Greetings NetSteppers. In this CCNA video cheat sheet we will be covering IPv4: specifically, IPv4 addressing and subnetting.

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IPv4 addresses can be classful or classless.

Let's look at the forest slide. The OSI network layer (layer 3) is responsible for logical addressing, routing, and path determination. In other words, the OSI network layer (layer 3) offers the same service as the U.S postal service. Your house is in a zip code that groups you into an area; your computer has a network prefix that groups you into an area. Your house has a unique street address; your computer has a unique IP address. The postal service routes mail to you, while the network routes IP packets to you. The network prefix is like the zip code while the host number is like your street address.

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There are two rules for grouping IP addresses.

* IP addresses in the same group or IP network must not be divided from each other by a router.
* IP addresses divided from each other by a router must be in different groups or IP networks.

Let's dig a little deeper and look at the tree slide.

Specifically, the Technicolor rainbow IPv4 address. Each address is divided into 4 octets. The term octet refers to the 8 bits that make up each decimal section.

* The red 1 is made up of 8 bits and is in the first octet.
* The green 2 is made up of 8 bits and is in the second octet.
* The blue 3 is made up of 8 bits and is in the third octet.
* The purple 4 is made up of 8 bits and is in the fourth octet.

In total, an IP address is made up of 32 bits and 4 octets, while each octet is separated by a decimal.

Now let’s focus on the table. The entire IPv4 address space can be divided into Class A, B and C networks. Class A’s first octet range is from 1 - 126 with valid network numbers from 1 – 126 where the final three octets are reserved for IP host addresses. Class A can only have 126 networks but it can have over 16 million IP hosts per network.

Class B’s first octet range is from 128 - 191 with valid network numbers from 128.0.0.0 – 191.255.0.0. This utilizes the 1st and 2nd octet for the network address and reserves the 3rd and 4th octets for IP host addresses Class B can over 16,000 networks and it can have over 65,000 IP hosts per network.

Class C’s first octet range is from 192 - 223 with valid network numbers from 192.0.0.0 – 223.255.255.0. This utilizes the 1st, 2nd and 3rd octets for the network address and reserves the 4th octet for IP host addresses Class C can have over 2 million networks but it can have only 254 useable hosts per network.

A Classful IP network is a network that follows the Class A, B or C rules.

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Staying at the tree level, let’s talk about Classless networks (IP subnetting). Subnetting is taking the Class A, B and C IP networks and dividing them further. With IP subnetting, you can take a classful Class A (which only had 126 available networks) and you can subnet it and create thousands of network addresses. So by subnetting you are subdividing the Class A network into smaller classless blocks.

Focusing on the drawing, we have 5 subnetted Class A networks. We are using the first three octets for our subnetted Class A network address. That only leaves the 4th octet (or 254 usable addresses) for IP hosts. Our LANs at the edge can put that to good use and our WAN is not wasting over 16 million addresses, it is only wasting over 250 addresses.

In summary.

* IP’s are a 32-bit number
* IP’s are written in dotted-decimal notation
* Dotted-decimal notation has four decimal octets
* Octet is vendor-neutral term for byte.
* Since each octet is 8 bits, the scope of numbers in each octet is between 0 and 255
* Each IP address is made up of 4 octets
* The IP address of 1.2.3.4 has a first octet of 1, the second octet of 2, and so on.
* Each unique interface needs a unique IP
* You can group together IP addresses in IP networks known as Class A, B and C networks
* You can take the Class A, B and C networks and subdivide them to more efficiently use the IP network given you.

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I want to stop and have a reality check. On this slide we will talk about the difference between academia and the real world.

In academia you need to know the classful address divisions.

In the real world everything is subnetted. With IPv4 address space running out, no organization can waste space by putting a class B on a point-to-point network. If your organization runs out of IPv4 address space, you have to go to ARIN (the keepers of the IPs) and beg for more space. You have to prove that you have used all your existing space and used it wisely.

At this point I want to add that, I can’t stress enough how imperative IP addressing is to the CCNA exam and being a productive network engineer.

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You now know enough about IPv4 addressing and subnetting to be dangerous. Continue to the video cheat sheet IPv4 - Part 1 to hone your IPv4 skills. Always keep learning but take it step by step.