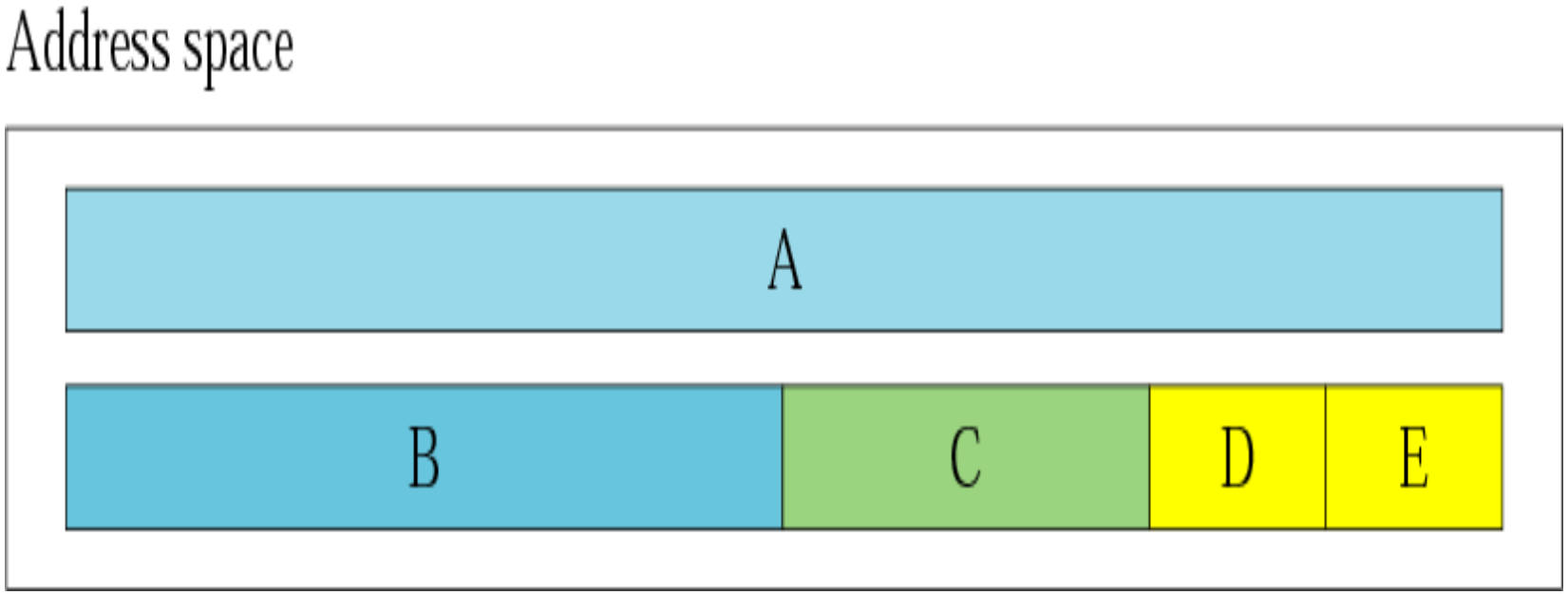
CLASSFUL ADDRESSIN G

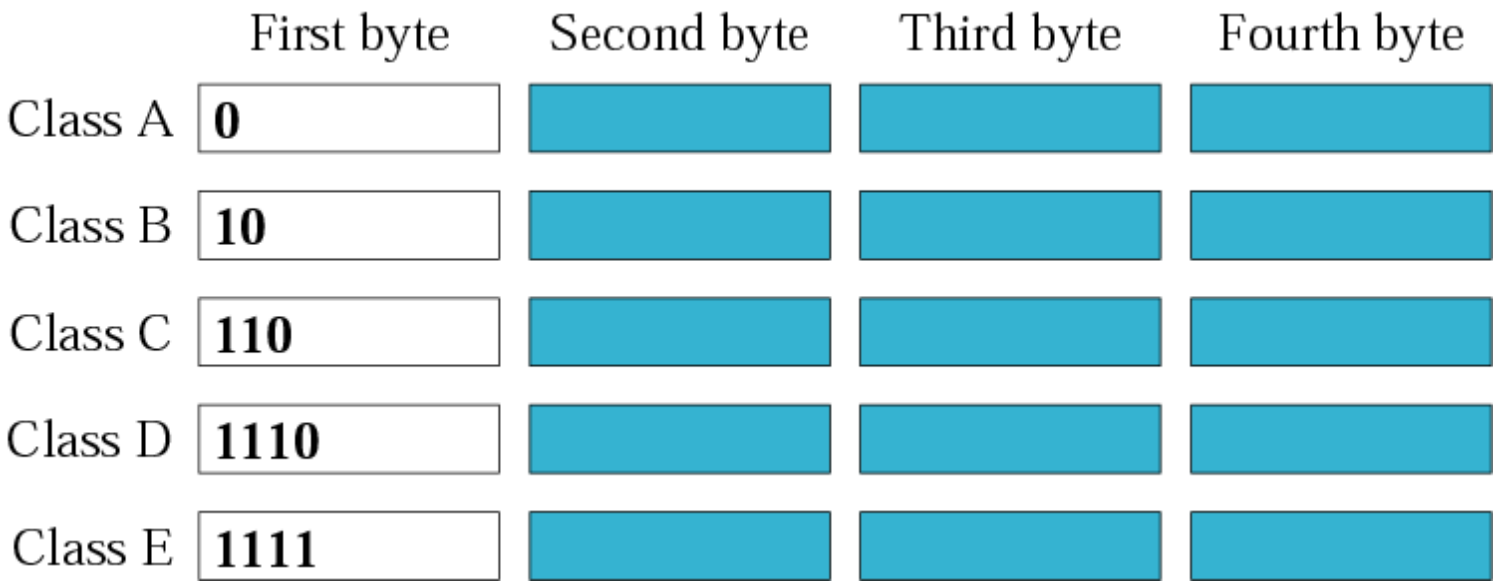
Occupation of the address space



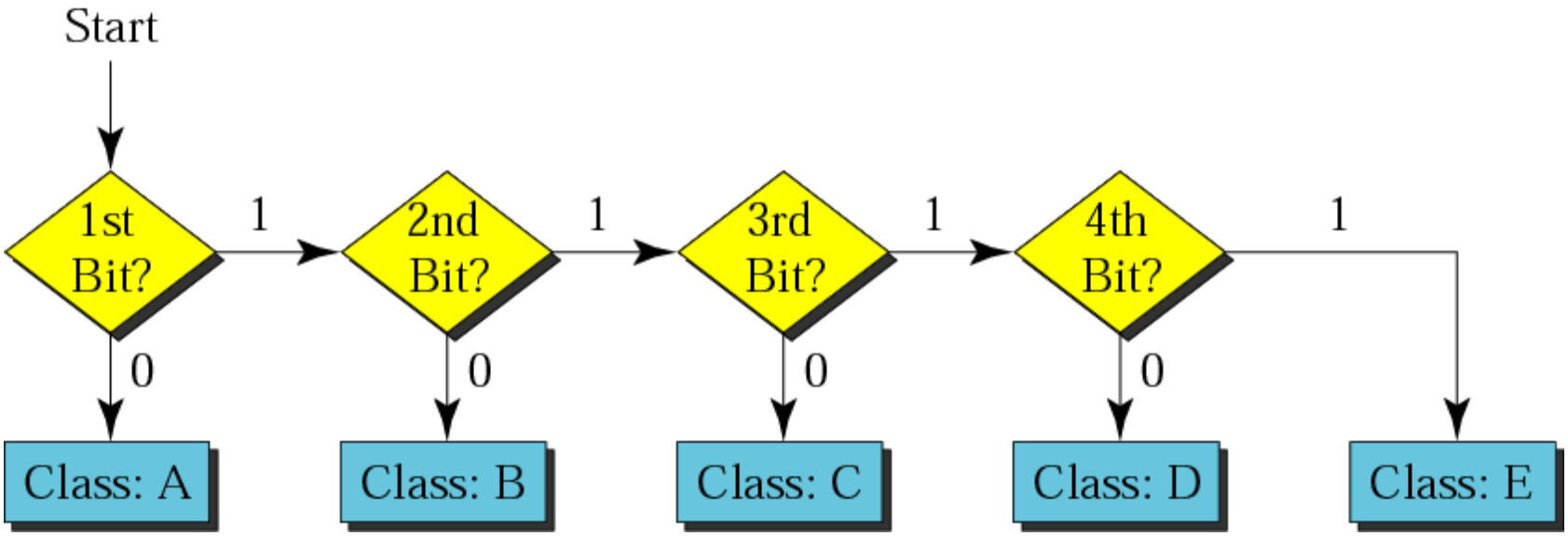
In classful addressing the address space is divided into 5 classes:

***A*, *B*, *C*, *D*, and *E*.**

Finding the class in binary notation



Finding the address class



Example

- How can we prove that we have 2,147,483,648 addresses in class A?

Solution

In class A, only 1 bit defines the class.
The remaining 31 bits are available
for the address. With 31 bits,
we can have 2^{31} or 2,147,483,648 addresses.

