Chettinad College of Engineering and Technology

Department of ECE

EC3401 NETWORKS AND SECURITY

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AP/ECE

UNIT II
NETWORK LAYER

What is IPv4?

- Introduction
- Notations
- Addressing Types
- Subnetting

“An IPv4 address is a 32-bit address that uniquely and universally defines the connection of a device (for example, computer or a router) to the Internet”

- Universal Communication
- Within an IP address, it encodes its network number and host number
- **Advanced Research Projects Agency Network**
- Address space – " The total number of addresses used by the protocol" [2^32= 4 billion addresses]
- Example- 192.0.2.126 could be an IPv4 address.

PARTS OF IPV4

Network part:

- The network part conjointly identifies the category of the network that's assigned.

Host Part:

- The host part uniquely identifies the machine on your network. This part of the IPv4 address is assigned to every host.
- For each host on the network, the network part is the same, however, the host half must vary.

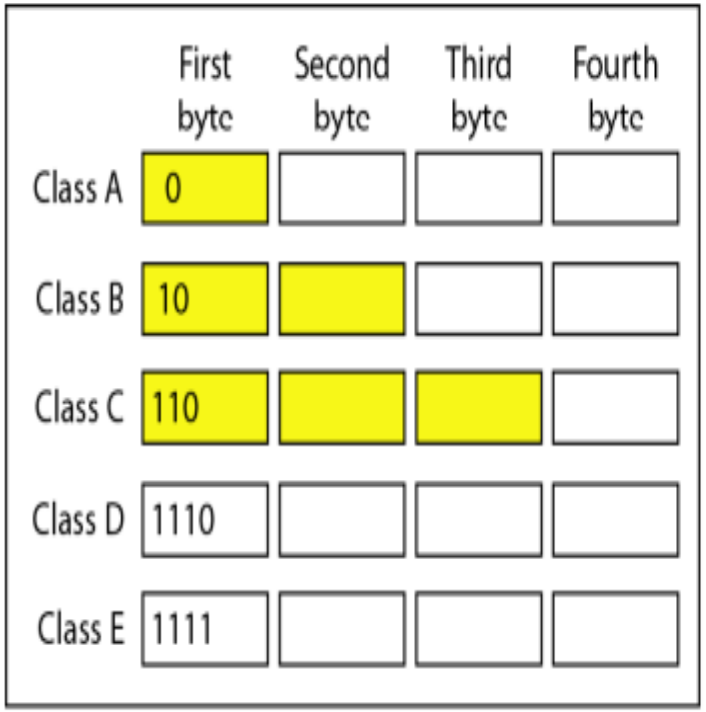
Addressing Types

- Classful Addressing
- Classless Addressing

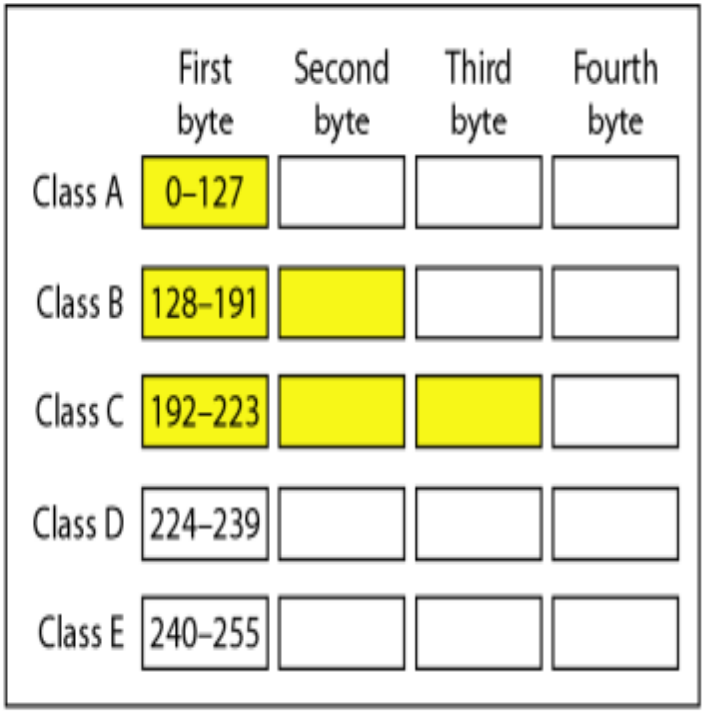
Classful addressing

- In Classful addressing, the address space is divided into five classes: A, B, C, D, and E

