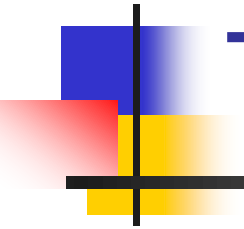

Traffic Analysis

รศ.ดร. อนันต์ ผลเพิ่ม

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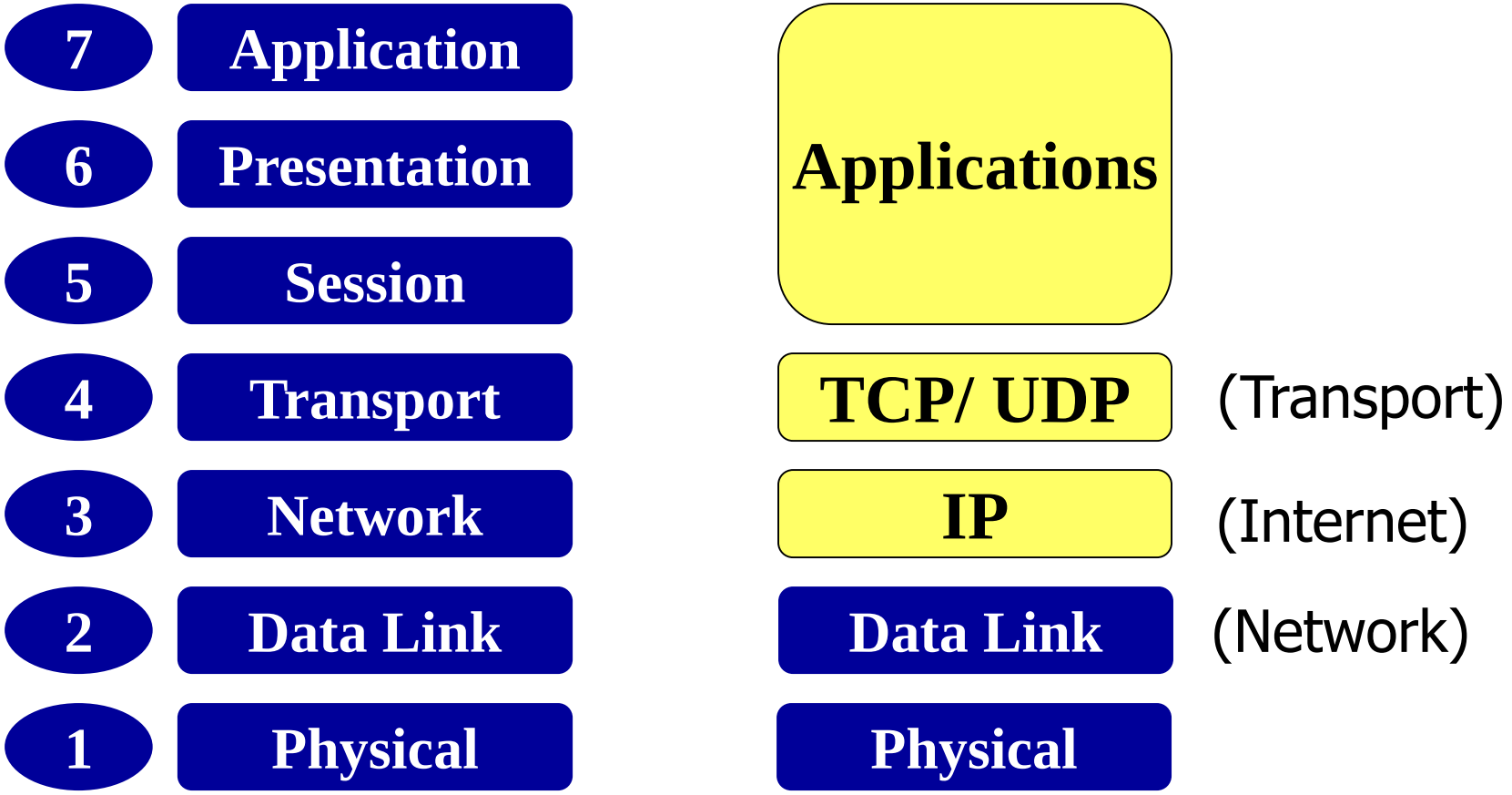
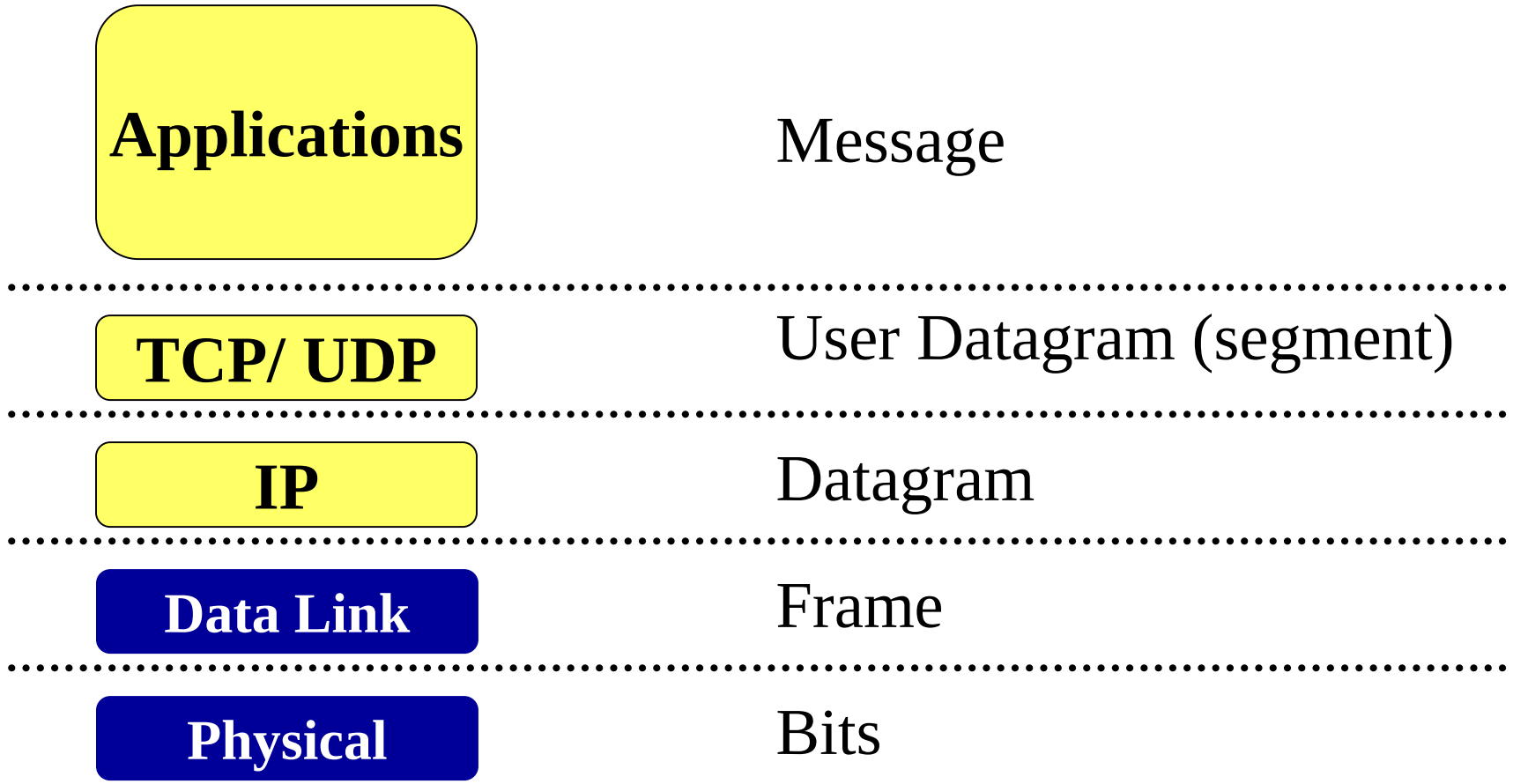
Kasetsart University, Bangkok, Thailand

