

# The Only IPv4 Subnetting Cheat Sheet You'll Ever Need

February 15, 2023 / By Nathan House



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Our beginner networking students often describe IPv4 subnetting as the most difficult concept to grasp. It can certainly be confusing, but it is necessary for any entry-level networking certification. Mastering IPv4 subnetting will also make you more efficient in network administration and design.

With that, we hope our IPv4 subnetting cheat sheet will be a great reference for you in your studies and career.

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## **IPv4 Subnets**

Subnetting allows a computer/host to know if the machine it wants to talk to is local or outside of its network. The subnet mask determines how many IPv4 addresses can be assigned within a network.

CIDR	SUBNET MASK	OF ADDRESSES	WILDCARD
/32	255.255.255.255	1	0.0.0.0
/31	255.255.255.254	2	0.0.0.1
/30	255.255.255.252	4	0.0.0.3
/29	255.255.255.248	8	0.0.0.7
/28	255.255.255.240	16	0.0.0.15
/27	255.255.255.224	32	0.0.0.31
/26	255.255.255.192	64	0.0.0.63
/25	255.255.255.128	128	0.0.0.127
/24	255.255.255.0	256	0.0.0.255
/23	255.255.254.0	512	0.0.1.255
/22	255.255.252.0	1024	0.0.3.255
/21	255.255.248.0	2,048	0.0.7.255
/20	255.255.240.0	4,096	0.0.15.255
/19	255.255.224.0	8,192	0.0.31.255
/18	255.255.192.0	16,384	0.0.63.255
/17	255.255.128.0	32,768	0.0.127.255
/16	255.255.0.0	65,536	0.0.255.255
/15	255.254.0.0	131,072	0.1.255.255
/14	255.252.0.0	262,144	0.3.255.255
/13	255.248.0.0	524,288	0.7.255.255
/12	255.240.0.0	1,048,576	0.15.255.255
/11	255.224.0.0	2,097,152	0.31.255.255

CIDR	SUBNET MASK	OF ADDRESSES	WILDCARD
/10	255.192.0.0	4,194,304	0.63.255.255
/9	255.128.0.0	8,388,608	0.127.255.255
/8	255.0.0.0	16,777,216	0.255.255.255
/7	254.0.0.0	33,554,432	1.255.255.255
/6	252.0.0.0	67,108,864	3.255.255.255
/5	248.0.0.0	134,217,728	7.255.255.255
/4	240.0.0.0	268,435,456	15.255.255.255
/3	224.0.0.0	536,870,912	31.255.255.255
/2	192.0.0.0	1,073,741,824	63.255.255.255
/1	128.0.0.0	2,147,483,648	127.255.255.255
/0	0.0.0.0	4,294,967,296	255.255.255.255

# **Decimal to Binary**

While IPv4 addresses appear to be four sets of numbers separated by decimals, they are actually made up of 32 ones and zeros. Understanding this will assist you in setting up your networks and is required on both the CompTIA Network+ and Cisco Certified Network Associate exams.

SUBNET MASK	WILDCARD
<b>255</b> 1111 1111	0 0000 0000
<b>254</b> 1111 1110	<b>1</b> 0000 0001
<b>252</b> 1111 1100	<b>3</b> 0000 0011
<b>248</b> 1111 1000	<b>7</b> 0000 0111
<b>240</b> 1111 0000	<b>15</b> 0000 1111
<b>224</b> 1110 0000	<b>31</b> 0001 1111

SUBNET MASK	WILDCARD
<b>192</b> 1100 0000	<b>63</b> 0011 1111
<b>128</b> 1000 0000	<b>127</b> 0111 1111
<b>o</b> 0000 0000	<b>255</b> 1111 1111

# **Why Learn Binary?**

Subnet masks determine which part of the IP address is for the **network**, and which is for the **host**. We can view this when examining the subnet mask in binary format. Any binary digit that is a "1" is for the network, while a "0" is for the host.

\*Note that subnet masks can only be written with all ones followed by all zeros.\*

The above example is called a /24 (pronounced whack 24) subnet because there are 24 binary digits in the "1" (or network) position. So, the first 24 binary digits (or three octets) of an IP range are for the network (non-changing), and the last eight binary digits (last octet) are for the hosts.
In this next example, our internet provider gave us an IP range of 199.44.6.0 with a /24 subnet, allowing 254 IP addresses.
*Remember that hosts cannot have an IP address that ends in the first or last number in the available range.*

Classful addressing will use the following subnet masks. 255.0.0.0/8 255.255.0.0/16 255.255.255.0/24

These are very easy to calculate.

But what if we want a /28 subnet mask, for instance?

First Four	Fifth	Sixth	Seventh	Eighth	Decimal
Why is this? We knov 01010000 converts to next four binary posit	o 80, our first				
How many hosts can	we have now	?			
digits are in the one p	osition. They	also gave us a	an IP range of 199.	44.6.80.	

In this example, our internet provider gave us a different subnet mask (/28). We see the first 28 binary

0101	0	0	0	1	81
0101	0	0	1	0	82
0101	0	0	1	1	83
0101	0	1	0	0	84
0101	0	1	0	1	85
0101	0	1	1	0	86
0101	0	1	1	1	87
0101	1	0	0	0	88
0101	1	0	0	1	89
0101	1	0	1	0	90
0101	1	0	1	1	91
0101	1	1	0	0	92
0101	1	1	0	1	93
0101	1	1	1	0	94

Without understanding decimal to binary, this would be a very difficult calculation.

