SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

19ECT301- COMMUNICATION NETWORKS

III YEAR/ V SEMESTER

UNIT 2 –DATA-LINK LAYER & NETWORK LAYER

TOPIC 1 – LINK LAYER ADDRESSING

IPv4 ADDRESSES

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

Topics discussed in this section:

Address Space
Notations
Classful Addressing
Classless Addressing
Network Address Translation (NAT)

Address Space

- An address space is the total number of addresses used by the protocol.

- If a protocol uses *N bits to define* an address, the address space is 2^N *because each bit can have two different values (0 or 1)* and *N bits can have* 2^N *values.*

Note

The address space of IPv4 is 2^{32} or 4,294,967,296.

Notations

There are two prevalent notations to show an IPv4 address:

- Binary notation
- Dotteddecimal notation

Binary Notation

- In binary notation, the IPv4 address is displayed as 32 bits.
- Each octet is often referred to as a byte.
- An IPv4 address referred to as a 4-byte address.
- Example

01110101 10010101 00011101 00000010

Dotted-Decimal Notation

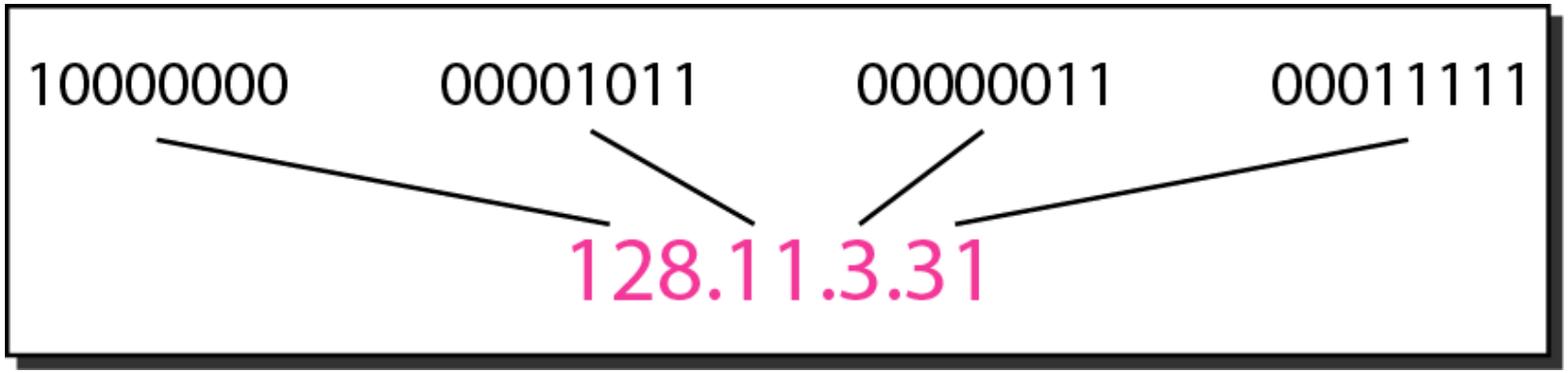
- To make the IPv4 address more compact and easier to read, Internet addresses are usually written in decimal form with a decimal point (dot) separating the bytes.

- Example

  117.149.29.2

- Because each byte (octet) is 8 bits, each number in dotted-decimal notation is a value ranging from 0 to 255.

Figure 19.1 ***Dotted-decimal notation and binary notation for an IPv4 address***



Example

Change the following IPv4 addresses from binary notation to dotted-decimal notation.

a. 10000001 00001011 00001011 11101111

b. 11000001 10000011 00011011 11111111

Solution

We replace each group of 8 bits with its equivalent decimal number and add dots for separation.

a. 129.11.11.239

b. 193.131.27.255

Example

Change the following IPv4 addresses from dotted-decimal notation to binary notation.

a. 111.56.45.78

b. 221.34.7.82

Solution

We replace each decimal number with its binary equivalent.

a. 01101111 00111000 00101101 01001110

b. 11011101 00100010 00000111 01010010

Example

Find the error, if any, in the following IPv4 addresses.

