

What is a Subnet Mask?

A **subnet mask** is used in networking to divide an IP address into two parts: the **network** and **host** components. This helps in identifying which part of the IP address refers to the network and which part refers to the specific device (host) on that network.

- The **network part** allows devices to recognize if they are on the same local network.
- The **host part** identifies individual devices within the network.

A subnet mask, like an IP address, is made up of 32 bits for IPv4 and is typically written in the same dotted-decimal format (e.g., 255.255.255.0).

How to Understand and Calculate Subnet Masks?

1. Subnet Mask Structure:

- A subnet mask consists of 32 bits, just like an IPv4 address.
- The bits set to 1 represent the network part, while the bits set to 0 represent the host part.
- For example, the subnet mask 255.255.255.0 is written in binary as 11111111.11111111.11111111.00000000.

2. Identifying the Network and Host Portions:

- In an IP address like 192.168.1.10 with a subnet mask of 255.255.255.0:
 - The first three octets (192.168.1) identify the **network**.
 - The last octet (10) identifies the **host**.

Common Subnet Masks and Their Purposes:

Subnet Mask Notation Network Bits Host Bits Number of Hosts

255.0.0.0	/8	8	24	16,777,214
255.255.0.0	/16	16	16	65,534
255.255.255.0	/24	24	8	254

The **notation** /n represents the number of bits used for the network part. For instance, /24 means the first 24 bits are used for the network, and the remaining 8 bits are for the host.

Calculating Subnets - An Easy Example:

Suppose you have an IP address 192.168.10.15 with a subnet mask of 255.255.255.0.

- **Step 1:** Convert the IP address and subnet mask to binary:
 - **IP Address:** 192.168.10.15 in binary is 11000000.10101000.00001010.00001111.
 - **Subnet Mask:** 255.255.255.0 in binary is 11111111.11111111.11111111.00000000.
- **Step 2:** Identify the Network and Host:

- The network part is represented by the bits covered by 1 in the subnet mask. In this case, the first 24 bits are the network (192.168.10).
- The remaining 8 bits represent the host (15).
- **Step 3:** Determine the Network Address:
 - The **network address** is obtained by performing a bitwise AND operation between the IP address and the subnet mask, which results in 192.168.10.0.

Examples of Common Subnet Masks:

1. **Subnet Mask: 255.255.255.0 (/24)**
 - **Network:** The first 3 octets (192.168.1) represent the network.
 - **Hosts:** The last octet (0-255) represents hosts, allowing for **254 hosts** (addresses 192.168.1.1 to 192.168.1.254, excluding 192.168.1.0 and 192.168.1.255 for network and broadcast addresses).
2. **Subnet Mask: 255.255.0.0 (/16)**
 - **Network:** The first 2 octets (172.16) represent the network.
 - **Hosts:** The last 2 octets represent hosts, allowing for **65,534 hosts**.

Easy Way to Remember:

- **Full Subnet Mask (255) = Network Part.**
- **Zeros (0) in Subnet Mask = Host Part.**

For example, in 255.255.255.0:

- The first three 255 represent **network** bits (24 bits).
- The 0 represents **host** bits (8 bits), indicating the number of available IPs in that subnet.

Conclusion:

A **subnet mask** helps differentiate which portion of an IP address is the **network** and which is the **host**. This makes networking more efficient by enabling the segmentation of IP addresses into subnetworks, making IP address management more structured and reducing unnecessary traffic.

When the **subnet mask is 255.255.255.0 (/24)**, the network is divided in such a way that the first 3 octets represent the **network** part, and the last octet represents the **host** part. Let's break down how to identify the **network address**, **broadcast address**, and the available **host addresses**.

Given Information:

- **Subnet Mask:** 255.255.255.0 (/24)
- **Example IP Address:** 192.168.1.10

1. Network Address:

The **network address** is the first address in the subnet, where all the host bits are set to 0. It represents the subnet itself.

- For an IP address like 192.168.1.10 with a subnet mask of 255.255.255.0:
 - The first three octets (192.168.1) represent the **network** part.
 - The last octet (10) is the **host** part.

To find the **network address**, set all the bits in the host part to 0:

- **Network Address:** 192.168.1.0

2. Broadcast Address:

The **broadcast address** is the last address in the subnet, where all the host bits are set to 1. It is used to communicate with all devices within that subnet.

- For the subnet 192.168.1.0 with a subnet mask of 255.255.255.0:
 - Set all the host bits to 1:
 - **Broadcast Address:** 192.168.1.255

3. Host Addresses:

The **host addresses** are the IP addresses available for devices on the network. They are all the addresses between the network address and the broadcast address.

