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IP Addressing, Subnetting, VLSM and IPv6

Introduction

An *IP address* is a numeric identifier assigned to each machine on an IP network. It designates the specific location of a device on the network. There are different classes of IP address from Class A to E. IP addresses can be subnetted, it allows you to take one larger network and break it into a bunch of smaller networks.

VLSM

Objectives

Upon completion of this laboratory exercise, the student will be able to

- Determine whether an IP address is Class A, B or C
- Determine the how to subnet a network given either networks or host needed
- Know how to use VLSM
- Learn how to shorten an IPv6 address

Equipment

None

Address Class Identification

Determine the whether the Address is Class A, B or C. Also determine which is the network and the host portion.

Address	Class	Network	Host
10.0.1.3	A	10	0.1.3
150.2.1.0	B	150.2	1.0
192.168.2.0	C	192.168.2	0
223.0.1.7	C	223.0.1	7
126.30.0.1	A	126	30.0.1
220.1.252.254	C	220.1.252	254
11.1.1.1	A	11	1.1.1
126.1.7.9	A	126	1.7.9
200.0.0.1	C	200.0.0	1
99.0.1.250	A	99	0.1.250

Subnetting Part 1

Complete the table based from the given network and the number of networks needed.

Network	Number of Networks Needed	No of Bits Needed	Subnet Mask	/Subnets Mask	Octet, Increment	Subnets	Usable IP	Broadcast
10.0.0.0	100	7	255.254.0.0	/8+7=/15	2nd, 2i	10.0.0.0 10.2.0.0 10.4.0.0 10.6.0.0 10.8.0.0 … 10.254.0.0	10.0.0.1 - 10.1.255.254 10.2.0.1 - 10.3.255.254 10.4.0.1 - 10.5.255.254 10.6.0.1 - 10.7.255.254 10.8.0.1 - 10.9.255.254 … 10.254.0.1 - 10.255.255.254	10.1.255.255 10.3.255.255 10.5.255.255 10.7.255.255 10.9.255.255 … 10.255.255.255
172.0.0.0	30	5	255.255.248.0	/16+5=/21	3rd, 8i	172.0.0.0 172.0.8.0 172.0.16.0 172.0.24.0 172.0.32.0 172.0.40.0 172.0.48.0 … 172.0.248.0	172.0.0.1 - 172.0.7.254 172.0.8.1 - 172.0.15.254 172.0.16.1 - 172.0.23.254 172.0.24.1 - 172.0.31.254 172.0.32.1 - 172.0.39.254 172.0.40.1 - 172.0.47.254 172.0.48.1 - 172.0.55.254 … 172.0.248.1 - 172.0.255.254	172.0.7.255 172.0.15.255 172.0.23.255 172.0.31.255 172.0.39.255 172.0.47.255 172.0.55.255 … 172.0.255.255
192.168.0.0	8	3	255.255.255.224	/24+3=/27	4th, 32i	192.168.0.0 192.168.0.32 192.168.0.64 192.168.0.96 192.168.0.128 192.168.0.160 192.168.0.192 … 192.168.0.224	192.168.0.1 - 192.168.0.30 192.168.0.33 - 192.168.0.62 192.168.0.65 - 192.168.0.94 192.168.0.97 - 192.168.0.126 192.168.0.129 - 192.168.0.158 192.168.0.161 - 192.168.0.190 192.168.0.193 - 192.168.0.222 … 192.168.0.225 - 192.168.0.254	192.168.0.31 192.168.0.63 192.168.0.95 192.168.0.127 192.168.0.159 192.168.0.191 192.168.0.223 … 192.168.0.255

Subnetting Part 2: Complete the table based from the given network and the number of host needed.

Network	Number of Hosts Needed	No of Bits Needed	/32-bits	Octet, Increment	Subnets	Usable IP	Broadcast
10.0.0.0	2000	11	/32-11=/21	3rd, 8i	10.0.0.0 10.0.8.0 10.0.16.0 10.0.24.0 … 10.0.248.0	10.0.0.1 - 10.0.7.254 10.0.8.1 - 10.0.15.254 10.0.16.1 - 10.0.23.254 10.0.24.1 - 10.0.31.254 … 10.0.248.1 - 10.0.255.254	10.0.7.255 10.0.15.255 10.0.23.255 10.0.31.255 ... 10.0.255.255
172.0.0.0	500	9	/32-9=/23	3rd, 2i	172.0.0.0 172.0.2.0 172.0.4.0 172.0.6.0 172.0.8.0 172.0.10.0 172.0.12.0 … 172.0.254.0	172.0.0.1 - 172.0.1.254 172.0.2.1 - 172.0.3.254 172.0.4.1 - 172.0.5.254 172.0.6.1 - 172.0.7.254 172.0.8.1 - 172.0.9.254 172.0.10.1 - 172.0.11.254 172.0.12.1 - 172.0.13.254 … 172.0.254.1 - 172.0.255.254	172.0.1.255 172.0.3.255 172.0.5.255 172.0.7.255 172.0.9.255 172.0.11.255 172.0.13.255 … 172.0.255.255
192.168.0.0	5	3	/32-3=/29	4th, 8i	192.168.0.0 192.168.0.8 192.168.0.16 192.168.0.24 192.168.0.32 192.168.0.40 192.168.0.48 … 192.168.0.248	192.168.0.1 - 192.168.0.6 192.168.0.9 - 192.168.0.14 192.168.0.17 - 192.168.0.22 192.168.0.25 - 192.168.0.30 192.168.0.33 - 192.168.0.38 192.168.0.41 - 192.168.0.46 192.168.0.49 - 192.168.0.54 … 192.168.0.249 - 192.168.0.254	192.168.0.7 192.168.0.15 192.168.0.23 192.168.0.31 192.168.0.39 192.168.0.47 192.168.0.55 … 192.168.0.255

VLSM: Complete the table given the network address and host needed.

