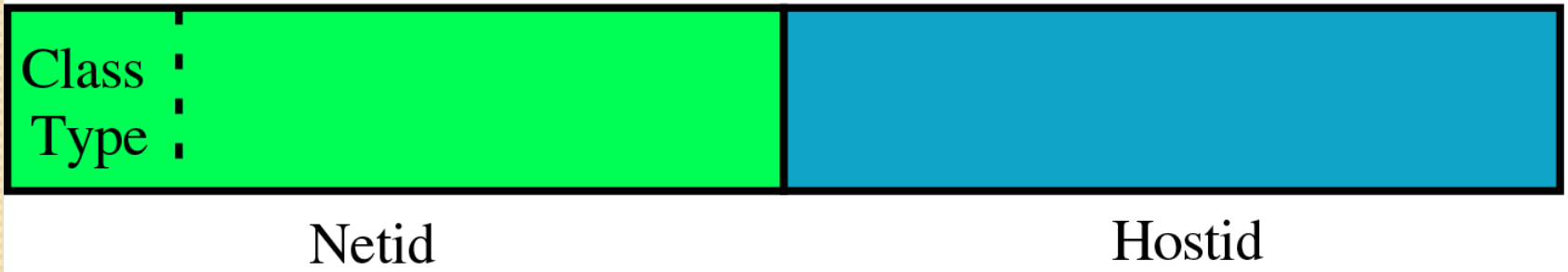
IP v4 Addressing

Introduction

An Internet address is made of four bytes (32 bits) that define a host's connection to a network.



Note

An IP address is a 32-bit address.

Note

The IP addresses are unique.

RULE:

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 and 1) and *N* bits can have 2^N values.

Note

The address space of IPv4 is

$$2^{32}$$

or

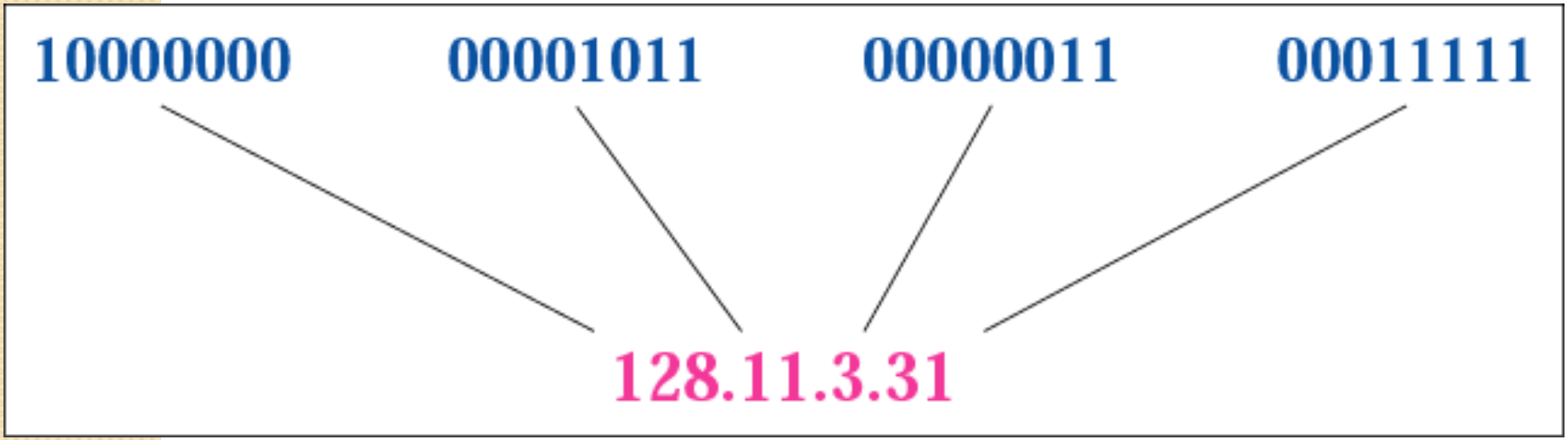
4,294,967,296.

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

Binary Notation

01110101 10010101 00011101 11101010

Dotted-decimal notation



Example 1

Change the following IP address from binary notation to dotted-decimal notation.

10000001 00001011 00001011 11101111

Solution

129.11.11.239

Example 2

Change the following IP address from dotted-decimal notation to binary notation.

111.56.45.78

Solution

01101111 00111000 00101101 01001110

Example 3

Find the error, if any, in the following IP address:

111.56.045.78

Solution

There are no leading zeroes in dotted-decimal notation (045).

Example 3 (continued)

Find the error, if any, in the following IP address:

75.45.301.14

Solution

In dotted-decimal notation, each number is less than or equal to 255; 301 is outside this range.