Example

Find the class of the following IP addresses

00000001 00001011 00001011 11101111

11000001 00001011 00001011 11101111

Solution

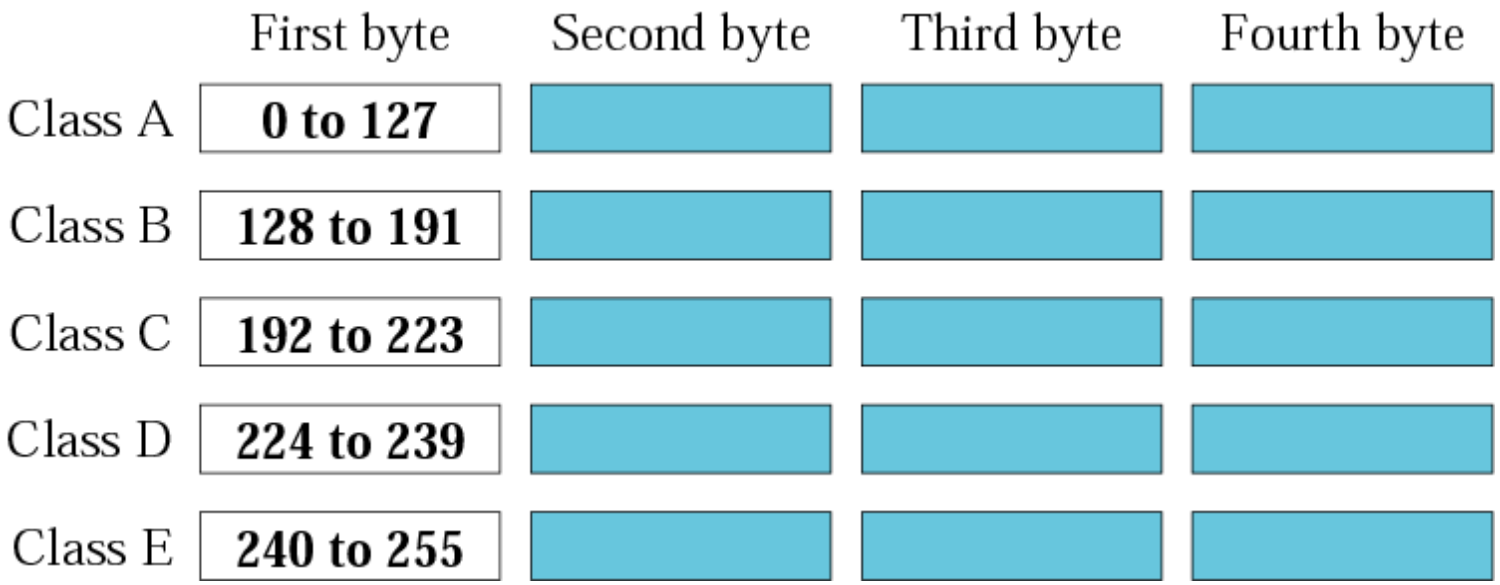
- **0**0000001 00001011 00001011 11101111

  1st is 0, hence it is Class A

- 11000001 00001011 00001011 11101111

  1st and 2nd bits are 1, and 3rd bit is 0 hence, Class C

Finding the class in decimal notation



Example

Find the class of the following addresses
158.223.1.108
227.13.14.88

Solution

- 158.223.1.108

1st byte = 158 (128<158<191) class B

- 227.13.14.88

1st byte = 227 (224<227<239) class D

Example

Find the class of each address:

