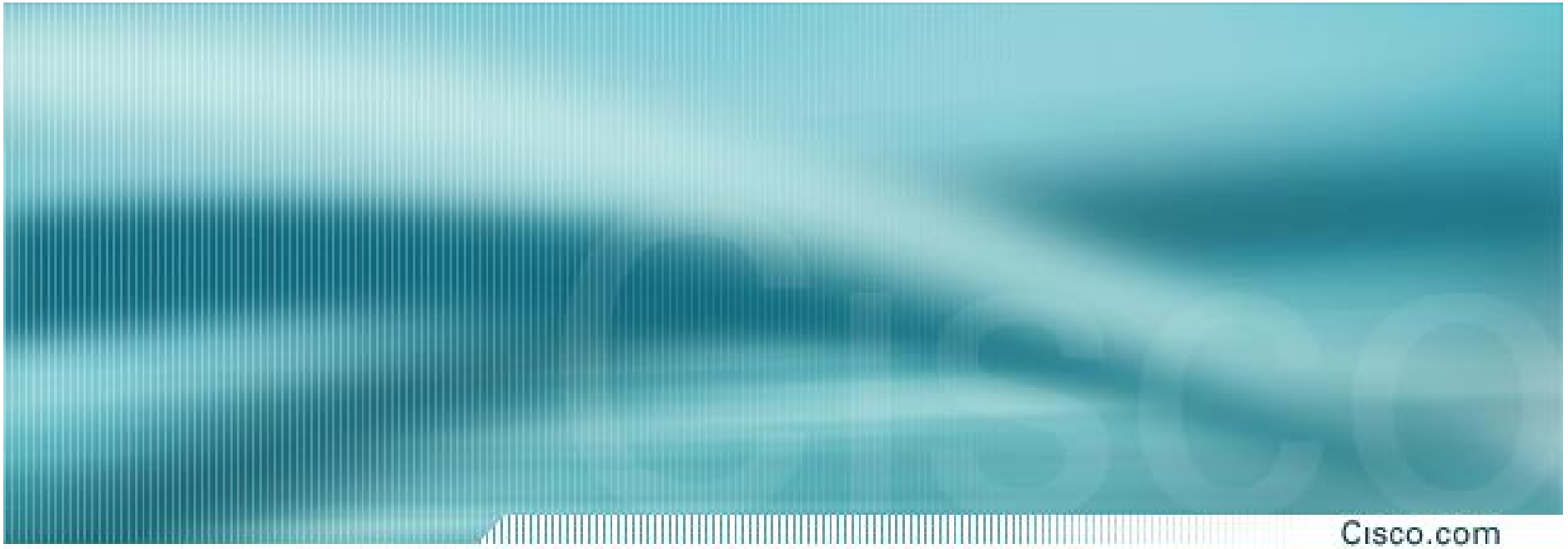

IP Addressing and Subnetting

Objectives

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Upon completion, you will be able to:

- Discuss the Types of Network Addressing
- Explain the Form of an IP Address
  - Network ID
  - Host ID
- Discuss the Classes of IP Addresses
- Understand the Function of the Mask

Let's Talk About Addressing!

- **Types of Addressing:**
  - **Layer 2 – MAC Addresses (Media Access Control)**

    0134.2345.12AB A MAC Address

    0134.23 Vendor Code

    45.12AB Serial Number
  - **Layer 3 – Logical Addresses (IPv4 or IPX)**
- **Assignment of IP Addresses:**
  - **Static Addresses – assigned by an Administrator**
  - **Dynamic Addresses – DHCP**
  - **"Hierarchical" vs. "Flat" Addressing Schemes**

Can You Count in Binary?

We are Very Familiar with our Decimal System…

0 1 2 3 4 5 6 7 8 9…10 11 12 13…

But,

We Need to Become Familiar with the Binary System…only 0's and 1's

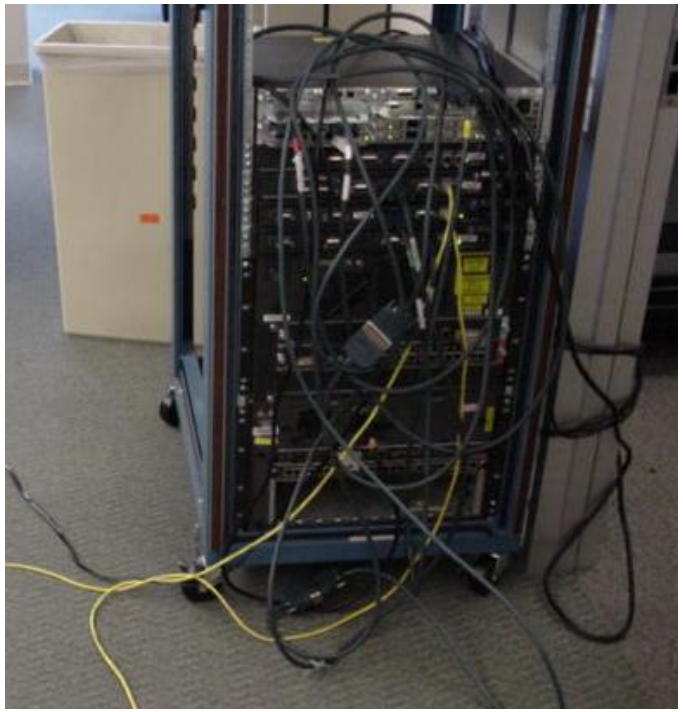
0000 1 10 11 100 101 110 111 1000 1001…

0 1 2 3 4 5 6 7 8 9

Basics of An IPv4 Address

- Layer 3 (L3) Logical IP Addresses are comprised of 4 Octets, separated by a .
- The Decimal form looks like this:

176.223.14.127



- The Binary form looks like:

