

Complex

Experiential Learning
(site visits)

Forum Theater

Jigsaw Discussion

Inquiry Learning

Role Playing

Active Review Sessions
(Games or Simulations)

Interactive Lecture

Hands-on Technology

Case Studies

Brainstorming

Groups Evaluations

Peer Review

Informal Groups

Triad Groups

Large Group
Discussion

Think-Pair-Share

Writing
(Minute Paper)

Self-assessment

Pause for reflection

NETWORK PROTOCOLS & SECURITY

23EC2210 R/A/E

Topic:

IPV4 AND IPV6 HEADERS

Session – 16&17

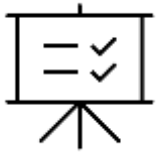
Simple

AIM OF THE SESSION



To familiarize students with the IPv4 and IPv6 header formats.

INSTRUCTIONAL OBJECTIVES



This Session is designed to:

1. Describe the responsibilities of IP protocol.
2. Describe the fields of IPv4 header.
3. Describe the fields of IPv6 header.

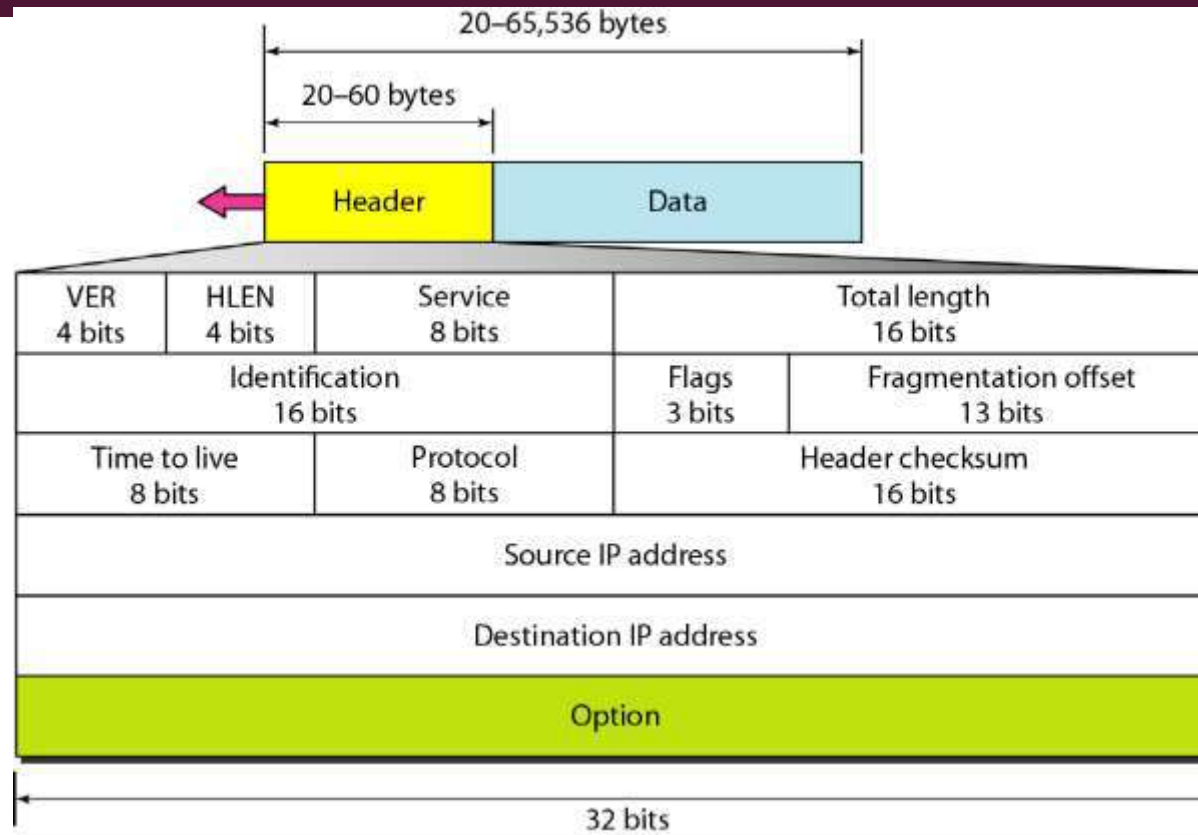
LEARNING OUTCOMES



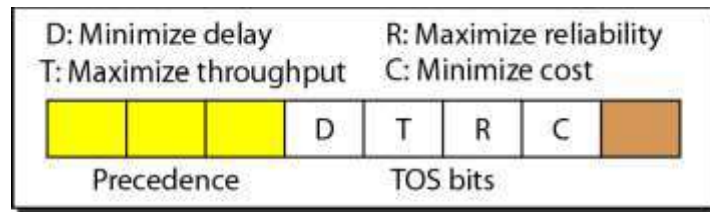
At the end of this session, you should be able to:

