5.1.5 Variable Length Subnet Mask (VLSM) Facts

Classful IP Addresses

Classful addresses are IP addresses that use a default subnet mask, as follows:

- Class A: 255.0.0.0
- Class B: 255.255.0.0
- Class C: 255.255.255.0

They are considered classful because the default subnet mask identifies the network portion and host portion of the IP address.

Classless IP Addresses

Classless addresses, on the other hand, use a custom mask value to separate the network and host portions of the IP address. Classless addressing is made possible using Classless Inter-Domain Routing (CIDR). CIDR allows you to use only part of an octet for the network address. This is called *partial subnetting*, or *variable-length subnet masking* (VLSM).

VLSM

When using VLSM, you ignore the default subnet mask boundaries and specify a custom number of subnet mask bits. For example, you could define a subnet mask of 255.255.252.0. In addition to the first and second octets, this mask also assigns the first six bits in the third octet to be used for the network portion of the address. This mask would appear in binary notation as follows:

11111111.11111111.11111100.00000000

As you can see, the six bits are reallocated from the host address to the network address. This allows you to create additional subnets, but it reduces the number of host addresses available within each one.

For example, suppose your network is composed of four separate physical network segments connected by routers. The network uses the 10.0.0.0 private IP addressing scheme, but you want to divide the 10.0.0.0 network into four separate subnets. Under classful addressing, this network would use the first octet for the network address and the last three octets for node addresses. However you need to divide this large network into four subnets. To do this, you need to reconfigure the subnet mask to include the first two bits of the second octet, creating four additional networks. Instead of using the default Class A subnet mask of 11111111.00000000.00000000.00000000 (255.0.0.0), you use a subnet mask of 11111111.11000000.00000000.00000000 (255.192.0.0). Using CIDR notation, you can specify a prefix of **/10** to indicate you are using 10 bits for the subnet mask.

The following are four possible values in the IP address for the two extra bits that have been added to the subnet mask:

- 00 = 0
- 01 = 64
- 10 = 128
- 11 = 192

These values define the lower and upper boundaries for the four subnets created by the classless subnet mask, as shown in the following table:

Subnet Address	Subnet Mask	Subnet Host Address Range	Subnet Broadcast Address
10.0.0.0	255.192.0.0	10.0.0.1–10.63.255.254	10.63.255.255
10.64.0.0	255.192.0.0	10.64.0.1–10.127.255.254	10.127.255.255
10.128.0.0	255.192.0.0	10.128.0.1–10.191.255.254	10.191.255.255
10.192.0.0	255.192.0.0	10.192.0.1–10.255.255.254	10.255.255.255

On the internet, you can access many subnet calculators to calculate subnet boundaries, host addresses, and broadcast addresses.