Unicast, Multicast, and Reserved Addresses

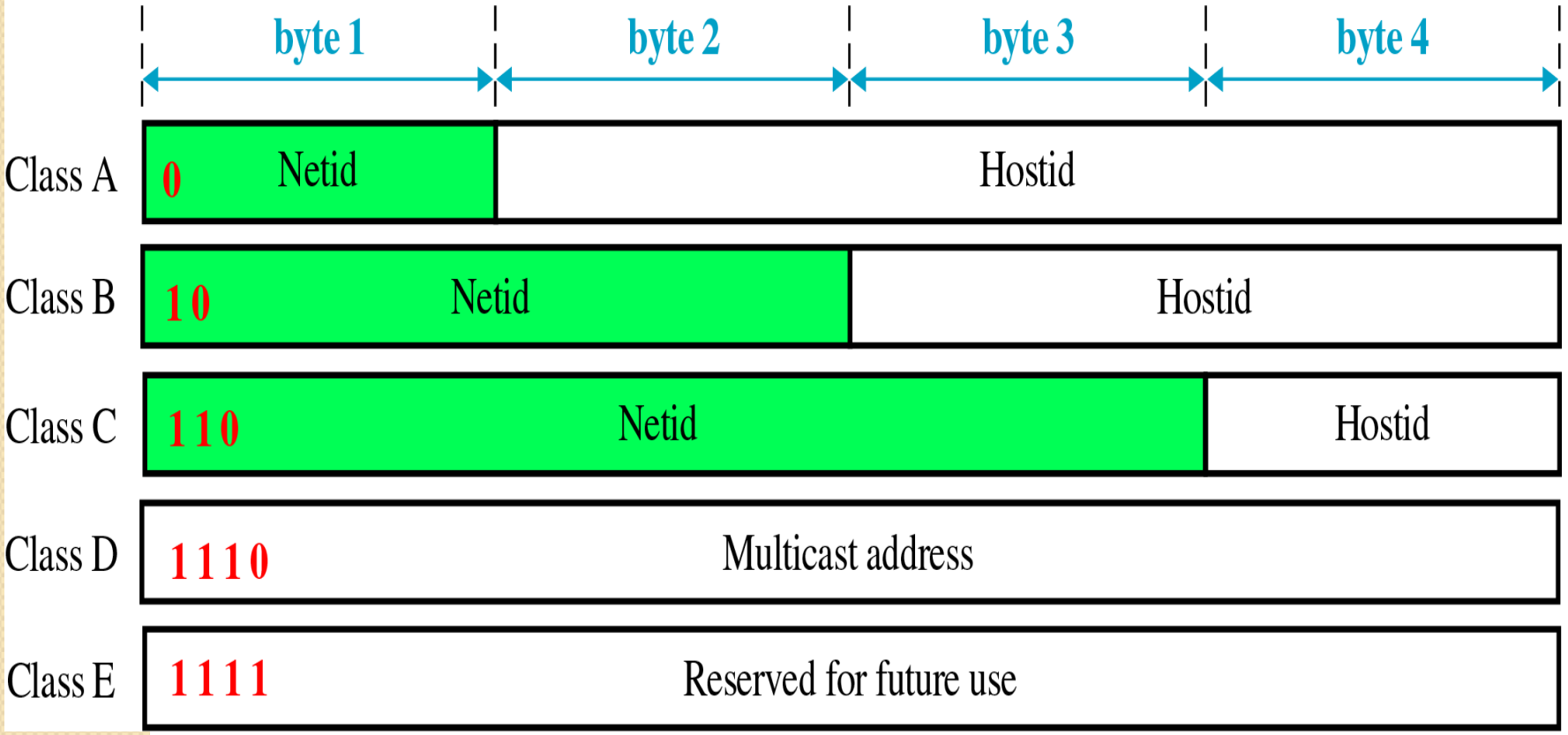
Addresses in classes A, B, and C are for unicast communication, from one source to one destination. A host needs to have at least one **unicast address** to be able to send or receive packets.

Addresses in class D are for multicast communication, from one source to a group of destinations. If a host belongs to a group or groups, it may have one or more multicast addresses. A **multicast address** can be used only as a destination address, but never as a source address.

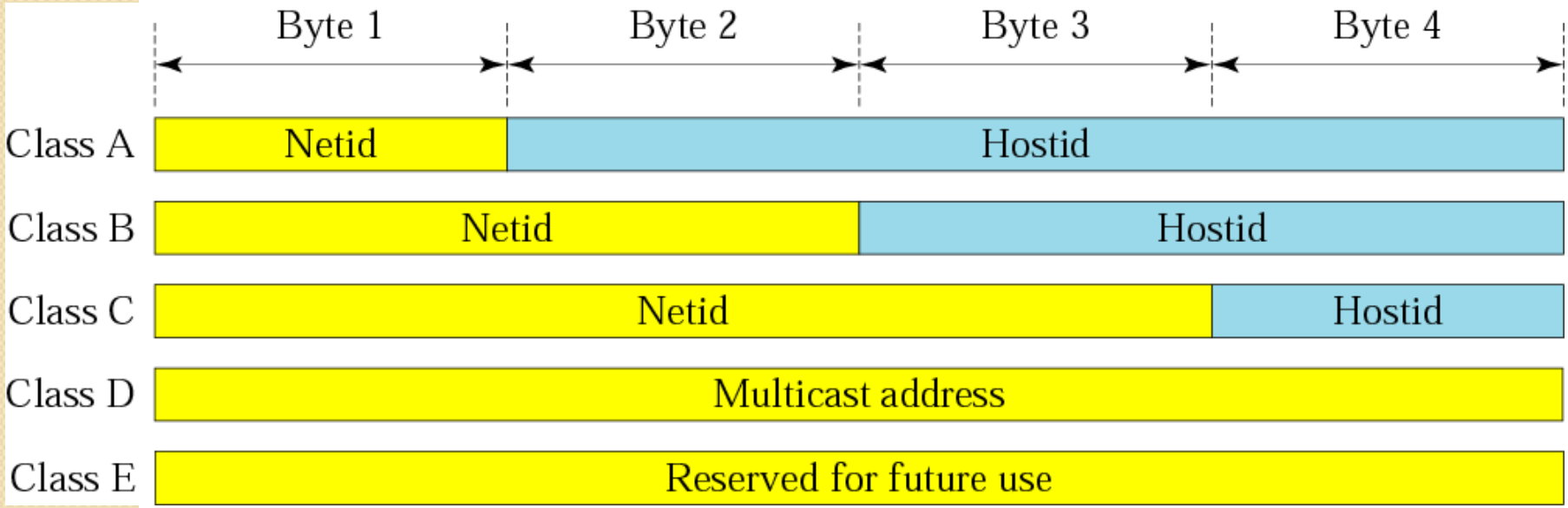
Addresses in class E are reserved. The original idea was to use them for special purposes. They have been used only in a few cases.