128 64 32 16 8 4 2 1

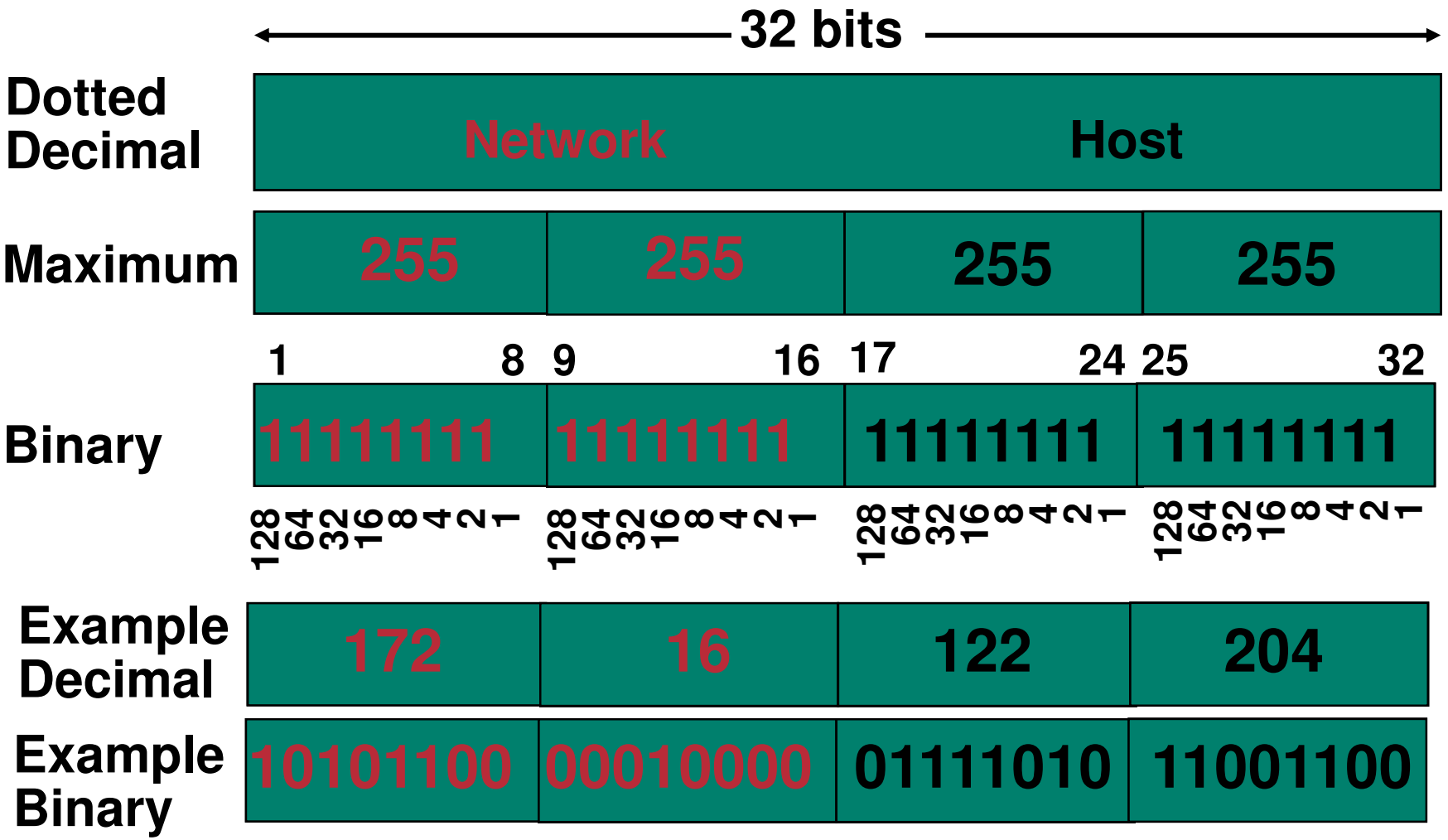
10110000.11011111.00001110.01111111

Basics of An IPv4 Address

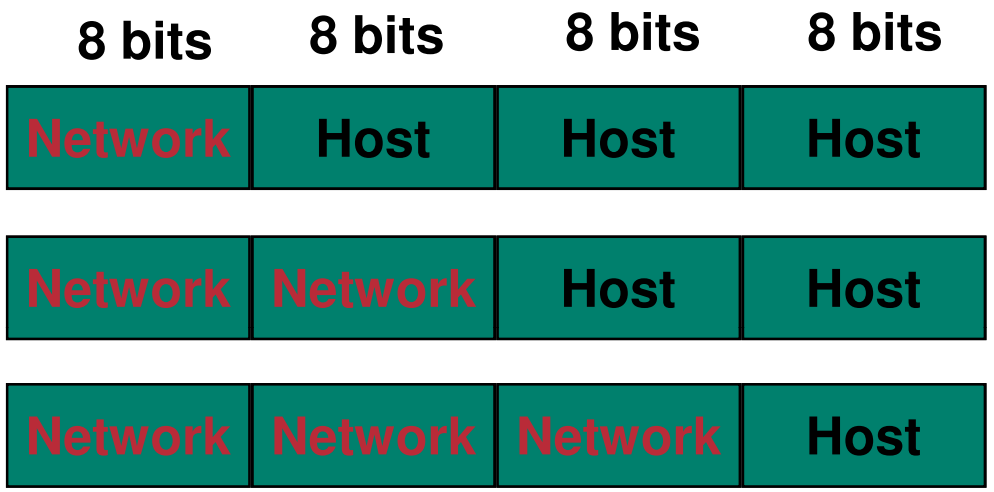
- Each of the 4 Octets has 8 Bits
- Each of these Bits has a "Binary Value"
- Each Bit can only be a One or a Zero
- Let's Look at One of the Octets – 8 Bits

Each of these 8 bits has a distinct value, that starts at "1" from the right side and moving to the left, doubles each time to 2, 4, 8, 16, 32, 64, and finally 128, as shown above.