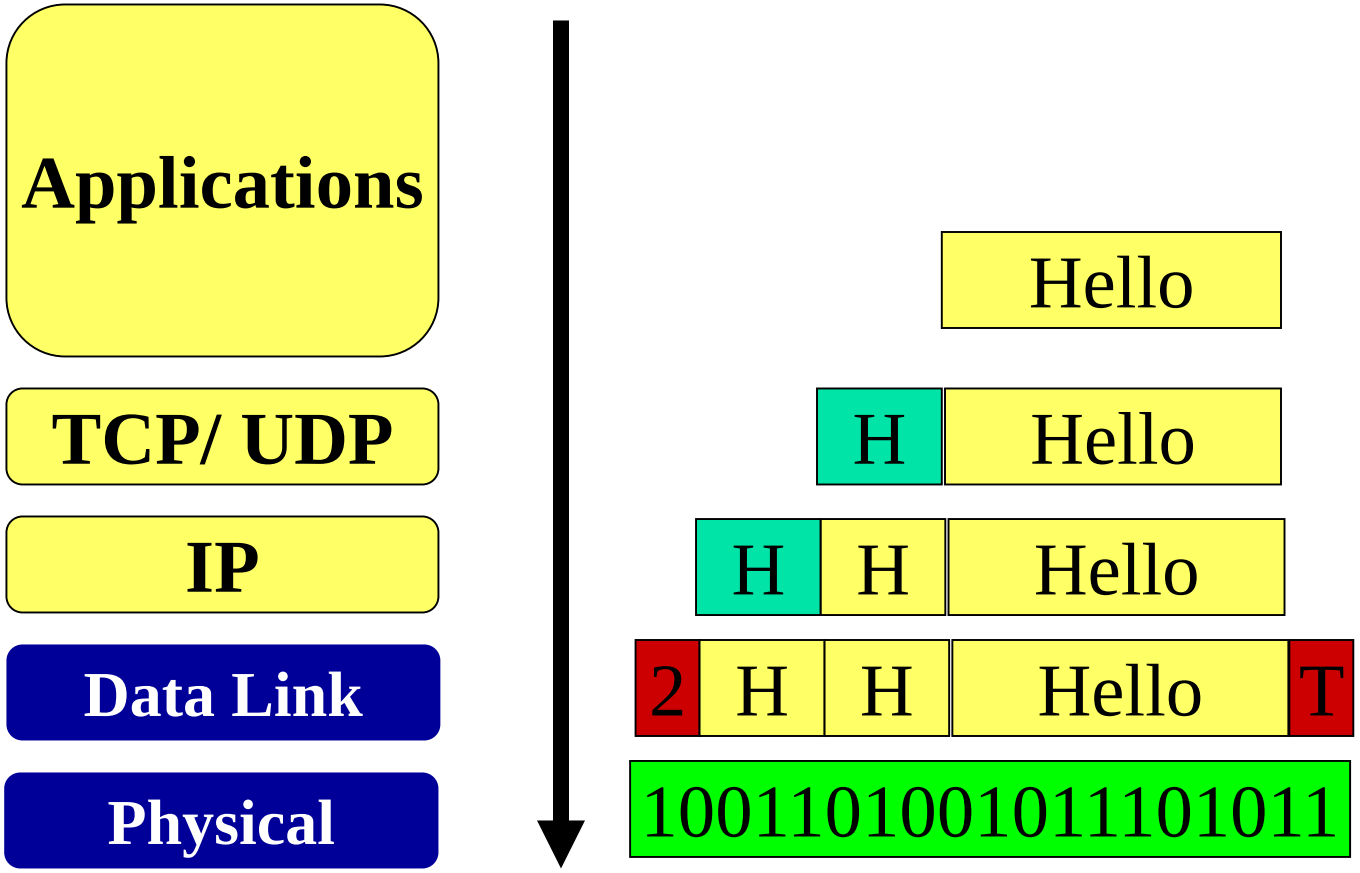
OSI Model and TCP/IP



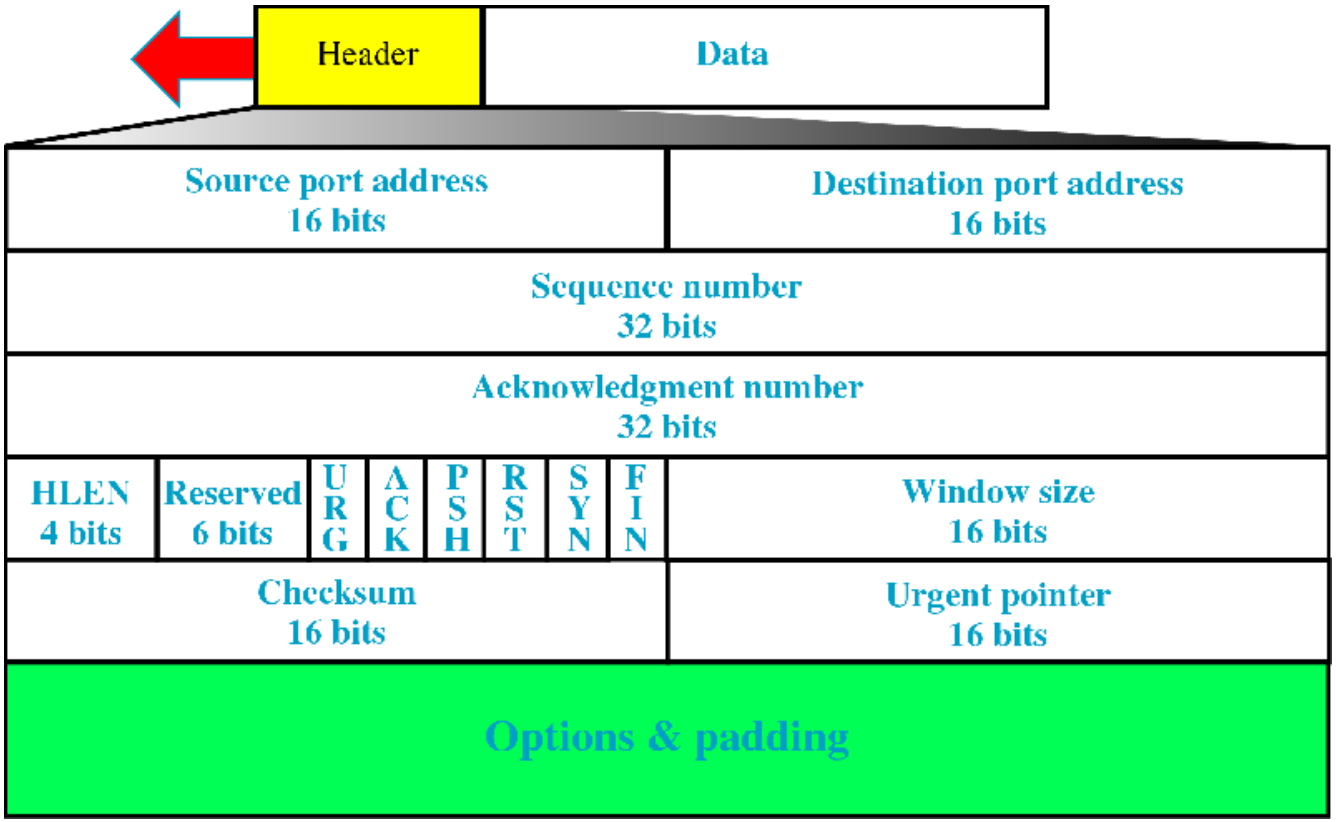
TCP/IP Encapsulation