a. 111.56.045.78
b. 221.34.7.8.20
c. 75.45.301.14
d. 11100010.23.14.67

Solution

a. ***There must be no leading zero (045).***

b. ***There can be no more than four numbers.***

c. ***Each number needs to be less than or equal to 255.***

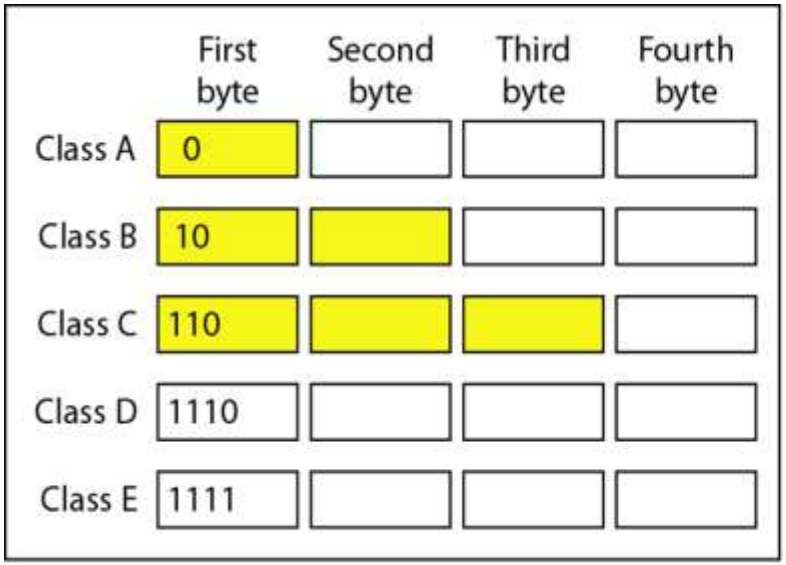
d. ***A mixture of binary notation and dotted-decimal notation is not allowed.***

Classful Addressing

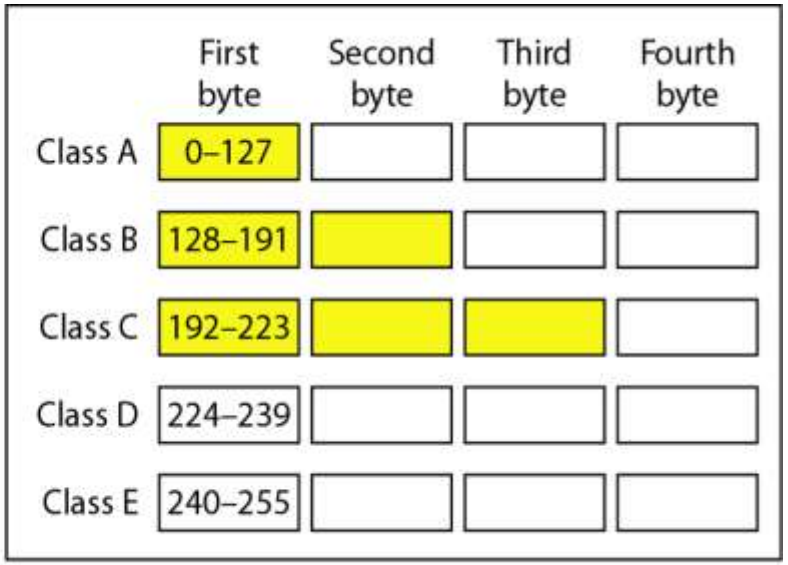
- In classful addressing, the address space is divided into five classes: A, B, C, D,and E.

- Each class occupies some part of the address space.

Figure 19.2 *Finding the classes in binary and dotted-decimal notation*



a. Binary notation



b. Dotted-decimal notation

Example

Find the class of each address.

a. **0**0000001 00001011 00001011 11101111
b. **110**00001 10000011 00011011 11111111
c. **14**.23.120.8
d. **252**.5.15.111

Solution

a. ***The first bit is 0. This is a class A address.***

b. ***The first 2 bits are 1; the third bit is 0. This is a class C address.***

c. ***The first byte is 14; the class is A.***

d. ***The first byte is 252; the class is E.***

Classes and Blocks

- One problem with classful addressing is that each class is divided into a fixed number of blocks with each block having a fixed size as shown in Table

Number of blocks and block size in classful IPv4 addressing

Class	*Number of Blocks*	*Block Size*	*Application*
A	128	16,777,216	Unicast
B	16,384	65,536	Unicast
C	2,097,152	256	Unicast
D	1	268,435,456	Multicast
E	1	268,435,456	Reserved

THANK YOU