IPv4 Addressing

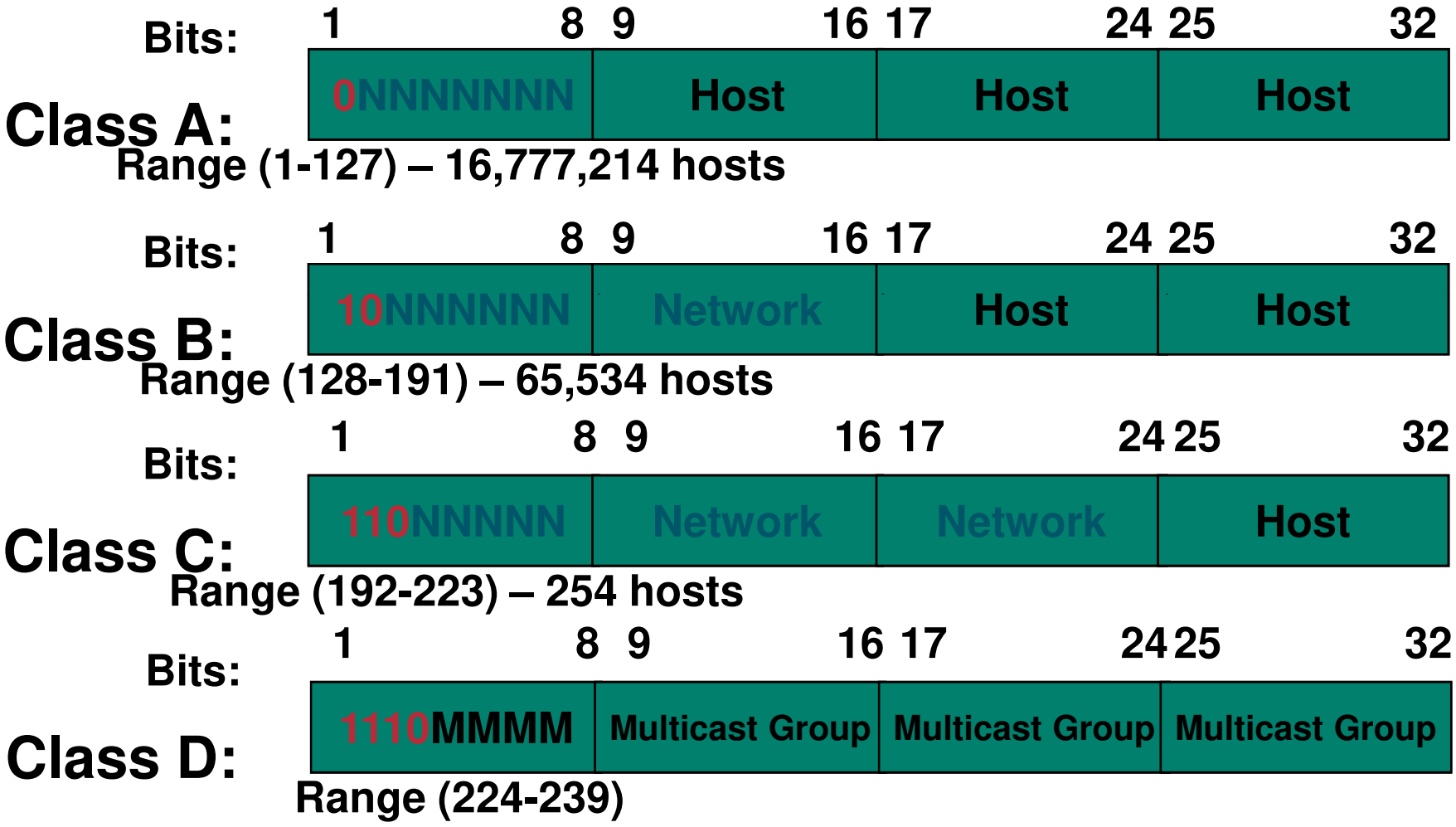


IPv4 Address Classes

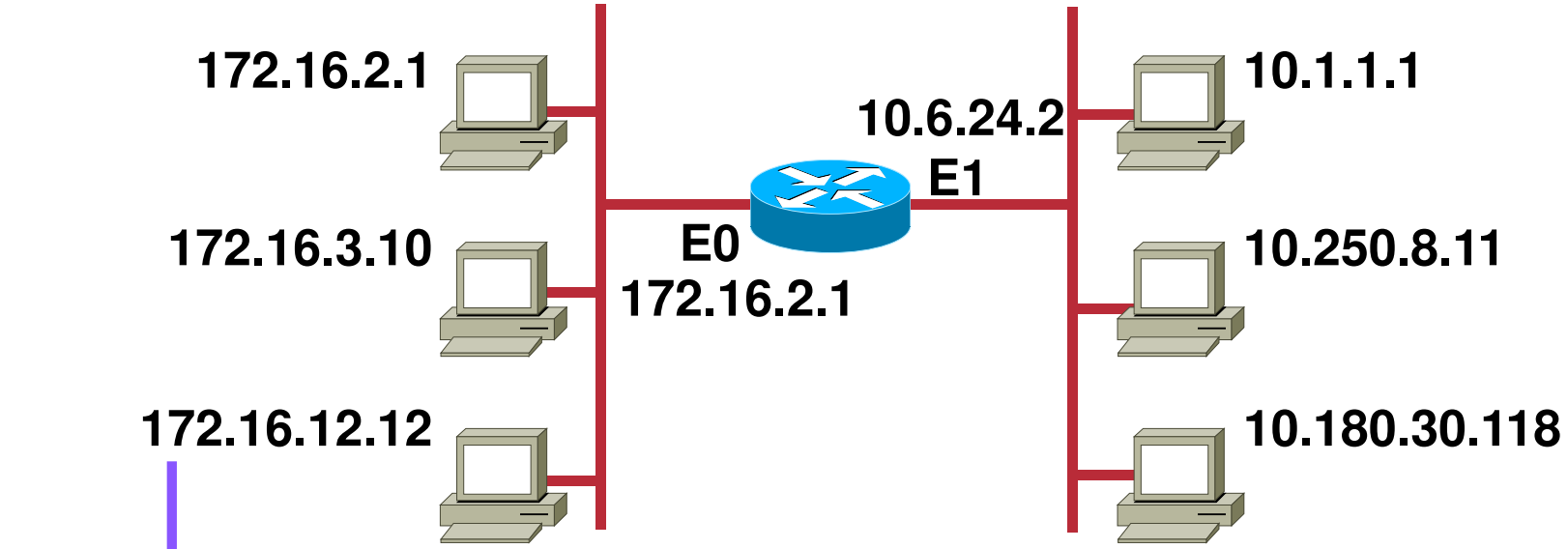


- Class A:
- Class B:
- Class C:
- Class D: Multicast
- Class E: Research

IPv4 Address Classes



Host Addresses

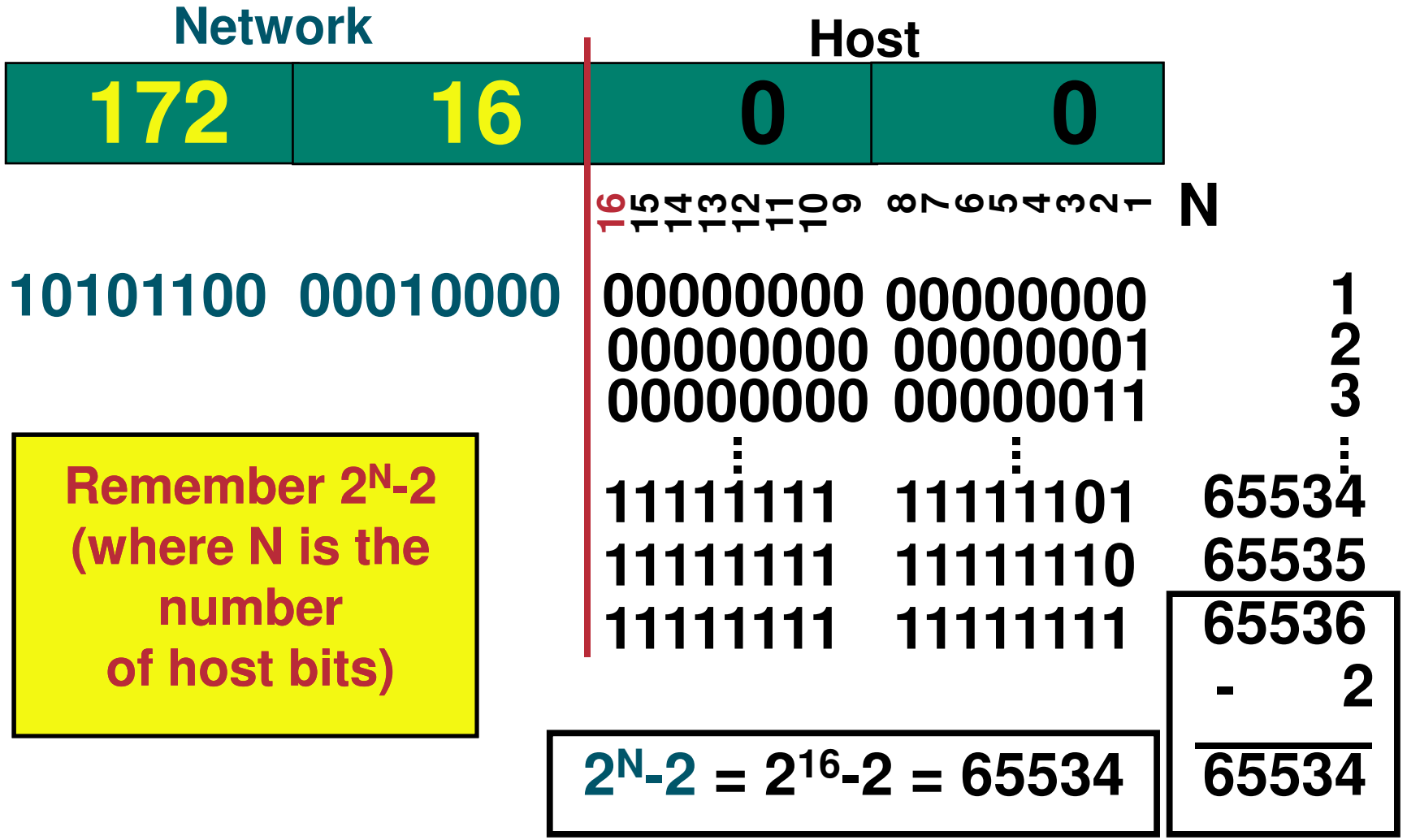


172.16 . 12 . 12

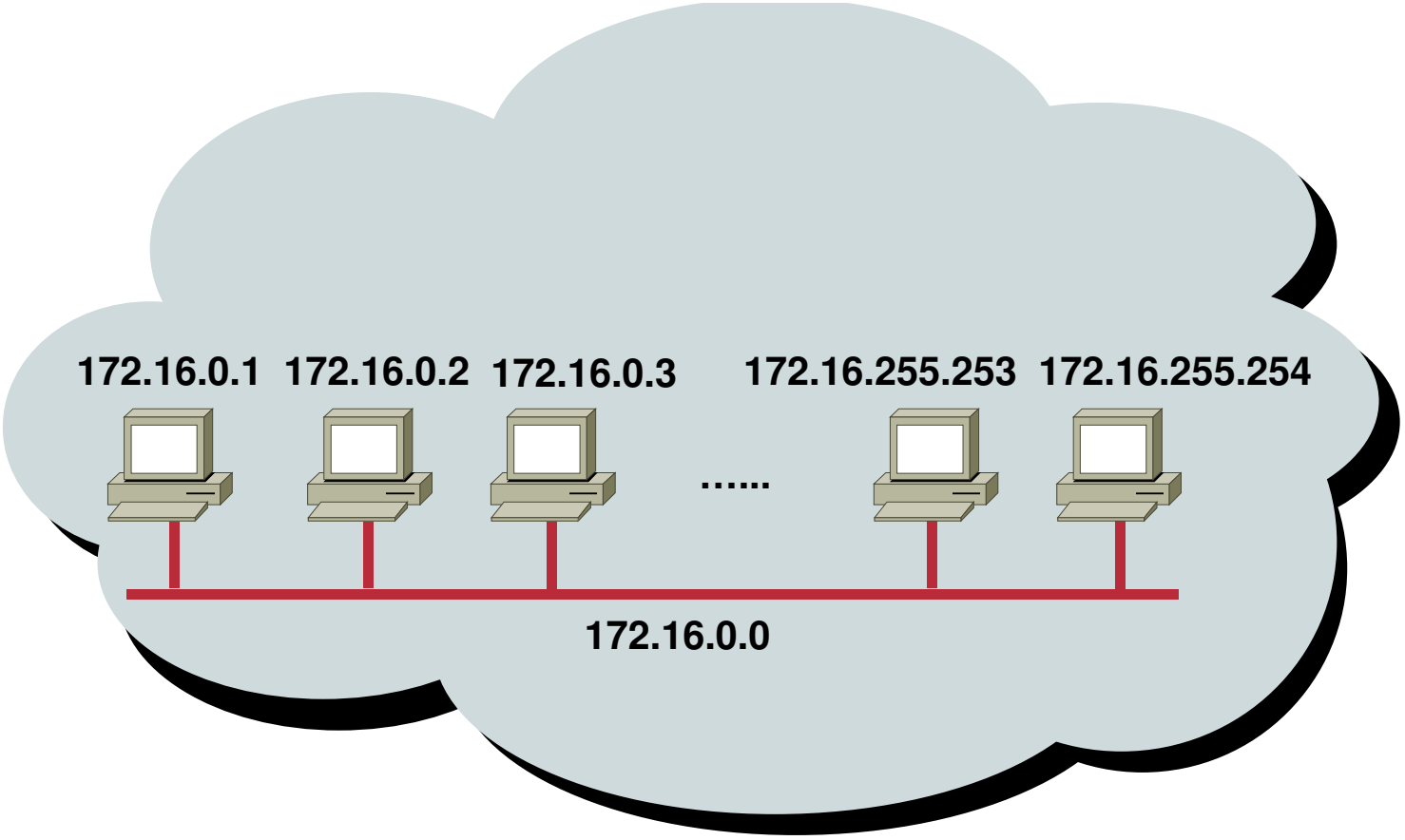
Network Host

Routing Table	
Network	Interface
172.16.0.0	E0
10.0.0.0	E1

Determining Available Host Addresses

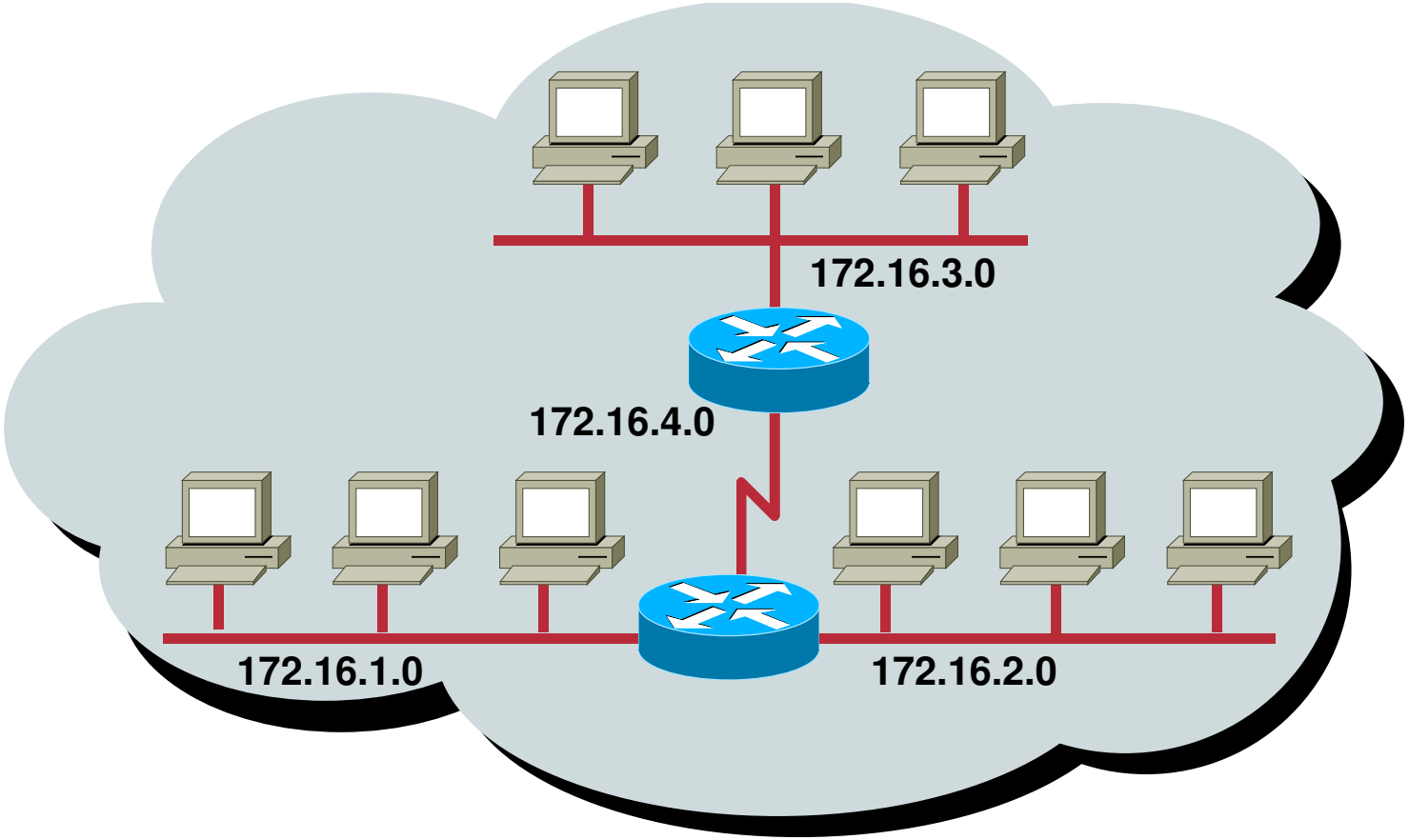


Addressing without Subnets