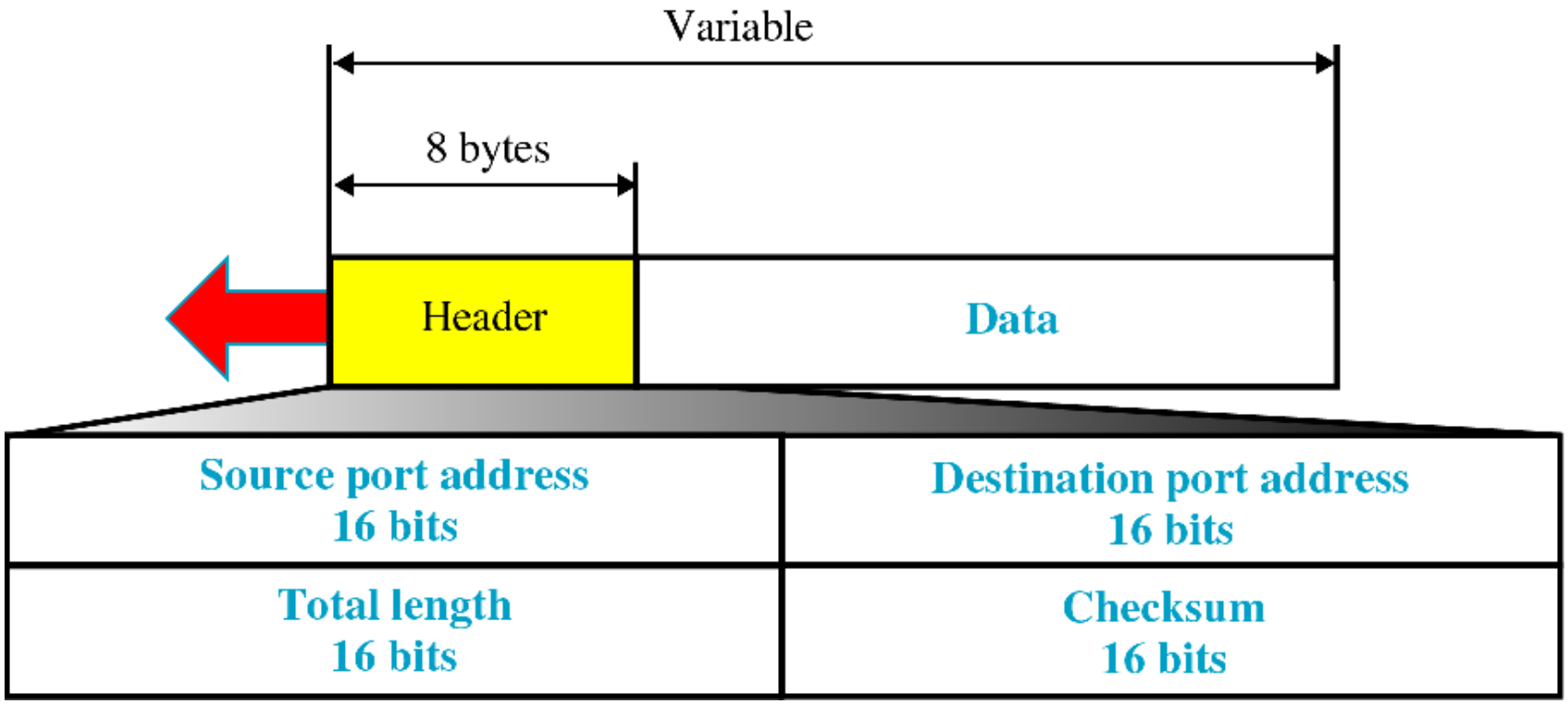
Data Flow


Applications
TCP/ UDP
IP
Data Link
Physical
Hello
H
Hello
H
H
Hello
2
H
H
Hello
T
10011010010111010 11

