

Write out a key grid of powers of 2 and decimal masks as a reference. Additionally, keep in mind what the defaults are for the network classes.

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

Class A = /8 Class B = /16 Class C = /20

What valid host range is the IP 172.23.61.41/20 a part of?

A. Convert the /CIDR to decimal mask:

$$/20 = 255.255.240.0$$

This is a Class B network, so the default is /16. Reference the chart to see that /16 + 4 = .240

B. Find the number of hosts

$$32-20 = 12 \gg 2^{12} = 4096, \text{ then } 4096 - 2 = 4094 \text{ hosts}$$

There are 32 bits in an IPv4 address. Subtract the mask from the number of potential hosts. That number becomes the number 2 is raised to in as a power of 2. You then subtract two hosts (by default, Cisco doesn't allow .0 and .255 addresses for non-network and broadcast hosts).

C. Find the number of subnets

$$20-16=4 \gg 2^4 = 8, \text{ then } 8-2 = 6 \text{ subnets}$$

Subtract the default mask for the network class, in this case class B /16, from the given mask. Once again you subtract two from the result because of Cisco convention for allowable addresses/networks.

D. Convert the parts of the IP subject to the mask and the mask itself to decimal. Then do a logical AND operation (0+0=0; 1+0=0; 0+1=0; 1+1=1) between the IP and the mask to get the network address.

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Given IP: 172.23. 0011 1101.0010 1001
Mask:    255.255.1111 0000.0000 0000
AND:    xxx.xxx.0011 0000.0000 0000
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Convert the binary result of the AND operation to decimal...

xxx.xxxx. 48.0

... to derive the network address

172.23.48.0

E. Use the network address, the number of hosts and number of subnets to figure out the first and last IPs.

First = 172.23.48.1

Last = 172.23.63.254