Easy Subnetting

Adapted by Beau Sanders from an article originally published on the Internet by Greg Stanley, MCP

Let's begin by creating the following chart based on the formula **2^N -2 = X**:

First, write down a binary 1 for every bit in an octet:

1 1 1 1 1 1 1 1

Next, ABOVE each bit, write its **value**:

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

Now, BELOW each bit, write the **value of that bit plus the other bits to its left**:

128 64 32 16 8 4 2 1
1 1 1 1 1 1 1 1
128 192 224 240 248 252 254 255

Finally, BELOW all that, write the **value of 2^N-2**, starting from the left. This will give you the **number of subnets**:

128 64 32 16 8 4 2 1
1 1 1 1 1 1 1 1
128 192 224 240 248 252 254 255

0 2 6 14 30 62 126 254

Now lets see how this all works. In our first example we are given the Network ID: **192.62.123.0**

What subnet mask will you need for 10 subnets?

A quick look at the chart indicates that 224 will give you 6 subnets, but 240 yields 14 subnets. We need 10 subnets which is less than 14 and more than 6. The answer: **255.255.255.240**

All bits to the right of 240 (including other octets if Class A or B) make up the **Host ID**. The 240 and everything to the left of that compose the **Network ID**.

Now let's look at the **ranges of subnets**, also called **increments of subnets**. Look above 240 and you see **16**. This is the **first subnet address**, as well as the **range incrementing value**. The next subnet address will be 16 + 16, or 32. The next will be 32 + 16, or 48, and so on. The first address in each range is the address of the subnet itself (the Subnet Network ID) and the last address is the broadcast address for that subnet. The first and last addresses are not considered usable subnet addresses.

The following are the **ranges** (**increments**) for our Class C network in this example:

	Subnet Address	First Host Address	Last Host Address	Broadcast Address
~~0~~	~~192.62.123.0~~	~~192.62.123.1~~	~~192.62.123.14~~	~~192.62.123.15~~
1	192.62.123.16	192.62.123.17	192.62.123.30	192.62.123.31
2	192.62.123.32	192.62.123.33	192.62.123.46	192.62.123.47
3	192.62.123.48	192.62.123.49	192.62.123.62	192.62.123.63
4	192.62.123.64	192.62.123.65	192.62.123.78	192.62.123.79
5	192.62.123.80	192.62.123.81	192.62.123.94	192.62.123.95
6	192.62.123.96	192.62.123.97	192.62.123.110	192.62.123.111
7	192.62.123.112	192.62.123.113	192.62.123.126	192.62.123.127
8	192.62.123.128	192.62.123.129	192.62.123.142	192.62.123.143
9	192.62.123.144	192.62.123.145	192.62.123.158	192.62.123.159
10	192.62.123.160	192.62.123.161	192.62.123.175	192.62.123.175
11	192.62.123.176	192.62.123.177	192.62.123.190	192.62.123.191
12	192.62.123.192	192.62.123.193	192.62.123.206	192.62.123.207
13	192.62.123.208	192.62.123.209	192.62.123.222	192.62.123.223
14	192.62.123.224	192.62.123.225	192.62.123.238	192.62.123.239
~~15~~	~~192.62.123.240~~	~~192.62.123.241~~	~~192.62.123.254~~	~~192.62.123.255~~

You will notice that one other range could have been added, but the last range is always invalid because the subnet address cannot be made of all binary 1s (end in 255). Just remember to stop your ranges when you reach a subnet address that is the same as the subnet mask.

This chart also produces one other pertinent number in addition to the number of subnets. You guessed it, the **number of hosts per subnet**.

Once again, use the formula **2^N-2**. This time however, N is found a little differently. To find the number of hosts per subnet, N is now the number of bits **to the right of the subnet mask value**, instead of the left. Don't forget the other octets as well, if you are working on a Class A or B network.

Example… 240 yields:

1,048,574 hosts per subnet on a Class A Network (2^20-2)
4,094 hosts per subnet on a Class B Network (2^12-2)
14 hosts per subnet on a Class C Network (2^ 4-2)

Here's another example, this time using a **Class B** network address. All of the same rules apply, but calculating the ranges is a little more confusing because you have **two octets** to contend with.

First, we are assigned a Class B Network ID: **172.190.0.0**

What subnet mask will you need for 10 subnets?

Once again, a quick look at our chart indicates 224 will only give you 6 subnets, but 240 yields you 14. The answer: **255.255.240.0**

All bits to the right of 240, including the other 8 bits for the last octet, make up the **Host ID**. The 240 and everything to the left of that make up the **Network ID**.

Now, let's look at the **ranges**, or **increments**. Look above 240 and you see 16. As in the previous example, this is the **incrementing range** and the beginning of the first range, but a ".0" needs to be added for the last octet (e.g. 16.0).

The next subnet address will be 16.0 + 16.0, or 32.0. The next subnet address will be 32.0 + 16.0, or 48.0, and so on. The first address in each range is the address for the subnet itself and the last address is the broadcast address for that subnet, neither of which can be a useable subnet host address. That rule doesn't change, but remember that the other octet is now included:

	Subnet Address	First Host Address	Last Host Address	Broadcast Address
~~0~~	~~172.190.0.0~~	~~172.190.0.1~~	~~172.190.15.254~~	~~172.190.15.255~~
1	172.190.16.0	172.190.16.1	172.190.31.254	172.190.31.255
2	172.190.32.0	172.190.32.1	172.190.47.254	172.190.47.255
3	172.190.48.0	172.190.48.1	172.190.63.254	172.190.63.255
4	172.190.64.0	172.190.64.1	172.190.79.254	172.190.79.255
5	172.190.80.0	172.190.80.1	172.190.95.254	172.190.95.255
6	172.190.96.0	172.190.96.1	172.190.111.254	172.190.111.255
7	172.190.112.0	172.190.112.1	172.190.127.254	172.190.127.255
8	172.190.128.0	172.190.128.1	172.190.143.254	172.190.143.255
9	172.190.144.0	172.190.144.1	172.190.159.254	172.190.159.255
10	172.190.160.0	172.190.160.1	172.190.175.254	172.190.175.255
11	172.190.176.0	172.190.176.1	172.190.191.254	172.190.191.255
12	172.190.192.0	172.190.192.1	172.190.207.254	172.190.207.255
13	172.190.208.0	172.190.208.1	172.190.223.254	172.190.223.255
14	172.190.224.0	172.190.224.1	172.190.239.254	172.190.239.255
~~15~~	~~172.190.240.0~~	~~172.190.240.1~~	~~172.190.255.254~~	~~172.190.255.255~~

Another tip on **subnet ranges**… you can use the **"Magic Number"** theory by subtracting the "non-255" number in the subnet mask from 256 to get the **incremental value**. In the examples above, if you subtract 240 from 256, the incremental value is 16!

More help with subnetting is available at EasySubnetting.com