Subnetting Notes and Examples

First Example

Source:

Mask
255.255.255.192

CIDR: Classless Inter-Domain Routing

1) Find CIDR from Mask

1. Add bits from 255 octets: 8 + 8 + 8 = 24
2. Find number of bits in 4th octet: 11000000 (128 + 64 = 192)
    a. 2 bits
3. 26 bits = /26 CIDR

IP Address: 192.168.45.55 - What is the Network ID?

2) Find Network ID from mask and IP address

1. Identify Network ID
    a. 192.168.45 are a part of the network ID because in the mask these octets are 255 (all 1s)
2. Examine remaining octets
    a. Find octet mask bits 192 = 11000000
    b. Find octet IP address bits 55 in binary = 00100111 (32+16+4+2+1)
3. Compare bits

1	1	0	0	0	0	0	0
0	0	1	0	0	1	1	1

Network ID is 192.168.45.0

4. Put together
    a. Network ID: 192.168.48.0/26

b. Subnet mask of 255.255.255.192

3) Broadcast Range for Network

IP Address: 192.168.45.55 - What is the Network ID?
192.168.45.0/26
255.255.255.192
00110111
4th octet mask bits: 11000000
128 64 | 32 16 8 4 2 1

32 + 16 + 8 + 4 + 2 + 1

= 63

Note: It's always one number less than the number in front of it. 63 is 1 less than 64

Broadcast address = 192.168.45.63

> *If something is sent to that address it'll go out to everybody on this network*

Available Addresses in Network = 62 (usable ip addresses)

> found by subtracting 1 from the broadcast address number

Calculator: https://www.calculator.net/ip-subnet-calculator.html

Example with explanations

Network ID: 192.168.1.0
- We don't know what IP addresses belong to it until we know what the subnet mask is

- /24 - CIDR notation (classless inner domain routing)
  - This tells you how many binary digits (bits) are turned on in the subnet mask

> Subnet mask displayed in binary
> 8 + 8 + 8 = 24 (the ones are binary turned on)
> when we convert this from binary to decimal we get 255
- Remember, when an octet is all 1s it will always equal 255

Subnet mask is 255.255.255.0

Find CIDR from Mask

Mask 255.255.248.0

To determine how many bits there are:

Step 1 - Add the 255 octets

> 255 = 8 bits
Since there are two, then we know we have 16 bits in the first two octets
= 16

Step 2 - Find the number of bits in the 248 octet

To find out how many bits are in 248 we add starting at 128 until we reach 248:

128	64	32	16	8	4	2	1

128 + 64 = 192 | 192 + 32 = 224 | 224 + 16 = 240 | 240 + 8 = **248**
So now we know that the first 5 bits are active and the rest are 0's: 11111000
> *The 1's are our subnetting bits and the 0's are considered to be a host bit*

Now we add the 1's to find out how many bits are in 11111000
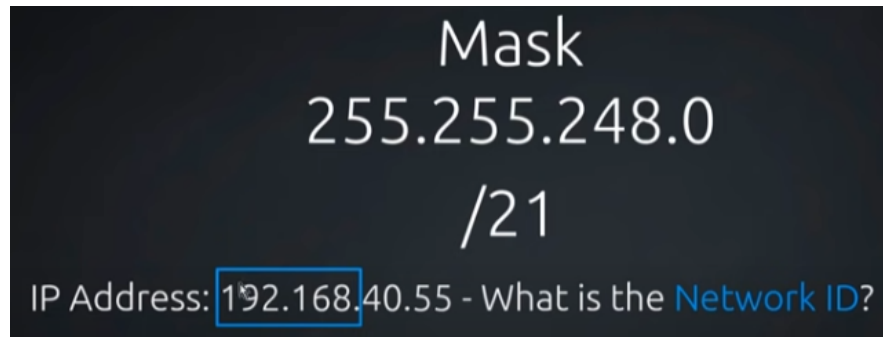**= 5 bits**

Step 3 - Add the bits together

16 + 5 = 21 bits
That's how many bits are in our subnet mask, this gives us a CIDR of /21

CIDR = /21

Find Network ID from mask and IP address

Step 1 - Identify Network ID

We start off by knowing that 192.168 are going to be part of the network ID, because in the mask these octets are 255 (all 1's). And if there is all 1s, that means we need to use these numbers.

In fact, the mask means, use these numbers wherever the mask has a 1.

Step 2 - Examine third octet

We know that the bits from /21 go into the first and second octets, then bleed off into the third.
1. Find the octet masks bits (do this by adding the numbers in the conversion grid)
   a. **248 = 11111000**
2. Find the octet IP address bits
   a. **40 = 00101000** *(found this by adding 32 + 8 in conversion grid)*
3. Compare bits:

1	1	1	1	1	0	0	0
0	0	1	0	1	0	0	0

> We know that all of the 40 bits also go into the network ID because the bits for that number do not extend past the mask bits (see red line). If there were bits that extended, those would be a part of the host bits.

Step 3 - Put Together

- The Network ID is 192.168.40.0/21
- With a subnet mask of 255.255.248.0

Step 4 - Note the host bits

We have the entire 4th octet as well as the 3 bits left from the 3rd octet
> *So, for example, 41.55 would be a host*