a. 227.12.14.87

b. 193.14.56.22

c. 14.23.120.8

d. 252.5.15.111

Solution

a. **The first byte is 227 (between 224 and 239); the class is D.**

b. **The first byte is 193 (between 192 and 223); the class is C.**

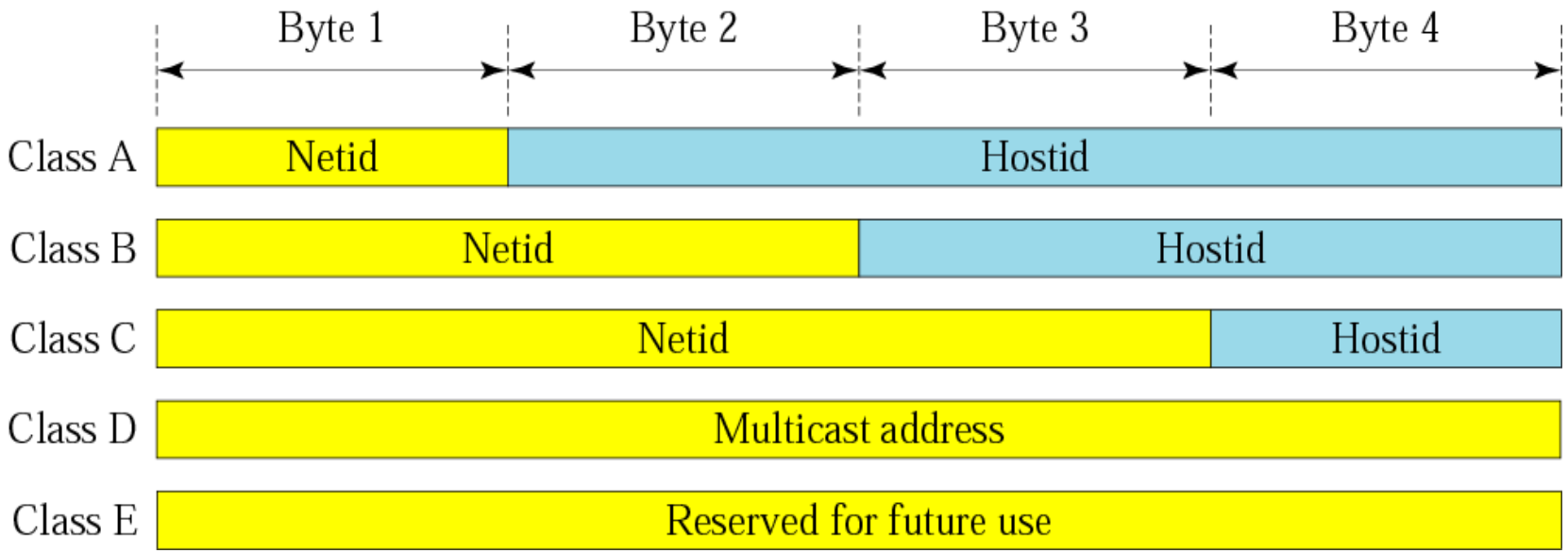
c. **The first byte is 14 (between 0 and 127); the class is A.**