1. Illustrate the header formats of IPv4 and IPv6.
2. Understand the importance of each field in IPv4 and IPv6 headers.

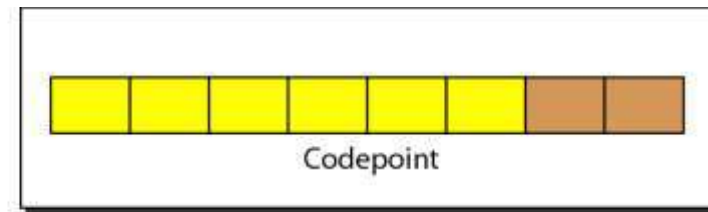
IPV4 DATAGRAM FORMAT



SERVICE TYPE OR DIFFERENTIATED SERVICES



Service type



Differentiated services

TYPES OF SERVICE

<i>TOS Bits</i>	<i>Description</i>
0000	Normal (default)
0001	Minimize cost
0010	Maximize reliability
0100	Maximize throughput
1000	Minimize delay

VALUES FOR CODEPOINTS

<i>Value</i>	<i>Protocol</i>
1	ICMP
2	IGMP
6	TCP
17	UDP
89	OSPF

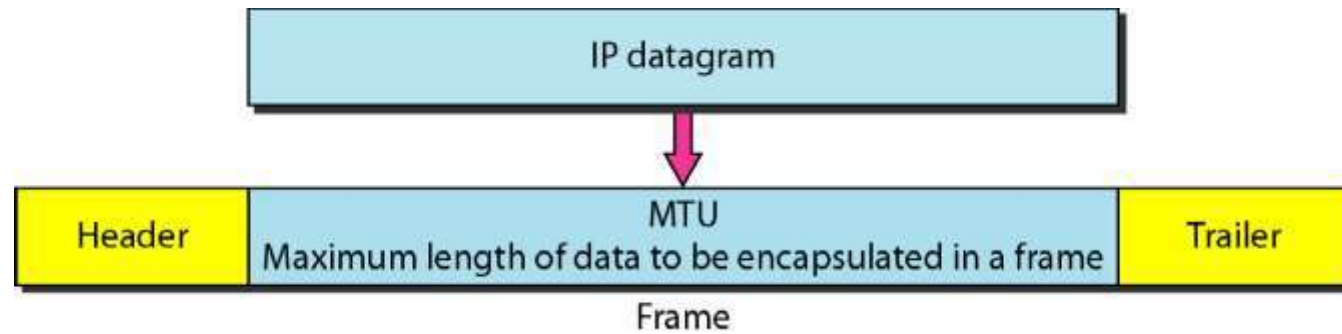
Table *Values for codepoints*

<i>Category</i>	<i>Codepoint</i>	<i>Assigning Authority</i>
1	XXXXX0	Internet
2	XXXXX11	Local
3	XXXXX01	Temporary or experimental