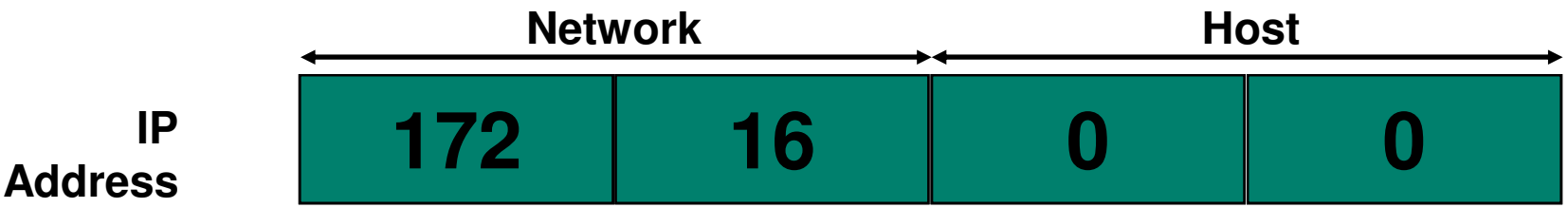
- **Network 172.16.0.0**

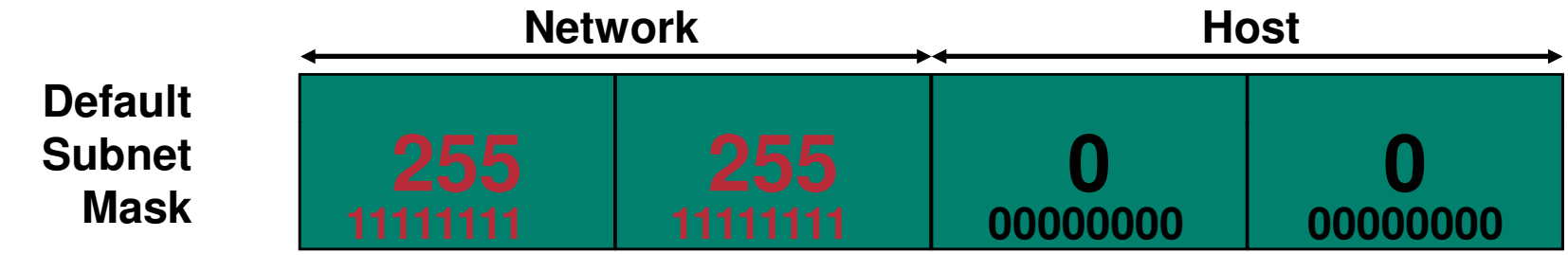
Addressing with Subnets



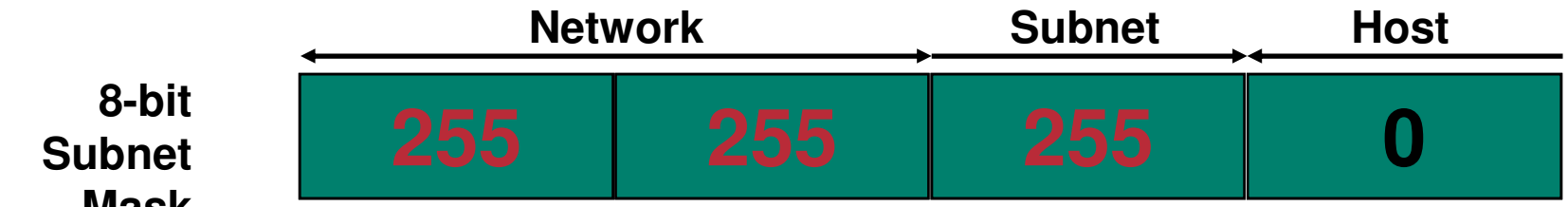
- **Network 172.16.0.0**

Subnet Mask





Also written as "/16" where 16 represents the number of 1s in the mask.



Also written as "/24" where 24 represents the number of 1s in the mask.

Decimal Equivalents of Bit Patterns

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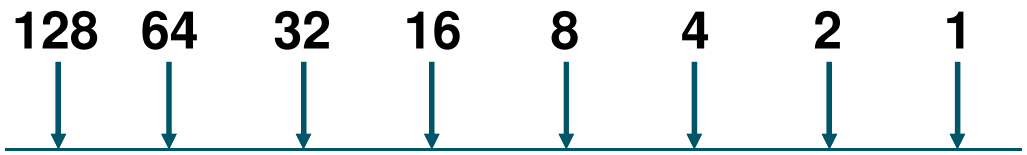

1	0	0	0	0	0	0	0	=	128
