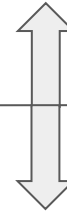


OSI and TCP/IP Models

Layer	Name	Example Protocol	Naming	Transported	Hardware Device
7	Application	http	url	data	
6	Presentation	---			
5	Session	---			
4	Transport	TCP/IP	socket	segment	
3	Network / Internet	IPv4/IPv6	IP	packet	router
2	Data Link / Link	Ethernet	MAC	frame	switch
1	Physical	802.11g	Interface	symbols	hub, bridge

Host layers



Media layers

Offsets	Octet	0								1								2								3							
Octet	Bit	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0	0	Version				IHL				DSCP						ECN		Total Length															
4	32	Identification																Flags		Fragment Offset													
8	64	Time To Live								Protocol								Header Checksum															
12	96	Source IP Address																															
16	128	Destination IP Address																															
20	160	Options (if IHL > 5)																															
:	:																																
60	480																																

IPv4 Packet Header

Offsets	Octet	0								1								2								3							
Octet	Bit	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0	0	1 0 1 0 1 0 0 1								1 1 0 1 1 1 1 0								0 0 0 0 1 0 0 1								1 0 1 0 0 0 0 0							
4	32	1 1 1 0 1 1 0 1								0 0 0 1 1 0 0 0								1 0 1 0 0 0 1 1								0 0 1 0 0 1 0 1							
8	64	Time To Live								Protocol								Header Checksum															
12	96	Source IP Address																															
16	128	Destination IP Address																															
20	160	Options (if IHL > 5)																															
:	:																																
60	480																																

Checksum Calc

0								1								2								3							
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Version				IHL				DSCP						ECN		Total Length															
Identification																Flags				Fragment Offset											
Time To Live								Protocol								Header Checksum															
Source IP Address																															
Destination IP Address																															

- 1010 1001 1101 1110 → 43486
- 0000 1001 1010 0000 → 2464
- 1110 1101 0001 1000 → 60696
- 1010 0011 0010 0101 → 41765
- 1010 1001 1101 1110 → 43486
- 1000 1011 0110 1100 → 0
- 1110 1101 0001 1000 → 60696
- 1010 0011 0010 0101 → 41765
- 0000 1001 1010 0000 → 2464
- 1110 1101 0001 1000 → 60696

$$2^{16} = 65,536$$

$$\text{max_int} = 65,535$$

35692 ← header_checksum

sum = 357518 (without the header_checksum)

$$(q / r) = 357518 / 2^{16} \rightarrow (5 \ 29838)$$

$$\text{checksum} = \text{max_int} - (q + r) \rightarrow 35692$$

$$(\text{header_checksum} == \text{checksum}) ? 0 : \text{error} \rightarrow 0$$

Checksum: using 8-bits (from 156.txt)

45
2
16
5
12
0 → 156: header_checksum
55
17
192
+ 10
354

$$(q / r) = 354 / 2^8$$
$$checksum = max_int - (q + r)$$
$$(header_checksum == checksum) ? 0 : error \rightarrow 0$$

$$2^8 = 256$$
$$max_int = 255$$

(1 98)
→ 156

Checksum: using 8-bits (from 229_error.txt)

45
2
16
5
12
0
55
17
192
34
+ 378

→ 229: header_checksum

(q / r) = 378 / 2^8
checksum = max_int - (q + r)
(header_checksum == checksum) ? 0 : error

→ (1 122)
→ 132
→ error

2^8 = 256
max_int = 255