

CCNA 200-301, Volume I

Chapter 14

Analyzing Existing Subnets

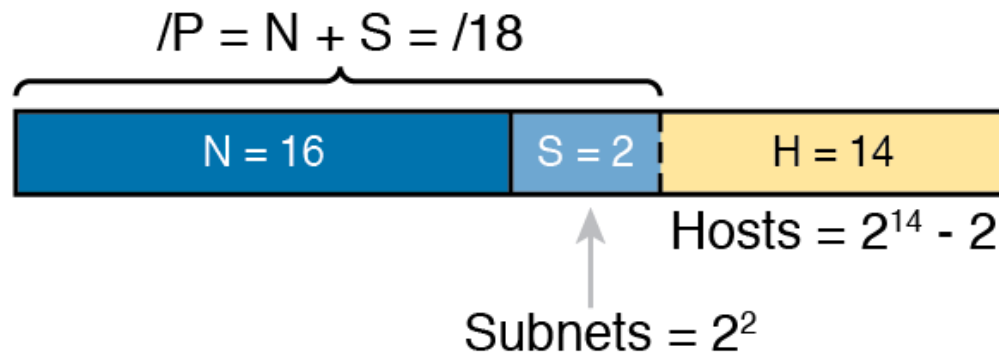
Objectives

- Defining a Subnet
- Analyzing Existing Subnets: Binary
- Analyzing Existing Subnets: Decimal

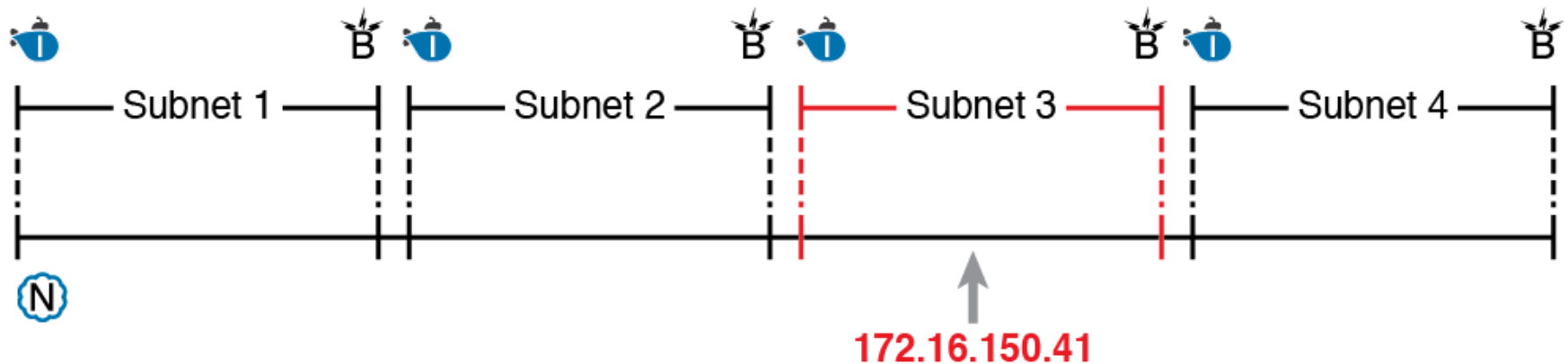
Defining a Subnet

- An IP subnet is a subset of a classful network, created by choice of some network engineer. However, that engineer cannot pick just any arbitrary subset of addresses; instead, the engineer must follow certain rules, such as the following:
 - The subnet contains a set of consecutive numbers.
 - The subnet holds 2^H numbers, where H is the number of host bits defined by the subnet mask.
 - Two special numbers in the range cannot be used as IP addresses:
 - The first (lowest) number acts as an identifier for the subnet (*subnet ID*).
 - The last (highest) number acts as a *subnet broadcast address*.
 - The remaining addresses, whose values sit between the subnet ID and subnet broadcast address, are used as *unicast IP addresses*.
- This section reviews and expands the basic concepts of the subnet ID, subnet broadcast address, and range of addresses in a subnet.

