a TCP packet so that it can hand it to the TCP protocol to process. The answer is that protocols use information in their header known as a "demultiplexing key" to determine the higher layer. CN5E Labs (1.0) © 2012 D. Wetherall 8

Turn-in: Hand in your answers to the [below] questions.

Look at the Ethernet and IP headers of a download packet in detail to answer the following questions:

1. Which Ethernet header field is the demultiplexing key that tells it the next higher layer is IP? What value is used in this field to indicate "IP"?

```
Frame 13: 1484 bytes on wire (11872 bits), 1484 bytes captured (11872 bits) on interface \Device\NPF_{FF8BDE0E-2083-4888-BFC9-2460E1FE7C6F}, id 0
Ethernet II, Src: Verizon_12:f1:29 (18:78:d4:12:f1:29), Dst: HewlettP_db:3e:fd (c8:d3:ff:db:3e:fd)
  v Destination: HewlettP db:3e:fd (c8:d3:ff:db:3e:fd)
        Address: HewlettP_db:3e:fd (c8:d3:ff:db:3e:fd)
        .....0. .... = LG bit: Globally unique address (factory default)
               ...0 .... ....
                               .... = IG bit: Individual address (unicast)
  v Source: Verizon_12:f1:29 (18:78:d4:12:f1:29)
        Address: Verizon_12:f1:29 (18:78:d4:12:f1:29)
        .....0 ..... = LG bit: Globally unique address (factory default)
.....0 ..... = IG bit: Individual address (unicast)
     Type: IPv4 (0x0800)
> Internet Protocol Version 4, Src: 172.217.3.100, Dst: 192.168.1.151
> Transmission Control Protocol, Src Port: 80, Dst Port: 50360, Seq: 1, Ack: 142, Len: 1430
      c8 d3 ff db 3e fd 18 78 d4 12 f1 29 08 00 45 80
0010 05 be f0 4a 00 00 3d 06 14 f3 ac d9 03 64 c0 a8 0020 01 97 00 50 c4 b8 32 dd f5 c1 34 90 53 2c 50 10
                                                               ...J..=. ....d..
...P..2. ..4.S,P.
0030 01 05 da 2d 00 00 48 54 54 50 2f 31 2e 31 20 32
0040 30 30 20 4f 4b 0d 0a 44 61 74 65 3a 20 57 65 64 0050 2c 20 33 30 20 53 65 70 20 32 30 32 30 20 32 30
                                                               00 OK··D ate: Wed
                                                               , 30 Sep 2020 20
:33:03 G MT Expi
0060 3a 33 33 3a 30 33 20 47 4d 54 0d 0a 45 78 70 69
```

The protocol field is the demultiplexing key that tells it the next higher layer is IP. [08 00] is the value used to indicate IP.

2. Which IP header field is the demultiplexing key that tells it the next higher layer is TCP? What value is used in this field to indicate "TCP"?

```
■ Wireshark · Packet 13 · Ethernet (tcp port 80)

✓ Source: Verizon_12:f1:29 (18:78:d4:12:f1:29)
         Address: Verizon_12:f1:29 (18:78:d4:12:f1:29)
         .... .0. .... = LG bit: Globally unique address (factory default)
         .... = IG bit: Individual address (unicast)
      Type: IPv4 (0x0800)
 Internet Protocol Version 4, Src: 172.217.3.100, Dst: 192.168.1.151
      0100 .... = Version: 4
       .... 0101 = Header Length: 20 bytes (5)
    > Differentiated Services Field: 0x80 (DSCP: CS4, ECN: Not-ECT)
      Total Length: 1470
      Identification: 0xf04a (61514)
    > Flags: 0x0000
      Fragment offset: 0
      Time to live: 61
      Protocol: TCP (6)
      Header checksum: 0x14f3 [validation disabled]
      [Header checksum status: Unverified]
      Source: 172.217.3.100
      Destination: 192.168.1.151
 0010 05 be f0 4a 00 00 3d 06 14 f3 ac d9 03 64 c0 a8
                                                         ...J..=. .....d..
 0020 01 97 00 50 c4 b8 32 dd f5 c1 34 90 53 2c 50 10
                                                         ...P..2. ..4.S,P.
```

The protocol field is the demultiplexing key that tells it the next higher layer is IP. [06] is the value used to indicate IP.