

SUBNETTING

Basic terms

IP address - identifies a device connected to the network. It is a **32-bit** address, 4 octets.

Subnet - separate part of an organization's network

Subnet mask - identifies which part of an IP address is reserved for the network and which part is to be used for a host or hosts.

IPv4

192.168.1.7 /24

Reserved for the network host subnet mask

Classes of IP addresses:

Class	IP address range	Network mask	Prefix	Number of networks	Number of hosts
A	1. -127	255.0.0.0	/8	125	16,777,214
B	128. -191	255.255.0.0	/16	16,382	65,534
C	192. -223	255.255.255.0	/24	2,097,150	254
D	224. -239	Multicast addresses			
E	240. -254	Restricted / Experimental / Do not use			

Private IP addresses:

A: 10.0.0.0 - 10.255.255.255

B: 172.16.0.0 - 172.31.255.255

C: 192.168.0.0 - 192.168.255.255

Default subnet masks:

Class A: 255.0.0.0

Class B: 255.255.0.0

Class C: 255.255.255.0

Number of Subnets = 2^n n=no. of subnet bits

Number of Hosts = $2^n - 2$ n = no. of host bits

CIDR

Classless Inter-Domain Routing – uses a slash followed by a number, called **the prefix**.

CIDR	Decimal	Available hosts
/30	255.255.255.252	4
/29	255.255.255.248	8
/28	255.255.255.240	16
/27	255.255.255.224	32
/26	255.255.255.192	64
/25	255.255.255.128	128
/24	255.255.255.0	256
/16	255.255.0.0	65.536
/8	255.0.0.0	16.777.216

Full table:

<https://www.ripe.net/support/training/material/LIR-Training-Course/LIR-Training-Handbook-Appendices/CIDR-Chart-IPv4.pdf>

Examples

215.20.5.0 /24

We need 5 networks

1. Convert to binary the number of networks you need

128	64	32	16	8	4	2	1
0	0	0	0	0	1	0	1

5= 00000101

2. Convert your original mask to binary, find how many bits you need and find the increment

255.255.255.0 =

11111111.11111111.11111111.00000000

We need **3 bits** to get 5 networks

5= 00000101

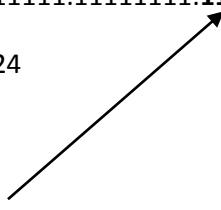
Our new subnet mask is:

11111111.11111111.11111111.**111**00000

255.255.255.224

Our increment

32



3. Find networks

Network	Hosts	Broadcast Address
215.20.5.0	215.20.5.1 to 215.20.5.30	215.20.5.31
215.20.5.32	215.20.5.33 to 215.20.5.62	215.20.5.63
215.20.5.64	215.20.5.65 to 215.20.5.94	215.20.5.95
215.20.5.96	215.20.5.97 to 215.20.5.126	215.20.5.127
215.20.5.128	215.20.5.129 to 215.20.5.158	215.20.5.159
215.20.5.160	215.20.5.161 to 215.20.5.190	215.20.5.191
215.20.5.192	215.20.5.193 to 215.20.5.222	215.20.5.223
215.20.5.224	215.20.5.225 to 215.20.5.254	215.20.5.255

215.20.5.0 /24

We need 30 hosts

1. Convert to binary the number of networks you need

128	64	32	16	8	4	2	1
0	0	0	1	1	1	1	0

30 = 00011110

2. Convert your original mask to binary, find how many bits you need and find the increment

255.255.255.0 =

11111111.11111111.11111111.00000000

We need **5 bits** to get 30 hosts

11111111.11111111.11111111.11100000

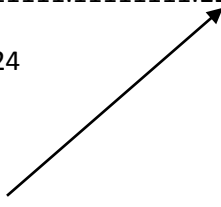
Our new subnet mask is:

11111111.11111111.11111111.11100000

255.255.255.224

Our increment

32



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Network	Hosts	Broadcast Address
215.20.5.0	215.20.5.1 to 215.20.5.30	215.20.5.31
215.20.5.32	215.20.5.33 to 215.20.5.62	215.20.5.63
215.20.5.64	215.20.5.65 to 215.20.5.94	215.20.5.95
215.20.5.96	215.20.5.97 to 215.20.5.126	215.20.5.127
215.20.5.128	215.20.5.129 to 215.20.5.158	215.20.5.159
215.20.5.160	215.20.5.161 to 215.20.5.190	215.20.5.191
215.20.5.192	215.20.5.193 to 215.20.5.222	215.20.5.223
215.20.5.224	215.20.5.225 to 215.20.5.254	215.20.5.255

EXCEPTIONS

Network values:

2,4,8,16,32,64,128

Host values:

3,7,15,31,,63,127

To keep it simple:

Subtract 1 for networks

Add 1 for hosts

VLSM

Variable Length Subnet Masking allows you to divide an IP address (a network address) to subnets of **different sizes**, unlike same-size subnetting.

Examples:

Address: 192.168.1.0/24

Amount of Hosts	Network Address/Mask
38	192.168.1.0/26
11	192.168.1.64/28
4	192.168.1.80/29

Address: 200.10.10.0/24

Amount of Hosts	Network Address/Mask
100	200.10.10.0/25
21	200.10.10.128/27
2	200.10.10.160/30
2	200.10.10.164/30
2	200.10.10.168/30

Address: 150.150.0.0/16

Amount of Hosts	Network Address/Mask
280	150.150.0.0/23
111	150.150.2.0/25
22	150.150.2.128/27

Address: 10.0.0.0/8

Amount of Hosts	Network Address/Mask
8749	10.0.0.0/18
2333	10.0.64.0/20
211	10.0.80.0/24
22	10.0.81.0/27

Address: 120.120.120.0/24

Amount of Hosts	Network Address/Mask
109	120.120.120.0/25
33	120.120.120.128/26
2	120.120.120.192/30
2	120.120.120.196/30
2	120.120.120.200/30
2	120.120.120.204/30
2	120.120.120.208/30

Address: 172.172.0.0/16

Amount of Hosts	Network Address/Mask
987	172.172.0.0/22
311	172.172.4.0/23
2	172.172.6.0/30

LINKS

Subnetting calculators:

www.subnet-calculator.com

www.jodies.de/ipcalc

VLSM:

www.vlsm-calc.net

TIPS

- ✓ Take your time!
- ✓ Play with SIMPLE examples first
- ✓ Master ALL basics
- ✓ Do subnetting 1000 times – you will learn it ;-)
- ✓ Want to take the CCNA / MTA exam? Make sure you can answer in LESS than 5 seconds: 'What is the broadcast address for a host 192.168.76.4 /29'
- ✓ Use online subnetting calculators and tests
- ✓ And again... TAKE YOUR TIME!