Address Structure: Class B Network, /18 Mask



Network 172.16.0.0, Divided into Four Equal Subnets



Legend:



Network ID

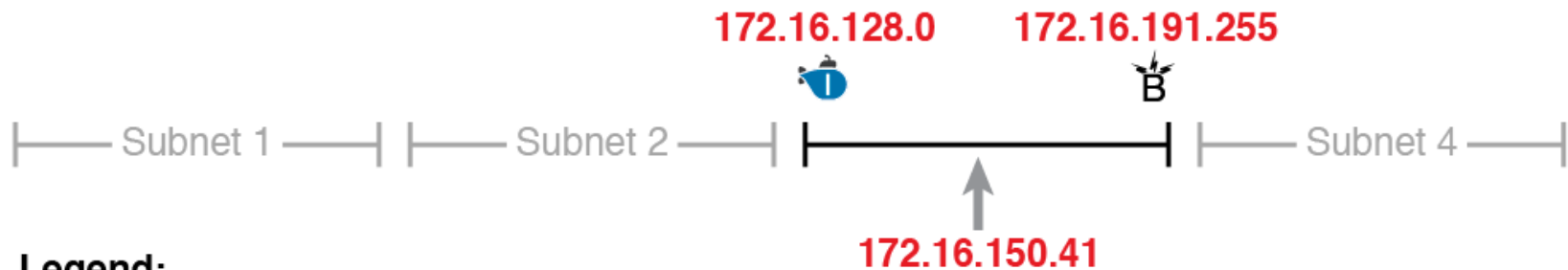


Subnet ID



Subnet Broadcast Address

Resident Subnet for 172.16.150.41, 255.255.192.0



Legend:



Subnet ID



Subnet Broadcast Address

Summary of Subnet ID Key Facts

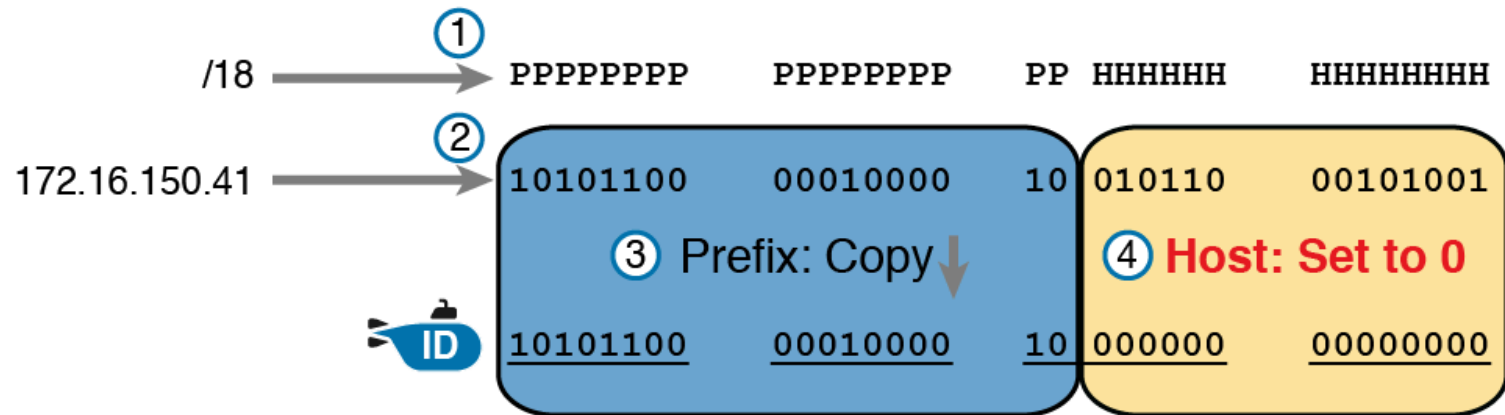
Definition	Number that represents the subnet
Numeric Value	First (smallest) number in the subnet
Literal Synonyms	Subnet number, subnet address, prefix, resident subnet
Common-Use Synonyms	Network, network ID, network number, network address
Typically Seen In...	Routing tables, documentation

