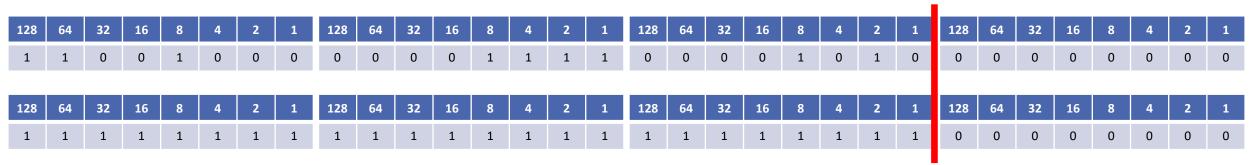# Subnetting

- To understand this lecture, think about it from the point of view of the originally intended IPv4 design again, where all hosts which can communicate on the Internet have a public IP address.

- Let's say we're the network designer for a small business with four departments spread over two offices, and we want to manage our own public address space.

- Rather than purchasing separate address ranges for the different departments, we can purchase a single range and subnet it into smaller portions.

Borrowing Host Bits

- Let's say we've been allocated Class C 200.15.10.0/24

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	0	0	1	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	1	0	1	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	0	0	0	0	0	0	0	0

- To subnet the network into smaller subnets, we need to 'borrow' host bits and add them to the network portion of the address

- The network address line always moves to the right when we subnet

- The further to the right we go, the more subnets we'll have of that size but less hosts

Calculating the Number of Networks

- To calculate the number of available subnets, the formula is $2^{subnet\text{-}bits}$

- If a Class C network uses a /28 subnet mask then we've borrowed 4 bits from the default of /24

- $2^4 = 16$ available subnets

- If a Class B network uses a /28 subnet mask then we've borrowed 12 bits from the default of /16

- $2^{12} = 4096$ available subnets

- Hosts on different subnets need to go via a router if they want to communicate with each other

Calculating the Number of Hosts

- To calculate the number of available hosts, the formula is $2^{\text{host-bits}}$ minus 2

- We subtract 2 because the network address and broadcast address cannot be assigned to hosts

- If a Class C network uses a /28 subnet mask then we have 4 bits left for hosts

- $2^4 - 2 = 14$

- If a Class B network uses a /28 subnet mask then we have 4 bits left for hosts

- $2^4 - 2 = 14$

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