



IP Address and Subnetting – Part 2

Amazon Web Services

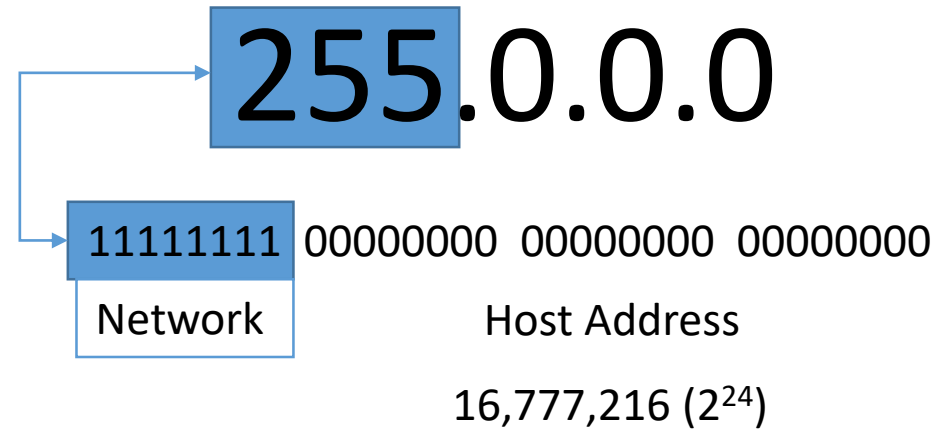
What is a Subnet Mask?

A subnet mask is a number that defines a range of IP addresses available within a network. It is a 32-bit number that masks an IP address, and divides the IP address into network address and host address.

Applying a subnet mask to an IP address separates network address from host address. The network bits are represented by the 1's in the mask, and the host bits are represented by 0's. Performing a bitwise logical AND operation on the IP address with the subnet mask produces the network address.

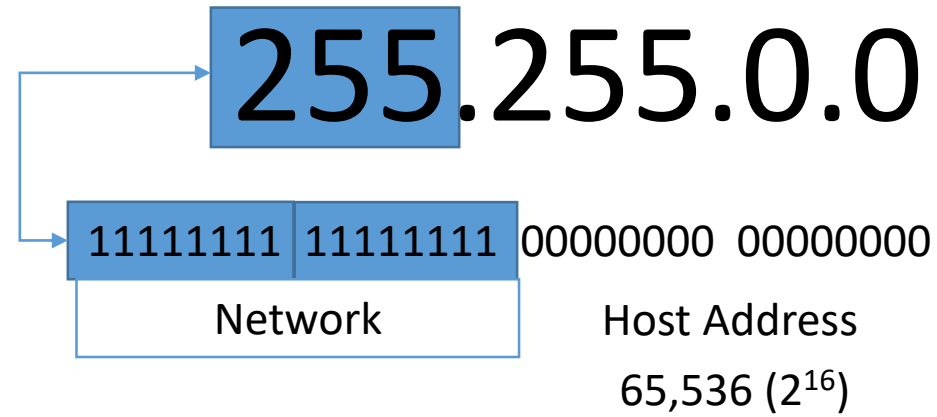
Default Subnet Mask

Class A Subnet Mask



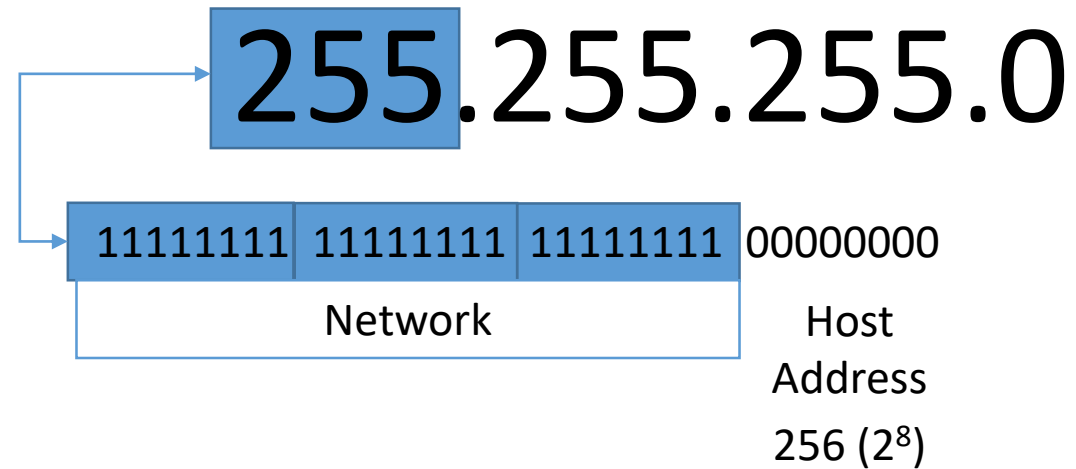
Default Subnet Mask

Class B Subnet Mask



Default Subnet Mask

Class C Subnet Mask



What is a Subnet Mask?