Summary of Subnet Broadcast Address

Key Facts

Definition	A reserved number in each subnet that, when used as the destination address of a packet, causes the device to forward the packet to all hosts in that subnet
Numeric Value	Last (highest) number in the subnet
Literal Synonyms	Directed broadcast address
Broader-Use Synonyms	Network broadcast
Typically Seen In...	In calculations of the range of addresses in a subnet

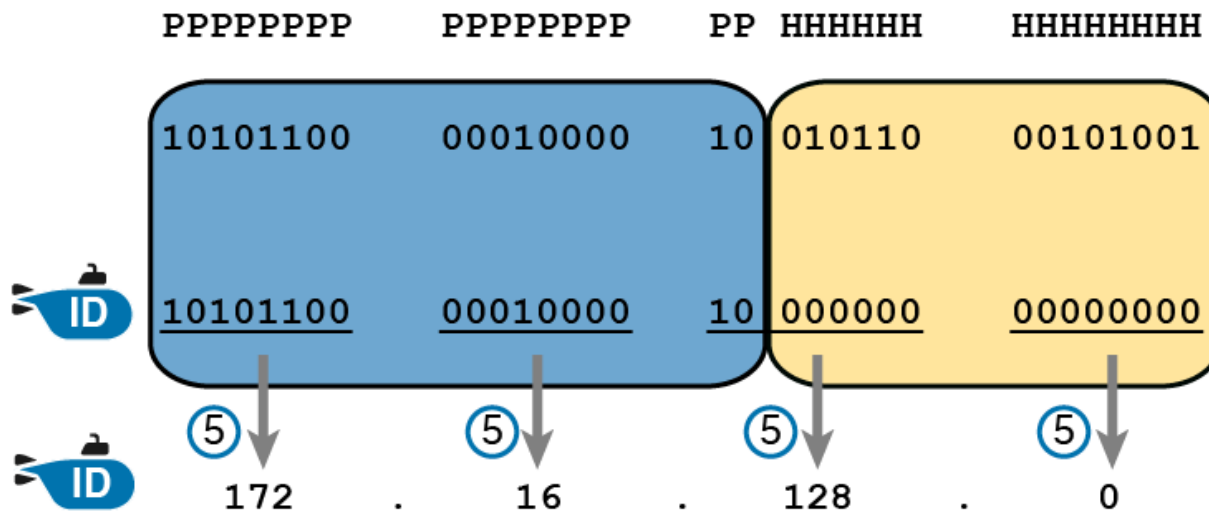
Binary Concept: Convert the IP Address to the Subnet ID



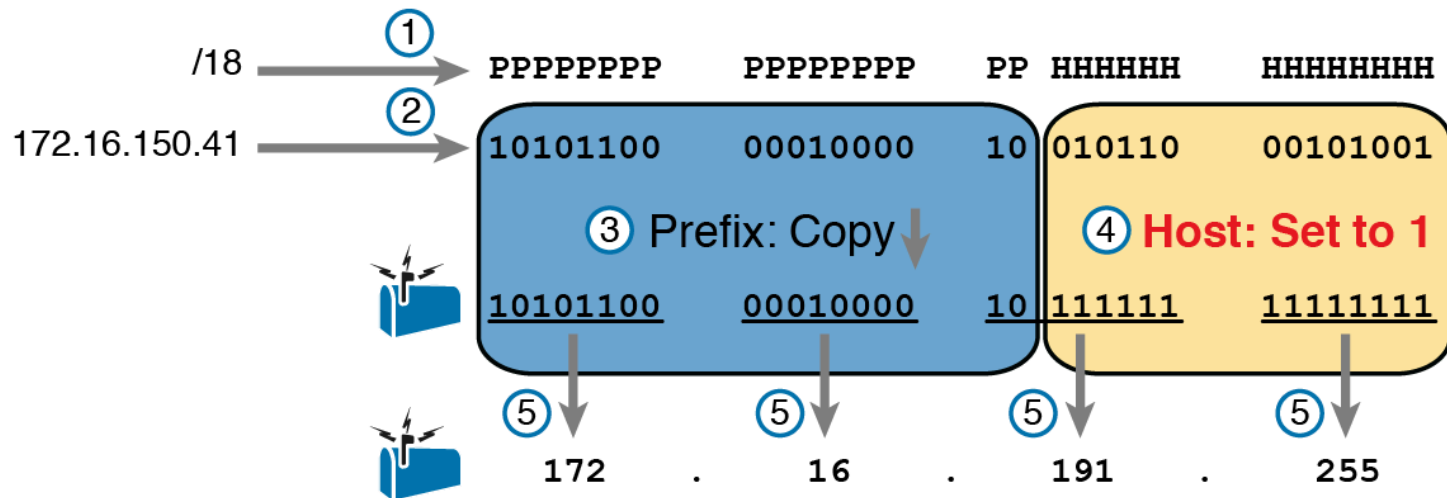
Legend:



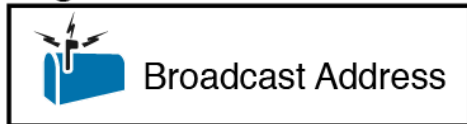
Converting the Subnet ID from Binary to DDN



Finding a Subnet Broadcast Address: Binary



Legend:



Subnet Analysis for Address 8.1.4.5, Mask 255.255.0.0

Prefix Length	/16	11111111 11111111 00000000 00000000
Address	8.1.4.5	00001000 00000001 00000100 00000101
Subnet ID	8.1.0.0	00001000 00000001 00000000 00000000
Broadcast Address	8.1.255.255	00001000 00000001 11111111 11111111

Subnet Analysis for Subnet with Address 130.4.102.1, Mask 255.255.255.0

Prefix Length	/24	11111111 11111111 11111111 00000000
Address	130.4.102.1	10000010 00000100 01100110 00000001
Subnet ID	130.4.100.0	10000010 00000100 01100100 00000000
Broadcast Address	130.4.102.255	10000010 00000100 01100110 11111111

Subnet Analysis for Subnet with Address 199.1.1.100, Mask 255.255.255.0

Prefix Length	/24	11111111 11111111 11111111 00000000
Address	199.1.1.100	11000111 00000001 00000001 01100100
Subnet ID	199.1.1.0	11000111 00000001 00000001 00000000
Broadcast Address	199.1.1.255	11000111 00000001 00000001 11111111

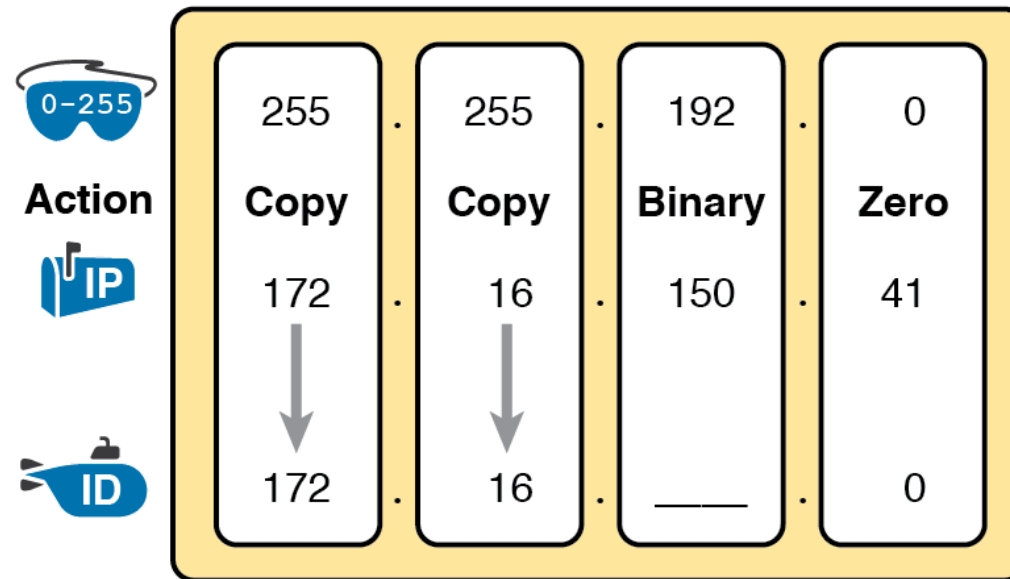
Subnet Analysis for Subnet with Address 130.4.102.1, Mask 255.255.252.0