- **Range of Host Addresses:**
 - **First Host Address:** 192.168.1.1
 - **Last Host Address:** 192.168.1.254

Thus, in the subnet 192.168.1.0/24:

- The **network address** is 192.168.1.0.
- The **broadcast address** is 192.168.1.255.
- **Available host addresses** range from 192.168.1.1 to 192.168.1.254.

Summary:

Address Type	Address	Description
Network Address	192.168.1.0	Identifies the subnet itself.
First Host	192.168.1.1	The first usable IP address.
Last Host	192.168.1.254	The last usable IP address.
Broadcast Address	192.168.1.255	Used to communicate with all hosts.

With the subnet mask 255.255.255.0, you have **254 possible host addresses** in that subnet, which are usable for devices.

EXAMPLE:

255.255.255.0 (8+8+8+0 = 24) CIDR /24

255.255.255.240 (8+8+8+4 = 28) CIDR/28

255.255.255.248 (8+8+8+5 = 29) CIDR NOTATION /29

IP : 192.168.1.0

SUB NET : 255.255.255.248 / 29

248 – 256(0 to 255) = 8 (HOST)

IP Address:	192.168.1.150
Network Address:	192.168.1.144
Usable Host IP Range:	192.168.1.145 - 192.168.1.150
Broadcast Address:	192.168.1.151
Total Number of Hosts:	8
Number of Usable Hosts:	6
Subnet Mask:	255.255.255.248
Wildcard Mask:	0.0.0.7
Binary Subnet Mask:	11111111.11111111.11111111.11111000
IP Class:	C
CIDR Notation:	/29
IP Type:	Private

All 32 of the Possible /29 Networks for 192.168.1.*

Network Address	Usable Host Range	Broadcast Address:
192.168.1.0	192.168.1.1 - 192.168.1.6	192.168.1.7
192.168.1.8	192.168.1.9 - 192.168.1.14	192.168.1.15
192.168.1.16	192.168.1.17 - 192.168.1.22	192.168.1.23
192.168.1.24	192.168.1.25 - 192.168.1.30	192.168.1.31
192.168.1.32	192.168.1.33 - 192.168.1.38	192.168.1.39
192.168.1.40	192.168.1.41 - 192.168.1.46	192.168.1.47
192.168.1.48	192.168.1.49 - 192.168.1.54	192.168.1.55
192.168.1.56	192.168.1.57 - 192.168.1.62	192.168.1.63
192.168.1.64	192.168.1.65 - 192.168.1.70	192.168.1.71
192.168.1.72	192.168.1.73 - 192.168.1.78	192.168.1.79
192.168.1.80	192.168.1.81 - 192.168.1.86	192.168.1.87
192.168.1.88	192.168.1.89 - 192.168.1.94	192.168.1.95
192.168.1.96	192.168.1.97 - 192.168.1.102	192.168.1.103
192.168.1.104	192.168.1.105 - 192.168.1.110	192.168.1.111
192.168.1.112	192.168.1.113 - 192.168.1.118	192.168.1.119
192.168.1.120	192.168.1.121 - 192.168.1.126	192.168.1.127
192.168.1.128	192.168.1.129 - 192.168.1.134	192.168.1.135
192.168.1.136	192.168.1.137 - 192.168.1.142	192.168.1.143
192.168.1.144	192.168.1.145 - 192.168.1.150	192.168.1.151
192.168.1.152	192.168.1.153 - 192.168.1.158	192.168.1.159
192.168.1.160	192.168.1.161 - 192.168.1.166	192.168.1.167
192.168.1.168	192.168.1.169 - 192.168.1.174	192.168.1.175
192.168.1.176	192.168.1.177 - 192.168.1.182	192.168.1.183
192.168.1.184	192.168.1.185 - 192.168.1.190	192.168.1.191
192.168.1.192	192.168.1.193 - 192.168.1.198	192.168.1.199
192.168.1.200	192.168.1.201 - 192.168.1.206	192.168.1.207
192.168.1.208	192.168.1.209 - 192.168.1.214	192.168.1.215
192.168.1.216	192.168.1.217 - 192.168.1.222	192.168.1.223
192.168.1.224	192.168.1.225 - 192.168.1.230	192.168.1.231
192.168.1.232	192.168.1.233 - 192.168.1.238	192.168.1.239
192.168.1.240	192.168.1.241 - 192.168.1.246	192.168.1.247
192.168.1.248	192.168.1.249 - 192.168.1.254	192.168.1.255