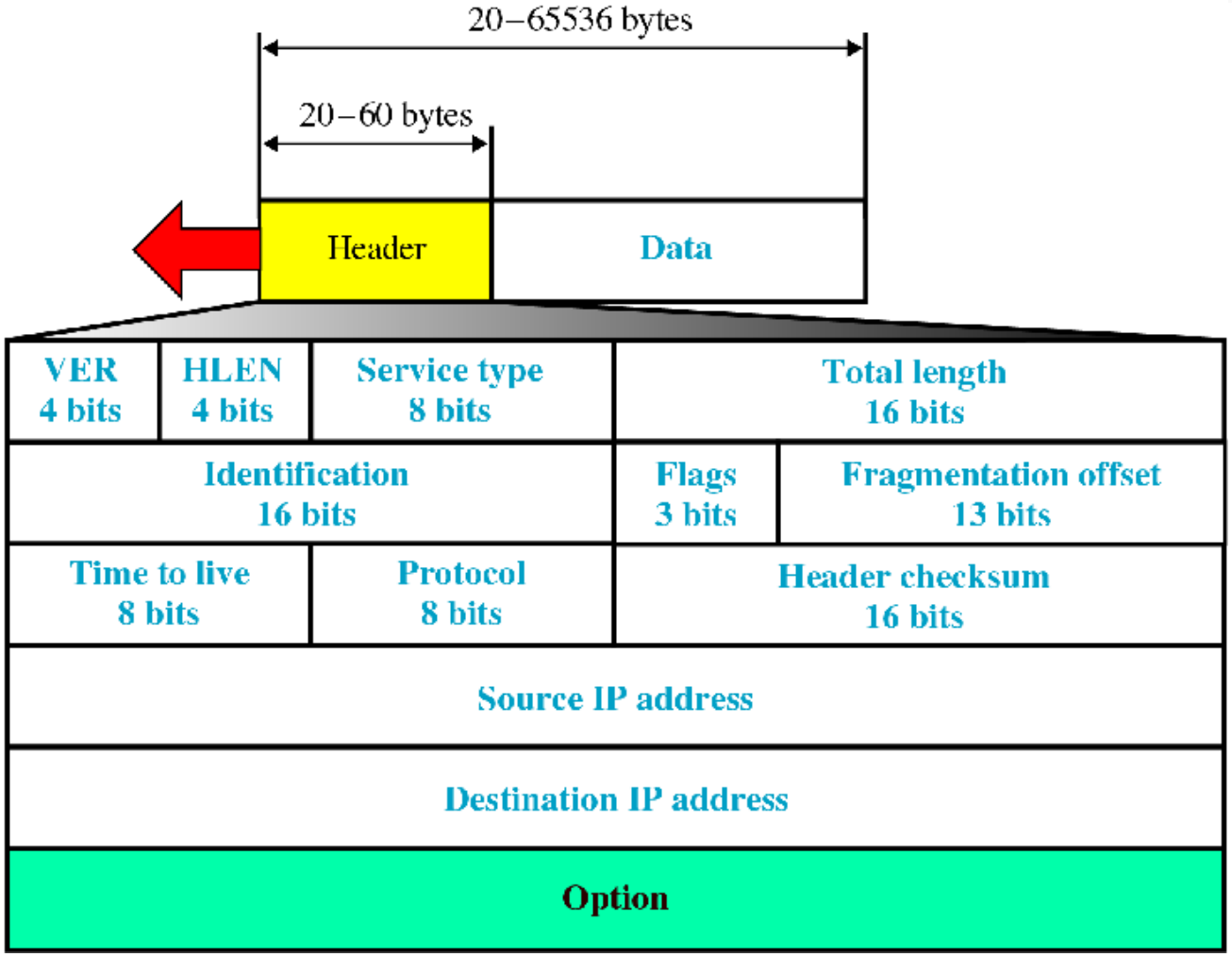
TCP Segment Format



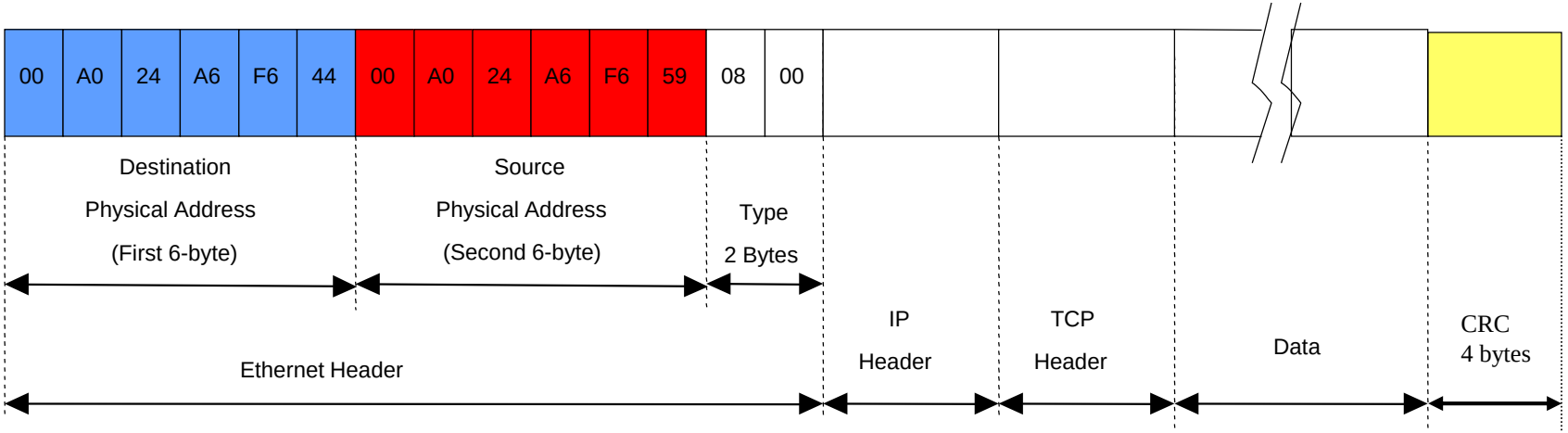
UDP Datagram Format



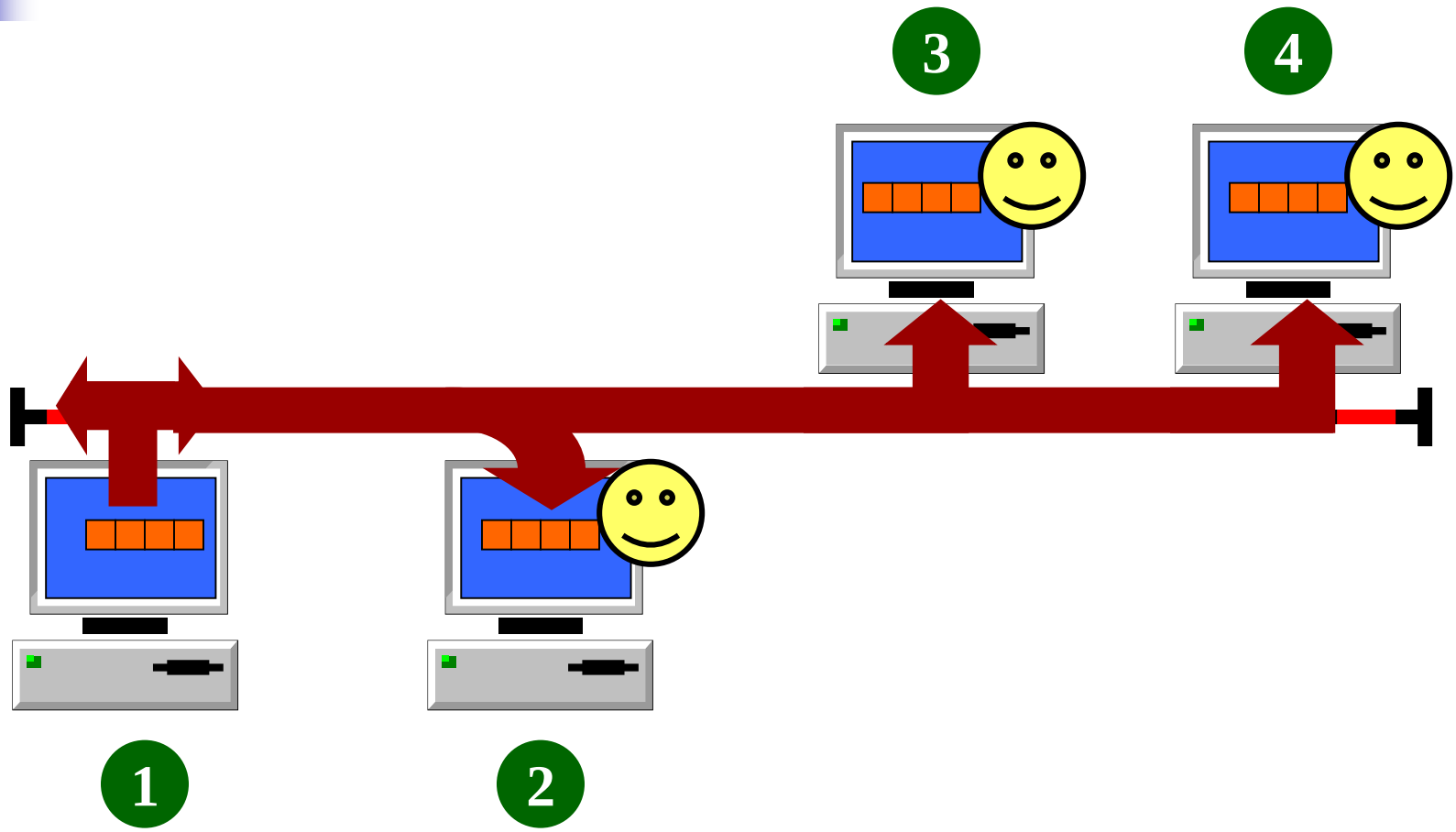
IP Datagram


20–65536 bytes
20–60 bytes
Header
Data
VER
4 bits
HLEN
4 bits
Service type
8 bits
Total length
16 bits
Identification
16 bits
Flags
3 bits
Fragmentation offset
13 bits
Time to live
8 bits
Protocol
8 bits
Header checksum
16 bits
Source IP address
Destination IP address
Option

