By: Ron Staples

www.configbytes.com

Version 5.0

THE LAST SUBNET "HOW-TO" YOU'LL EVER NEED.

This document assumes that you already have a basic understanding of subnetting. This document is best used as a supplement to help strengthen your subnetting skills, explanation of subnet-zero is beyond the scope of this document.

The last subnet "how-to "you'll ever need.

By: Ron Staples rstaples@configbytes.com www.configbytes.com August 01 2013 v5

Since 1995 I must have been taught how to subnet at least a dozen times from different instructors. Each time I've been taught a different way, which only has added to the confusion and anxiety each time I was faced with the task to subnet.

There are plenty of subnet calculators online that can be used to subnet a large project; however these devices cannot be used on certification exams, and when you are in a heated troubleshooting situation that requires you to follow the network and quickly identify if a host is out of range, you may not have the time or resources to access the online tools.

It wasn't until the summer of 2008 when I found this simple and easy way to subnet; to be able to understand what hosts belonged to which network by simply looking at it, was finally achievable. The method that I use consists of memorizing the following chart. No complicated binary math, just this simple chart.

Class C Subnet						
4th Octet	128	192	224	240	248	252
CIDR Notation	/25	/26	/27	/28	/29	/30
Number of Hosts (-2)	128	64	32	16	8	4
Number of Networks	2	4	8	16	32	64

Your goal as a future network engineer is to be able to look at an IP with its /CIDR and know off the top of your head what network the host belongs to.

The best way to learn this is to print the chart on a 5 x 7 index card. Review it for 15 min a day for a week. Trust me on this, it helps. I've done it, use your down time to do this; i.e. your lunch/coffee breaks – simply pull this from your wallet and review it. Practice writing it out from front to back and reverse. By the time you are done, when you see a subnet you will immediately see this chart. I had mine taped to my monitor for weeks.

An IPv4 (Internet Protocol version 4 (RFC 791)) consists of 32 bits. Each number is represented in 8 bits for 4 decimal numbers separated by a dot (.)

128	64	32	16	8	4	2	1	= 192
1	1	0	0	0	0	0	0	

11000000.10101000.00000001.00000001
192. 168. 1. 1

Ok you know this already… *right*? Let's move on… I promise no more binary.

Once you memorize the chart to the point where you can write it backwards, hopefully within 20 seconds, without the use of paper and pencil. You may be presented with an exam question similar to the one below.

Your manager has given you the following IP range 192.168.13.0/29; he wants you to assign the last host ID of the eighth subnet to Ethernet 1, and the first host ID of the ninth subnet to Serial 0.

Subnet zero will not be used. <http://en.wikipedia.org/wiki/Subnetwork

Please note that subnet zero is NOT taken into consideration and is beyond the scope of this document.

Looking at our chart we know that /29, has 8 hosts and 32 networks. The third and fourth column shows this clearly.

So our networks are 0, 8, 16, 24, 32, 40, 48, etc.
0 **(1-6)** 7 8 (9-14) 15 16 (17-22) 23 24 (25-30) 31 32 (33-38) 39 40 (41-46) 47 48

Note the numbers in brackets are useable ip addresses, followed by the br**odd**cast ip and the next network. Remember, the broadcast ip will always be **ODD** and the network ip will always be **EVEN**.

Network ID	**ALWAYS EVEN**
First Host ID	ALWAYS ODD
Last Host ID	ALWAYS EVEN
Broadcast ID	**ALWAYS ODD**

The task given wants us to assign the last host ID; in the eighth subnet to Ethernet 0.

Remember, subnets start from Zero (0) so 0 through 7 = 8 hosts. I know it's a little confusing but *8 is actually the START of the second subnet*. 0 through 7 = first network and 8 through 15 = the second network and so on...

Beware, math incoming…
Example: IP 192.168.13.46/29. Let's break it down into steps.