ENCAPSULATION OF A SMALL DATAGRAM IN AN ETHERNET FRAME



FIGURE *MAXIMUM TRANSFER UNIT
(MTU)*



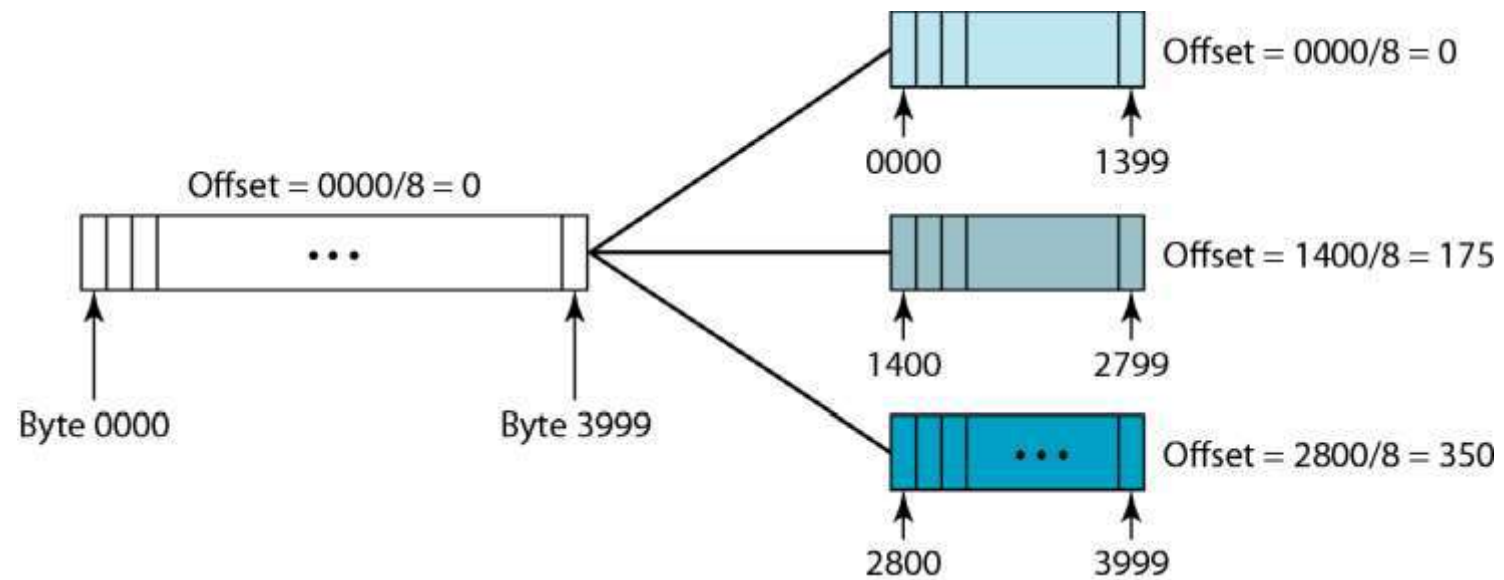
MTUS FOR SOME NETWORKS

<i>Protocol</i>	<i>MTU</i>
Hyperchannel	65,535
Token Ring (16 Mbps)	17,914
Token Ring (4 Mbps)	4,464
FDDI	4,352
Ethernet	1,500
X.25	576
PPP	296

