IPv4 and IPv6 Protocols

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Internet layer

- Receives and forwards data to next stage
- Uses IP version 4 (IPv4),
- Uses IP version 6 (IPv6) protocol or
- [IPv6 Routing Protocol for Low Power Lossy Networks (LLNs)] in IoT/M2M
- 6LoWPAN in IoT/M2M

1. Ipv4 Protocol

IPv4 Protocol headers and data stack

- TCP Header plus data consist of stack from the transport layer

- From internet layer, each packet consists of 5-words basic IP header fields of 160 bits and extended header up to n words.

- 1 word = 32 bits

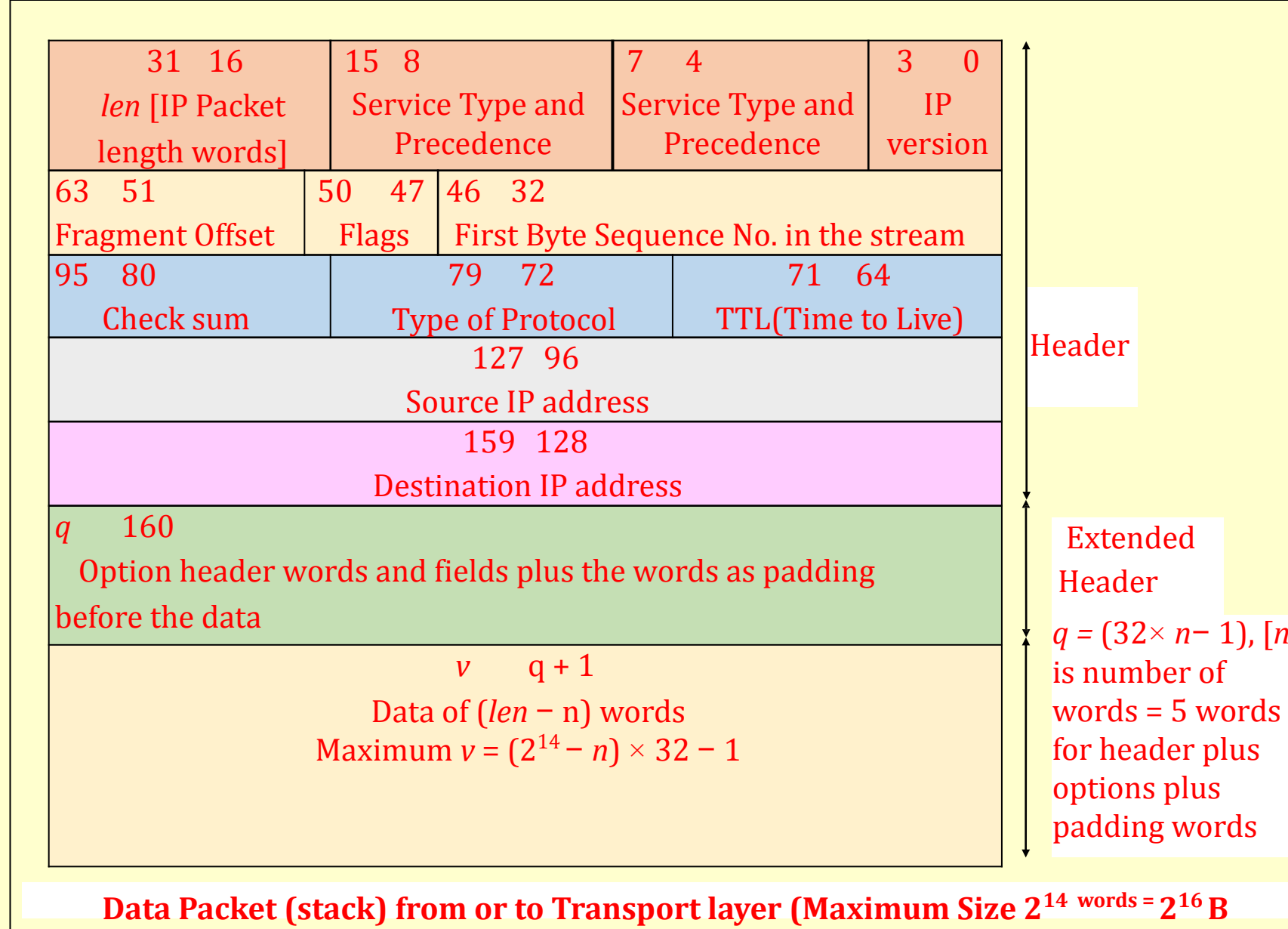- n = total number of header words added at IP layer

31 16	15 8	7 4	3 0
len [IP Packet length words]	Service Type and Precedence	Service Type and Precedence	IP version

63 51	50 47	46 32
Fragment Offset	Flags	First Byte Sequence No. in the stream

95 80	79 72	71 64
Check sum	Type of Protocol	TTL(Time to Live)

127   96
Source IP address

159   128
Destination IP address

q 160
Option header words and fields plus the words as padding before the data

v q + 1

Data of (*len* − n) words

Maximum $v = (2^{14} − n) \times 32 − 1$

Header

Extended Header

$q = (32 \times n − 1)$, [n is number of words = 5 words for header plus options plus padding words

Data Packet (stack) from or to Transport layer (Maximum Size 2^{14} words = 2^{16} B

Fig. 4.3 Data stack received or transmitted at or to transport layer and packet consisting of IP header fields of 160 bits word extended header of 1 (or 15) words (when required) plus data stack of maximum v words from or for the transport layer

Chapter- 4 L03: "Internet of Things", Raj Kamal, 2017

IPv4 Header and Data Stack (Packet Size) to next stage

- IP header first consists of five words
- The header extends by using option words and padding words
- Data stack to network layer has maximum V = (n + *len*) words where V <= ($2^{14} - n$) words
- Packet maximum 2^{14} word meaning 2^{16} B

Header first word fields

- b31-b16 *len* [IP Packet length in words]
- b15-b4 Service Type and Precedence
- b3-b0 IP version (=0100 for version 4)

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Header second word fields

- b63-b51 Fragment Offset (specify which data stack *len* words consist of which fragment in the data stack of   transport layer)
- b50-b47 Flags
- b46-b32 first Byte Sequence Number in the packet of the TCP stream

Header third word fields

- b95-b80 checksum (sum of header bits)
- b79-b72 type of protocol (for example, is it ICMP)
- b71-b64 time to live (number of hops try to reach to destination)

Header fourth and fifth word fields

- b127-b96 32-bit source IP address
- b159-b128 32-bit destination IP address

2. Ipv6 Protocol

IPv6 Protocol features

- Large addressing space and
- Route aggregation

IPv6

- IPv6 addresses of 128 bits
- Vastly enlarged address space compared to IPv4
- An Pv6 address field provides a numerical label

Label in IPv6

- It identifies a network interface of a node or other network nodes and subnets participating in IPv6 Internet

- A device called node when it communicates on a network

IPv6

- Permitting the hierarchical address allocation
- Thus route aggregation across the Internet
- Thus limit the expansion of routing tables.

IPv6

- Provisions additional optimization for the delivery of services using routers, subnets and interfaces,
- Manages device mobility, security, and configuration aspects

IPv6

- Expanded and simple use of multicast addressing
- Provisions jumbo grams (big size datagram)
- Permits extensibility of options

Summary

We learnt
- IPv4 and IPv6 protocol basic features
- 32-bit IP4 addresses
- 32-bit IPv6 addresses
- Internet layer in IPv6 receives and transmits from/to adaptation layer when using IEEE 802.15.4 WPAN devices