Subnetting Shortcuts

This is a supplement to the ICND1 subnetting homework, labs 8 – 11. It assumes the reader understands address classes, the formula for subnets and hosts and subnet masks.

Class C Example

Start with 192.168.110.0/24
Subnet this address to 192.168.110.0/27

The questions are how many subnets do you get with the new subnet mask, what are they and what are the usable addresses?

First, figure out where the new bit boundary is (between which bits) and then look to the left of the bit boundary to see by what number the subnets are incremented. In this example, the subnetting takes place in the 4th octet and the bit boundary lies between the 32 & 16. Therefore the subnets will increment by a factor of 32.

128	64	32	16	8	4	2	1

Remember that the first subnet will always be the 0 subnet. The possible subnets in this example are:

192.168.110.0/27	192.168.110.128/27
192.168.110.32/27	192.168.110.160/27
192.168.110.64/27	192.168.110.192/27
192.168.110.96/27	192.168.110.224/27

The first good host on every subnet will be the subnet address plus 1. The last good host on a subnet will be the next subnet address minus 2. Two is subtracted because the next subnet address minus 1 will be the broadcast for the previous subnet.

For example: The first subnet is 192.168.110.0/27. The first usable host address is 192.168.110.1. The last usable host on the 1st subnet is 192.168.100.30. The last usable host was derived from taking the next subnet, 192.168.110.32/27 and subtracting 2.

Taking it one step further, how can it be determined if an IP address is either the subnet itself or a broadcast for a given subnet without figuring it out in binary?

Example: 192.168.200.202/28

Again, look at where the bit boundary will fall:

128	64	32	16	8	4	2	1

This time it falls between the bit value of 16 and 8 in the fourth octet. The subnets are incremented by a factor of 16 because 16 falls to the left of the bit boundary.

Look at the octet that is being subnetted; in this case the 4th octet. Divide that value by 16 (the number the subnets are incremented by).

202/16 = 12 with a remainder of 10 – this indicates that the address is an address on the 13th subnet (one is added to 12 because the 0 subnet needs to be added) and it's the 10th host. This is a usable address because:

1) There is a remainder
2) The remainder is not 1 less than the number by which the subnets are incremented

If there is no remainder it indicates that the address is a subnet address. If the remainder is 1 less than the number, the subnets are incremented by (in the above example 16) it indicates that the address is a broadcast address.

For example: If the address were 192.168.200.192/27. Divide the last octet by 16: 192/16 = 12 with no remainder. This is the 13th subnet and cannot therefore, be assigned to a host.

If the address were 192.168.200.207/27: Divide the last octet by 16: 207/16 = 12 with a remainder of 15. Because the remainder is one less than the divider (16), it indicates that this is the broadcast address for the 13th subnet and may not be assigned to a host.

One step further: To figure out what subnet the above host is on simply subtract the remainder from the 207 (the value in the 4th octet). 207-15=192; therefore the address 192.168.200.207 is the broadcast address on the 192.168.200.192 subnet. This method will work to figure out what subnet any host is on. Another example: 192.168.200.38 is a usable host on the 192.168.200.32 subnet. Divide 38 (value in last octet) by 32. 32 goes into 38 once and the remainder is 6. By subtracting 6 from 38, the subnet address is discovered, or, in this case 32.

The same shortcut can be used for class A and class B address. However, because there is more than one octet in the host field, the entire host field must be looked at to determine if an address is a subnet address or broadcast address on a given subnet.

Class B Example:

172.16.207.0/20 – Is this a usable host?

This time look at the last 2 octets:

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

The bit boundary falls between the bit values of 16 and 8 in the third octet. There are a total of 12 bits in the host field and the host field must be looked at in its entirety. All 12 bits may not be 0's and may not be 1's.

The bit boundary shows that the subnets will increment by a factor of 16. There are 4 subnet bits so there are 16 possible networks, each with 4094 hosts. (Derived from host formula: 2^12-2 = 4094)

The address in question is 172.16.207.0/20
The 3rd octet; the one that was subnetted needs to be divided by 16
207/16 = 12 with a remainder of 15. The remainder is 1 less than the next subnet, but is 172.16.207.0 a broadcast address? When there is more than one octet being used for hosts, there is one more thing to consider. In this case what are the values in the last octet? Are they all 1's? If so, this is the broadcast address for this subnet. If not, than it is not. In this example, the last octet are all 0's. So the host field is not all 1's or all 0's; therefore, this is not a broadcast address. The broadcast address for this subnet would be 172.16.207.255

See the following example in binary:

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

This is the 3rd and 4th octet in binary. The 3rd octet has all 1's in the host field, but the 4th octet does not.

When working with more than one octet in the host field, more than one octet must be taken into consideration when figuring out the subnet address and the broadcast address for a given subnet.