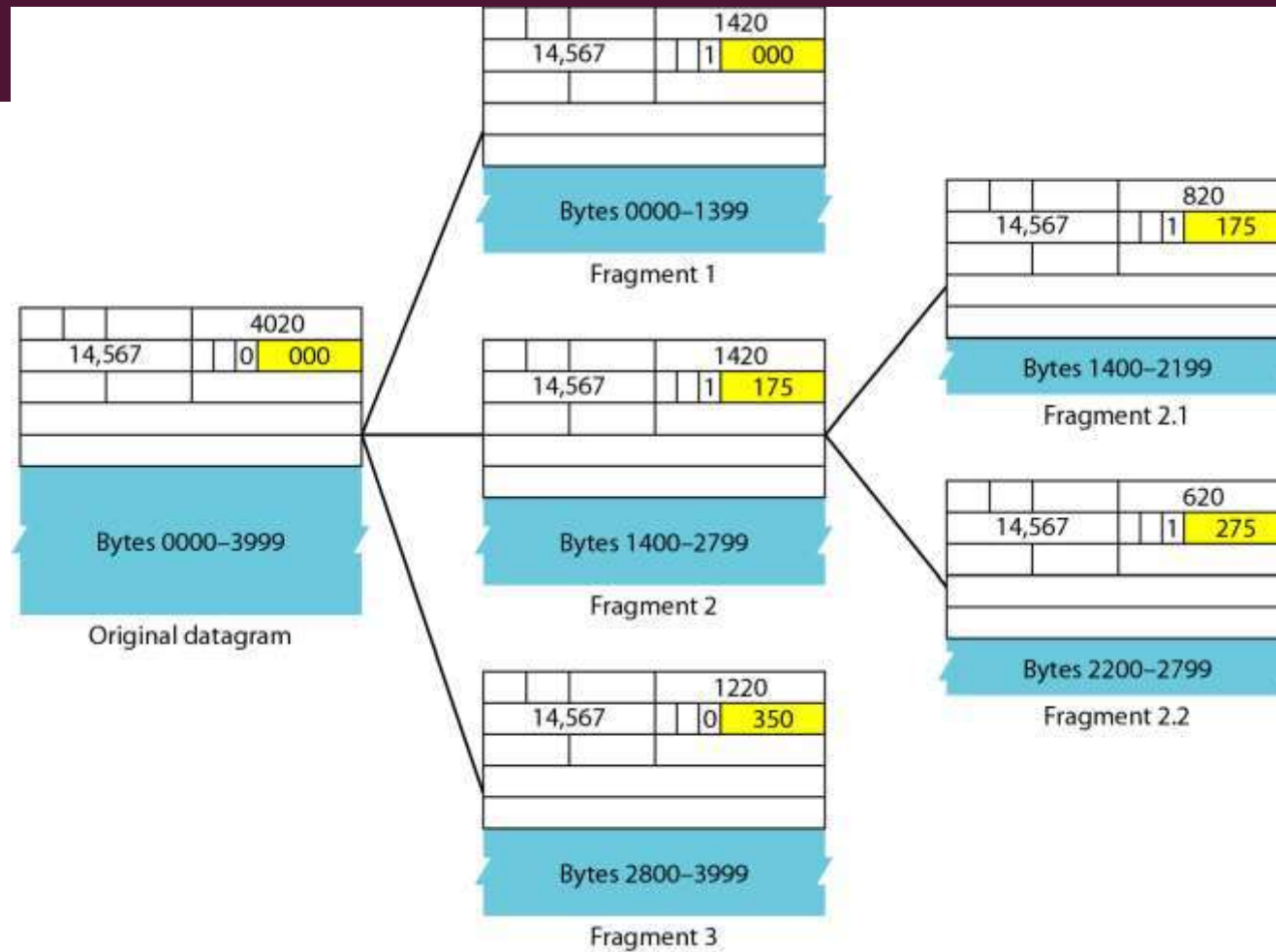
FLAGS USED IN FRAGMENTATION



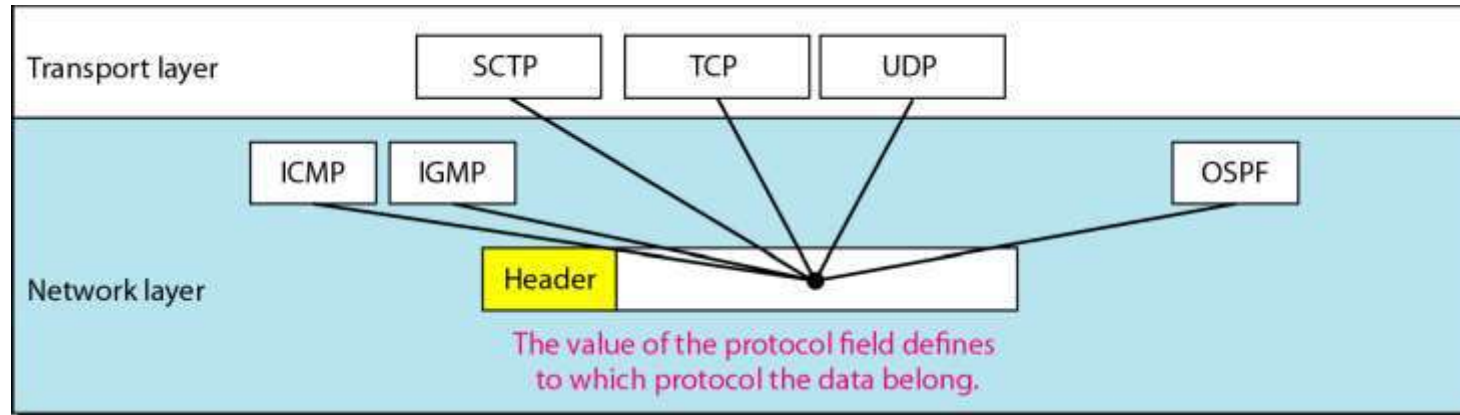
FRAGMENTATION EXAMPLE



DETAILED FRAGMENTATION EXAMPLE



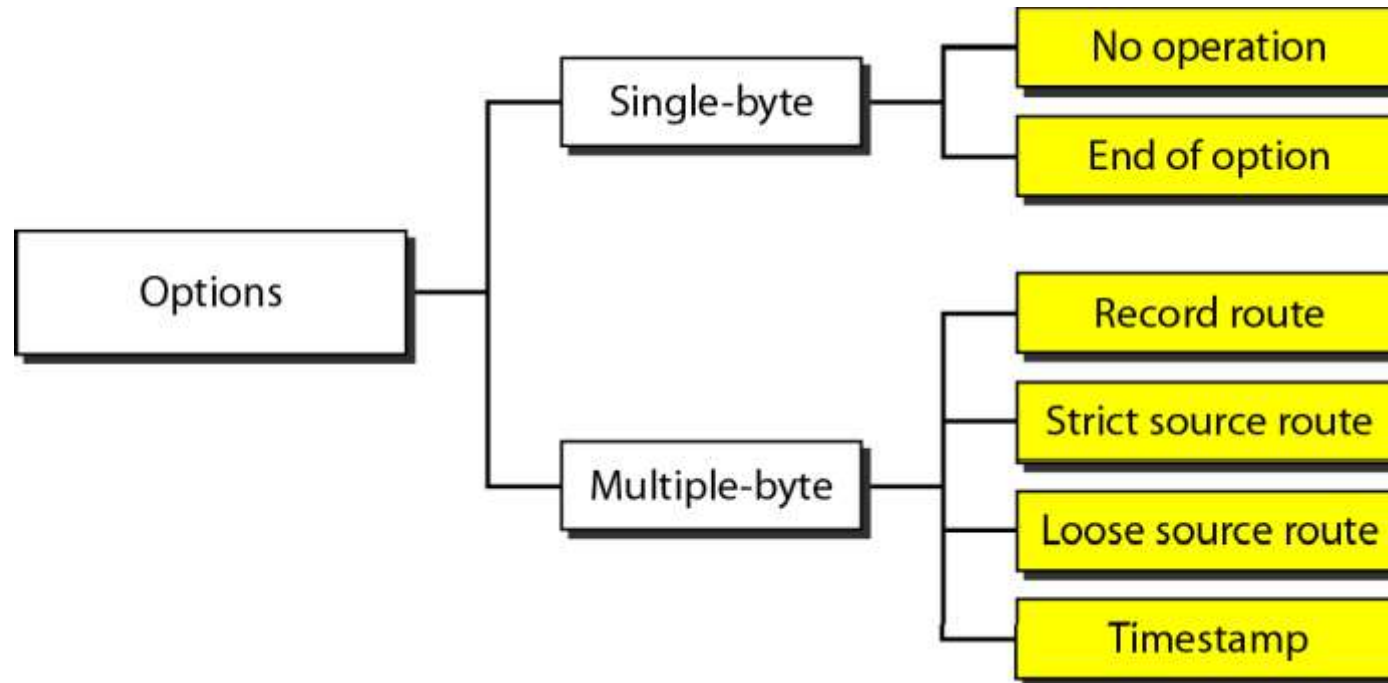
PROTOCOL FIELD AND ENCAPSULATED DATA



PROTOCOL VALUES

<i>Value</i>	<i>Protocol</i>