d. **The first byte is 252 (between 240 and 255); the class is E.**

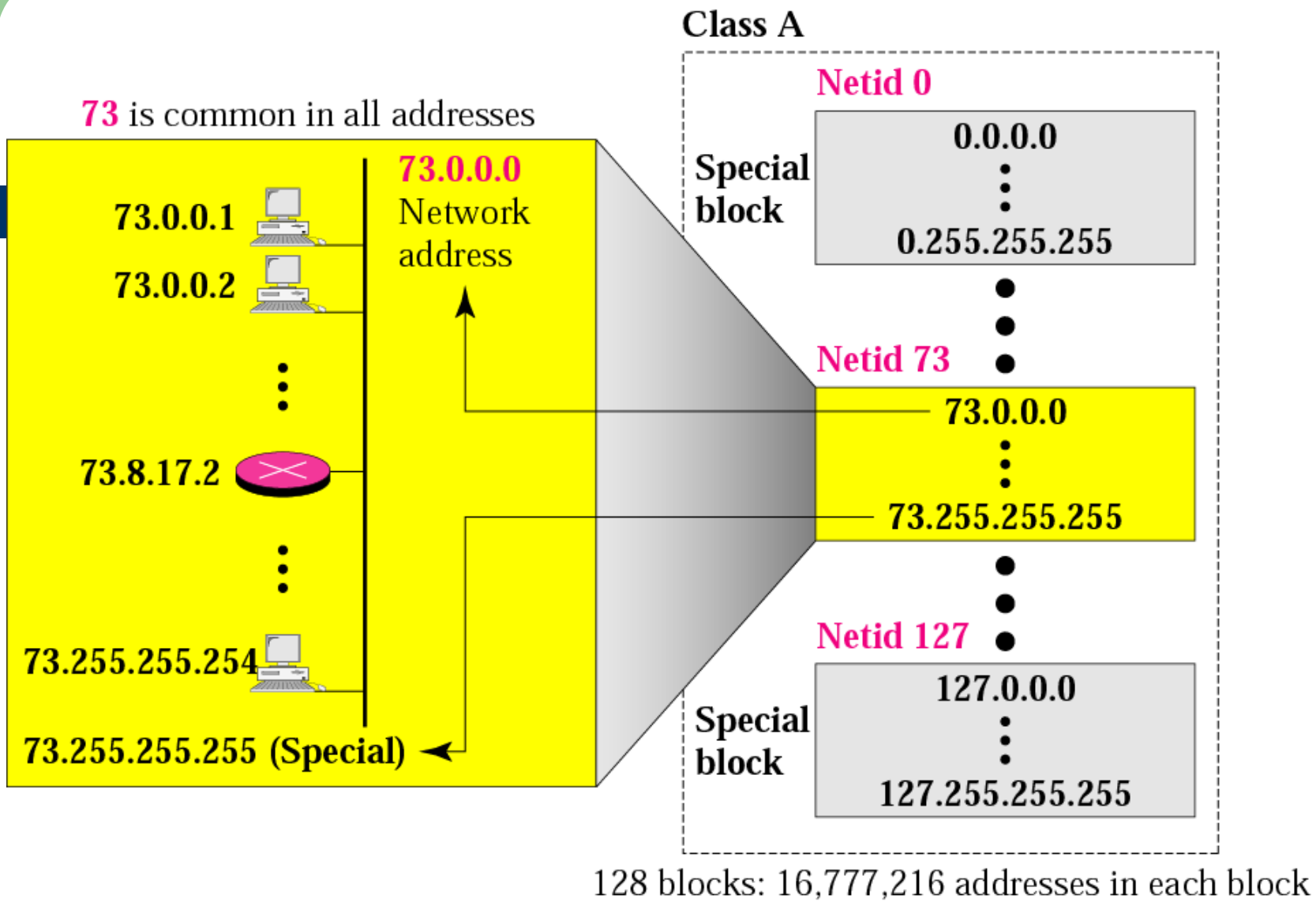
Parts of IP Address

- In classful addressing, an IP address of class A,B and C is divided into two parts : netid and hostid.
- The netid and hostid are of varying lengths, depending on the class of the address.
  - Netid: The part of an IP address that identifies the network.
  - Hostid: The part of an IP address that identifies a host in a network.