Prefix Length	/22	11111111 11111111 11111 100 00000000
Address	130.4.102.1	10000010 00000100 01100 110 0000000 1
Subnet ID	130.4.100.0	10000010 00000100 01100 100 00000000
Broadcast Address	130.4.103.255	10000010 00000100 01100 111 11111111

Subnet Analysis for Subnet with Address 199.1.1.100, Mask 255.255.255.224

Prefix Length	/27	11111111 11111111 11111111 111 000000
Address	199.1.1.100	11000111 000000001 000000001 011 00100
Subnet ID	199.1.1.96	11000111 000000001 000000001 011 00000
Broadcast Address	199.1.1.127	11000111 000000001 000000001 011 11111

Binary Shortcut Example



Legend:

	DDN Mask		IP Address		Subnet ID
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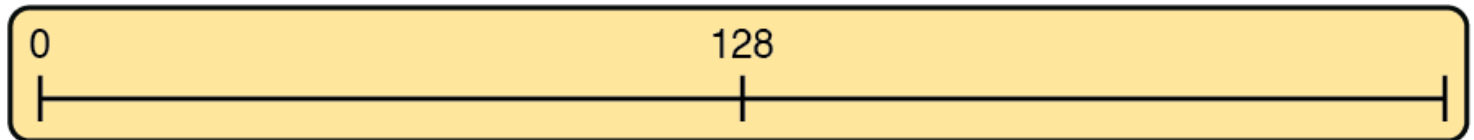
Practice Problems: Find Subnet ID and Broadcast, Easy Masks

	IP Address	Mask	Subnet ID	Broadcast Address
1	10.77.55.3	255.255.255.0		
2	172.30.99.4	255.255.255.0		
3	192.168.6.54	255.255.255.0		
4	10.77.3.14	255.255.0.0		
5	172.22.55.77	255.255.0.0		
6	1.99.53.76	255.0.0.0		

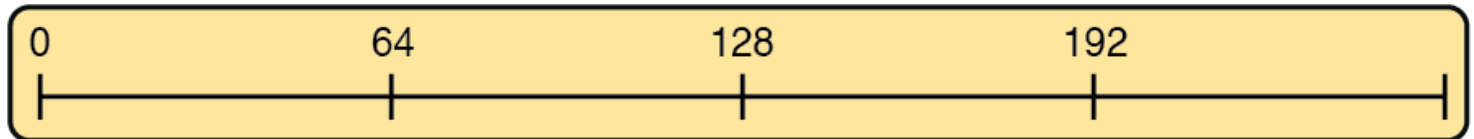
Numeric Patterns in the Interesting Octet