Every router and host on internet has a unique IP address .all IP address are of 32 bit and they use source and destination field of the IP header. The first part of address is called network ID which identify the network on the internet and second called the host ID used to identify the individual host on that network.

Classes of IP address :-



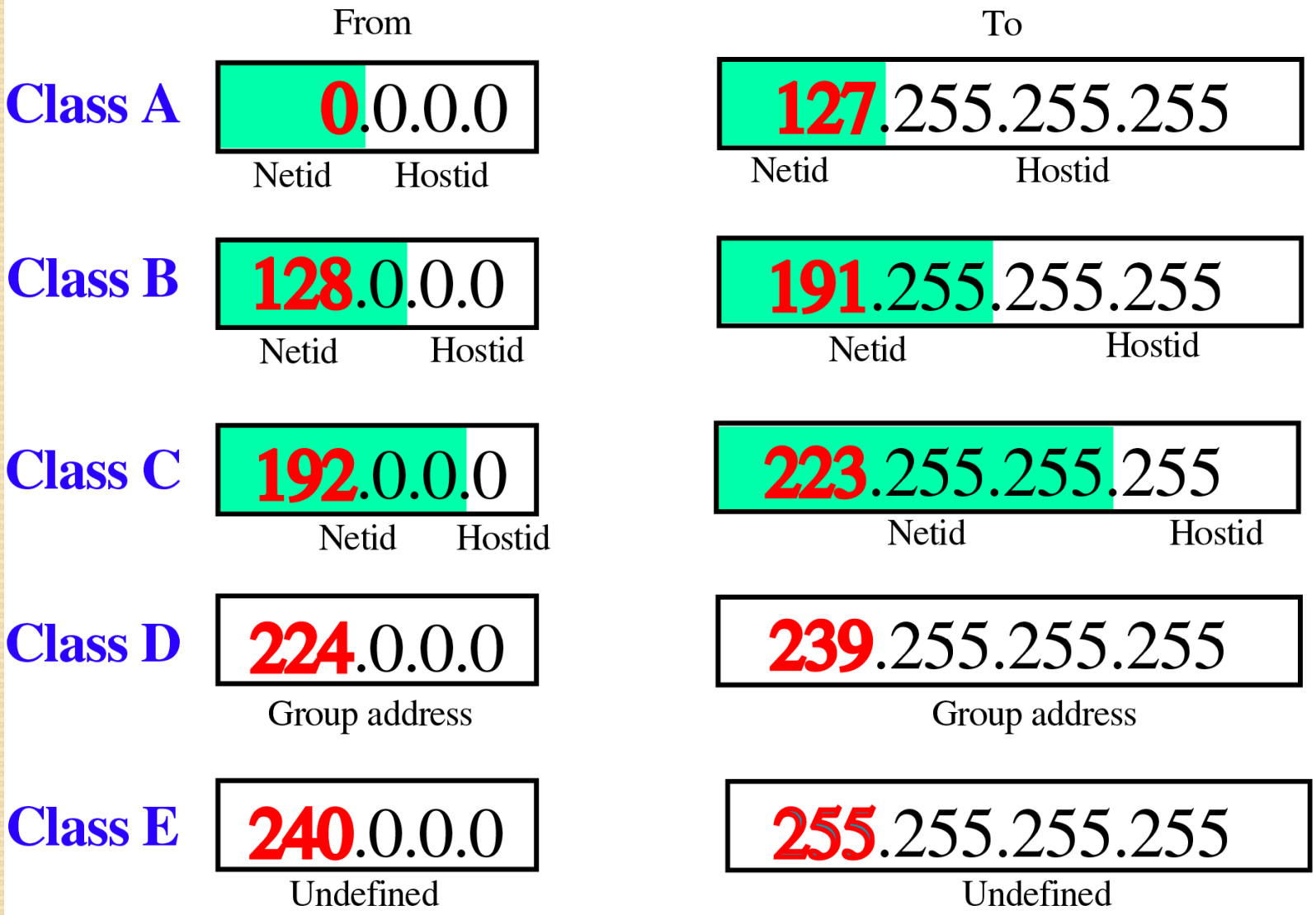
Netid and hostid



Note

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

Class Ranges of Internet Addresses



Class A address

32 bit

0	7 bit / network ID	24 bit host ID

The n/w field is of 7 bit and the host field is of 24 bits . One bit is used for the class type. So the n/w field can have numbers b/w 0 to 127. but the host number ranges from 0.0.0.0 to 127.255.255.255. hence in class A there can be 127 types of n/w's. bit 0 in fist field indicates that it is class A n/w address.

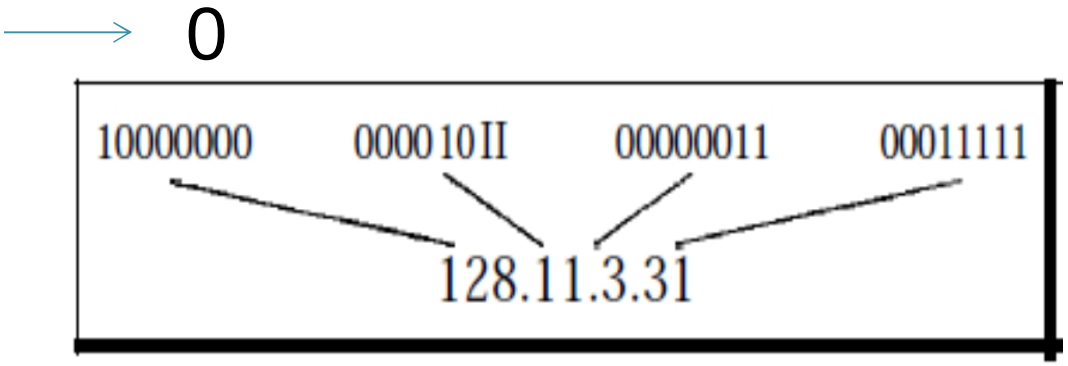
2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0

0 0 0 0 0 0 0 0

0 0 0 0 0 0 0 1

.