1	1	0	0	0	0	0	0	=	192
1	1	1	0	0	0	0	0	=	224
1	1	1	1	0	0	0	0	=	240
1	1	1	1	1	0	0	0	=	248
1	1	1	1	1	1	0	0	=	252
1	1	1	1	1	1	1	0	=	254
1	1	1	1	1	1	1	1	=	255

Know your two's

- $2^1 = 2$
- $2^2 = 4$
- $2^3 = 8$
- $2^4 = 16$
- $2^5 = 32$
- $2^6 = 64$
- $2^7 = 128$
- $2^8 = 256$
- $2^9 = 512$
- $2^{10} = 1024$
- $2^{11} = 2048$
- $2^{12} = 4096$
- $2^{13} = 8192$
- $2^{14} = 16384$
- $2^{15} = 32768$
- $2^{16} = 65536$

Know Your CIDR Values

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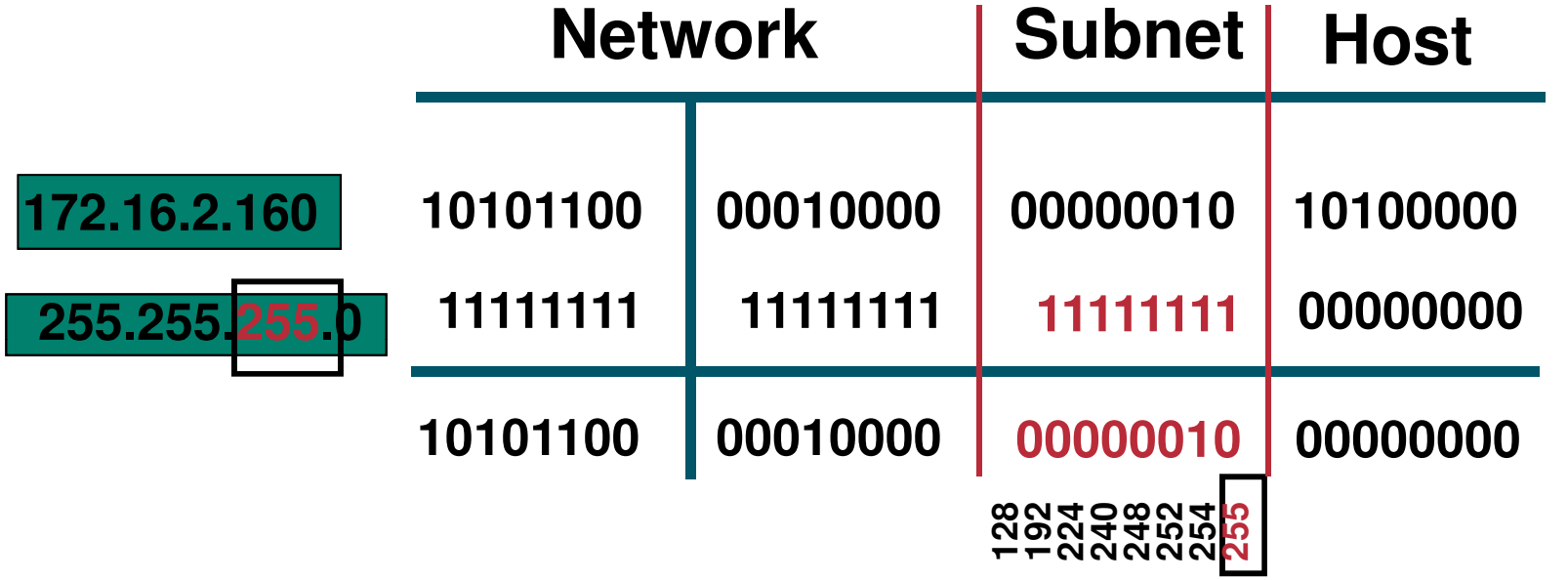