Finding the classes in binary and dotted-decimal notation



a. Binary notation



b. Dotted-decimal notation

Address Class	1st octet range (decimal)	1st octet bits (green bits do not change)	Network(N) and Host(H) parts of address	Default subnet mask (decimal and binary)	Number of possible networks and hosts per network
A	1-127**	00000000-01111111	N.H.H.H	255.0.0.0	128 nets (2^7) 16,777,214 hosts per net (2^24-2)
B	128-191	10000000-10111111	N.N.H.H	255.255.0.0	16,384 nets (2^14) 65,534 hosts per net (2^16-2)
C	192-223	11000000-11011111	N.N.N.H	255.255.255.0	2,097,150 nets (2^21) 254 hosts per net (2^8-2)
D	224-239	11100000-11101111	NA (multicast)		
E	240-255	11110000-11111111	NA (experimental)		

Hierarchy in Addressing

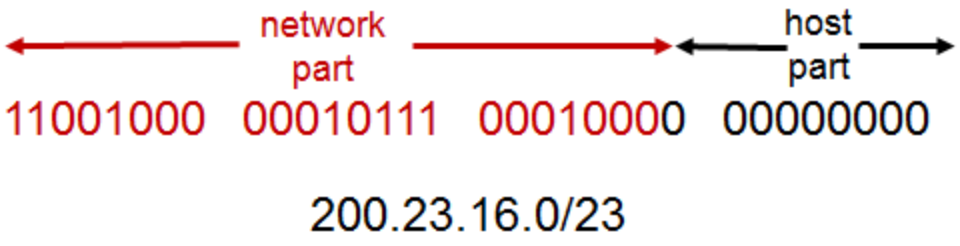
- Prefix – Defines the network
- Suffix – Defines the node

Classful IPv4 addressing

- Class A:
  - For very large organizations
  - 2^{24} = 16 million hosts allowed
- Class B:
  - For large organizations
  - 2^{16} = 65 thousand hosts allowed
- Class C
  - For small organizations
  - 2^{8} = 255 hosts allowed
- Class D
  - Multicast addresses
  - No network/host hierarchy

Classless IPv4 addressing

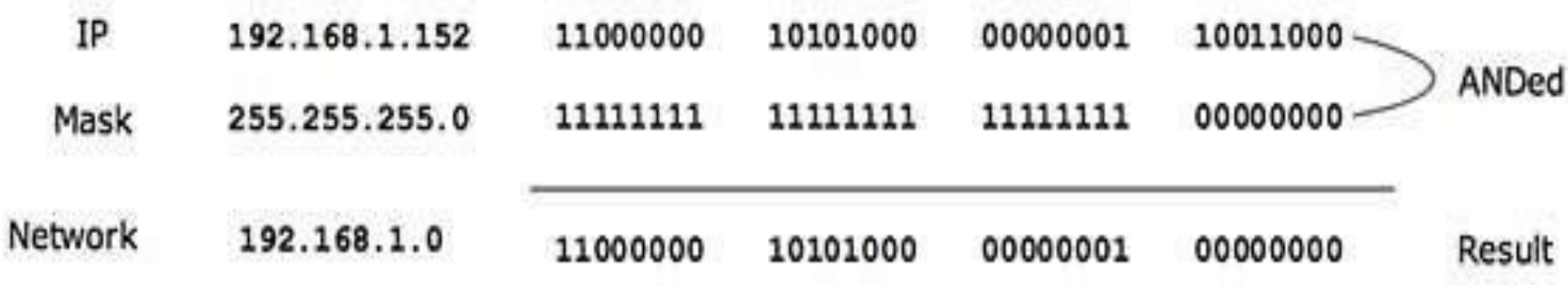
- Also called classless inter-domain routing (CIDR)
- Key idea: Network component of the address (ie: prefix) can have any length (usually from 8—32)
- Address format: a.b.c.d/x, where x is the prefix length
  - Customary to use 0s for all suffix bits



