

# THE STRUCTURE OF A SUBNET AND BROADCAST ADDRESSES

## The Structure of a Subnet

A subnet is, by definition, defined by its netmask and the first IP address within the subnet, known as the network address. A netmask of 255.255.255.248 only allows 3 bits of freedom within a subnet, so that means it defines 8 IP addresses (see above), but only SIX can actually be used. The first and last IP addresses of all subnets are reserved, and cannot be used by devices.

The first IP address is the network address, or net address, for the subnet, while the last is the so-called broadcast address.

The table below shows the subnet 192.168.0.0/255.255.255.248:

IP in Binary	IP quads	Comment
11000000101010000000000000000000	192.168.0.0	Network Address
11000000101010000000000000000001	192.168.0.1	Usable IP Address
11000000101010000000000000000010	192.168.0.2	Usable IP Address
11000000101010000000000000000011	192.168.0.3	Usable IP Address
11000000101010000000000000000100	192.168.0.4	Usable IP Address
11000000101010000000000000000101	192.168.0.5	Usable IP Address
11000000101010000000000000000110	192.168.0.6	Usable IP Address
11000000101010000000000000000111	192.168.0.7	Broadcast Address

IP in Binary	IP quads	Comment
111111111111111111111111111111111000	255.255.255.248	Netmask

## Broadcast Addresses

Using your subnet's broadcast address, you can single IP packet every device on your local subnet. Like the network address, the broadcast address can be calculated given only a computer's IP address and netmask. In this case, the maths is a little more complicated, but not much.

To calculate broadcast addresses we need to learn about two more binary operators – binary inversion, and the OR operator. Inversion is as simply as it sounds, all 1s are turned to 0s, and all 0s to 1s. The OR operator is defined by the truth table below:

A	B	A OR B
0	0	0
0	1	1
1	0	1
1	1	1

To calculate the broadcast address, first invert the netmask, then OR that inverted netmask with your IP address.

Source: <https://www.bartbusschots.ie/s/2014/12/07/taming-the-terminal-part-25-of-n-ip-subnets/>