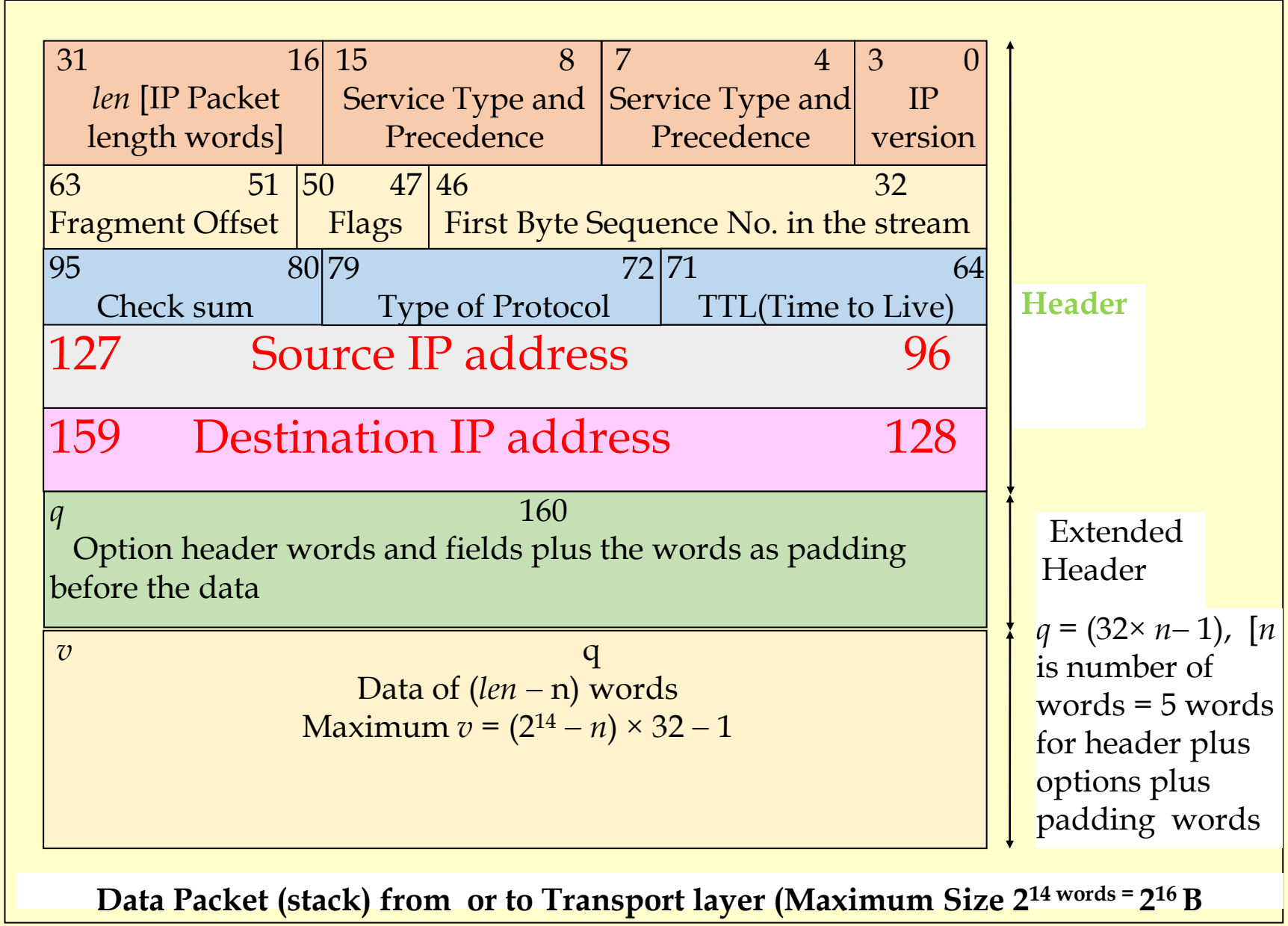
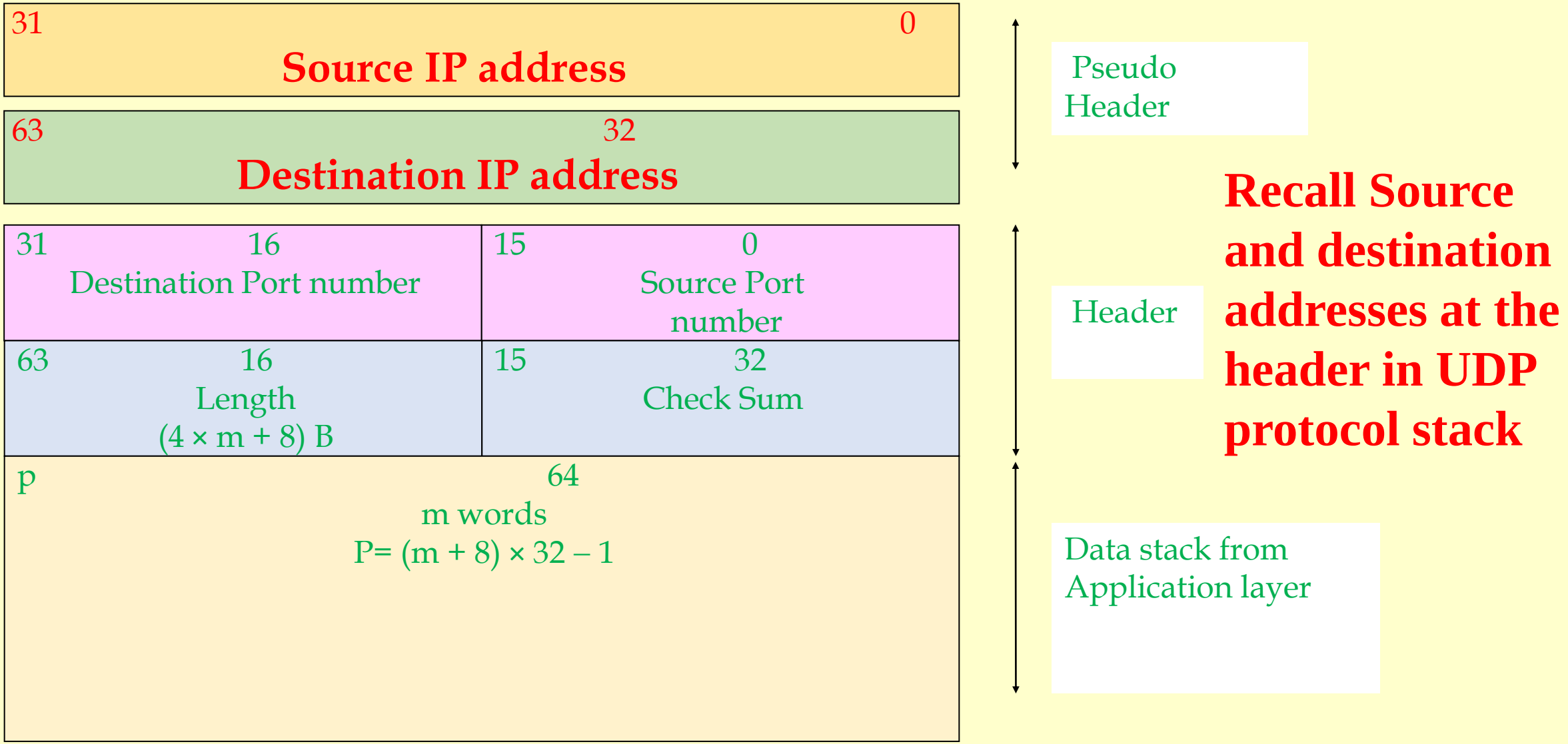
Lesson 6
IP addressing and MAC addressing, DNS and DHCP