Subnets of 172.16.0.0: 172.16.___.0

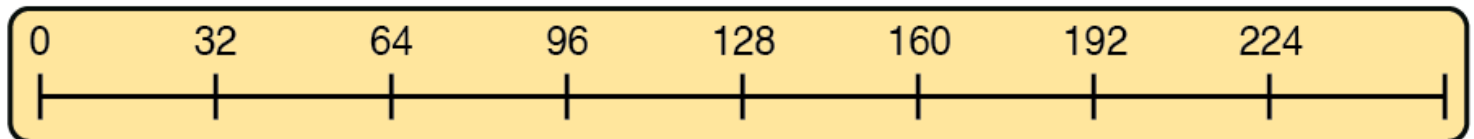
255.255.128.0
2 Subnets



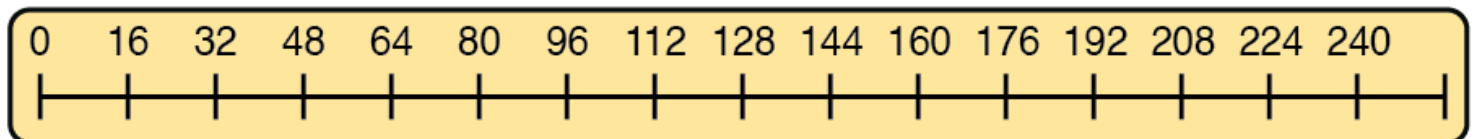
255.255.192.0
4 Subnets



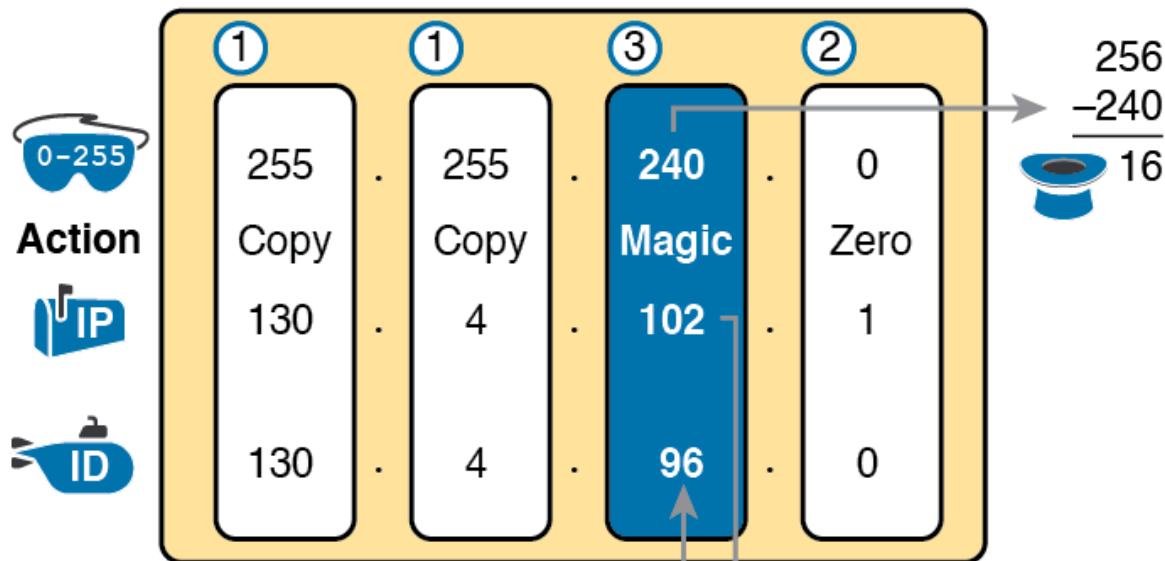
255.255.224.0
8 Subnets



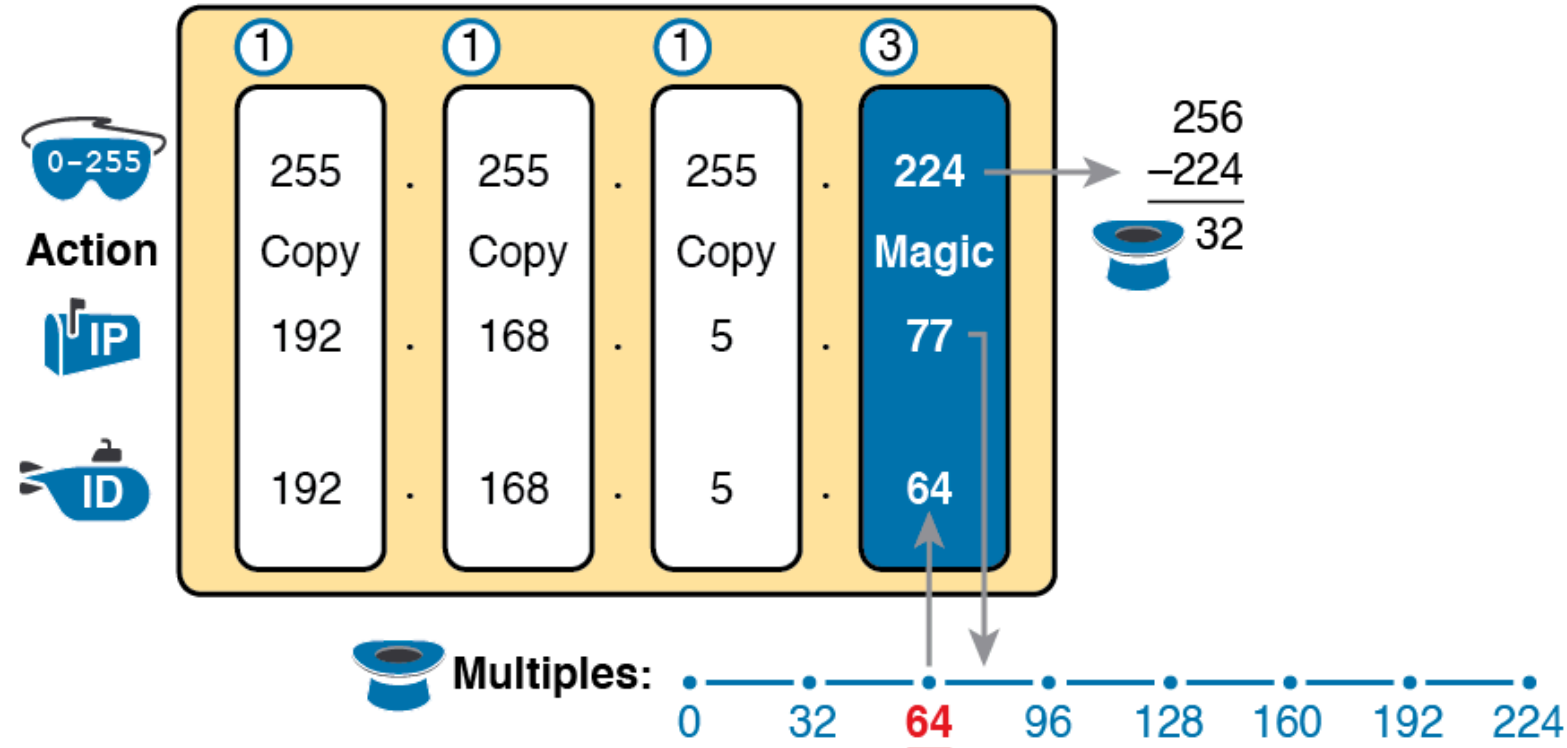
255.255.240.0
16 Subnets



Find the Subnet ID: 130.4.102.1, 255.255.240.0



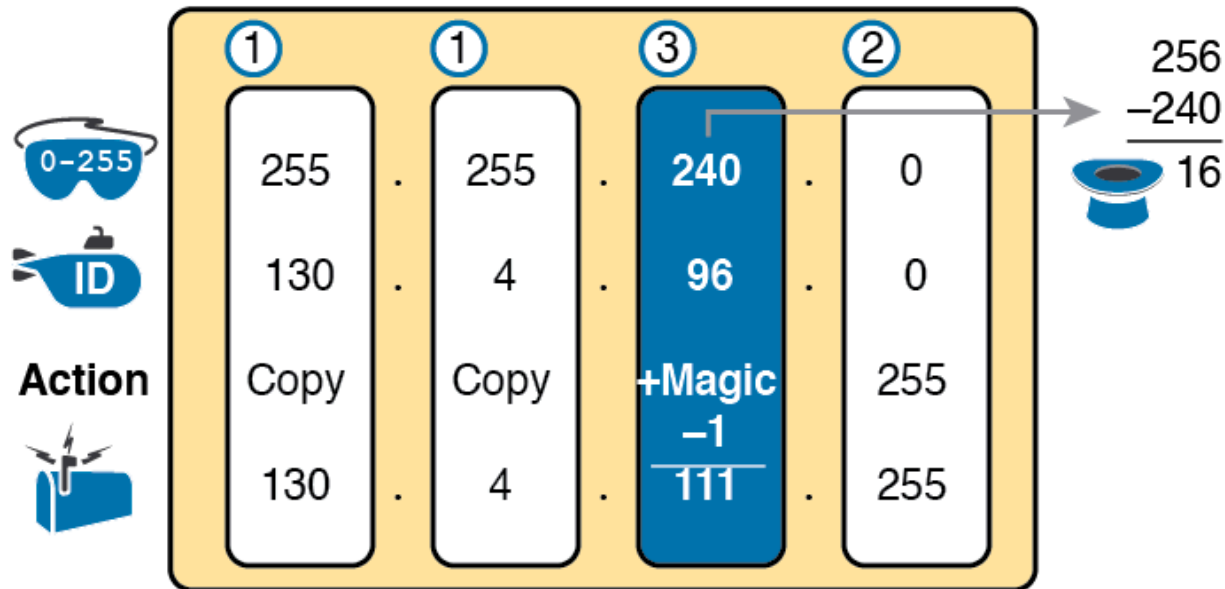