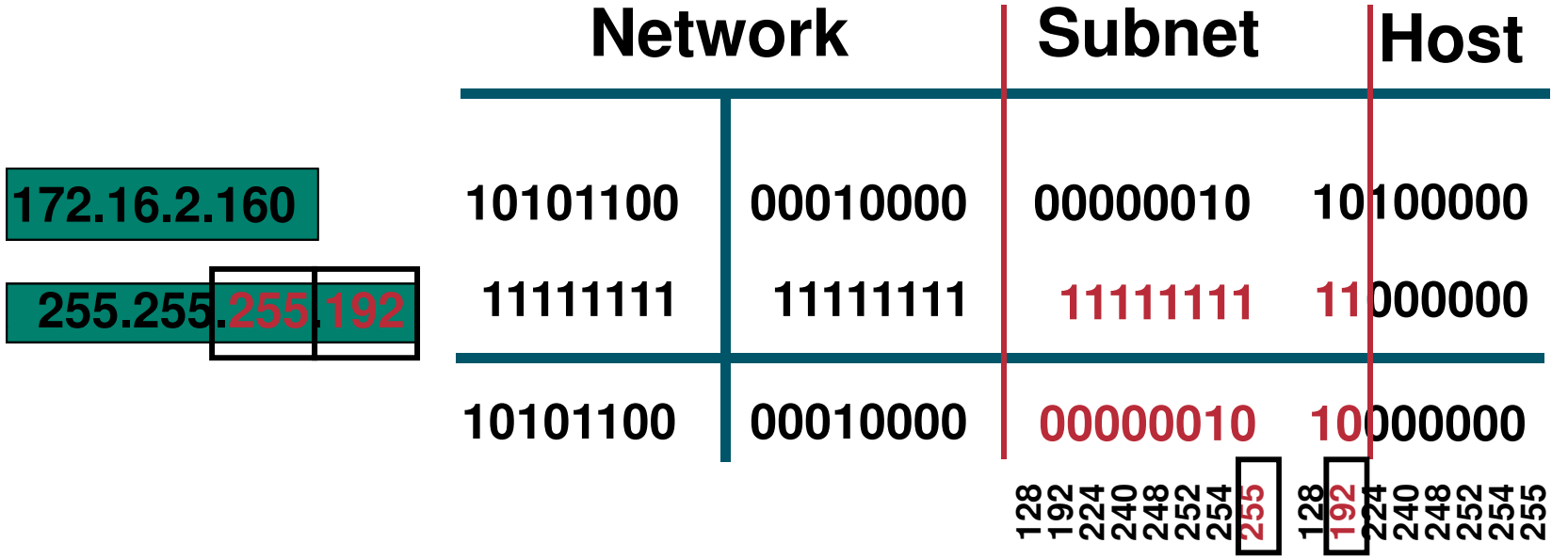
- 255.0.0.0 /8
- 255.128.0.0 /9
- 255.192.0.0 /10
- 255.224.0.0 /11
- 255.240.0.0 /12
- 255.248.0.0 /13
- 255.252.0.0 /14
- 255.254.0.0 /15
- 255.255.0.0 /16
- 255.255.128.0 /17
- 255.255.192.0 /18
- 255.255.224.0 /19
- 255.255.240.0 /20
- 255.255.248.0 /21
- 255.255.252.0 /22
- 255.255.254.0 /23
- 255.255.255.0 /24
- 255.255.255.128 /25
- 255.255.255.192 /26
- 255.255.255.224 /27
- 255.255.255.240 /28
- 255.255.255.248 /29
- 255.255.255.252 /30