Class A Network
IP Addresses = 16,777,216 (2^{24})

Class B Network
IP Addresses = 65,536 (2^{16})

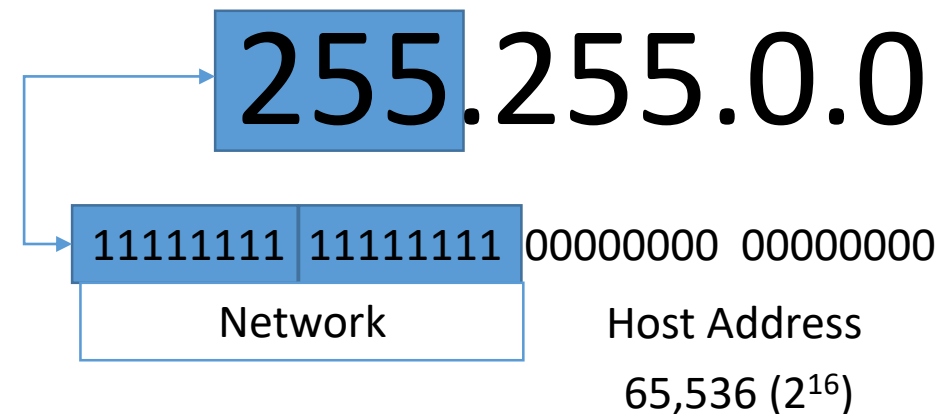
Class C Network
IP Addresses = 256 (2^8)

*Business Requirement:
Create a network that can host
25 Servers and 75 Workstations*

What is Classless Inter Domain Routing (CIDR)

CIDR (Classless Inter-Domain Routing) allows more flexible allocation of Internet Protocol (IP) addresses than was possible with the original system of IP address classes. Using CIDR which is another way to represent Subnet Masks, which allows you to create much smaller networks. CIDR notations help to identify the network address and the number of hosts you can have in a given network.

Example – Class B Network



IP Subnetting & CIDR

Class A – Default Subnet Mask – 255.0.0.0

IP Range – 1-126

8 Bits represent the network and the remaining the number of hosts.

Network	Hosts		
255	0	0	0
1 1 1 1 1 1 1 1	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0
1 Represents Network Bits	0 Represents Host Bits		
Network (8 Bits)	Hosts (24 Bits)		

What is the CIDR Value?

CIDR Value = /8

IP Subnetting & CIDR

Class B – Default Subnet Mask – 255.255.0.0

IP Range – 128-191

16-Bits represent the network and the remaining the number of hosts.

Network		Hosts	
255	255	0	0
1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0
1 Represents Network Bits		0 Represents Host Bits	
Network (16 Bits)		Hosts (16 Bits)	

What is the CIDR Value?

CIDR Value = /16

IP Subnetting & CIDR

Class C – Default Subnet Mask – 255.255.255.0

IP Range – 192-223

24 Bits represent the network and the remaining the number of hosts.

Network			Hosts
255	255	255	0
1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	0 0 0 0 0 0 0 0
1 Represents Network Bits			0 Represents Host Bits
Network (24 Bits)			Hosts (8 Bits)

What is the CIDR Value?

CIDR Value = /24

IP Networks & CIDR

192.168.1.0/24

Block 1	Block 2	Block 3	Block 4
1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	0 0 0 0 0 0 0 0
2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1

IP Networks & CIDR

192.168.1.0/24

Block 1	Block 2	Block 3	Block 4
1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	0 0 0 0 0 0 0 0
2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1
255	255	255	0

IP Networks & CIDR

192.168.1.0/25

255	255	255	0
Block 1	Block 2	Block 3	Block 4
2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1
1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	0 0 0 0 0 0 0 0

IP Networks & CIDR

192.168.1.0/25

255	255	255	0
Block 1	Block 2	Block 3	Block 4
2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1
1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	0 0 0 0 0 0 0 0

IP Networks & CIDR

192.168.1.0/25

255	255	255	0
Block 1	Block 2	Block 3	Block 4
2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1
1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	0 0 0 0 0 0 0 0

IP Networks & CIDR

192.168.1.0/25

255	255	255	0
Block 1	Block 2	Block 3	Block 4
2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1
1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	1 0 0 0 0 0 0 0

IP Networks & CIDR

255	255	255	0
Block 1	Block 2	Block 3	Block 4
2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1
1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	1 0 0 0 0 0 0 0
255	255	255	128

192.168.1.0/25

IP Networks & CIDR

255	255	255	0
Block 1	Block 2	Block 3	Block 4
2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1
1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	1 0 0 0 0 0 0 0
255	255	255	128

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Block 4: $2^7 = 128$

Number of Networks

2^n (Where 'n' represents the total number of network bits borrowed from the host block)

$2^1 = 2$ (Create 2 Networks)