SUBNET MASK

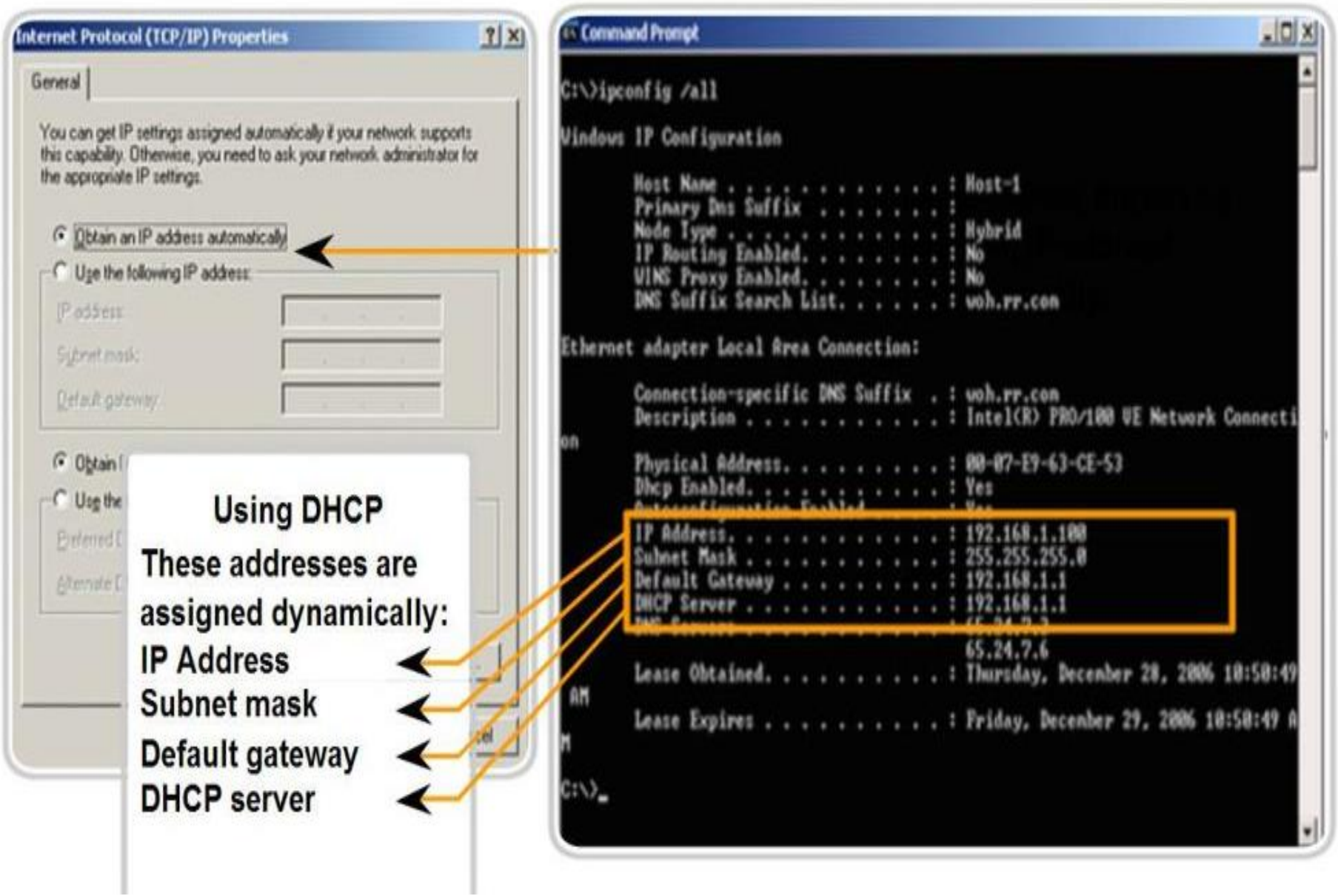
- The 32-bit IP address contains information about the host and its network.
- It is very necessary to distinguish both.
- For this, routers use Subnet Mask, which is as long as the size of the network address in the IP address.
- Subnet Mask is also 32 bits long.
- If the IP address in binary is ANDed with its Subnet Mask, the result yields the Network address.

