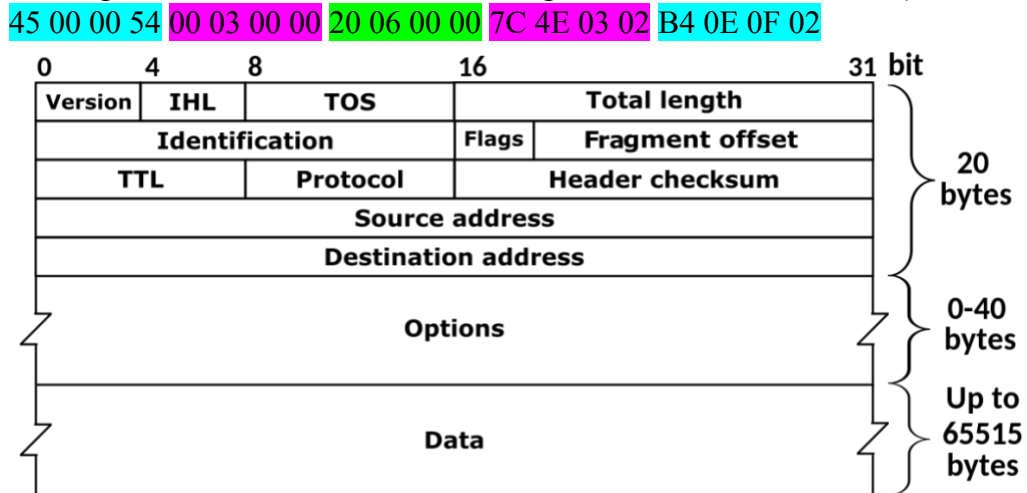


Computer Networks 2nd Year, 1st Semester

Tutorial 5

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1. Explain the TCP/IP model corresponds with the layers of OSI model. Use a diagram. Show the protocols running on each TCP/IP layers.
 2. An HLEN value of decimal 12 means,
 - i. What is the header length in bytes?
 - $12 * 4 \text{ bytes} = 48 \text{ bytes}$
 - ii. What is the length of 'options' field?
 - $48 \text{ bytes} - 20 \text{ bytes} = 28 \text{ bytes}$
 3. What is the value of the total length field if the header is 28 Bytes and data field 400Bytes?
 - $\text{Total Length} = \text{Header Size} + \text{Data Size}$
 - $\text{Total Length} = 28 \text{ bytes} + 400 \text{ bytes} = 428 \text{ bytes}$
 4. What is the length of the data field when HLEN value 14 and total length value of 40000?
 - $\text{IP Header Size} = 14 * 4 \text{ bytes} = 56 \text{ bytes}$
 - $\text{Length of data field} = 40000 \text{ bytes} - 56 \text{ bytes} = 39944 \text{ bytes}$
 5. Which fields of the IP header change from router to router?
 - Time To Live (TTL)
 - Header Checksum
 6. Calculate the HLEN value if the total length is 1200 Bytes, 1176 of which is data from the upper layers.
 - $\text{IP Header Size} = \text{Total Length} - \text{Data from Upper Layers}$
 - $\text{IP Header Size} = 1200 \text{ bytes} - 1176 \text{ bytes} = 24 \text{ bytes}$
 - $\text{HLEN} = \text{IP Header Size} / 4 = 24 / 4 = 6$
 7. Can the value of the header length be less than 20? When is it exactly 20?
 - No, the minimum value of the header length is 20.
 - It is 20 when there are no "option" fields included in the IP Header.

8. An IP datagram has arrived with the following information in the header (in hexadecimal):



- Version: 4 (45 00 00 54) → HEX(4) = DEC(4)
- HLEN (IP Header Length): 5 (45 00 00 54) → HEX(5) = DEC(5)
- Differentiated Services: 0 (45 00 00 54)
- Total Length: 84 bytes (45 00 00 54) → HEX(54) = DEC(84)
- Identification: 3 (00 03 00 00) → HEX(3) = DEC(3)
- Flags: 0 & Fragment Offset: 0 (00 03 00 00)
- Time to Live: 32 (20 06 00 00) → HEX(20) = DEC(32)
- Protocol: TCP (20 06 00 00)
- Header Checksum: 0 (20 06 00 00) → No Errors
- Source IP Address: 124.78.3.2 (7C 4E 03 02)
- Destination IP Address: 180.14.15.2 (B4 0E 0F 02)

- Are there any options?
 - No, because IP header size is 20 bytes.
(HLEN is 5 → 5*4 = 20)
- Is the packet fragmented?
 - No, because the M bit is 0 (no more fragments) and Fragmentation Offset is also 0 (i.e., the 0th byte → 0/8 = 0), Thus, we've got only one packet which is not fragmented.
- What is the size of the data?
 - Data Size = 64 bytes
(84 bytes – 20 bytes)

- iv. How many more routers can the packet travel to?
 - 32 more routers (TTL is 32)
 - v. What is the identification number of the packet?
 - Identification Number is 3
 - vi. What is the type of Service?
 - Normal / Default Service
(In Differentiated Services, Type of Service is 00000000)
9. A datagram is fragmented into three smaller datagrams / fragments. Which of the following is true?
- a) The *do not fragment* bit is set to 1 for all three datagrams.
 - b) The *more fragment* bit is set to 0 for all three datagrams.
 - c) The identification field is the same for all three datagrams.
 - d) The offset field is the same for all three datagrams.
 - e) None of the above.
10. If the fragmentation offset has a value of 100 (in decimal), it means that _____.
- a) The datagram has not been fragmented.
 - b) The datagram is 100 Bytes in size.
 - c) The first byte of the datagram is byte 100.
 - d) The first byte of the datagram is byte 800.
11. The checksum in the IP packet covers _____
- a) Just the header
 - b) Just the data
 - c) The header and the data
 - d) Just the source and the destination addresses