Computer Network

Lecture-28

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Unit-3

Logical 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.

Note: Two devices on the Internet can never have the same address at the same time.

Note: If a device operating at the network layer has m connections to the Internet, then it needs to have m addresses. Router is such a device that uses many addresses.

Logical Addressing

Address Space

- A protocol such as IPv4 that defines addresses has an 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 values.
- IPv4 uses 32-bit addresses, which means that the address space is 2^{32} or 4,294,967,296 (more than 4 billion).

Logical Addressing

Notations

There are two prevalent notations to show an IPv4 address: binary notation and dotted decimal notation.

Binary Notation

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

The following is an example of an IPv4 address in binary notation:

01110101 10010101 00011101 00000010

Dotted-Decimal Notation

The following is the dotted-decimal notation of the above address:

117.149.29.2

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Example

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

a. 10000001 00001011 00001011 11101111

b. 11000001 10000011 00011011 11111111

Solution

a. 129.11.11.239

b. 193.131.27.255

Logical Addressing

Example

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

a. 111.56.45.78

b. 221.34.7.82

Solution

a. 01101111 00111000 00101101 01001110

b. 11011101 00100010 00000111 01010010

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Example

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

a. 111.56.045.78

b. 221.34.7.8.20

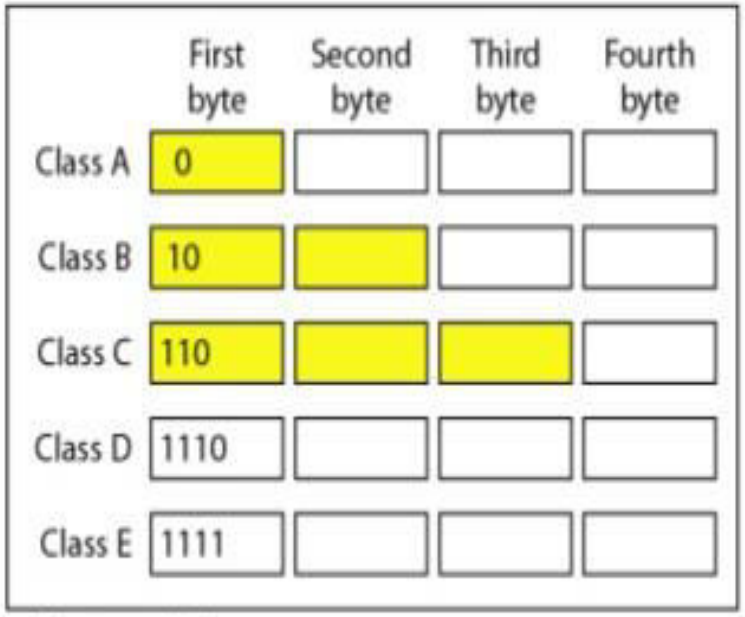
c. 75.45.301.14

d. 11100010.23.14.67

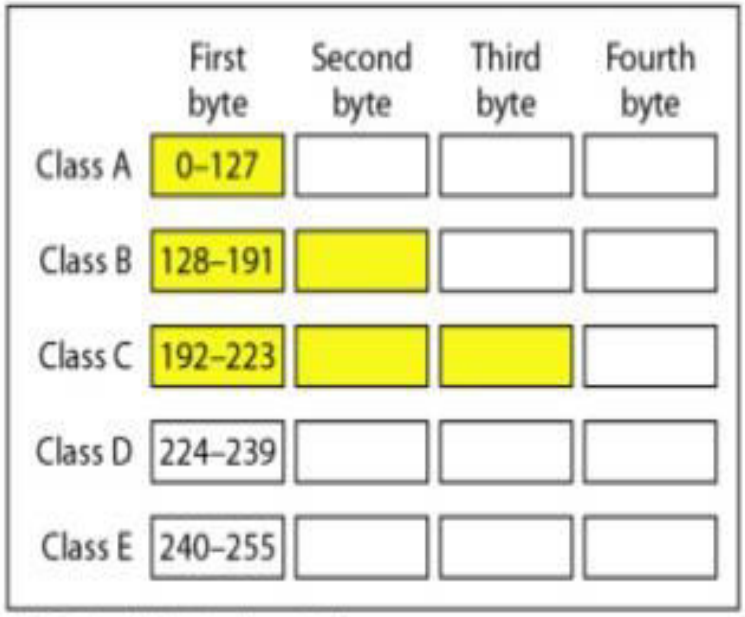
Logical Addressing

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.



a. Binary notation



b. Dotted-decimal notation

Logical Addressing

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

Logical Addressing

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 the following table:-

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

Note: In classful addressing, a large part of the available addresses were wasted.

Logical Addressing

Netid and Hostid

In classful addressing, an IP address in class A, B, or C is divided into netid and hostid. These parts are of varying lengths, depending on the class of the address.

- In class A, one byte defines the netid and three bytes define the hostid.
- In class B, two bytes define the netid and two bytes define the hostid.
- In class C, three bytes define the netid and one byte defines the hostid.

Logical Addressing

Mask

Mask is a 32-bit number made of contiguous 1's followed by contiguous 0's. The masks for classes A, B, and C are shown in the following table. The concept does not apply to classes D and E.

Class	*Binary*	*Dotted-Decimal*	*CIDR*
A	11111111 00000000 00000000 00000000	255.0.0.0	/8
B	11111111 11111111 00000000 00000000	255.255.0.0	/16
C	11111111 11111111 11111111 00000000	255.255.255.0	/24

The mask is used to find the netid and the hostid. For example, the mask for a class A address has eight 1s, which means the first 8 bits of any address in class A define the netid; the next 24 bits define the hostid.

Logical Addressing

- The last column of Table shows the mask in the form /n where n can be 8, 16, or 24 in classful addressing.
- This notation is also called slash notation or Classless Interdomain Routing (CIDR) notation.
- This notation is used in classless addressing.

Logical Addressing

Subnetting

- If an organization was granted a large block in class A or B, it could divide the addresses into several contiguous groups and assign each group to smaller networks called subnets.
- Subnetting increases the number of 1’s in the mask.

Logical Addressing

Supernetting

- In supernetting, an organization can combine several class C blocks to create a larger range of addresses. In other words, several networks are combined to create a super network or a supernet. An organization can apply for a set of class C blocks instead of just one.

- For example, an organization that needs 1000 addresses can be granted four contiguous class C blocks. The organization can then use these addresses to create one super network.
- Supernetting decreases the number of 1's in the mask. For example, if an organization is given four class C addresses, the mask changes from /24 to /22.