



# **SNS COLLEGE OF TECHNOLOGY**

**Coimbatore-35**

**An Autonomous Institution**



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Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

**DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING**

## **19 ECT301- 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.

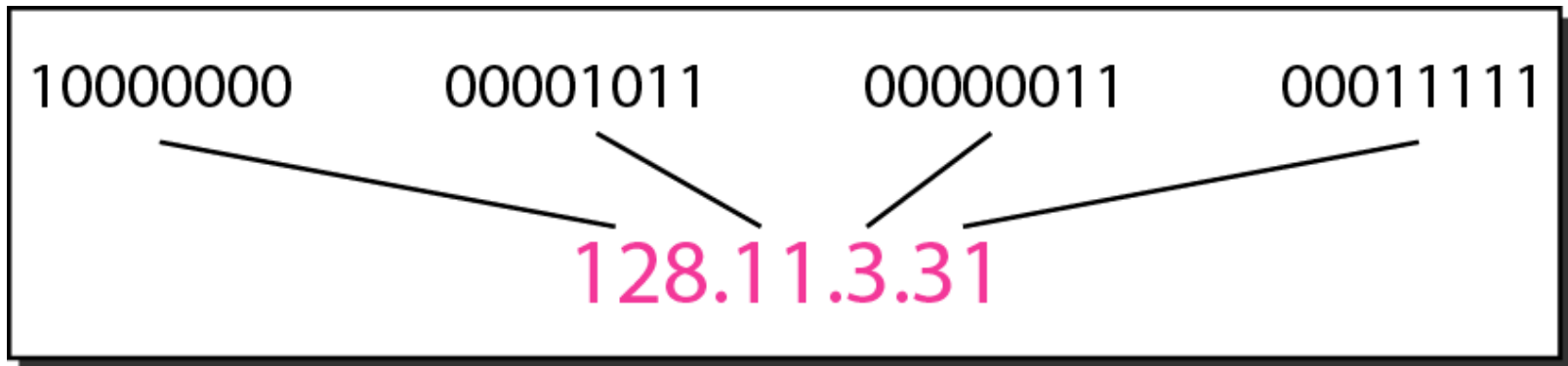
- Example

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 ..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 ..2** *Finding the classes in binary and dotted-decimal notation*

|         | First byte | Second byte | Third byte | Fourth byte |
|---------|------------|-------------|------------|-------------|
| Class A | 0          |             |            |             |
| Class B | 10         |             |            |             |
| Class C | 110        |             |            |             |
| Class D | 1110       |             |            |             |
| Class E | 1111       |             |            |             |

a. Binary notation

|         | First byte | Second byte | Third byte | Fourth byte |
|---------|------------|-------------|------------|-------------|
| Class A | 0-127      |             |            |             |
| Class B | 128-191    |             |            |             |
| Class C | 192-223    |             |            |             |
| Class D | 224-239    |             |            |             |
| Class E | 240-255    |             |            |             |

b. Dotted-decimal notation



## *Example*

*Find the class of each address.*

- a. 00000001 00001011 00001011 11101111
- b. 11000001 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*

| <i>Class</i> | <i>Number of Blocks</i> | <i>Block Size</i> | <i>Application</i> |
|--------------|-------------------------|-------------------|--------------------|
| 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**