IP Networks & CIDR

255	255	255	0
Block 1	Block 2	Block 3	Block 4
2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1
1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	1 0 0 0 0 0 0 0
255	255	255	128

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Block 4: $2^7 = 128$

Number of Networks

2^n (Where 'n' represents the total number of network of bits borrowed from the host block)

$2^1 = 2$ (Create 2 Networks)

Number of IP Addresses Per Network

2^n (Where 'n' represents the total number of host bits remaining)

$2^7 = 128$ (Each network can have up to 128 IP Addresses)

Available IP Addresses vs. Usable IP Addresses

192.168.1.0/25

Number of IP Addresses Per Network

2^n (Where 'n' represents the total number of host bits remaining)

$2^7 = 128$ (Each network can have up to 128 IP Addresses)

- First IP Address on every network is the Network ID
- Last IP Address on every network is Broadcast ID

Important Note:

Number of Usable IP Addresses Per Network

$2^n - 2$ (Where 'n' represents the total number of host bits remaining)

$2^7 - 2 = 126$ (Each network can have up to 126 USABLE IP Addresses)

255	255	255	0
Block 1	Block 2	Block 3	Block 4
2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1
1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	1 0 0 0 0 0 0 0
255	255	255	128

192.168.1.0/25

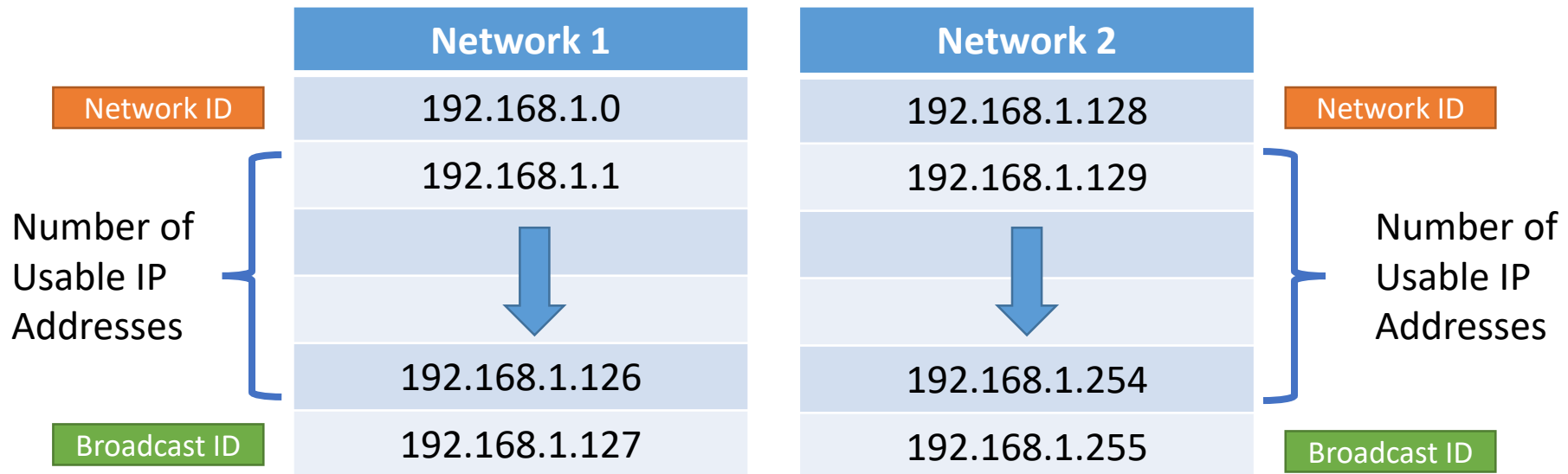
Block 4: $2^7 = 128$

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255	255	255	0
Block 1	Block 2	Block 3	Block 4
2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1
1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	1 0 0 0 0 0 0 0
255	255	255	128

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Block 4 – $2^7 = 128$



IP Networks

192.168.1.0/27

255	255	255	0
Block 1	Block 2	Block 3	Block 4
2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1
1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	0 0 0 0 0 0 0 0

IP Networks

192.168.1.0/27

255	255	255	0
Block 1	Block 2	Block 3	Block 4
2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1
1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	0 0 0 0 0 0 0 0

IP Networks

192.168.1.0/27

255	255	255	0
Block 1	Block 2	Block 3	Block 4
2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1	2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 128 64 32 16 8 4 2 1
1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	1 1 1 0 0 0 0 0

Number of Hosts

- Use of 27 Bits from the 32 Bit range
 - $32 - 27 = 5$ Bits
 - $2^5 = 32$ IP Addresses per Network
 - Remember the n-2 for usable IPs (Hosts)
 - $32 - 2 = 30$ Hosts in the Network

Number of Network

- Use of first 3 Bits from the last 8 Bits
 - $2^3 = 8$
 - 8 Networks

Next Video

Introduction to On-Premise Networking