Ethernet Frame

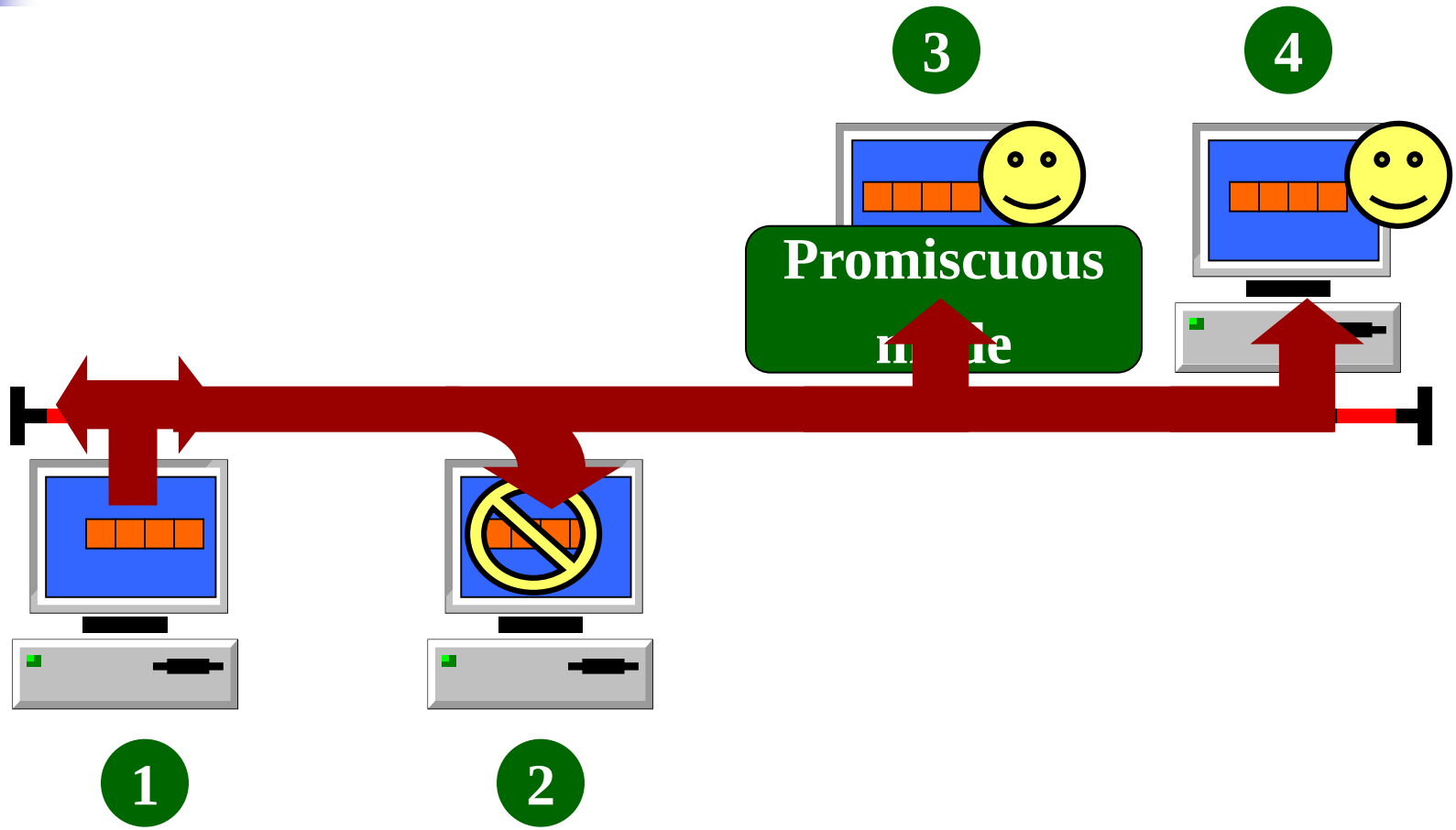


Regular Ethernet

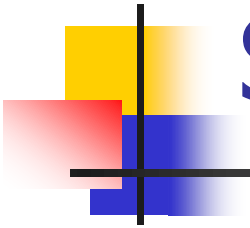


Station 1 transmits to all (broadcast)

Regular Ethernet



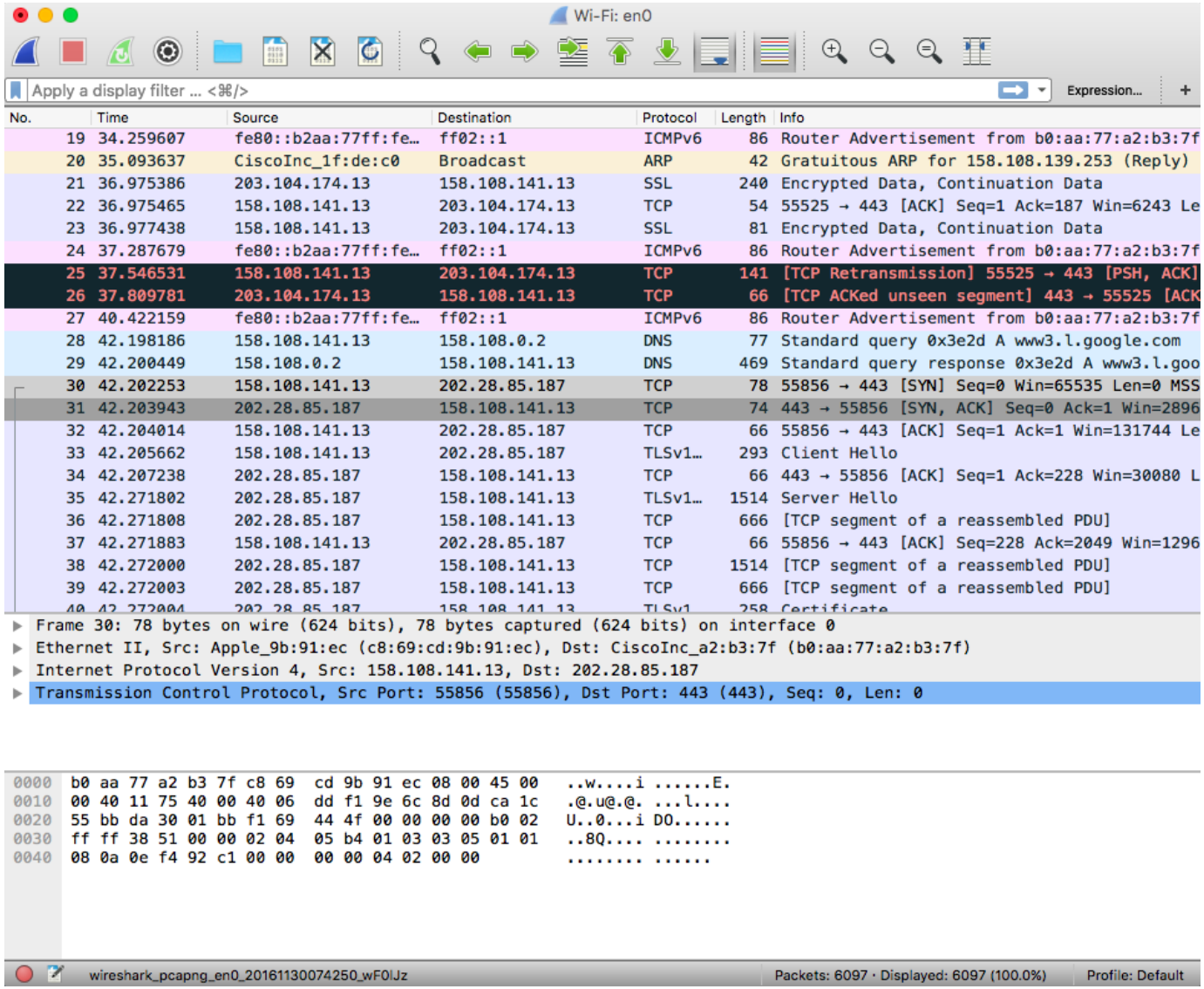
Station 1 transmits to station 4



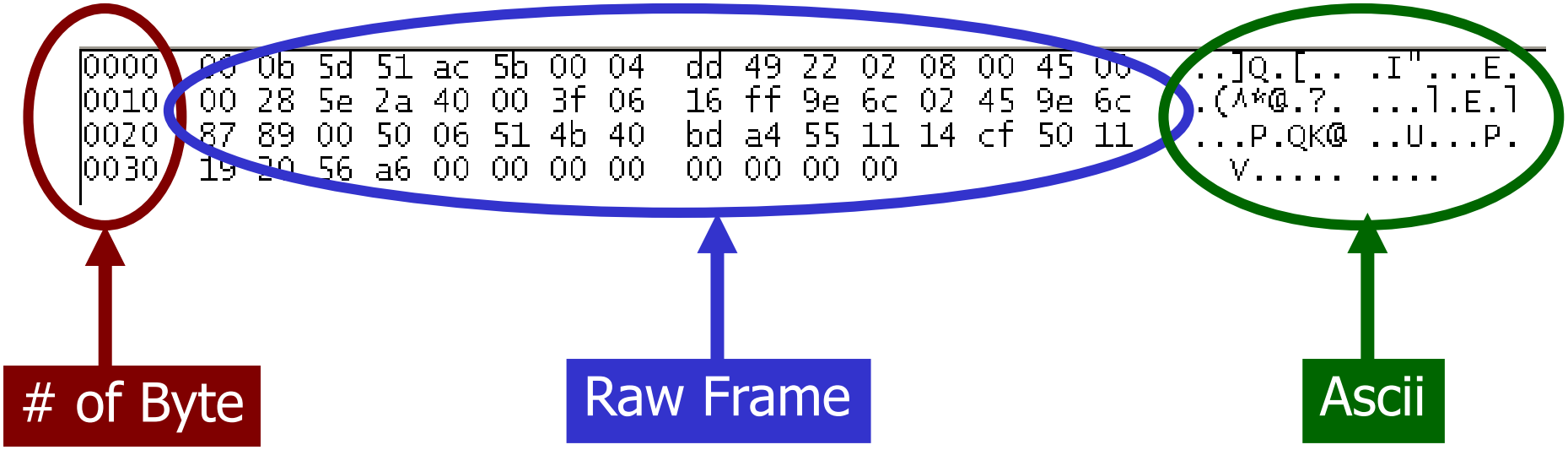
Sniffer

- Network and protocol analyzer
- For network maintenance and trouble shooting
- Capture, monitor, analyze, trouble shooting
- Example: Etherpeek, Ethereal, Wireshark

