

The Only IPv4 Subnetting Cheat Sheet You'll Ever Need

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IPv4 SUBNETTING CHEAT SHEET



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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.

Click to download a pdf copy [here](#) to keep with you, and when you're ready, read on.

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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
255 1111 1111	0 0000 0000
254 1111 1110	1 0000 0001
252 1111 1100	3 0000 0011
248 1111 1000	7 0000 0111
240 1111 0000	15 0000 1111
224 1110 0000	31 0001 1111

SUBNET MASK	WILDCARD
192 1100 0000	63 0011 1111
128 1000 0000	127 0111 1111
0 0000 0000	255 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?

In this example, our internet provider gave us a different subnet mask (/28). We see the first 28 binary digits are in the one position. They also gave us an IP range of 199.44.6.80.

How many hosts can we have now?

Why is this? We know the first four binary characters are part of the network, so cannot change. 01010000 converts to 80, our first IP in the range. We now look at all available combinations of the next four binary positions.

First Four	Fifth	Sixth	Seventh	Eighth	Decimal

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
B	128.0.0.0 – 191.255.255.255
C	192.0.0.0 – 223.255.255.255
D	224.0.0.0 – 239.255.255.255

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 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.

Want more help learning subnetting? Check out these courses in our VIP Members Section

CompTIA Network+ Cert. (N10-008): The Total Course

4.8 ★★★★★

TCP/IP: The Complete Course

4.9 ★★★★★

The Only IP Course you Will Ever Need!

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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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different 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?

⊕ How many IPv4 addresses are in /24 subnets?

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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 AI "Cyber Security Educator of the Year 2020" award and finalist for Influencer of the year 2022.

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