Subnet Mask with Subnets



- Network number extended by eight bits
- Without a subnet mask you cannot tell the host address nor the network it resides on!

Subnet Mask with Subnets (cont.)

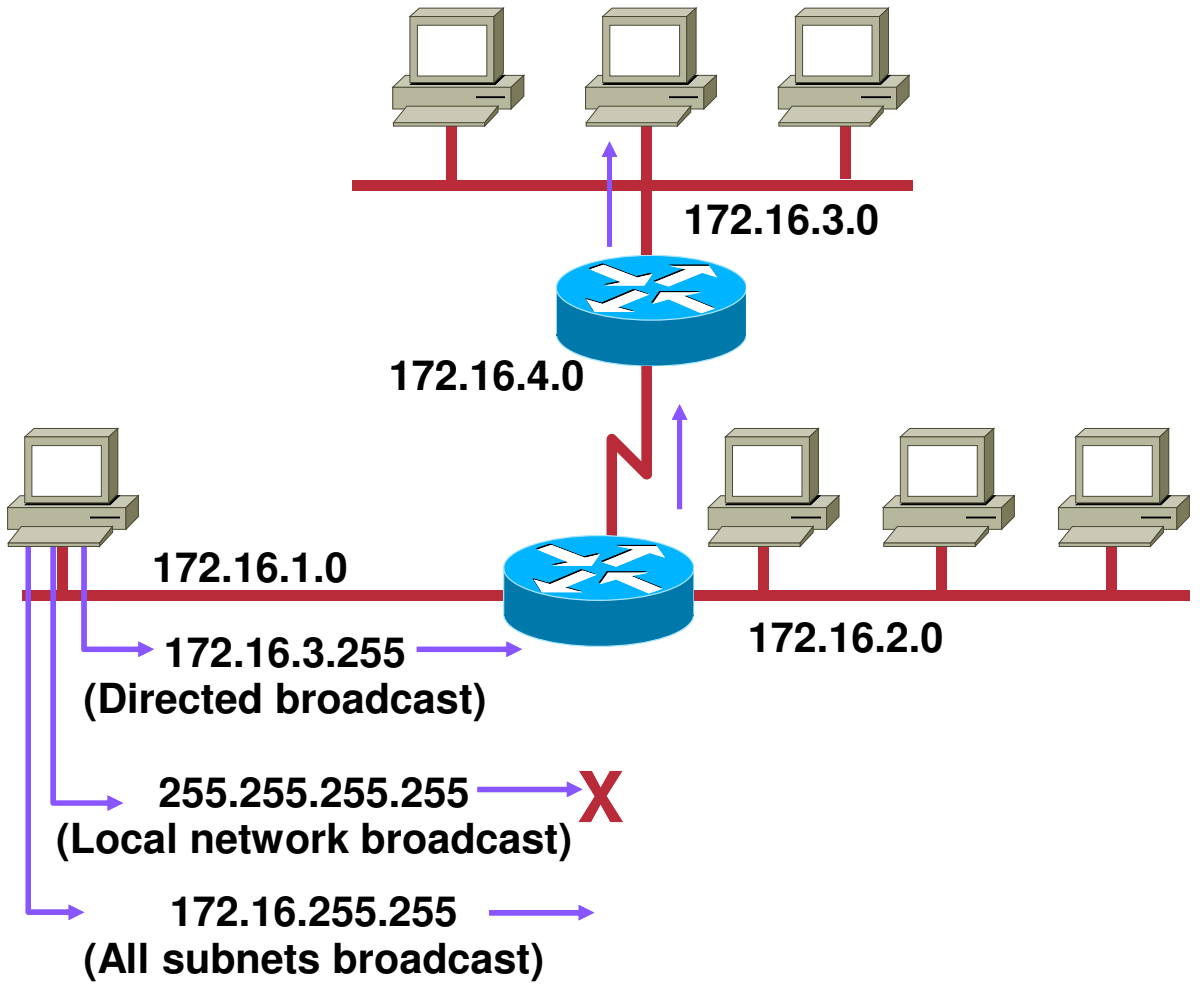


Network Number

172	16	2	128

- **Network number extended by ten bits**

Broadcast Addresses

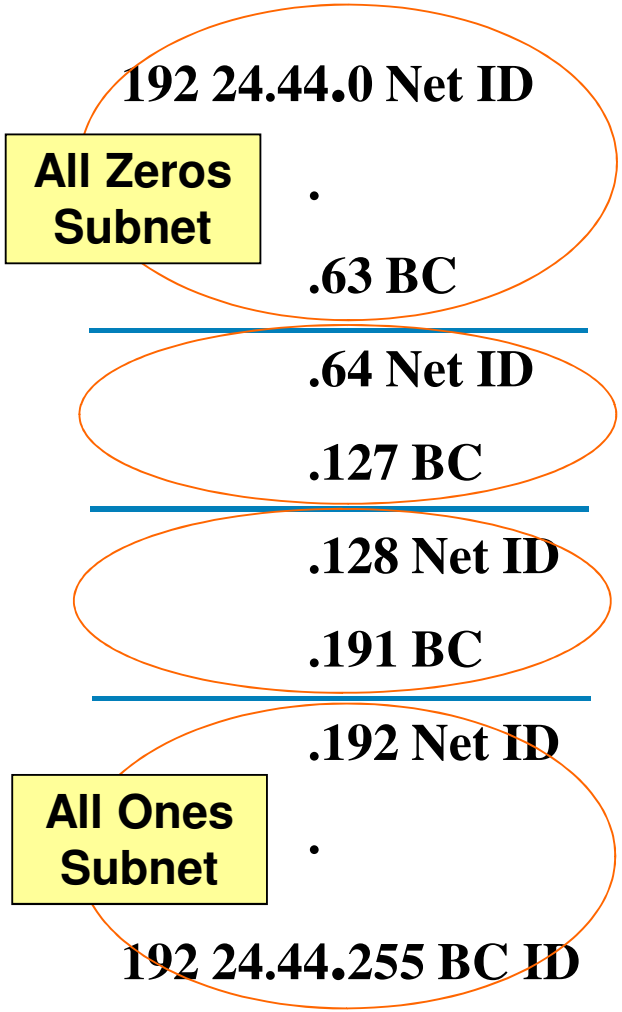


All Zeros and All Ones Subnets

RFC 1878 states:

"This practice of excluding the "all-zeros subnet" and the "all-ones subnet" is obsolete! Modern software will be able to utilize all definable sub-networks."