Netid and hostid



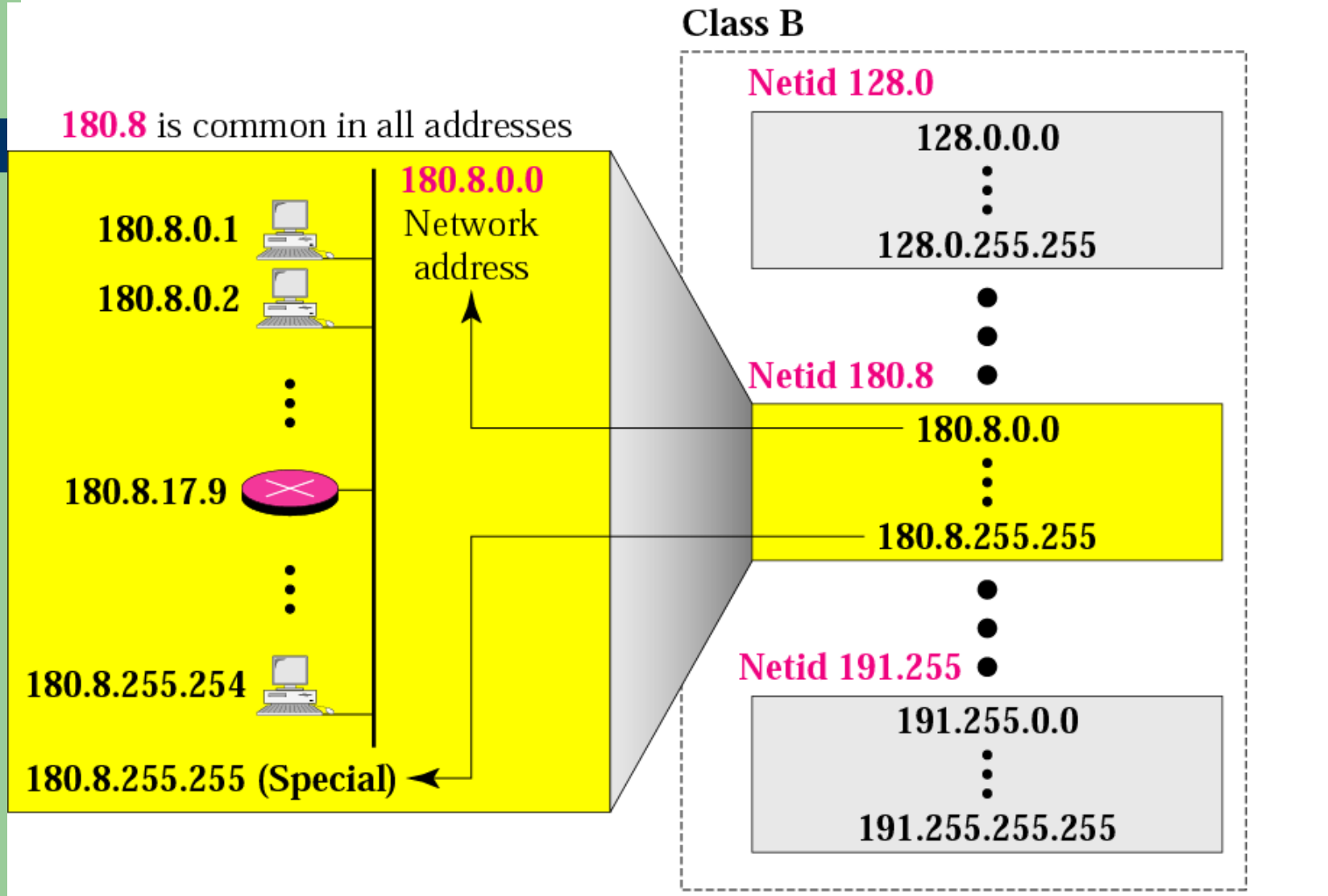
Blocks in class A



Note

Millions of class A addresses are wasted.

Blocks in class B

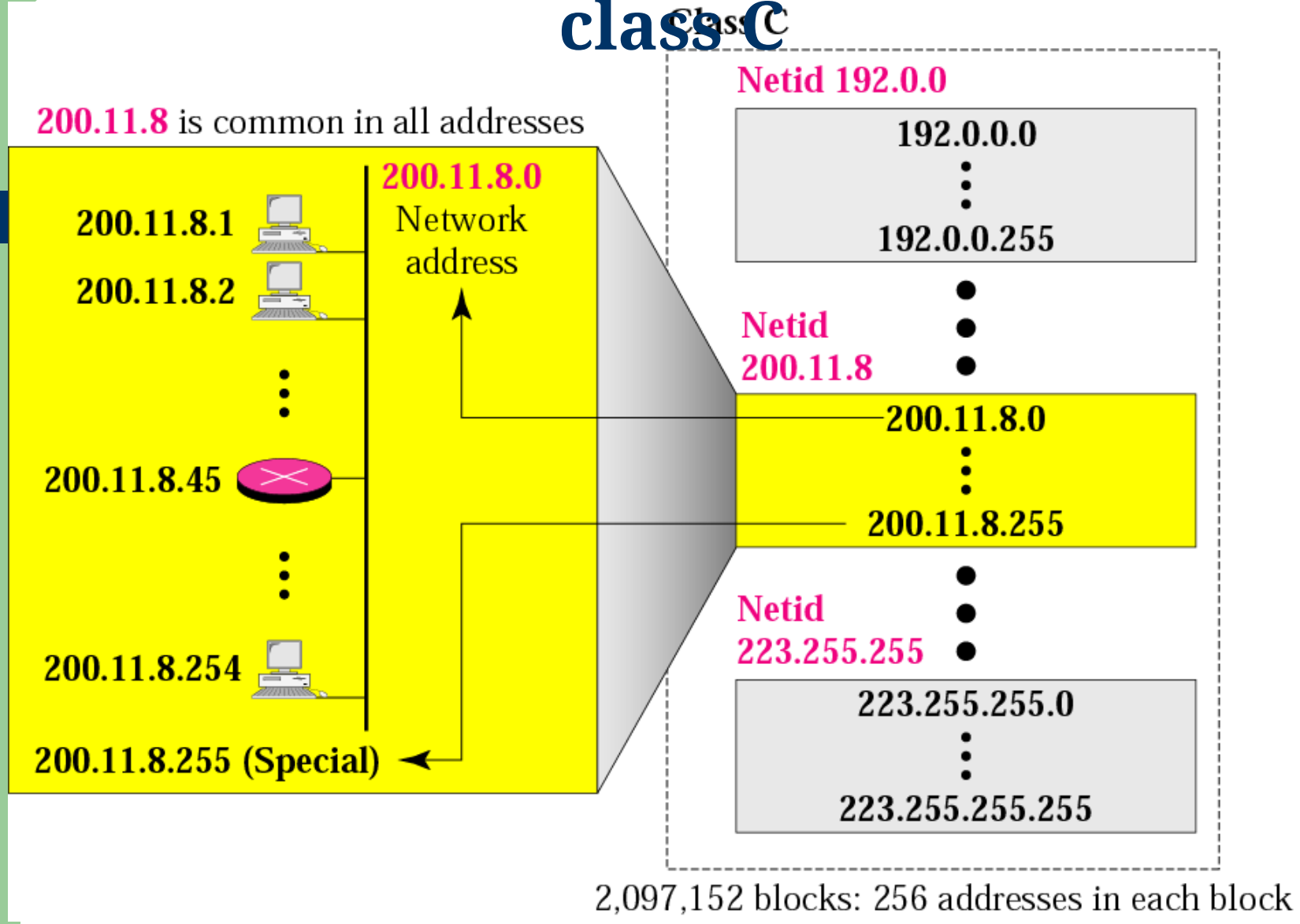


16,384 blocks: 65,536 addresses in each block

Note

Many class B addresses are wasted.