For example, say the IP Address is 192.168.1.152 and the Subnet Mask is 255.255.255.0 then –

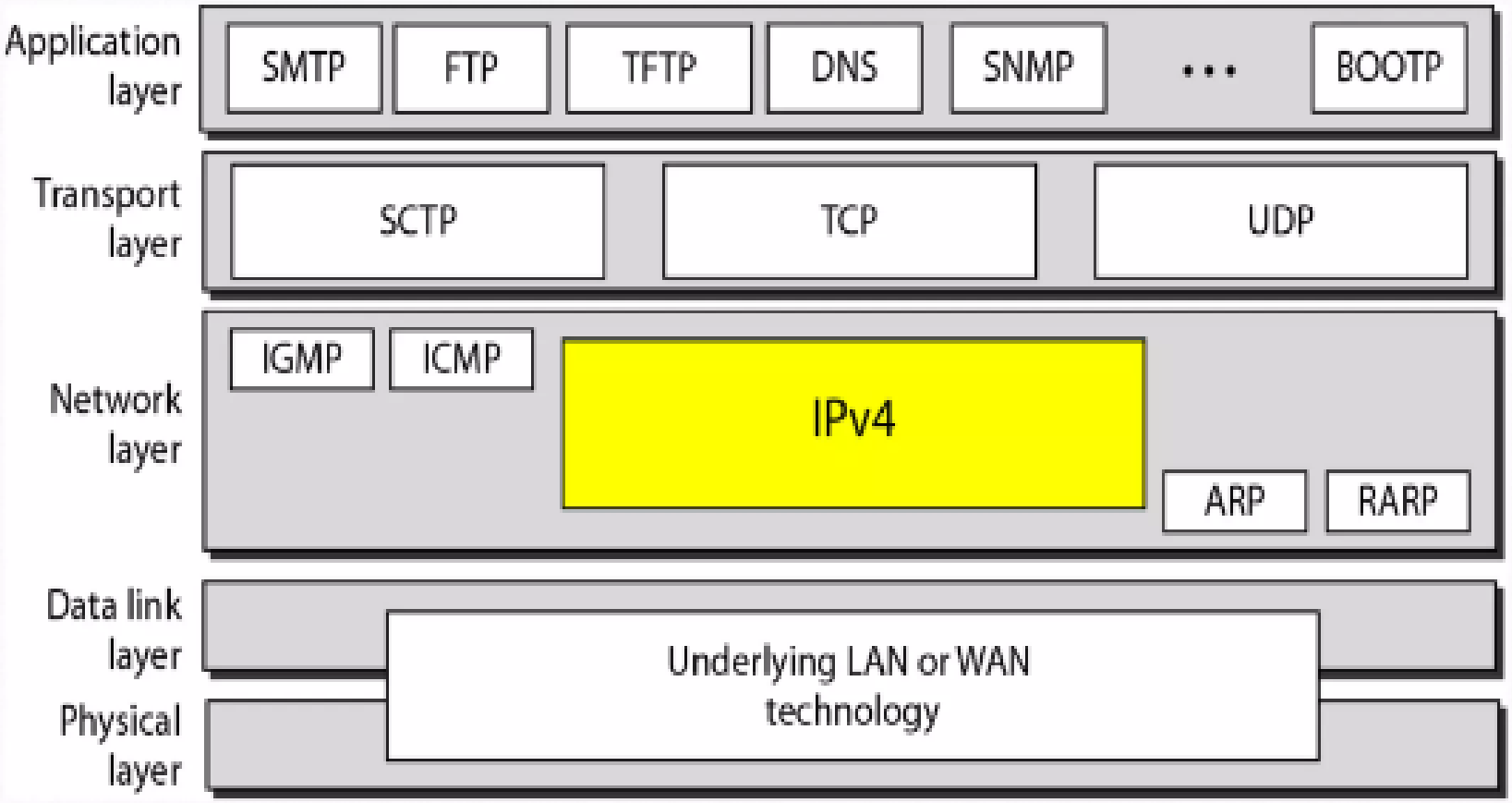


This way the Subnet Mask helps extract the Network ID and the Host from an IP Address. It can be identified now that 192.168.1.0 is the Network number and 192.168.1.152 is the host on that network.