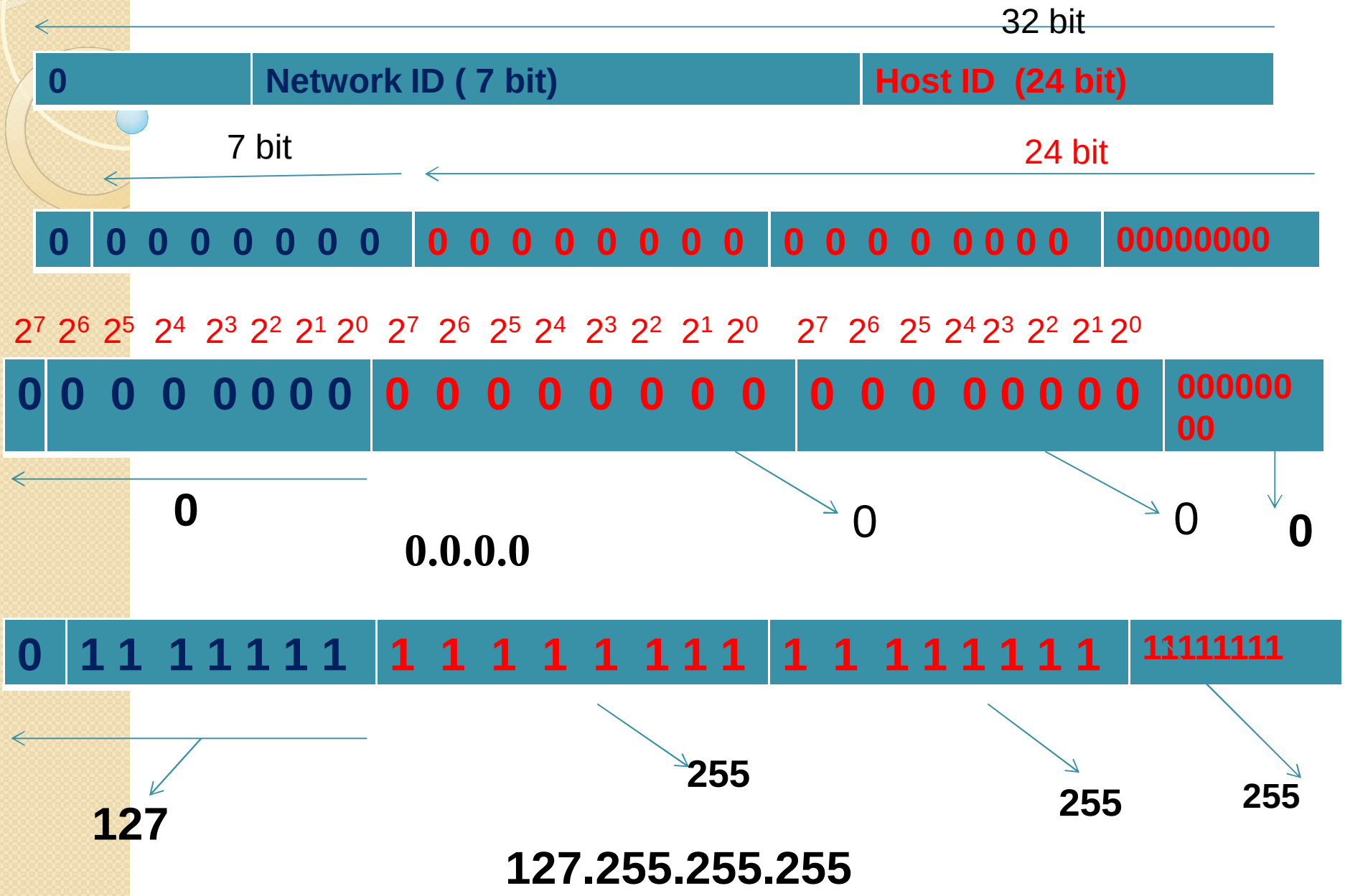
0 1 1 1 1 1 1 1



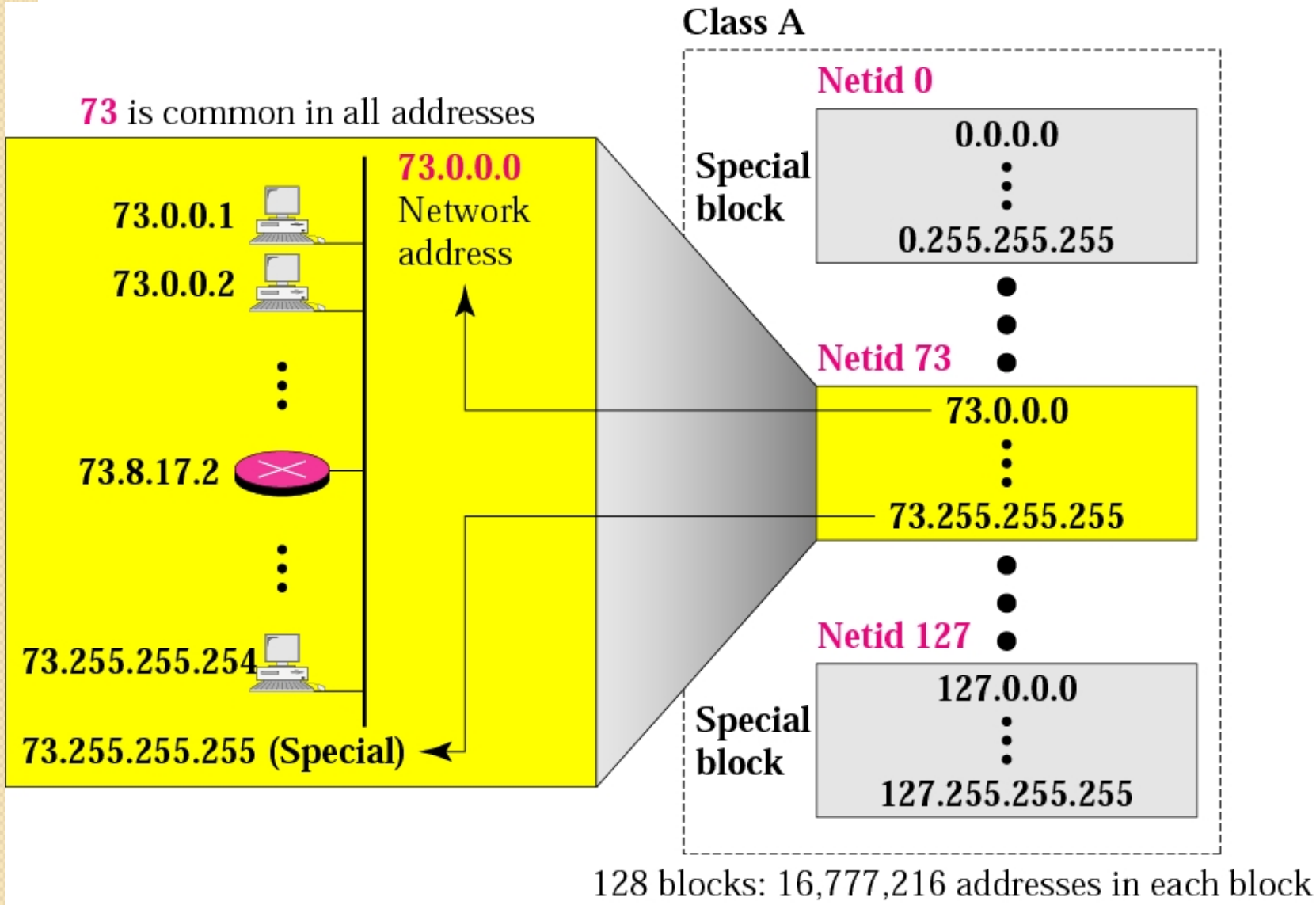
Same way total number of host will be ranges from 0. 0.0.0 to 127. 255.255.255

127

Class A address



Blocks in class A



128 blocks: 16,777,216 addresses in each block

Network Address in Class A

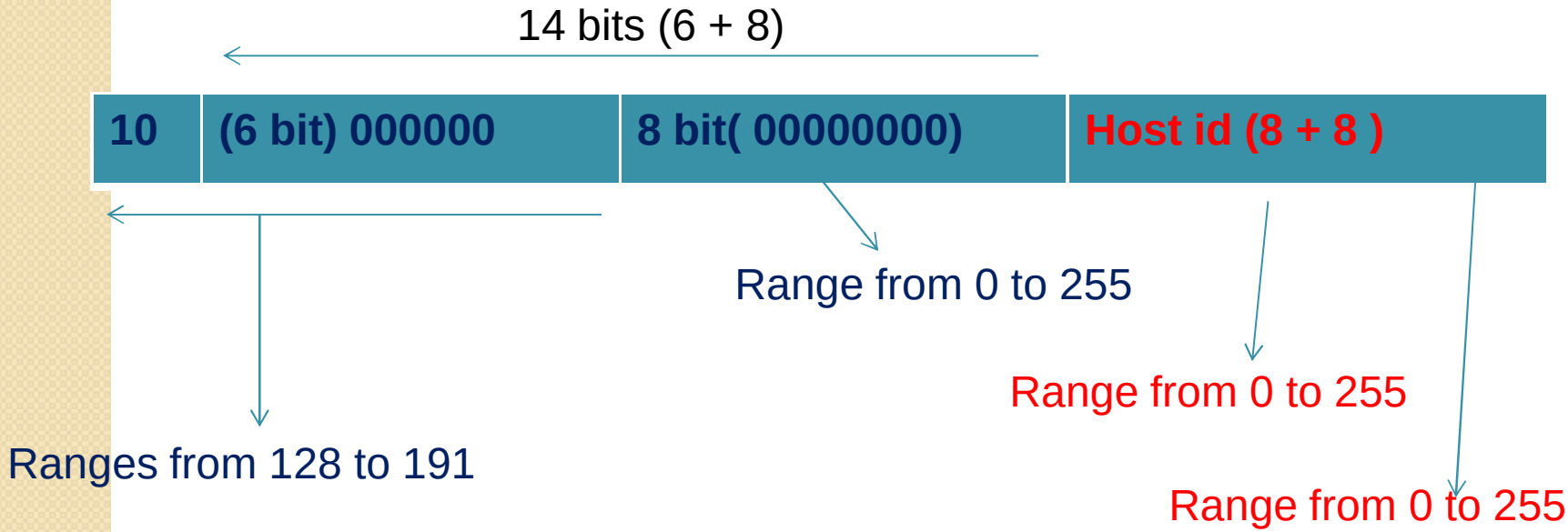
- Class A divided in to 128 blocks.
- We can assign class A addresses to 128 org.'s. each having 16,777,216 nodes .
- Each block have different netid. First block covers address from **0**.0.0.0 to **0**.255.255.255. here netid is 0.
- 2nd block covers from **1**.0.0.0 to **1**.255.255.255 with netid as **1.**
- Last block covers addresses from 127.0.0.0 to 127.255.255.255 with netid as 127.
- **The first address of each block is used as network address** which assigned to any organization and identify the organization to the rest of network.
- **A network address is an address that defines a network. It can not assigned to a host. A n/w address is netid+hostid .**