1	ICMP
2	IGMP
6	TCP
17	UDP
89	OSPF

TAXONOMY OF OPTIONS IN IPV4

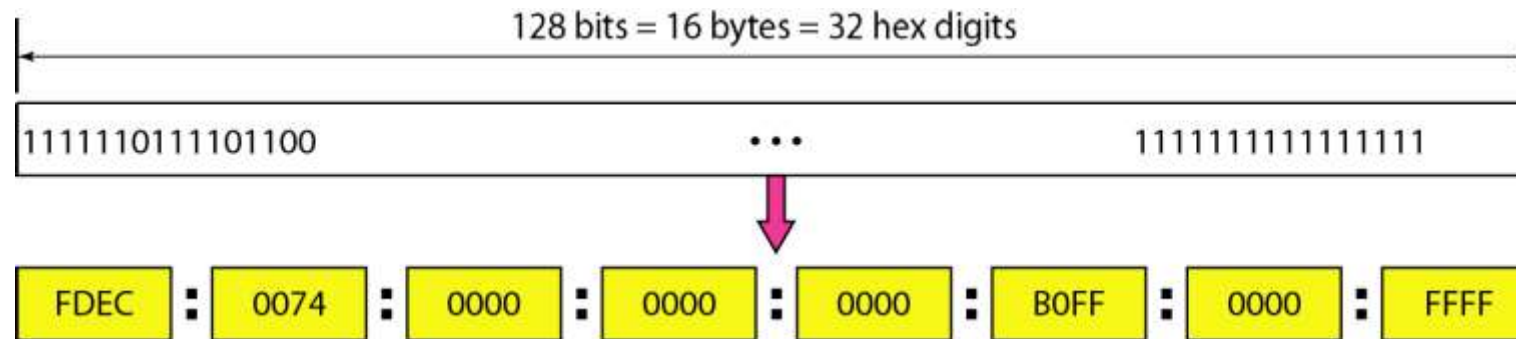



IPV6

Despite all short-term solutions, address depletion is still a long-term problem for the Internet. This and other problems in the IP protocol itself have been the motivation for IPv6.