# **IPv4 Address Classes**

These were the first effort to divide network IDs and set how many public IPv4 addresses you can have.

A	0.0.0.0 – 127.255.255.255
В	128.0.0.0 – 191.255.255.255
С	192.0.0.0 – 223.255.255.
D	224.0.0.0 – 239.255.255

## Reserved (Private) IP Ranges

These IP address ranges are reserved for internal networks. You will never see public IPv4 addresses in these ranges.

CLASS A	10.0.0.0 – 10.255.255.255
CLASS B	172.16.0.0 – 172.31.255.255
CLASS C	192.168.0.0 – 192.168.255.255
LOCALHOST	127.0.0.0 – 127.255.255.255
ZEROCONF (APIPA/BONJOUR)	169.254.0.0 – 169.254.255.255

# **Terminology**

If you want to discuss IPv4, you need to learn the following terms.

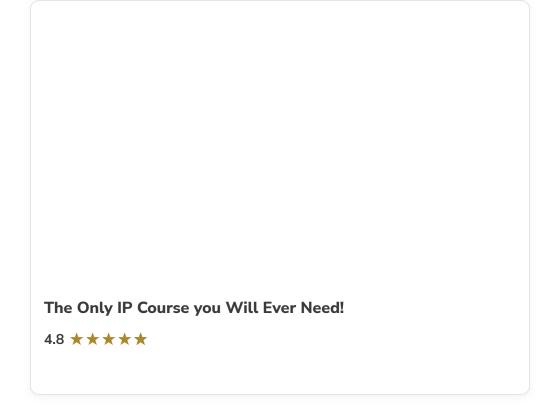
WILDCARD MASK	A wildcard mask indicates which parts of an IP address are available for examination.
CIDR	Classless interdomain routing was developed to provide more granularity
CIDK	than legacy classful addressing; CIDR notation is expressed as /XX

## **Conclusion**

IPv4 subnetting can be confusing at first, but we promise with practice it will become second nature.

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4.8 ★★★★★				
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4.5 * * * * *				



## **Frequently Asked Questions**

— How is subnetting calculated in IPv4?

Subnetting is the process of dividing a large network into smaller ones.

Subnetting requires the following steps:

1. **Decide how many subnets you need**. A home network may only need one if everyone on the network is trusted. You may want one dedicated to a home office or one for guests. On a larger enterprise scale, different departments, office floors, resources, or locations may require their own subnets.



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aiπerent subnet than one with only 30 devices.

3. **Choose a subnet mask** based on your answers to one and two. This separates the network portion of the address from the host portion. The network portion will never change while the host portion will be unique to each host on the subnet. For example, a subnet mask of 255.255.255.0 will mean that the first three octets of the IP address will be the same for every host on the network, while the last octet will be unique to each attached device.

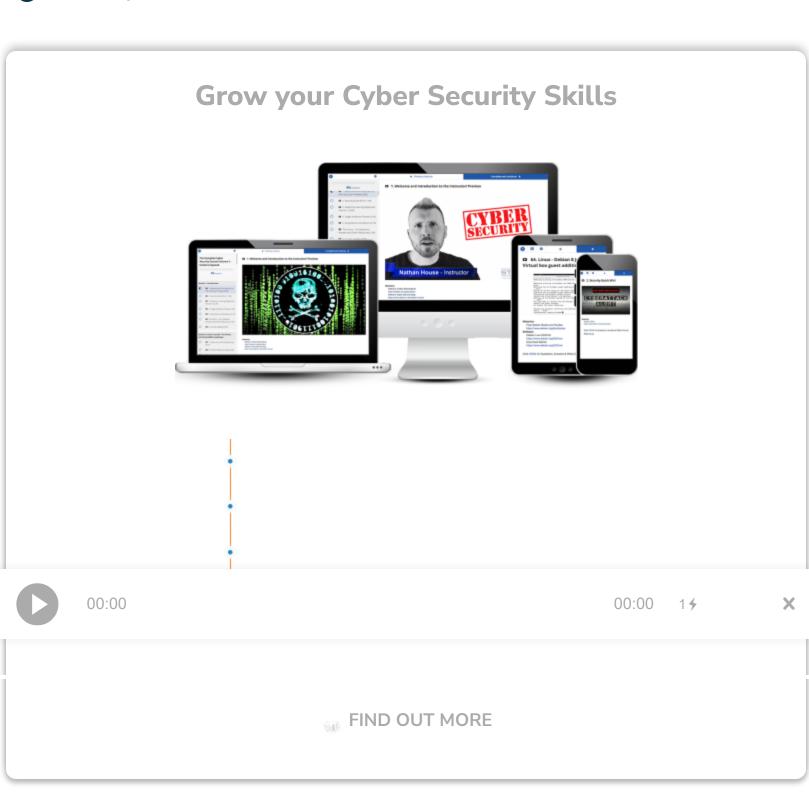
- 4. **Assign an appropriate IP address range to each subnet**. As stated earlier, all machines on the network will share the network portion of this range.
- + What is a 255.255.0.0 subnet mask?

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Nathan House is the founder and CEO of StationX. He has over 25 years of experience in cyber security, where he has advised some of the largest companies in the world. Nathan is the author of the popular "The Complete Cyber Security Course", which has been taken by over half a million students in 195 countries. He is the winner of the Al "Cyber Security Educator of the Year 2020" award and finalist for Influencer of the year 2022.

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