/29 has 8 hosts and 32 networks. (/29 = 255.255.255.248)
The third octet is 192.168.13.46

192.168.13.40	Network ID	**ALWAYS EVEN**
192.168.13.41	First Host ID	**ALWAYS ODD**
192.168.13.46	Last Host ID	**ALWAYS EVEN**
192.168.13.47	Broadcast ID	**ALWAYS ODD**

Now we find the subnet

1. 8 hosts multiplied by X networks = NETWORK ID of the following subnet.
2. 8 x 6 = 48 (8 hosts multiplied by 6 networks)
3. 48 is the network ID of the 7th subnet.
4. .47 is the BROADCAST ID of the 6th subnet.

Now we know that 192.168.13.46 is the LAST USEABLE ip in that range. 40 41 42 43 44 45 46 47

Now our manager wants to use the 8th network for E1
8 x 8 = 64 (8 hosts multiplied by 8 networks) .64th
Assigning the last host ID to E1
Counting out 8 hosts backwards, starting with .63
63 62 61 60 59 58 57 56 (useable addresses)
Our last host ID will be 192.168.13.62

Please note that subnet zero is NOT taken into consideration and is beyond the scope of this document.

From here I'm confident that you can find the answer to the second part…
*Assign the first host ID of the **ninth subnet** to Serial 0.*

You already know what the 8th subnet range is and where the 9th one starts.

Using our chart, the range of addresses will be the following:. 192.168.13.64 - 192.168.13.71 IP
We then assign the **first host ID to Serial 0; which is 192.168.13.65**

192.168.13.**56**	**Network ID**	**ALWAYS EVEN**
192.168.13.57	First Host ID	ALWAYS ODD
192.168.13.62	Last Host ID	ALWAYS EVEN
192.168.13.**63**	**Broadcast ID**	**ALWAYS ODD**

It all depends on how you are able to learn this material. Personally I find it a lot easier to memorize the subnet chart than to memorize the entire binary math. When I see a /29, I immediately see 255.255.255.248 w/8 hosts (-2) and 32 networks.

So what do you see when you look at 192.168.26.75/28

What is the netmask?	
What subnet is the host on?	

You have 20 seconds. **GO!**

ALWAYS EVEN	**Network ID**	
ALWAYS ODD	First Host ID	
ALWAYS EVEN	Last Host ID	
ALWAYS ODD	**Broadcast ID**	

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Router 1	IP Number	
	Subnetmask	
Router 2	IP Number	
	Subnetmask	

Configure the above point 2 point using 192.168.20.251 /30
The even host number is to be assigned to the even router number.

Network ID	*ALWAYS EVEN*	192.168.20.252
First Host ID	**ALWAYS ODD**	192.168.20.**253**
Last Host ID	**ALWAYS EVEN**	**192.168.20.254**
Broadcast ID	*ALWAYS ODD*	**192.168.20.**255

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Practice Charts

Bits	10000000	11000000	1110000	11110000	11111000	**11111100**	11111110	111111111
Subnet	128	192	224	240	248	**252**	254	255
Hosts	128	64	32	16	8	**4**	2	1
Networks	2	4	8	16	32	**64**	128	256
CIDR	/25	/26	/27	/28	/29	**/30**	/31	/32

Class C Subnet			
CIDIR	**4th Octet**	**HOSTS**	**NETWORKS**
/25			
/26			
/27			
/28			
/29			
/30			
/31			
/32			

Please note that subnet zero is NOT taken into consideration and is beyond the scope of this document.

Sources

http://www.cisco.com/web/about/ciscoitatwork/downloads/ciscoitatwork/pdf/Cisco_IT_IP_Addressing_Best_Practices.pdf

http://en.wikipedia.org/wiki/Subnetwork

http://tools.ietf.org/html/rfc1878

http://tools.ietf.org/html/rfc1918

http://tools.ietf.org/html/rfc3021

Note :

/31 Is supported in Cisco IOS 12.2(2)T, however I’ve seen it used on a production network. Typicaly used as a unicast number.

/32 Are commonly used for local loopback interfaces and broadcast,

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