An IPv6 address is 128 bits long

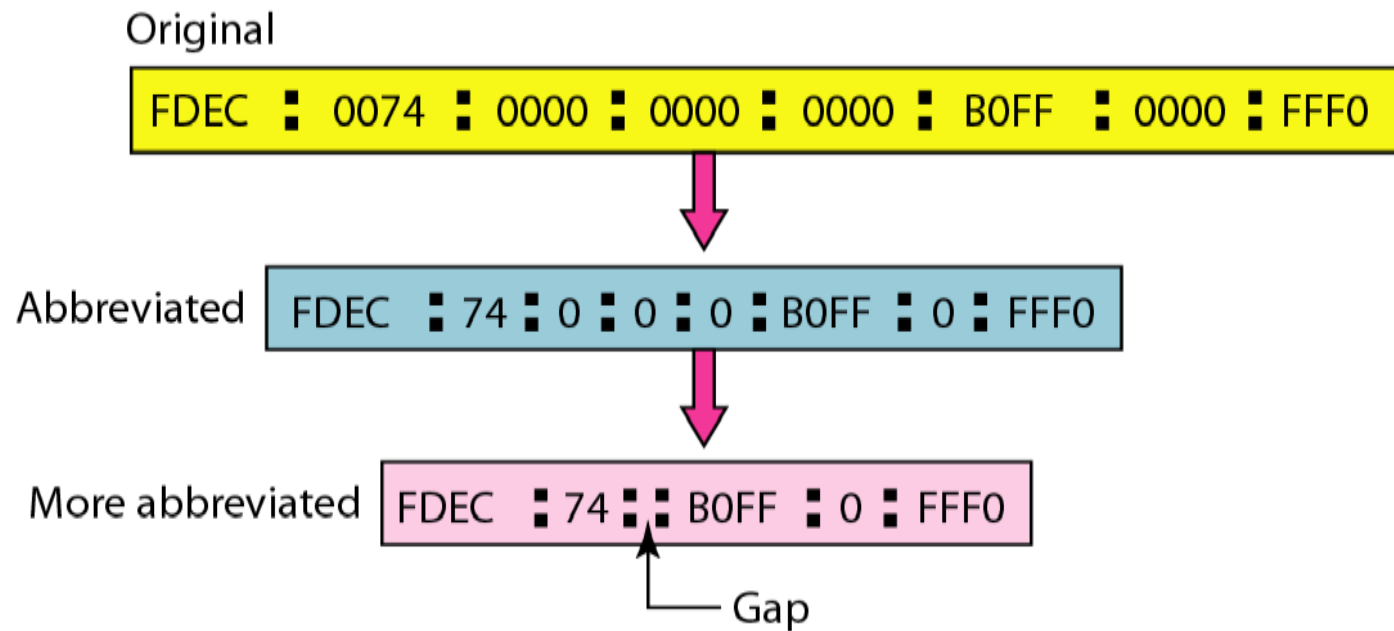
IPV6 ADDRESS IN BINARY AND HEXADECIMAL COLON NOTATION





The leading zeros of a section (four digits between two colons) can be omitted. Only the leading zeros can be dropped, not the trailing zeros

ABBREVIATED IPV6 ADDRESSES



Expand the address 0:15::1:12:1213 to its original.

Solution

We first need to align the left side of the double colon to the left of the original pattern and the right side of the double colon to the right of the original pattern to find how many 0s we need to replace the double colon.

XXXX:XXXX:XXXX:XXXX:XXXX:XXXX:XXXX:XXXX
0: 15: : 1: 12:1213

This means that the original address is.

0000:0015:0000:0000:0000:0001:0012:1213

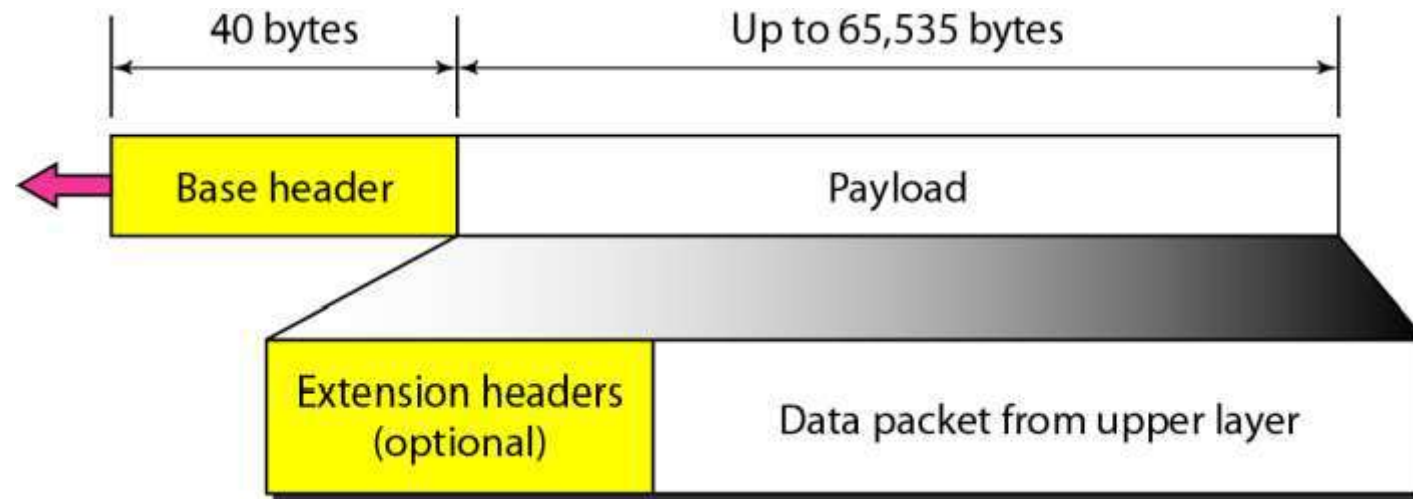
IPV6

The network layer protocol in the TCP/IP protocol suite is currently IPv4. Although IPv4 is well designed, data communication has evolved since the inception of IPv4 in the 1970s. IPv4 has some deficiencies that make it unsuitable for the fast-growing Internet..

