IPv4 Simple Subnetting

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This tutorial introduces CIDR (classless) subnetting on /16 and /24 boundaries for Class A and B networks. It prepares you to take quiz IPv4c. Other boundaries and related binary calculations are introduced in a later tutorial.

We assume you are familiar with the network mask, network address, broadcast address, and similar constructs from the non-subnet world of classful addressing. If not, see the handout on IPv4 Classful Addresses and quiz IPv4b.

1 Subdividing the Host Range

CIDR stands for Classless Inter-Domain Routing, and has the objective to get around the limitations of only three network sizes (Class A, B, and C) by measuring network sizes as some number of bits. This gives a lot more options.

Telephone numbers sometimes work much the same way. In Laie, my office phone number is 293-3478. The 293 portion identifies my phone as being in or near Laie. The 3478 portion identifies my exact phone line. We can say that 293 is the network address, and 3478 is the host address.

BYUH actually controls the entire 3000 series of host addresses in this telephone network. We could call that a subnet. It is common for organizations to control a block of 10, 100, 1000, or more phone numbers.

(293) is the network. (3) is the subnet. (478) is the host.

2 Class B /24

In a Class B address, the first two octets are the network address. The last two octets are the host address: (net.net.host.host).

In a Class B /24 subnet, the first two octets are the network address. The next octet is the subnet number. The last octet is the host address: (net.net.subnet.host).

There are 2^8 (256) IP addresses within each subnet. Only 254 are usable as host addresses because the first and last are reserved as the network address and the broadcast address respectively.

There are 2^8 (256) subnets within the Class B network. Technically only 254 are valid subnets because the first and last are reserved. Practically speaking, all 256 subnets are used. For purposes of this tutorial and the related quizzes, we will distinguish between the valid subnets (all but the first and last) and the two invalid subnets (the first and the last).

172	210	19	7	source address
255	255	0	0	Class B network mask
255	255	255	0	/24 subnet mask
172	210	0	0	B network part of addr
172	210	19	0	/24 subnet part of addr
0	0	19	7	B host part of address
0	0	0	7	/24 host part of addr
172	210	0	1	B first valid host addr
172	210	255	254	B last valid host addr
172	210	255	255	B broadcast address
172	210	0	0	B/24 first invalid subn
172	210	1	0	B/24 first valid subnet
172	210	254	0	B/24 last valid subnet
172	210	255	0	B/24 last invalid subnet
172	210	19	1	/24 first local host addr
172	210	19	7	our full address
172	210	19	254	/24 last local host addr
172	210	19	255	/24 broadcast addr

As you can see by reviewing the table above, subnetting is a way to subdivide a Class B address into 256 smaller Class C addresses. Eight bits (one octet) are removed from the host address and added to the network address.

Because we are reaching beyond the limits set by classful addressing, this variation is called CIDR, or classless addressing.

In terms of our post office example, CIDR helps us set up intermediate postal regions that are not as big as the original area, thus helping us keep mail closer

to home and avoiding long trips for our messages to the regional processing center.

3 Quiz

For each source address, give the answers. Cover the answers. Then test yourself.

Source: 130.135.68.30, Subnet /24.	Answers
In the network:	
network class (A, B, or C)	B
network address uses how many bits?	16
host address uses how many bits?	16
how many total IP addresses?	2^{16}
how many valid host addresses?	2^{16}-2
network mask	255.255.0.0
network address	130.135.0.0
host portion of address	0.0.68.30
broadcast address	130.135.255.255
first host address	130.135.0.1
last host address	130.135.255.254
/24 subnets within this network:	
subnet-only portion uses how many bits? ...	8
how many total subnets?	$2^8 = 256$
how many valid subnets?	2^8-2 = 254
first invalid subnet	130.135.0.0
first valid subnet	130.135.1.0
last invalid subnet	130.135.255.0
last valid subnet	130.135.254.0
host address uses how many bits?	8
how many total IP addresses?	$2^8 = 256$
how many valid host addresses? ..	2^8-2 = 254
mask in dotted form	255.255.255.0
local subnet address	130.135.68.0
host portion of the address	0.0.0.30
local subnet broadcast address	130.135.68.255
local subnet first host address ...	130.135.68.1
local subnet last host address .	130.135.68.254