Blocks in class C



Note

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

Note

Class D addresses are used for multicasting; there is only one block in this class.

Note

Class E addresses are reserved for special purposes; most of the block is wasted.

Network Addresses

The network address is the first address.

The network address defines the network to the rest of the Internet.

Given the network address, we can find the class of the address, the block, and the range of the addresses in the block

Note

In classful addressing, the network address (the first address in the block) is the one that is assigned to the organization.

Example

Given the network address 132.21.0.0, find the class, the block, and the range of the addresses

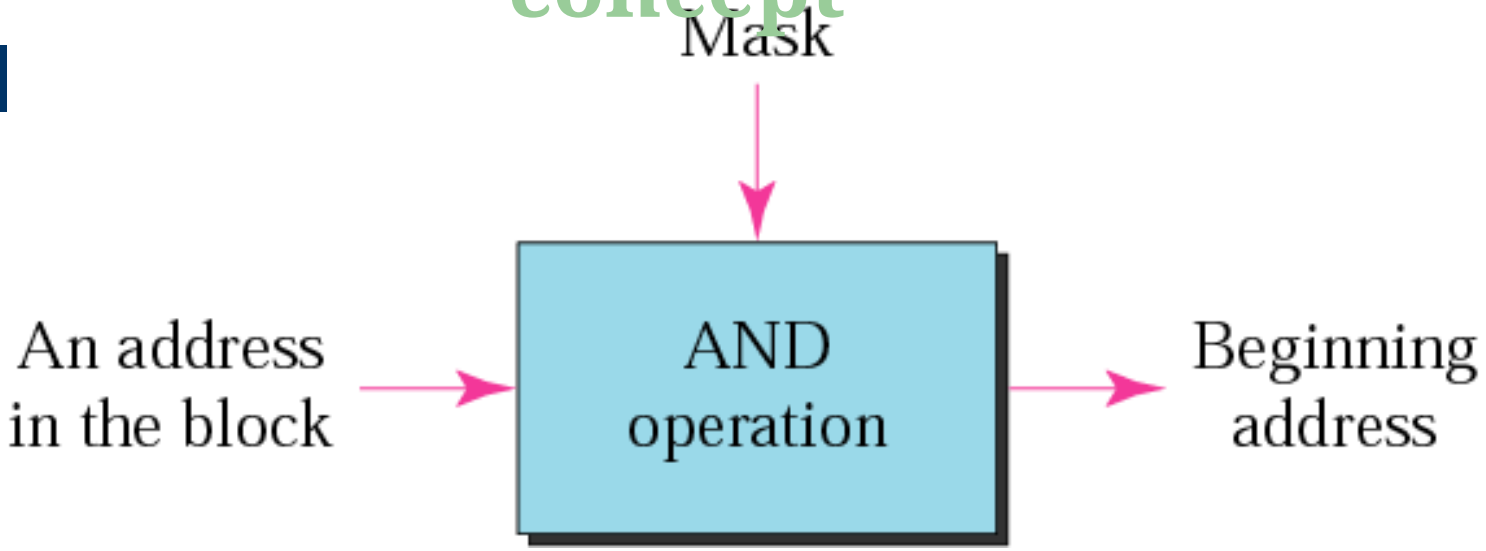
Solution

The 1st byte is between 128 and 191.
Hence, Class B
The block has a netid of 132.21.
The addresses range from
132.21.0.0 to 132.21.255.255.