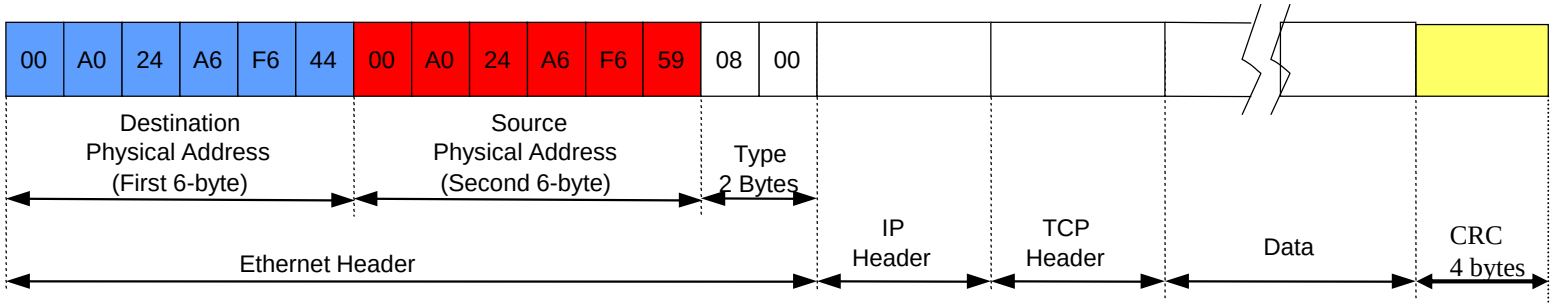
Wireshark


Wi-Fi: en0
Apply a display filter ... <⌘/>
Expression...
No. Time Source Destination Protocol Length Info
19 34.259607 fe80::b2aa:77ff:fe… ff02::1 ICMPv6 86 Router Advertisement from b0:aa:77:a2:b3:7f
20 35.093637 CiscoInc_1f:de:c0 Broadcast ARP 42 Gratuitous ARP for 158.108.139.253 (Reply)
21 36.975386 203.104.174.13 158.108.141.13 SSL 240 Encrypted Data, Continuation Data
22 36.975465 158.108.141.13 203.104.174.13 TCP 54 55525 → 443 [ACK] Seq=1 Ack=187 Win=6243 Le
23 36.977438 158.108.141.13 203.104.174.13 SSL 81 Encrypted Data, Continuation Data
24 37.287679 fe80::b2aa:77ff:fe… ff02::1 ICMPv6 86 Router Advertisement from b0:aa:77:a2:b3:7f
25 37.546531 158.108.141.13 203.104.174.13 TCP 141 [TCP Retransmission] 55525 → 443 [PSH, ACK]
26 37.809781 203.104.174.13 158.108.141.13 TCP 66 [TCP ACKed unseen segment] 443 → 55525 [ACK
27 40.422159 fe80::b2aa:77ff:fe… ff02::1 ICMPv6 86 Router Advertisement from b0:aa:77:a2:b3:7f
28 42.198186 158.108.141.13 158.108.0.2 DNS 77 Standard query 0x3e2d A www3.l.google.com
29 42.200449 158.108.0.2 158.108.141.13 DNS 469 Standard query response 0x3e2d A www3.l.goo
30 42.202253 158.108.141.13 202.28.85.187 TCP 78 55856 → 443 [SYN] Seq=0 Win=65535 Len=0 MSS
31 42.203943 202.28.85.187 158.108.141.13 TCP 74 443 → 55856 [SYN, ACK] Seq=0 Ack=1 Win=2896
32 42.204014 158.108.141.13 202.28.85.187 TCP 66 55856 → 443 [ACK] Seq=1 Ack=1 Win=131744 Le
33 42.205662 158.108.141.13 202.28.85.187 TLSv1… 293 Client Hello
34 42.207238 202.28.85.187 158.108.141.13 TCP 66 443 → 55856 [ACK] Seq=1 Ack=228 Win=30080 L
35 42.271802 202.28.85.187 158.108.141.13 TLSv1… 1514 Server Hello
36 42.271808 202.28.85.187 158.108.141.13 TCP 666 [TCP segment of a reassembled PDU]
37 42.271883 158.108.141.13 202.28.85.187 TCP 66 55856 → 443 [ACK] Seq=228 Ack=2049 Win=1296
38 42.272000 202.28.85.187 158.108.141.13 TCP 1514 [TCP segment of a reassembled PDU]
39 42.272003 202.28.85.187 158.108.141.13 TCP 666 [TCP segment of a reassembled PDU]
Frame 30: 78 bytes on wire (624 bits), 78 bytes captured (624 bits) on interface 0
Ethernet II, Src: Apple_9b:91:ec (c8:69:cd:9b:91:ec), Dst: CiscoInc_a2:b3:7f (b0:aa:77:a2:b3:7f)
Internet Protocol Version 4, Src: 158.108.141.13, Dst: 202.28.85.187
Transmission Control Protocol, Src Port: 55856 (55856), Dst Port: 443 (443), Seq: 0, Len: 0
0000 b0 aa 77 a2 b3 7f c8 69 cd 9b 91 ec 08 00 45 00 ..w....i ......E.
0010 00 40 11 75 40 00 40 06 dd f1 9e 6c 8d 0d ca 1c .@.u@.@. ...l....
0020 55 bb da 30 01 bb f1 69 44 4f 00 00 00 00 b0 02 U..0...i DO......
0030 ff ff 38 51 00 00 02 04 05 b4 01 03 03 05 01 01 ..8Q.... ....
0040 08 0a 0e f4 92 c1 00 00 00 00 04 02 00 00 ....
wireshark_pcapng_en0_20161130074250_wF0lJz
Packets: 6097 · Displayed: 6097 (100.0%)
Profile: Default

Raw Frame

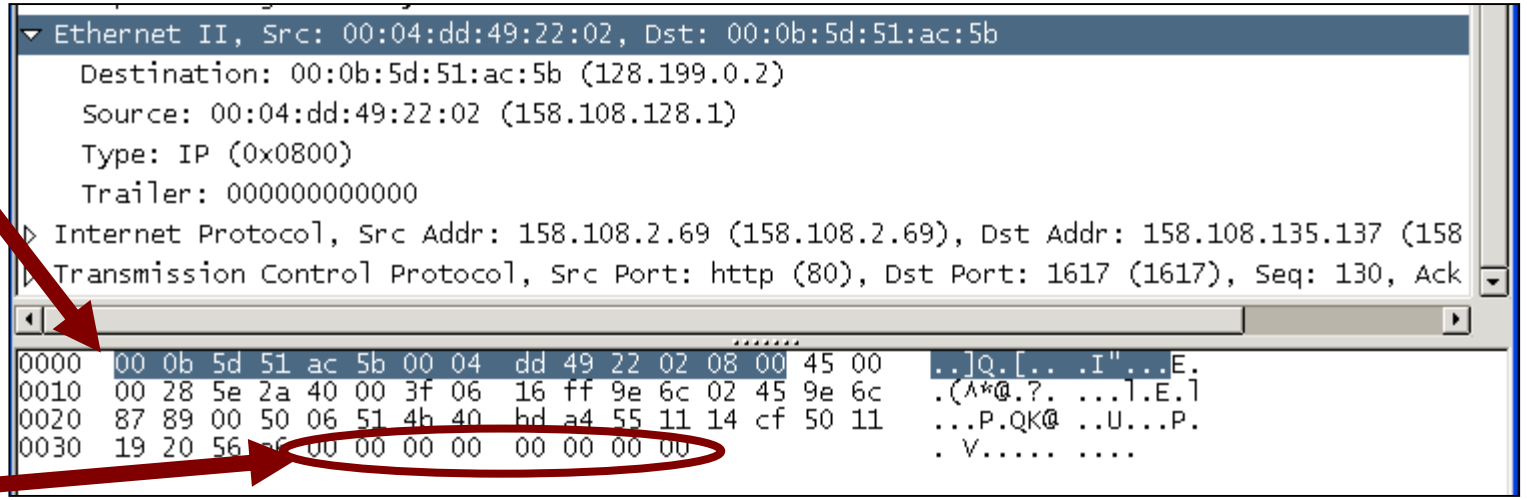

0000 00 0b 5d 51 ac 5b 00 04 dd 49 22 02 08 00 45 00
0010 00 28 5e 2a 40 00 3f 06 16 ff 9e 6c 02 45 9e 6c
0020 87 89 00 50 06 51 4b 40 bd a4 55 11 14 cf 50 11
0030 19 20 56 a6 00 00 00 00 00 00 00 00
..]Q.[.. .I"...E.
.(^*@.?. ...l.E.l
...P.QK@ ..U...P.
V..... ....
# of Byte
Raw Frame
Ascii