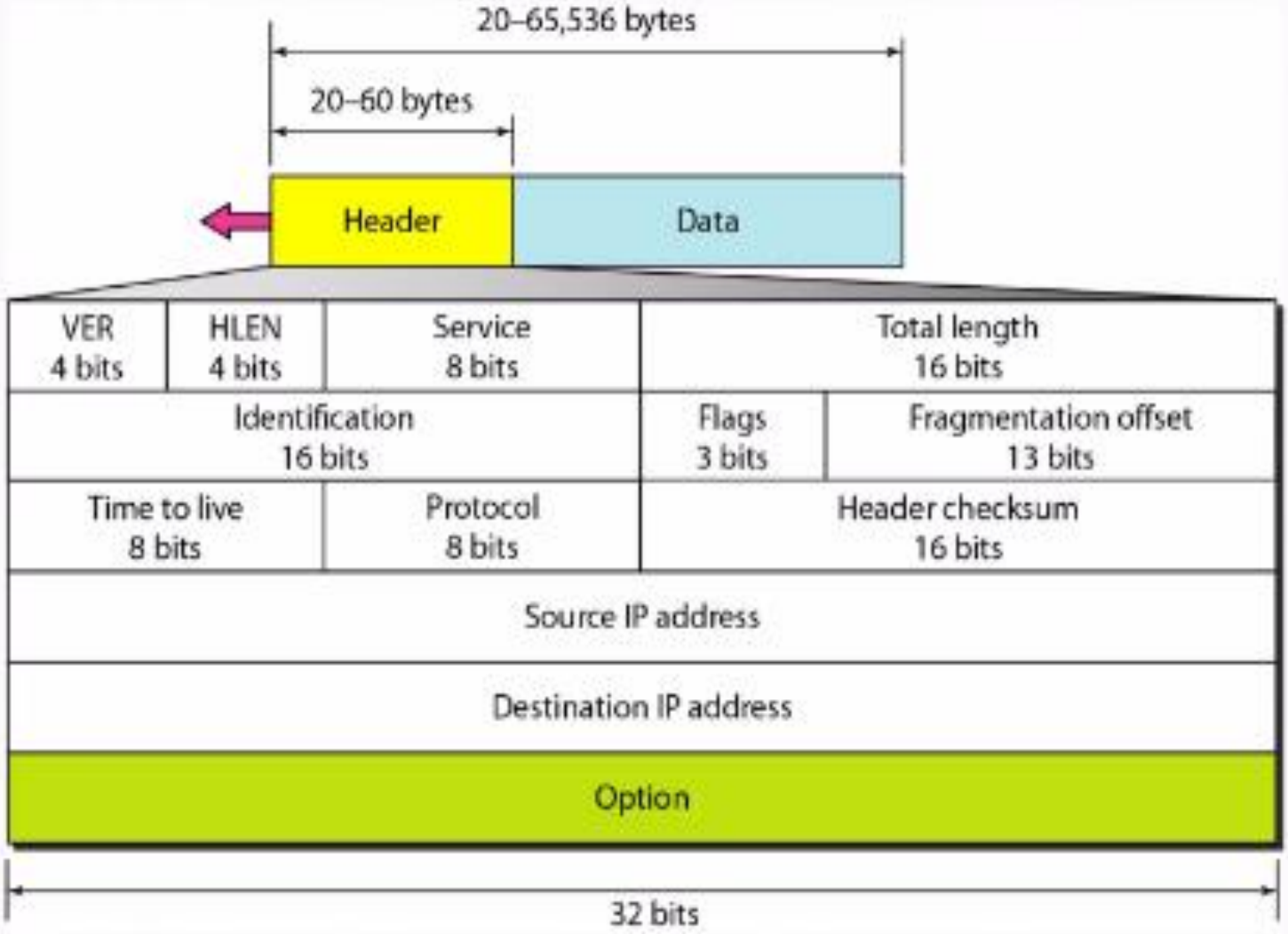
Assigning Dynamic Addresses



Protocol Suite

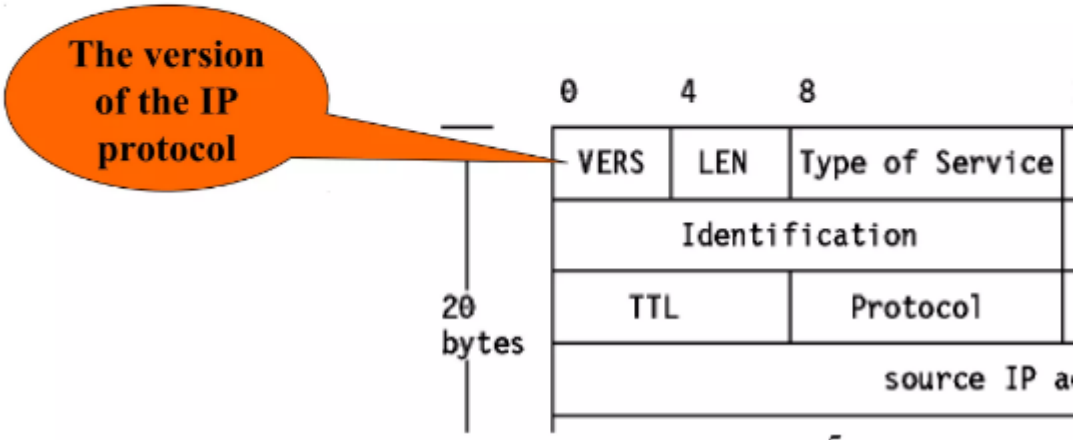


Datagram Format



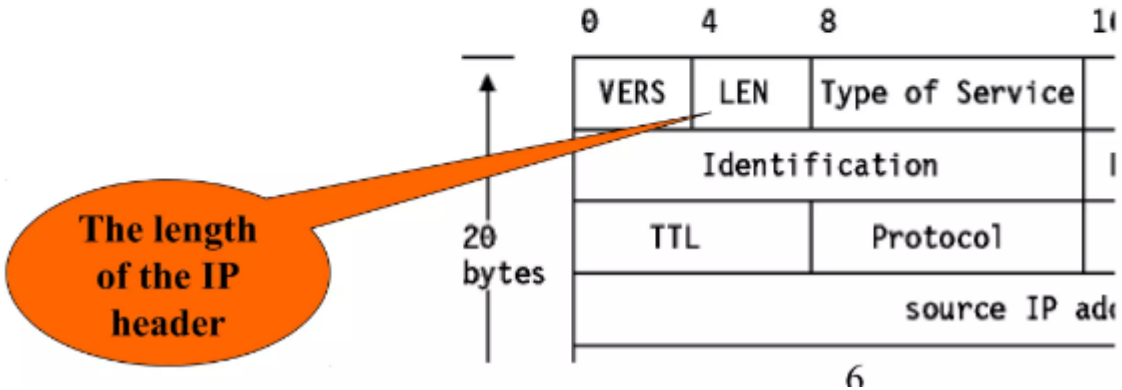
VERS - Version

The version of the IP protocol. The current version is 4. 5 is experimental and 6 is IPng (see IP: The Next Generation (IPng)).



LEN - Length

The length of the IP header counted in 32-bit quantities. This does not include the data field.



Type of Service

The type of service is an indication of the quality of service requested for this IP datagram.