Network	Number of Hosts Needed	No of Bits Needed	/32-bits	Octet, Increment	Subnet Mask	Subnets	Usable IP	Broadcast
192.168.0.0	120	7	25	128i	255.255.255.128	192.168.0.0	192.168.0.1-192.168.0.126	192.168.0.127
	60	6	26	64i	255.255.255.192	192.168.0.128	192.168.0.129-192.168.0.190	192.168.0.191
	20	5	27	32i	255.255.255.224	192.168.0.192	192.168.0.193-192.168.0.222	192.168.0.223
	5	3	29	8i	255.255.255.248	192.168.0.224	192.168.0.225-192.168.0.230	192.168.0.231
	2	2	30	4i	255.255.255.252	192.168.0.232	192.168.0.233-192.168.0.234	192.168.0.235
10.0.0.0	1000	10	/22	3rd, 4i	255.255.252.0	10.0.0.0	10.0.0.1 – 10.0.3.254	10.0.3.255
	500	9	/23	3rd, 2i	255.255.254.0	10.0.4.0	10.0.4.1 – 10.0.5.254	10.0.5.255
	500	9	/23	3rd, 2i	255.255.254.0	10.0.6.0	10.0.6.1 – 10.0.7.254	10.0.7.255
	210	8	/24	3rd, 1i	255.255.255.0	10.0.8.0	10.0.8.1 – 10.0.8.254	10.0.8.255
	125	7	/25	4th, 128i	255.255.255.128	10.0.9.0	10.0.9.1 – 10.0.9.126	10.0.9.127
	64	7	/25	4th, 128i	255.255.255.128	10.0.9.128	10.0.9.129 – 10.0.9.254	10.0.9.255
	15	5	/27	4th, 32i	255.255.255.224	10.0.10.0	10.0.10.1 – 10.0.10.30	10.0.10.31
	5	3	/29	4th, 8i	255.255.255.248	10.0.10.32	10.0.10.33 – 10.0.10.38	10.0.10.39
	2	2	/30	4th, 4i	255.255.255.252	10.0.10.40	10.0.10.41 – 10.0.10.42	10.0.10.43
172.16.0.0	1000	10	/22	3rd, 4i	255.255.252.0	172.16.0.0	172.16.0.1 – 172.16.3.254	172.16.3.255
	500	9	/23	3rd, 2i	255.255.254.0	172.16.4.0	172.16.4.1 – 172.16.5.254	172.16.5.255
	200	8	/24	3rd, 1i	255.255.255.0	172.16.6.0	172.16.6.1 – 172.16.6.254	172.16.6.255
	60	6	/26	4th, 64i	255.255.255.192	172.168.7.0	172.16.7.1 – 172.16.7.62	172.16.7.63
	60	6	/26	4th, 64i	255.255.255.192	172.16.7.64	172.16.7.65 – 172.16.7.126	172.16.7.127
	10	4	/28	4th, 16i	255.255.255.240	172.16.7.128	172.16.7.129 – 172.16.7.142	172.16.7.143
	10	4	/28	4th, 16i	255.255.255.240	172.16.7.144	172.16.7.145 – 172.16.7.158	172.16.7.159
	5	3	/29	4th, 8i	255.255.255.248	172.16.7.160	172.16.7.161 – 172.16.7.166	172.16.7.167
	2	2	/30	4th, 4i	255.255.255.252	172.16.7.168	172.16.7.169 – 172.16.7.170	172.16.7.171

IPv6

Shorten the following IPv6 address

FE80:0000:0000:0000:a00a:0000:a10a:0000 /64	FE80::a00a:0:a10a:0/64
2000:1000:0000:0000:0000:a10a:0000:0000 /64	2000:1000::a10a:0:0/64
0000:0000:0000:0000:0000:0000:0000:0000 /64	::/64
FE00:0001:0002:0003:a00a:0000:0000:0000 /0	FE00:1:2:3:a00a::/0
FE80:0000:0H00:0000:a00a:0000:a00a:0000 /64	FE80:0:H00:0:a00a:0:a00a:0/64

Conclusion:

- Determine whether an IP address is Class A, B, or C
- Determine how to subnet a network given either networks or hosts needed
- Know how to use VLSM
- Learn how to shorten an IPv6 address

After answering what is asked in the activity, I concluded that to determine whether an IP address is Class A, B, or C first to look at the first octet of the IP address and then based on the range that 1 – 126 is Class A, 128 – 191 is Class B and 192 – 233 is Class C. Note that this method applies only to IPv4 addresses, which use 32 bits to represent the address. IPv6 addresses, which use 128 bits, have a different addressing scheme and do not use classes. I also determine how to subnet a network given networks or host needed. Subnetting a network requires careful planning and consideration of the number of networks or hosts needed, the appropriate subnet mask to use, and the configuration of network devices to ensure that traffic is routed correctly between subnets. That idea also helps me to know how to use the VLSM. While to shorten an IPv6 address I concluded that to shorten an IPv6 address, there are several techniques that can be used. The first technique is zero compression, where any consecutive groups of 16-bit blocks that contain only zeros can be replaced with a double colon (::). This can only be done once at an address. The second technique is leading zero compression, where leading zeros in each 16-bit block can be removed. The third technique is abbreviating consecutive blocks. Multiple 16-bit blocks in an IPv6 address containing the same value can be abbreviated by omitting the repeated blocks and replacing them with a double colon. Lastly, mixed notation can be used, where the IPv4-compatible address portion is written in IPv4 format and the IPv6 portion is written in the IPv6 format. By using these techniques, the length of an IPv6 address can be significantly shortened, making it easier to read and write.