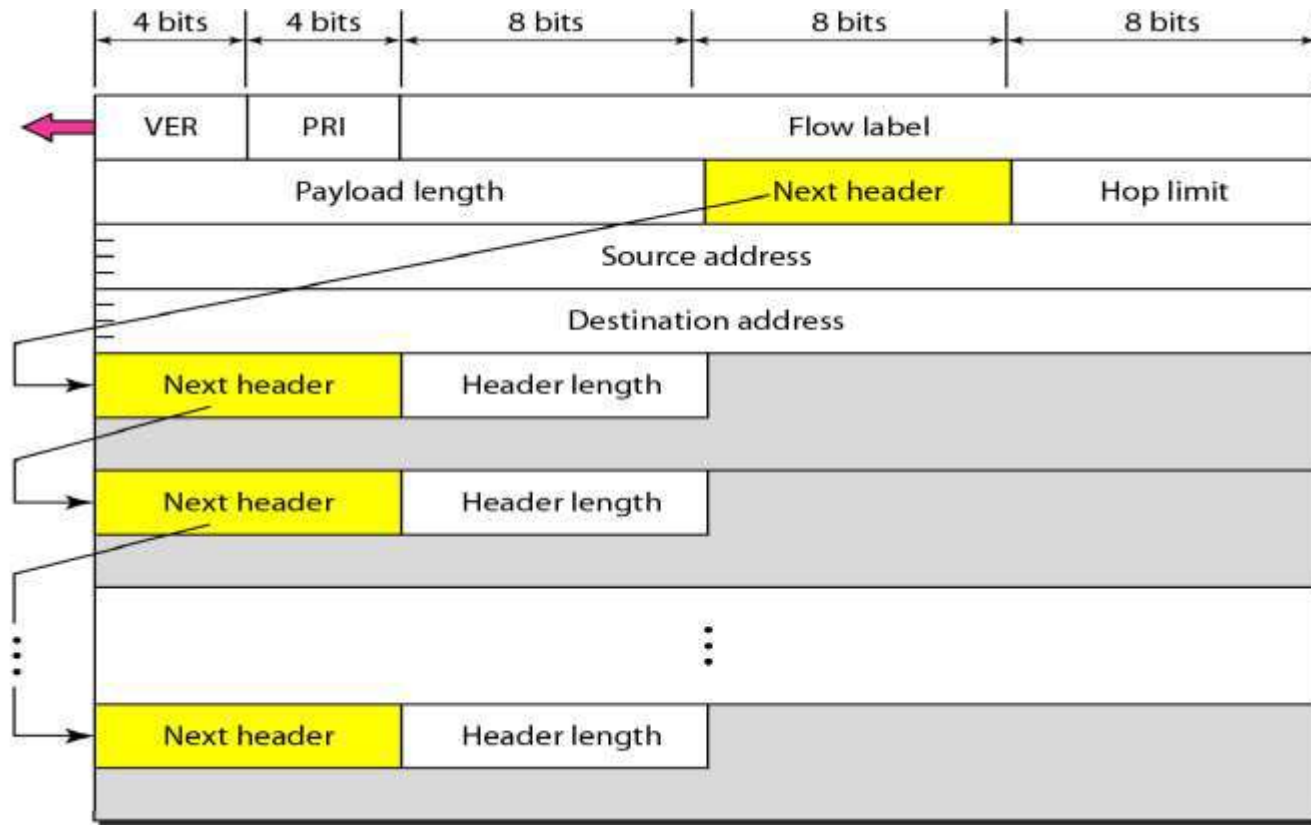
Topics discussed in this section:

**Advantages Packet Format
Extension Headers**

IPV6 DATAGRAM HEADER AND PAYLOAD



FORMAT OF AN IPV6 DATAGRAM



NEXT HEADER CODES FOR IPV6

<i>Code</i>	<i>Next Header</i>
0	Hop-by-hop option
2	ICMP
6	TCP
17	UDP
43	Source routing
44	Fragmentation
50	Encrypted security payload
51	Authentication
59	Null (no next header)
60	Destination option

