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 **I**nter-**D**omain **R**outing – 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

192.168.1.0 /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
	First useable	Last useable	
192.168.1.0	192.168.1.1	192.168.1.30	192.168.1.31
192.168.1.32	192.168.1.33	192.168.1.62	192.168.1.63
192.168.1.64	192.168.1.65	192.168.1.94	192.168.1.95
192.168.1.96	192.168.1.97	192.168.1.126	192.168.1.127
192.168.1.128	192.168.1.129	192.168.1.158	192.168.1.159
192.168.1.160	192.168.1.161	192.168.1.190	192.168.1.191
192.168.1.192	192.168.1.193	192.168.1.222	192.168.1.223
192.168.1.224	192.168.1.225	192.168.1.254	192.168.1.255

192.168.1.0 /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

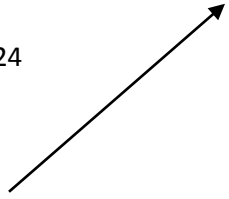
We need **5 bits** to get 30 hosts

11111111.11111111.11111111.11100000

Our new subnet mask is:

11111111.11111111.11111111.**111**00000

255.255.255.224



Our increment

32

3. Find networks

Network	Hosts		Broadcast Address
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192.168.1.64	192.168.1.65	192.168.1.94	192.168.1.95
192.168.1.96	192.168.1.97	192.168.1.126	192.168.1.127
192.168.1.128	192.168.1.129	192.168.1.158	192.168.1.159
192.168.1.160	192.168.1.161	192.168.1.190	192.168.1.191
192.168.1.192	192.168.1.193	192.168.1.222	192.168.1.223
192.168.1.224	192.168.1.225	192.168.1.254	192.168.1.255

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 **L**ength **S**ubnet **M**asking 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	Increment?	Network Address/Mask
44	64	192.168.1.0/26
11	16	192.168.1.64/28
4	8	192.168.1.80/29

Address: 1.1.1.0/24

Amount of Hosts	Increment?	Network Address/Mask
12	16	1.1.1.0/28
2	4	1.1.1.16/30
2	4	1.1.1.20/30
2	4	1.1.1.24/30

Address: 192.168.0.0/24

Amount of Hosts	Increment?	Network Address/Mask
277	2*	192.168.0.0/23
112	128	192.168.2.0/25
22	32	192.168.2.128/27
2	4	192.168.2.160/30

* in the 3rd octet!!!

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!**