Subnetting Large Networks

- Let's say we've been allocated Class B 135.15.0.0/16

128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1
1	0	0	0	0	1	1	1	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Example 1 – Class B on 4th Octet

128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1
1	0	0	0	0	1	1	1	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0

- If we subnet this into /29 subnets, we have 3 bits for host addressing.
- This allows 6 hosts per network (2^3 - 2) , the same as if we used /29 with a Class C address.
- Because we were allocated a Class B /16 address range, we have 13 bits for network addresses
- This allows 8192 subnets (2^{13})

Example 1 – Class B on 4th Octet

128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1
1	0	0	0	0	1	1	1	0	0	0	0	1	1	1	1	0	0	0	0	1	0	1	0	1	0	0	0	1	0	1	0

128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0

- For the IP address 135.15.10.138/29, what is the network address, broadcast address, and range of valid IP addresses?
- Pause the video and provide the answer

Example 1 – Class B on 4th Octet

128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1
1	0	0	0	0	1	1	1	0	0	0	0	1	1	1	1	0	0	0	0	1	0	1	0	1	0	0	0	1	0	1	0

128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0

- For the IP address 135.15.10.138/29, what is the network address, broadcast address, and range of valid IP addresses?
- The line is after the 8, so the network address goes up in multiples of 8
- Network address = 135.15.10.136
- Next network address = 135.15.10.144
- Broadcast address = 135.15.10.143
- Valid host addresses = 135.15.10.137 to 142

The Magic Number Method – Example 1

128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1
1	0	0	0	0	1	1	1	0	0	0	0	1	1	1	1	0	0	0	0	1	0	1	0	1	0	0	0	1	0	1	0
128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0

- For the IP address 135.15.10.138/29, what is the network address, broadcast address, and range of valid IP addresses?
- The subnet mask is 255.255.255.248
- Subtract the value in the subnetted octet from 256: 256 – 248 = 8
- The network address goes up in multiples of 8
- Network address = 135.15.10.136
- Next network address = 135.15.10.144
- Broadcast address = 135.15.10.143
- Valid host addresses = 135.15.10.137 to 142

Example 2A – Class A on 4th Octet

- For this example we're allocated Class A 60.0.0.0/8

128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1
0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1
1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

- If we apply the subnet mask 255.255.255.240, how many subnets do we have and how many hosts per subnet?
- Pause the video and calculate the answer

Example 2A – Class A on 4th Octet

128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1
0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0

- 255.255.255.240 subnet mask is /28
- 14 hosts per network (2^4 - 2)
- Because we were allocated a Class A /8 address range, we have 20 bits for network addresses
- This allows 1,048,576 subnets (2^{20})

Example 2B – Class A on 4th Octet

128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1
0	0	1	1	1	1	0	0	0	0	0	0	1	1	1	1	0	0	0	0	1	0	1	0	0	1	0	0	1	0	1	1

128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0

- For the IP address 60.15.10.75/28, what is the network address, broadcast address, and range of valid IP addresses?
- Pause the video and provide the answer

Example 2B – Class A on 4th Octet

128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1
0	0	1	1	1	1	0	0	0	0	0	0	1	1	1	1	0	0	0	0	1	0	1	0	0	1	0	0	1	0	1	1

128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0

- For the IP address 60.15.10.75/28, what is the network address, broadcast address, and range of valid IP addresses?
- The line is after the 16, so the network address goes up in multiples of 16
- Network address = 60.15.10.64
- Next network address = 60.15.10.80
- Broadcast address = 60.15.10.79
- Valid host addresses = 60.15.10.65 to 78

The Magic Number Method – Example 2B

128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1
0	0	1	1	1	1	0	0	0	0	0	0	1	1	1	1	0	0	0	0	1	0	1	0	0	1	0	0	1	0	1	1
128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0

- For the IP address 60.15.10.75/28, what is the network address, broadcast address, and range of valid IP addresses?
- The subnet mask is 255.255.255.240
- Subtract the value in the subnetted octect from 256: 256 – 240 = 16
- The network address goes up in multiples of 16
- Network address = 60.15.10.64
- Next network address = 60.15.10.80
- Broadcast address = 60.15.10.79
- Valid host addresses = 60.15.10.65 to 78