**subnet mask**

A **subnet mask** is a 32-bit number used to define which part of the IP address refers to the network and which part refers to the device (host).

* **Network Part**: Identifies the specific network.
* **Host Part**: Identifies the specific device within the network.

The subnet mask helps devices determine if the destination IP address is within the same network or a different one. If it's in the same network, data is sent directly to the destination device. If it's in a different network, the data is sent to the router for further forwarding.

When devices want to communicate over a network, they need to figure out whether the device they want to talk to is **on the same local network** or **on a different network**. This is where the **subnet mask** comes in.

1. **Same Network**: If the device you want to communicate with is on the same network, the data can be sent directly between the devices. They are like neighbors in the same building.
2. **Different Network**: If the device is not on the same network (like a device in a different building), the data needs to be sent through a **router**. The router acts like a post office, forwarding the data to the correct destination.

For example:

IP Address : 192.168.1.1

Subnet mask : 255.255.255.0

In this example , the first three parts of an IP address(192.168.1) represent the network, and the last part(10) represent the host.

**Problem Without Subnetting:**

Imagine you have **200 computers** in your office, and you need to assign each one an IP address. If you use a classful network like **Class C**, it gives you **256 addresses** (e.g., 192.168.1.0 to 192.168.1.255).

* You’re only using **200 addresses** but wasting **56 addresses** because they cannot be used elsewhere.

**Solution With Subnetting:**

By applying a **subnet mask** (e.g., 255.255.255.192), you divide the large network into **smaller networks (subnets)** with a customized size.

* This way, you can allocate only the required **200 addresses** to your office network while freeing up the remaining **56 addresses** for other networks.