32-bit IP version 4 address

- Four decimal numbers separated by dots, for example, 198.136.56.2 for 32 bits– 11000110 10001000 00111000 00000010.
- Each decimal number is decimal value of an Octet (=8 bits).



Recall Source and destination addresses at the header in TCP protocol stack



Recall Source and destination addresses at the header in UDP protocol stack

4-decimal Numbers IP version 4 address

- IP addresses can be between 0.0.0.0 to 255.255.255.255, total 2^{32} addresses due to 32-bit address.
- Three separate fields with a decimal number each for each set of 8 bits are easier to use.

Subnet address

- Internet address visible to outside world for the routers on the Internet
- Subnet address for use within the group internally, and is invisible to outside world.
- A subnet is a sub-network consisting of number of hosts or nodes or devices or machines.

Class A, B and C Networks

- Three x.x.x specifies a network group of $2^{24} – 2$ hosts
- Two x.x specifies a network group of $(2^{16} – 2)$ hosts,
- One *.x* specifies a smaller group of $(2^{8} – 2)$ hosts

Class A network group address

- Address *n.x.x.x*, where x is between 0 to 255 and *n* is between 1 and 126 for the addresses between 1.0.0.0 and 126.x.x.x.
- This is because the IP address 32-bit has msb bit 31 =0.

Class B Network

- Class B network group address means address *n.m.x.x*, where x is between 0 to 255 and *n.m* is between 128.1 to 191.254 for the addresses between 128.1.0.0 and 191.254.x.x.
- This is because the IP address 32-bit has two msb bits 31-30 = 10

Class C Network

- Class C network group address means address *n.m.k.x*, where *x* is between 0 to 255 and *n.m.k* is between 192.0.1 and 223.255.254 for the addresses between 192.0.1.0 and 223.255.254.x.
- This is because the IP address 32-bit has three msb bits 31-30-29 = 110

Dynamic IP Address

- A number of computers, laptops, mobiles and devices may need connection in an organisation to an IP router
- Number of actual users at an instant may be much less.
- Dynamic IP address solves this problem.

Dynamic IP Address

- Once a device connects to Internet, it needs to be allotted individual IP address, called dynamic IP address
- When the device connects to a router, the router and device use DHCP (Dynamic Host Control Protocol)
- DHCP actions assign an IP address at an instance to the device.

Domain Names System (DNS)

- An Application which provides the IP address for the corresponding service from the named domain service
- For example, an IP address, 198.136.56.2 (11000110 10001000 00111000 00000010) registered domain name rajkamal.org for the IP address.

128-bit address **IPv6 address**

- A hexadecimal digit represents 4-bit, 0 hex = 0000 binary to f hex = 1111.
- 128-bit address: 32 hexadecimal digits
- Eight sets of 4 hex-digits each separate by a colon or dot in an IPv6 address.
- Example is 16-hexadecimal digits, 40a0: 0acb:8a00:b372:0000: 0000:0000:0000.

IPv6 Large Number of addresses

- IANA manages the allocation process for the IPv6 addresses
- 64-bit in the last when all zeros then can be omitted

Classification of IPv6 addresses

- Three classes
- Each class differs in the primary addressing and routing methods.
- An interface may be at distinct node..

Unicast address

- For a single network interface
- 48-bit or more in unicast specify routing prefix
- 16-bit or less specify a subnet id
- 64-bit are interface identifier

Anycast address

- Address of a group of interfaces
- Anycast address means an address which can be present and used by a group of nodes or interfaces

Anycast address

- A packet sent to an anycast address delivered to just one of the member interfaces
- One may be *nearest* host
- The nearest is according to the routing protocol's definition of distance.

Multicast address

- Address used by multiple hosts
- Acquire the multicast address destination by participating in the multicast distribution protocol among the network routers
- A packet with multicast address delivers to all interfaces that have joined a corresponding multicast group.

MAC (Media Access Control) Address

- Each network card or Ethernet protocol using computer has a unique MAC address for the source and destination node addresses.

Ethernet frame communication

- Data stack (4 B to 1500 B)
- Source node MAC address and destination node MAC address.
- MAC address of each node specified in the firmware of the network card or chip or core

Address Resolution Protocol (**ARP) and RARP (Reverse ARP)**

- ARP uses a lookup table
- The network 32-bit address provides MAC address of the individual node using the table
- RARP also uses that lookup table
- The table stores the IP address in one column and node MAC address in another

Summary

We learnt

- 32-bit IP address
- Concept of subnet, DNS and DHCP
- IPv6 Address: Unicast, anycast and multicast
- MAC address
- ARP and RARP

End of Lesson 6 on

IP addressing and MAC addressing, DNS and DHCP