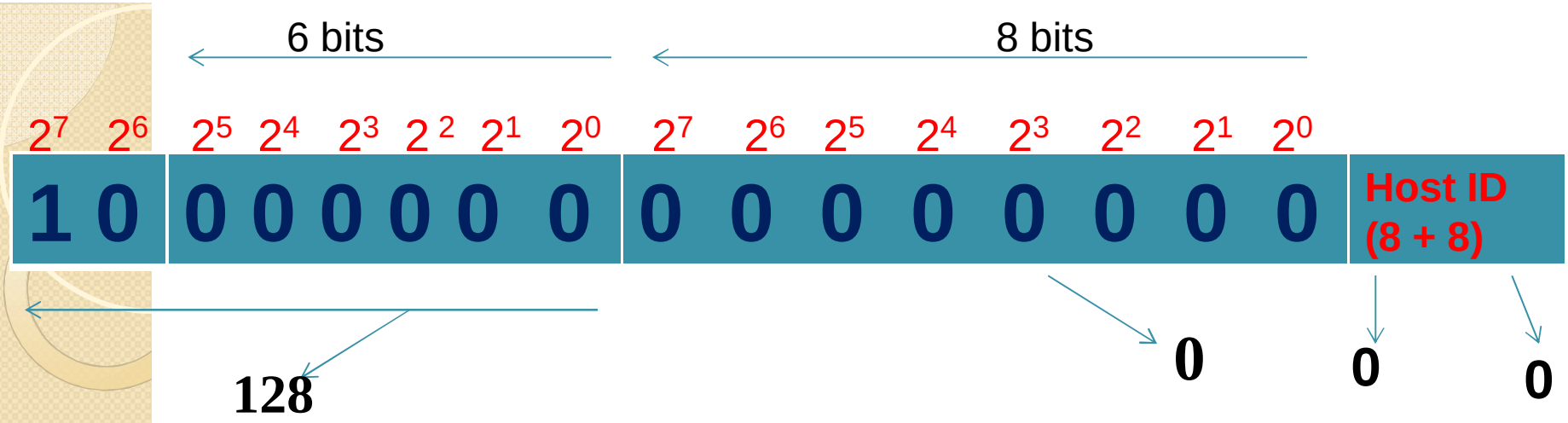
Note

Millions of class A addresses are wasted.

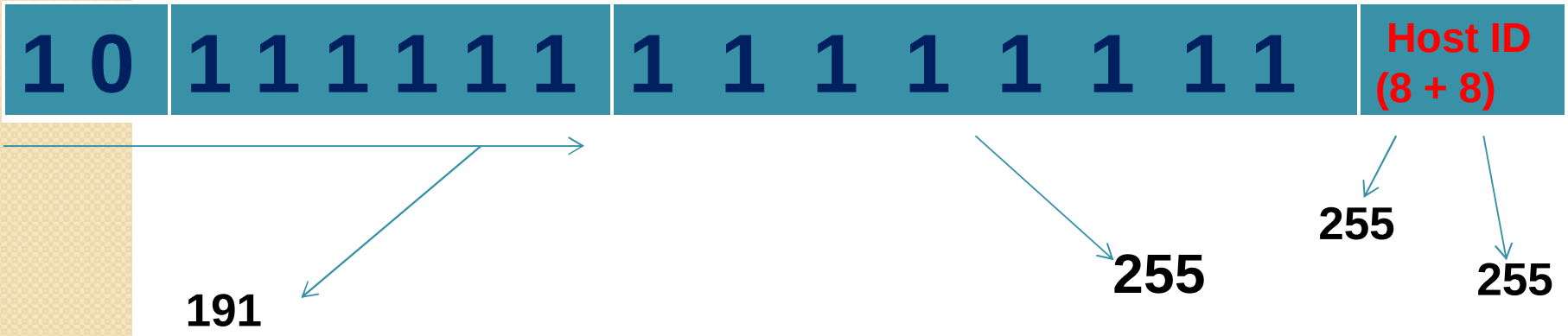
Class B address

The first field defines the class type and second field defines the networks. And last field defines the hosts. The n/w field values lies b/w 128 to 191. The first block covers the address from 128.0.0.0 to 128.255.255.255 and last block covers from 191.0.0.0 to 191.255.255.255.