Ethernet Header/Trailer

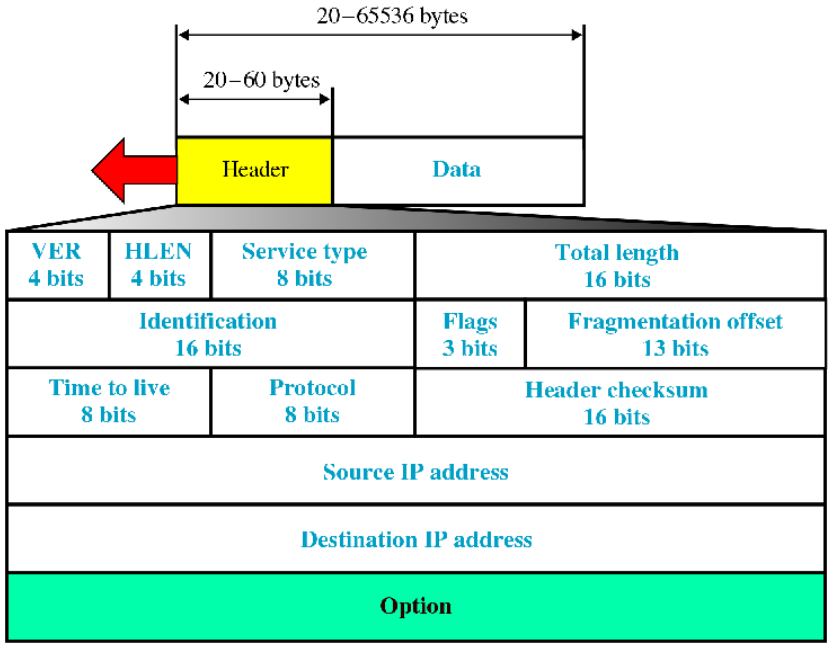


Ethernet Header

Ethernet Trailer



IPv4 Header



Destination IP Address

158.108.135.137

Source IP Address

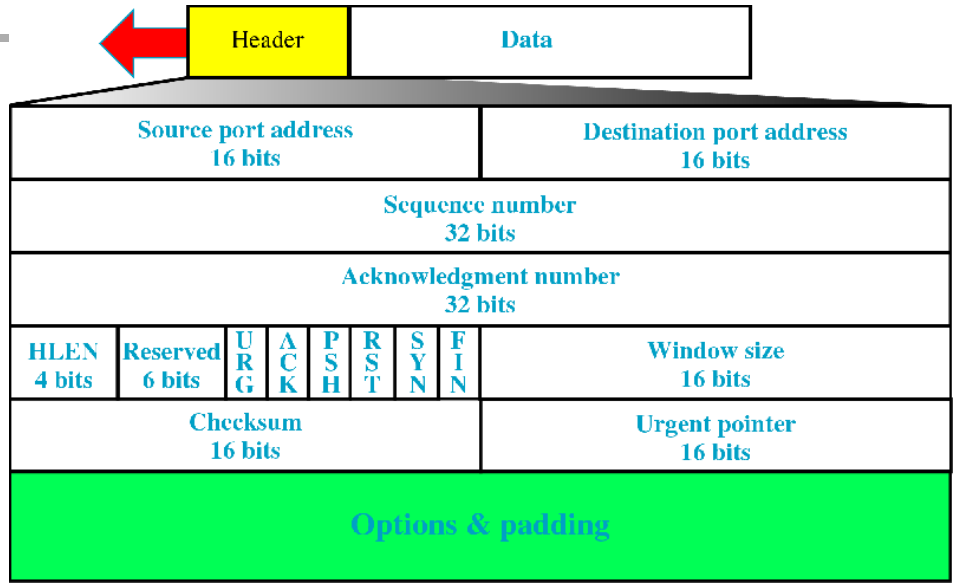
9e 6c 02 45

158.108.2.69

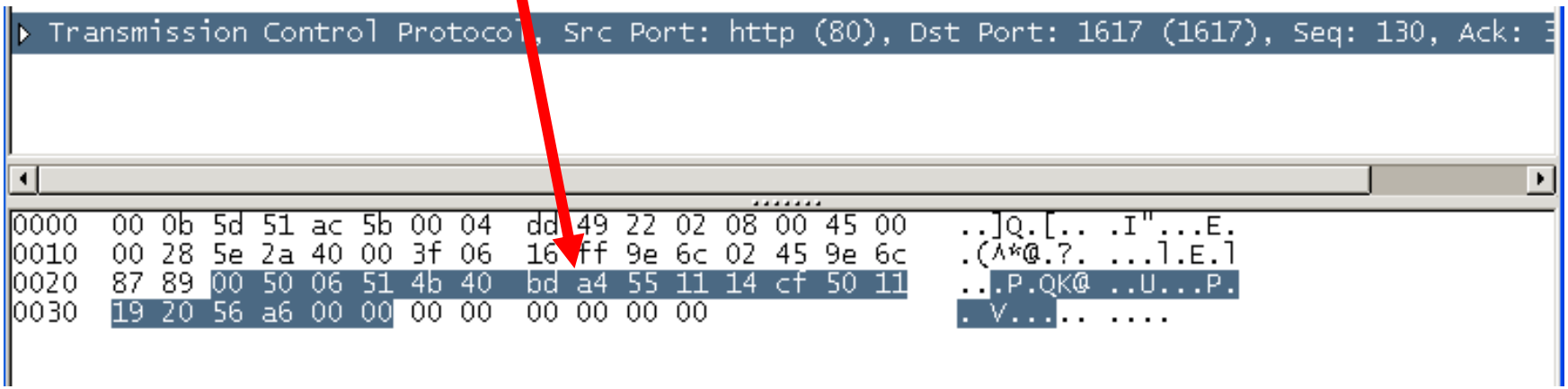
```
▷ Internet Protocol, Src Addr: 158.108.2.69 (158.108.2.69), Dst Addr: 158.108.135.137 (158.10
▷ Transmission Control Protocol, Src Port: http (80), Dst Port: 1617 (1617), Seq: 130, Ack: 3
```

```
0000  00 0b 5d 51 ac 5b 00 04   dd 49 22 02 08 00 45 00   ..]Q.[.. .I"...E.
0010  00 28 5e 2a 40 00 3f 06   16 ff 9e 6c 02 45 9e 6c   .(^*@.?. ...l.E.l
0020  87 89 00 50 06 51 4b 40   bd a4 55 11 14 cf 50 11   ...P.QK@ ..U...P.
0030  19 20 56 a6 00 00 00 00   00 00 00 00               . V..... ....
```

