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Classful and Classless IP Addresses

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Classful and Classless IP Addresses
In this video from ITFreeTraining, I will look at classful and classless IPv4 networking. Understanding these topics will help you later on when you start subnetting IP Addresses.

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Classful Addresses

- Network address architecture used in 1980's
- Replaced by Classless Inter-Domain Routing
- Sometimes still referred to today

Class	Leading bits	Start	End	Subnet mask	Networks	Addresses
A	0	0.0.0.0	127.255.255.255	255.0.0.0	128	16,777,216
B	10	128.0.0.0	191.255.255.255	255.255.0.0	16,384	65,536
C	110	192.0.0.0	223.255.255.255	255.255.255.0	2,097,152	256
D (Multicast)	1110	224.0.0.0	239.255.255.255			
E (Reserved)	1111	240.0.0.0	255.255.255.255			

Classful Addresses

0:13 –The first system I will look at is classful. This system was used back in the 1980's and was quite wasteful. It was later replaced by Classless which will be the next topic I cover. Although Classful networking is no longer used today, it is sometimes still referred to, so it is important to have a basic understanding.

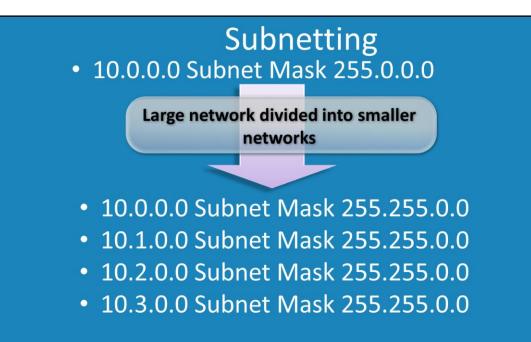Classful networking is broken up into five classes.

Class A: An IP Address that is class A is identified by its first bit being zero. This means essentially any IP Address from 0.0.0.0 to 127.255.255.255. When Classful networking was used, a default subnet mask was assigned to it. In the case of Class A, this was 255.0.0.0. This means that there were 127 Class A networks but each network had over 16 million addresses. Even though these networks could be sub-divided into smaller networks, which I will look at later in the video, you can see that these networks are quite large and addresses tend to be wasted.

Class B: Any IP Address starting with leading bits of 10 is a Class B address. This means from 128.0.0.0, all the way to 191.255.255.255 is a Class B address. This gave over 16 thousand networks with over 65 thousand address per network. This is still a large number of addresses per network, however, in a moment we will see how this can be reduced to make better use of the address space.

Class C: All IP Addresses that start with 110 are Class C. This means any address starting with 192.0.0.0 through to 223.255.255.255. This gives over 2 million networks with 256 addresses per network.

Class D: This is used with multicast. Multicast is when one packet is sent to multiple computers.

Class E: This is reserved. Maybe one day this will be used, but it is currently not. Classful addresses can be divided up into smaller parts to reduce the amount of wasted addresses.

Subnetting
- 10.0.0.0 Subnet Mask 255.0.0.0

Large network divided into smaller networks

- 10.0.0.0 Subnet Mask 255.255.0.0
- 10.1.0.0 Subnet Mask 255.255.0.0
- 10.2.0.0 Subnet Mask 255.255.0.0
- 10.3.0.0 Subnet Mask 255.255.0.0

Subnetting

3:05 – I will now briefly look at the topic of subnetting. This topic is covered in more detail in later videos, so do not fret if this is unfamiliar or you do not understand it yet. First, consider that I have been given a Class A network. By default, I will get 1 network with over 16 million addresses. Even though there are some large networks in the world, it is unlikely that 16 million devices will be on the same network, in the same location. So if this network was implemented as is, there would be a lot of waste. To get around this waste, the administrator can use a different subnet mask than the default and thus create more networks with less addresses on each network. As shown here, the subnet mask is changed to 255.255.0.0 which allows the original network to be divided up into 256 smaller networks with over 65 thousand addresses pet network. This is a much better use of the addresses. In later videos, I will go into subnetting in more detail, but I needed to look at it briefly so you can understand our next topic.

Classless Inter-Domain Routing

- Slow the growth of routing tables and IP address use
- Allows any subnet mask
- CIDR notation (network / bits in subnet mask)
    - 192.168.10.0/24 or 192.168.10.0 SM 255.255.255.0
    - 172.16.0.0/20   or 172.16.0.0 SM 255.224.0.0
    - 10.1.8.0/25   or 10.1.8.0 SM 255.255.254.0

Classless Inter-Domain Routing

4:20 – Classful networking was later replaced with Classless Inter-Domain Routing otherwise known as CIDR. You still need to be aware of Classful networking as sometimes it still gets referenced, but nowadays CIDR is the standard. CIDR was introduced in an attempt to reduce the growth of routing tables and IP Address use. We have already seen how wasteful Classful networks can be. So how does CIDR achieve this? CIDR achieves this by allowing any subnet mask to be used. In order to make things easier when working with subnet masks, CIDR introduces a new way of representing networks. The method is network, slash, followed by the number of bits that are used in the subnet mask. To understand this better, let's look at some examples. In this example, the network mask is /24. This means the first 24 bits are ones which is the same as a subnet mask of 255.255.255.0. Cases where the subnet masks are multiples of 8 are quite simple, but notice the next example where the subnet mask is slash 20. This would give a subnet mask of 255.224.0.0. The last example I will look at is slash 25. This would have a subnet mask of 255.255.254.0. Both ways of writing the subnet mask are equally valid and it is more of a choice by the administrator as to which one they will want to use. You can see that classless inter-domain routing is the simpler of the two systems to use. All the administrator needs to do is look at the IP Address and work out its subnet mask. The administrator does not need to be concerned what class the address is. Sometimes you may hear references to classful networks. For example, if you were allocated a block of IP Addresses, you may be told you have been allocated a Class C network. Other than that, you won't hear them mentioned that much nowadays.

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References
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