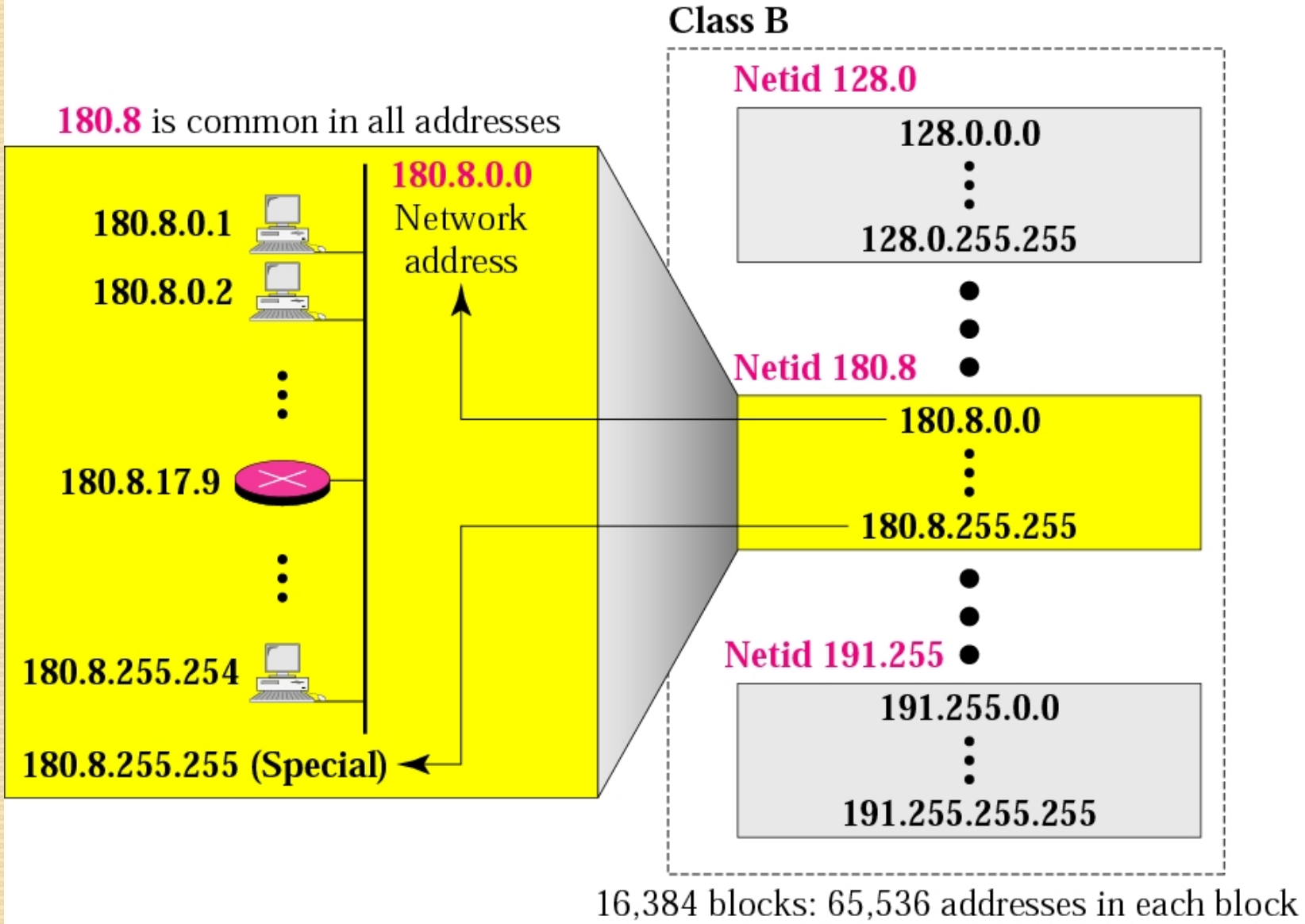


128.0.0.0



191.255.255.255

Blocks in class B



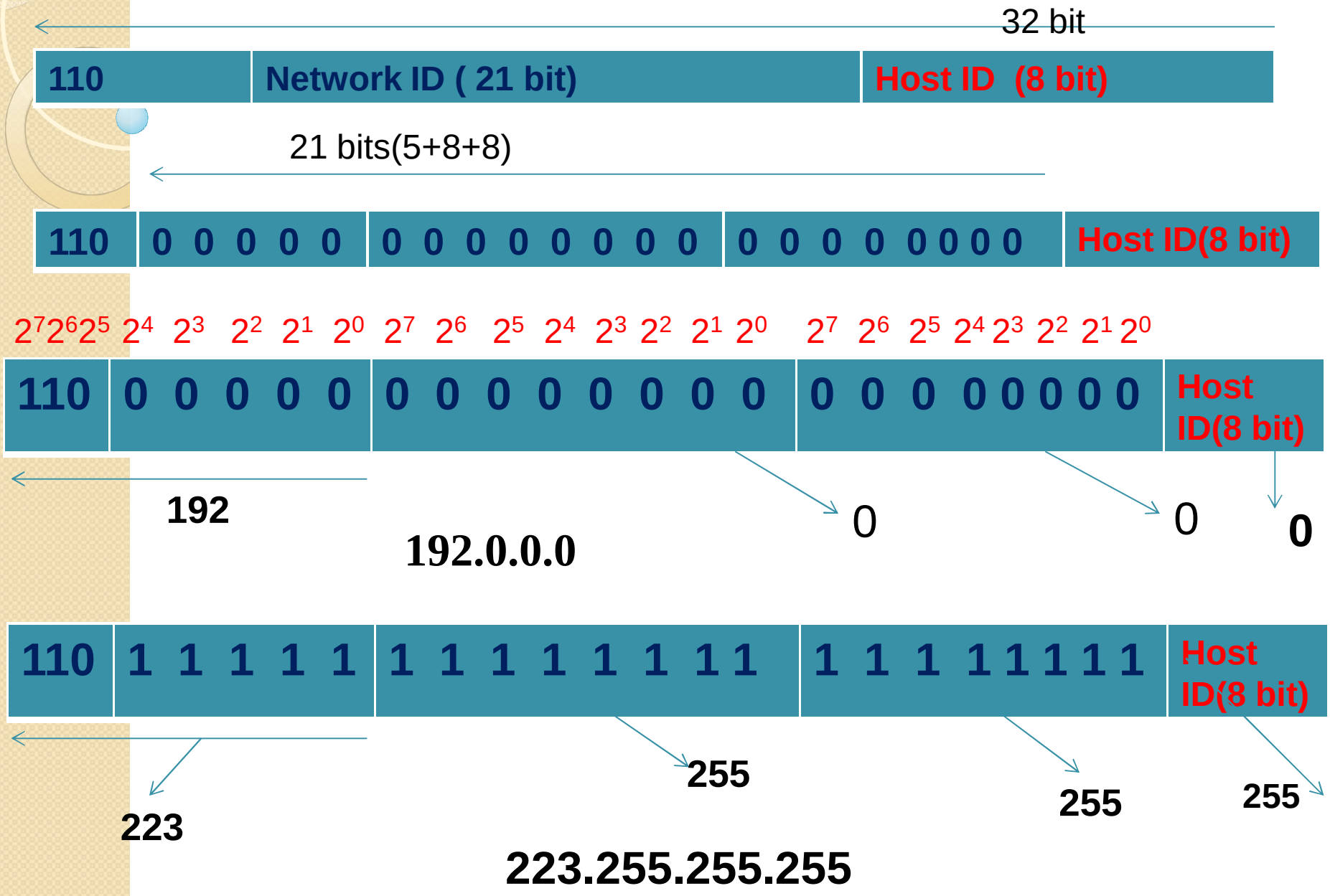
Class B Addresses

- Class B divided in to 16384 blocks.
- We can assign B class addresses to 16384 org.'s, each having 65536 nodes.
- Each block has different netid. First block covers address from **128.0**.0.0 to **128.0**.255.255. Here netid is **128.0**.
- 2nd block covers from **128.1**.0.0 to **128.1**.255.255 with netid as **128.1.**
- Last block covers addresses from **191.255**.0.0 to **191.255**.255.255 with netid as **191.255**.
- **Class B address are assigned to middle size org. having a large no's of nodes .**