Resident Subnet for 192.168.5.77, 255.255.255.224



Practice Problems: Find Subnet ID, Difficult Masks

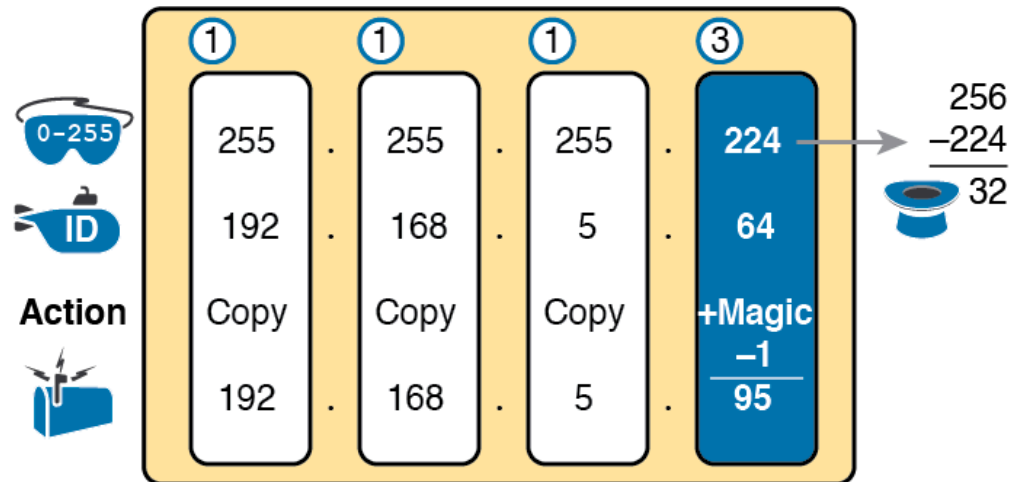
	IP Address	Mask	Subnet ID
1	10.77.55.3	255.248.0.0	
2	172.30.99.4	255.255.192.0	
3	192.168.6.54	255.255.255.252	
4	10.77.3.14	255.255.128.0	
5	172.22.55.77	255.255.254.0	
6	1.99.53.76	255.255.255.248	

Find the Subnet Broadcast: 130.4.96.0, 255.255.240.0



Find the Subnet Broadcast:

192.168.5.64, 255.255.255.224



DDN Mask Values, Binary Equivalent, Magic Numbers, and Prefixes

Prefix, interesting octet 2	/9	/10	/11	/12	/13	/14	/15	/16
Prefix, interesting octet 3	/17	/18	/19	/20	/21	/22	/23	/24
Prefix, interesting octet 4	/25	/26	/27	/28	/29	/30		
Magic number	128	64	32	16	8	4	2	1
DDN mask in the interesting octet	128	192	224	240	248	252	254	255