PRIORITIES FOR CONGESTION-CONTROLLED TRAFFIC

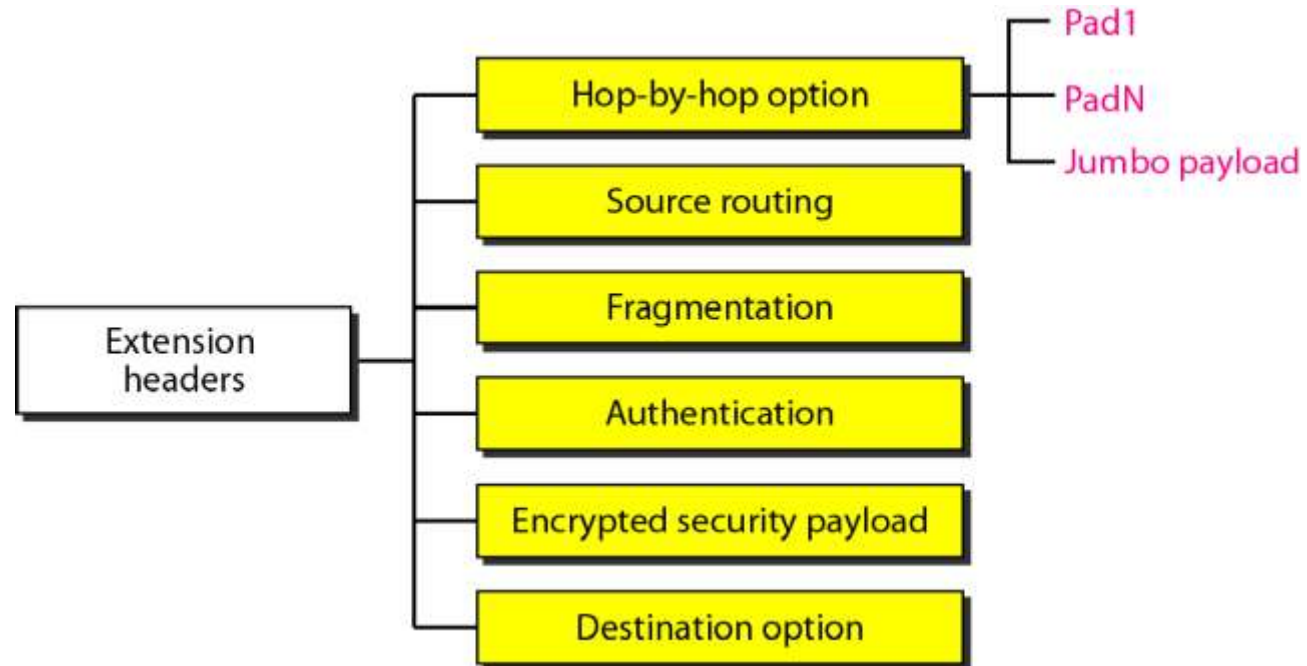
<i>Priority</i>	<i>Meaning</i>
0	No specific traffic
1	Background data
2	Unattended data traffic
3	Reserved
4	Attended bulk data traffic
5	Reserved
6	Interactive traffic
7	Control traffic

<i>Priority</i>	<i>Meaning</i>
8	Data with greatest redundancy
...	...
15	Data with least redundancy

COMPARISON BETWEEN IPV4 AND IPV6 PACKET HEADERS

<i>Comparison</i>
1. The header length field is eliminated in IPv6 because the length of the header is fixed in this version.
2. The service type field is eliminated in IPv6. The priority and flow label fields together take over the function of the service type field.
3. The total length field is eliminated in IPv6 and replaced by the payload length field.
4. The identification, flag, and offset fields are eliminated from the base header in IPv6. They are included in the fragmentation extension header.
5. The TTL field is called hop limit in IPv6.
6. The protocol field is replaced by the next header field.
7. The header checksum is eliminated because the checksum is provided by upper-layer protocols; it is therefore not needed at this level.
8. The option fields in IPv4 are implemented as extension headers in IPv6.

EXTENSION HEADER TYPES



COMPARISON BETWEEN IPV4 OPTIONS AND IPV6 EXTENSION HEADERS

<i>Comparison</i>
1. The no-operation and end-of-option options in IPv4 are replaced by Pad1 and PadN options in IPv6.
2. The record route option is not implemented in IPv6 because it was not used.
3. The timestamp option is not implemented because it was not used.
4. The source route option is called the source route extension header in IPv6.
5. The fragmentation fields in the base header section of IPv4 have moved to the fragmentation extension header in IPv6.
6. The authentication extension header is new in IPv6.
7. The encrypted security payload extension header is new in IPv6.



- IPv4 Header format
- IPv6 Header format



1. With a neat sketch describe the fields of IPv4 header.
2. With a neat sketch describe the fields of IPv6 header.



REFERENCES FOR FURTHER LEARNING OF THE SESSION

Reference Books:

1. Behrouz A. Forouzan , “Data Communication and Networking”, TMH, 5th Edition, 2012.
2. A.S.Tanenbaum, David J.Wetheral “Computer Networks” Pearson, 5th Edition.

THANK YOU



Team – Network Protocols & Security