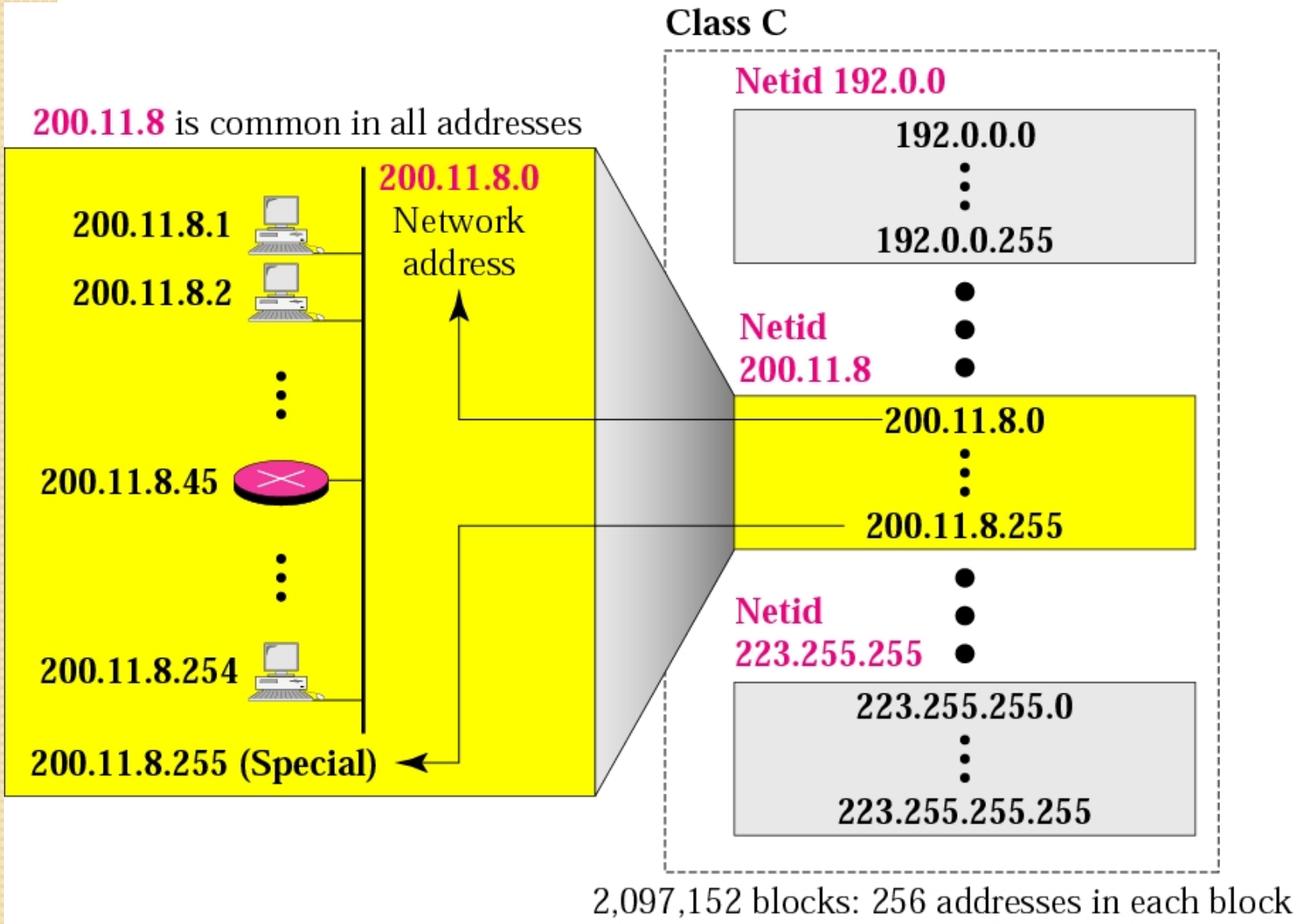
Note

Many class B addresses are wasted.

Class C address



Blocks in class C



Class C Addresses

- Class C divided in to 2,097,152 blocks.
- We can assign C class addresses to 2,097,152 org.'s. each having 256 nodes.
- First block covers address from **192.0.0**.0 to **192.0.0**.255. here netid is **192.0.0**
- Last block covers addresses from **223.255.255**.0 to **223.255.255**.255 with netid as **223.255.255**.
- Class C address are assigned to small size org. having a less no's of nodes .

Note

The number of addresses in a class C block is smaller than the needs of most organizations.