Today, the use of subnet zero and the all-ones subnet is generally accepted and most vendors support their use, though, on certain networks (and the CCNA Exam), particularly the ones using legacy software, the use of subnet zero and the all-ones subnet can lead to problems.



VLSM - Variable Length Subnet Mask

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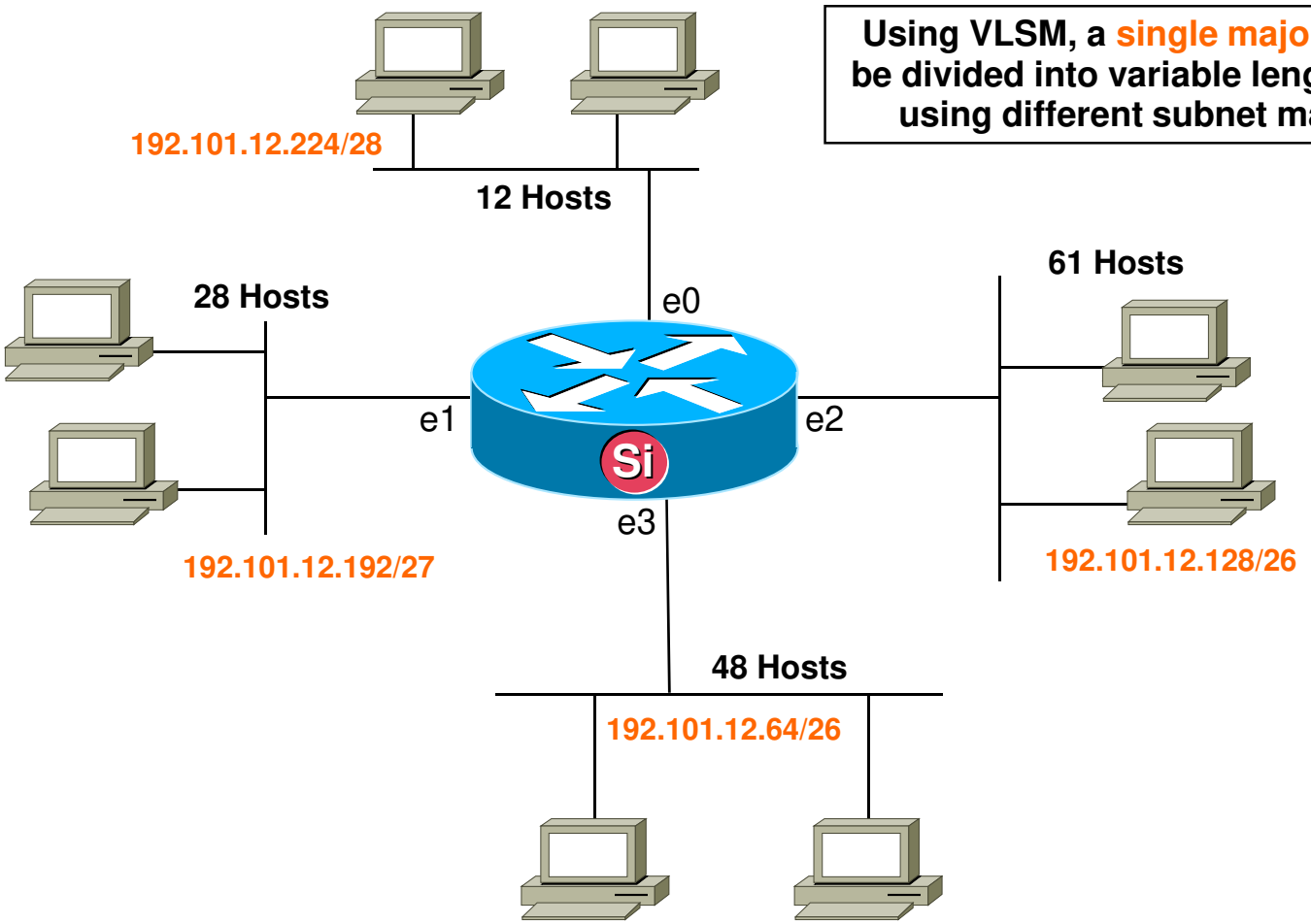

Using VLSM, a single major network can be divided into variable length subnets by using different subnet mask lengths