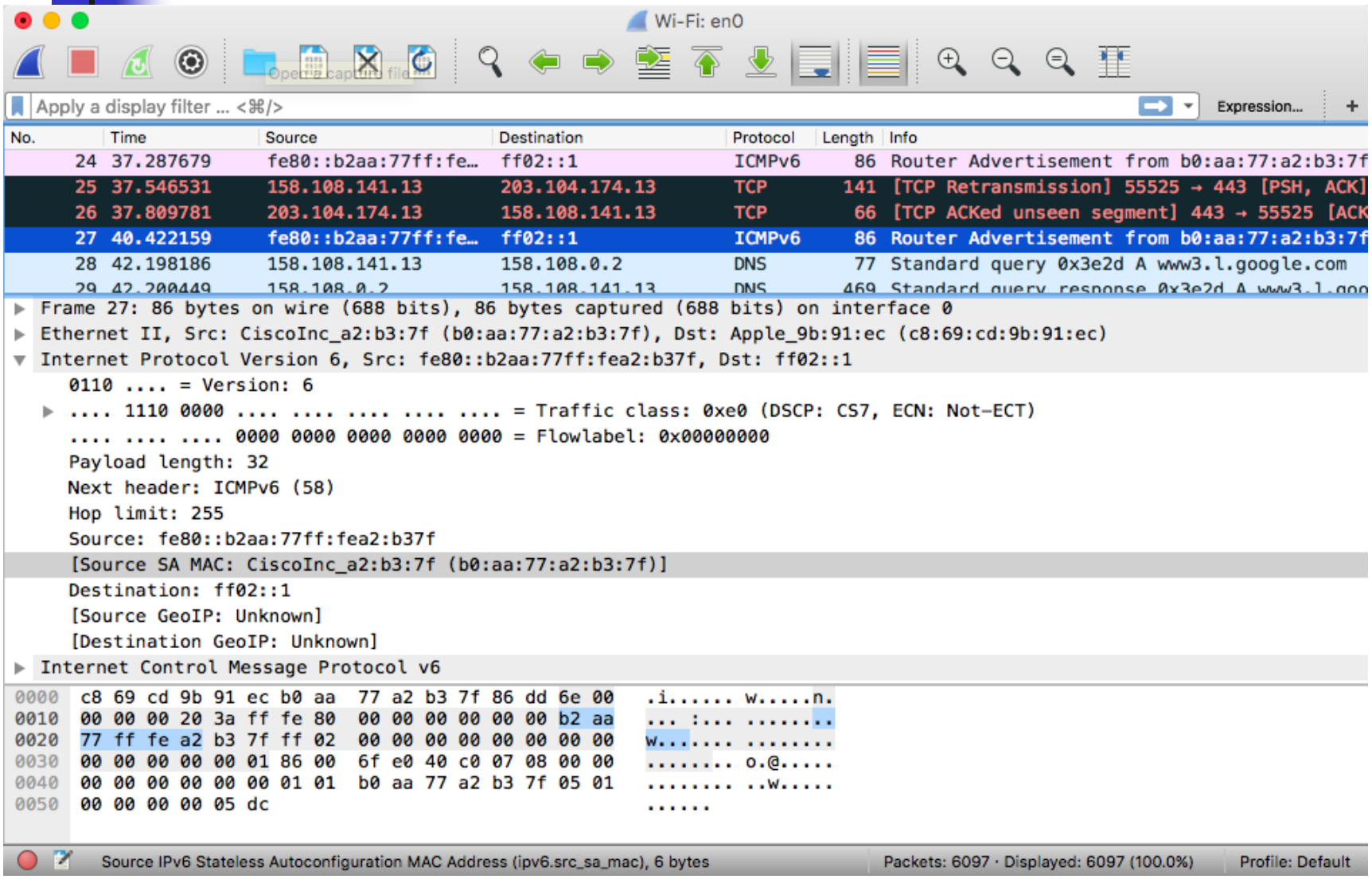
TCP Header



TCP Header



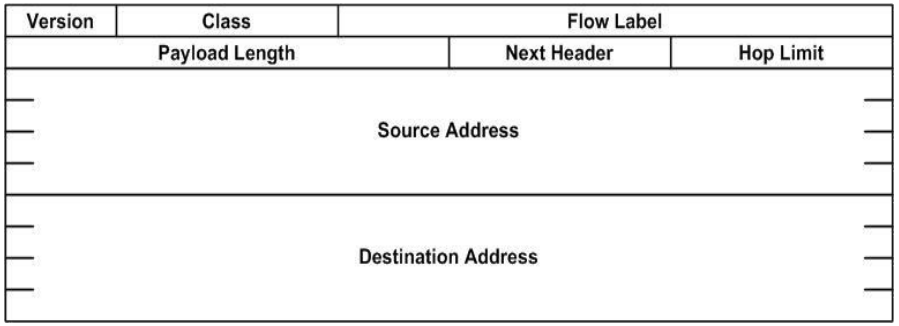
IPv6


Wi-Fi: en0
Apply a display filter ... <⌘/>
Expression...
No. Time Source Destination Protocol Length Info
24 37.287679 fe80::b2aa:77ff:fe… ff02::1 ICMPv6 86 Router Advertisement from b0:aa:77:a2:b3:7f
25 37.546531 158.108.141.13 203.104.174.13 TCP 141 [TCP Retransmission] 55525 → 443 [PSH, ACK]
26 37.809781 203.104.174.13 158.108.141.13 TCP 66 [TCP ACKed unseen segment] 443 → 55525 [ACK
27 40.422159 fe80::b2aa:77ff:fe… ff02::1 ICMPv6 86 Router Advertisement from b0:aa:77:a2:b3:7f
28 42.198186 158.108.141.13 158.108.0.2 DNS 77 Standard query 0x3e2d A www3.l.google.com
Frame 27: 86 bytes on wire (688 bits), 86 bytes captured (688 bits) on interface 0
Ethernet II, Src: CiscoInc_a2:b3:7f (b0:aa:77:a2:b3:7f), Dst: Apple_9b:91:ec (c8:69:cd:9b:91:ec)
Internet Protocol Version 6, Src: fe80::b2aa:77ff:fea2:b37f, Dst: ff02::1
0110 .... = Version: 6
.... 1110 0000 .... = Traffic class: 0xe0 (DSCP: CS7, ECN: Not-ECT)
.... 0000 0000 0000 0000 0000 = Flowlabel: 0x00000000
Payload length: 32
Next header: ICMPv6 (58)
Hop limit: 255
Source: fe80::b2aa:77ff:fea2:b37f
[Source SA MAC: CiscoInc_a2:b3:7f (b0:aa:77:a2:b3:7f)]
Destination: ff02::1
[Source GeoIP: Unknown]
[Destination GeoIP: Unknown]
Internet Control Message Protocol v6
0000 c8 69 cd 9b 91 ec b0 aa 77 a2 b3 7f 86 dd 6e 00 .i..... w.....n.
0010 00 00 00 20 3a ff fe 80 00 00 00 00 00 00 b2 aa ... :... ....
0020 77 ff fe a2 b3 7f ff 02 00 00 00 00 00 00 00 00 w..... ....
0030 00 00 00 00 00 01 86 00 6f e0 40 c0 07 08 00 00 .... o.@.....
0040 00 00 00 00 00 00 01 01 b0 aa 77 a2 b3 7f 05 01 ....w.....
0050 00 00 00 00 05 dc ......
Source IPv6 Stateless Autoconfiguration MAC Address (ipv6.src_sa_mac), 6 bytes
Packets: 6097 · Displayed: 6097 (100.0%)
Profile: Default

IPv6 Header

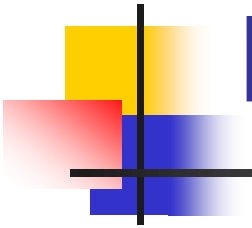
Destination IP Address

Source IP Address




```
▶ Frame 27: 86 bytes on wire (688 bits), 86 bytes captured (688 bits) on inte
▶ Ethernet II, Src: CiscoInc_a2:b3:7f (b0:aa:77:a2:b3:7f), Dst: Apple_9b:91:e
▶ Internet Protocol Version 6, Src: fe80::b2aa:77ff:fea2:b37f, Dst: ff02::1
▶ Internet Control Message Protocol v6
```

```
0000  c8 69 cd 9b 91 e4 b0 aa  77 a2 b3 7f 86 dd 6e 00   .i...... w.....n.
0010  00 00 00 20 3a ff fe 80  00 00 00 00 00 00 b2 aa   ... :... ........
0020  77 ff fe a2 b3 7f ff 02  00 00 00 00 00 00 00 00   w....... ........
0030  00 00 00 00 00 01 86 00  6f e0 40 c0 07 08 00 00   ........ o.@.....
0040  00 00 00 00 00 00 01 01  b0 aa 77 a2 b3 7f 05 01   ........ ..w.....
0050  00 00 00 00 05 dc                                 ......
```



Live Capture

- Demo