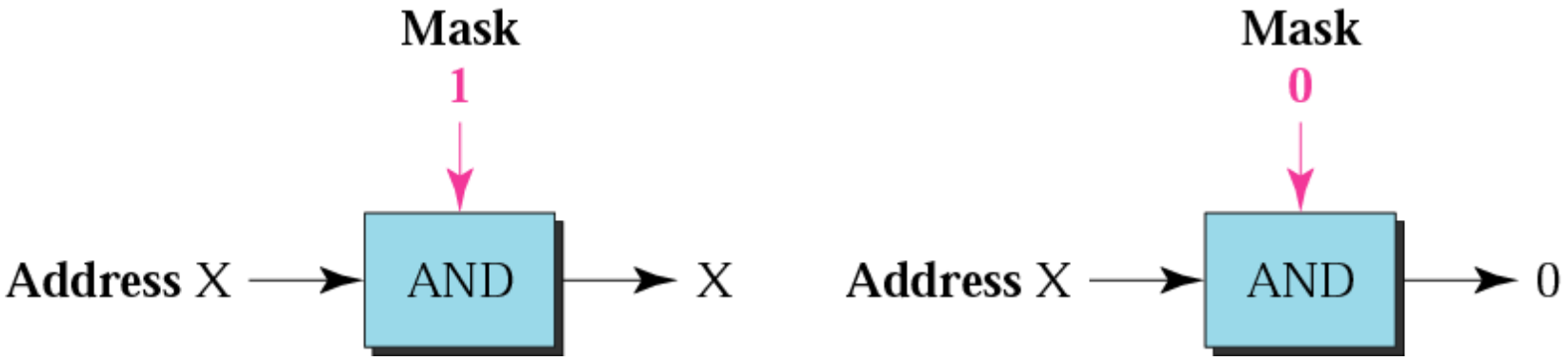
Mask

- A mask is a 32-bit binary number.
- The mask is ANDeD with IP address to get
  - The bloc address (Network address)
  - Mask And IP address = Block Address

Masking concept



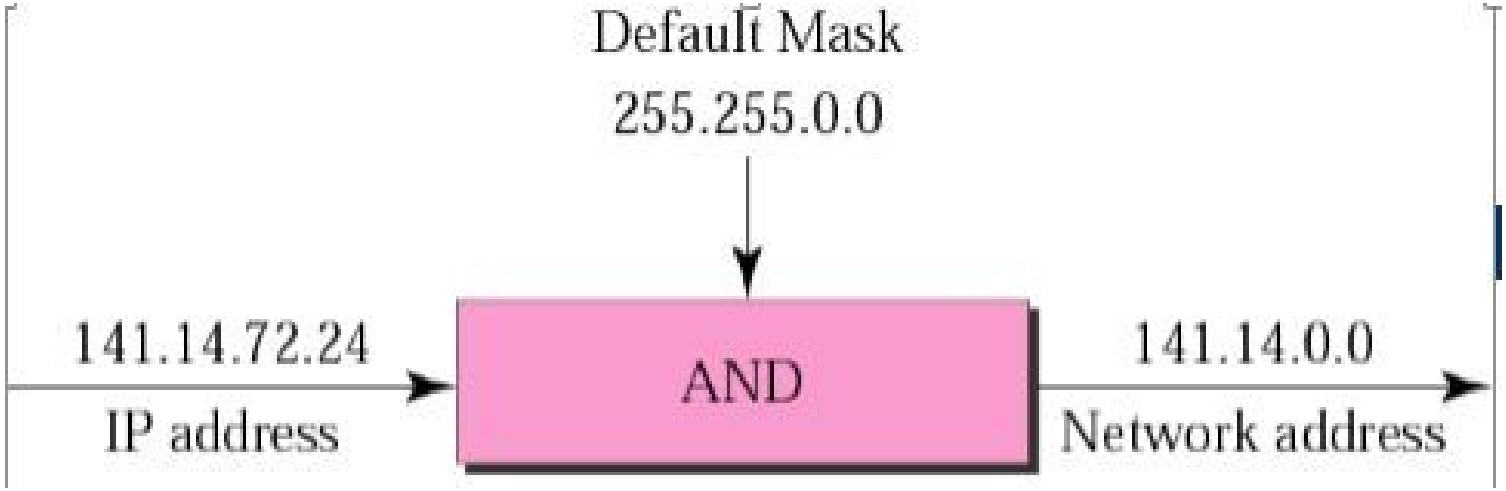
AND operation



Default Mask

- Class A default mask is 255.0.0.0
- Class B default mask is 255.255.0.0
- Class C Default mask 255.255.255.0

Masking


Default Mask
255.255.0.0
141.14.72.24
IP address
AND
141.14.0.0
Network address

Note

The network address is the beginning address of each block. It can be found by applying the default mask to any of the addresses in the block (including itself). It retains the netid of the block and sets the hostid to zero.

Subnet mask is used to separate the network address from the host address in IP address. As an IP address is the combination of network address and host address, subnet mask helps us and programs which use IP address in identifying the network portion and the host portion.

Private IP Addresses

- *Private IP* network is an IP network that is not directly connected to the Internet
- IP addresses in a private network can be assigned arbitrarily.
  - Not registered and not guaranteed to be globally unique
- Connecting a network using private addresses to the Internet requires the usage of **NAT**

Private IP Ranges

Class	Private Address Range
A	10.0.0.0 to 10.255.255.255
B	172.16.0.0 to 172.31.255.255
C	192.168.0.0 to 192.168.255

IP versions

- IPv4: 32-bit* number Written in Dotted Decimal Notation
  - 205.150.58.7
  - 4 billion different host addresses
- IPv6: 128-bit* number: Written in Hex Decimal Notation
  - 2001:0503:0C27:0000:0000:0000:0000:0000
  - 16 billion network addresses