**The Internet Protocol (IP)** is one of the core protocols in the layers of the Internet. It's used in all Internet communication to handle both addressing and routing.

The protocol describes the use of **IP addresses** to uniquely identify Internet-connected devices.

There are actually two versions of the Internet Protocol in use today:

* IPv4, the first version ever used on the Internet

[0-255].[0-255].[0-255].[0-255], e.g.- 74.125.20.113

* IPv6, a backwards-compatible successor

FFFF:FFFF:FFFF:FFFF:FFFF:FFFF:FFFF:FFFF, e.g.- 2001:0db8:0000:0042:0000:8a2e:0370:7334

Your IP address might be different tomorrow than it is today. Each ISP has a range of addresses they can assign, and they might give you a different one of those addresses each time they see your computer pop up on the network. That's called a **dynamic** IP address.

Switching to a different Wi-Fi network will definitely give you a new IP address, since each Wi-Fi provider has its own range of addresses that it can give out.

Computers that act as servers, like the computers that power Google.com, often have **static** IP addresses. That makes it easier for computers to quickly send search requests to the Google servers

## **IPv4 address hierarchy**

The first sequence of bits identifies the network, and the final bits identify the individual node in the network.

That IP address could break down into these 2 parts:

| **24,147** | **242, 217** |
| --- | --- |
| Comcast network | A home computer |

The first two octets (16 bits) identifies a network administered by the Comcast (an Internet Service Provider). The last two octets (the final 16 bits) identifies a home computer on that Comcast network.

### Subnets

Network administrators can break IP addresses into further subnetworks (subnets) as needed.

**Ip Packet**

The Internet Protocol (IP) describes the structure of the packets.

Graphical user interface, application

Description automatically generated

Think of IP packets like postal letters: the header is the envelope with all the routing information that's needed by the post office, and the payload is the letter that's read only by the recipient.

The Internet Protocol (IP) is the protocol that describes how to route messages from one computer to another computer on the network. Each message is split up into packets, and the packets hop from router to router on the way to their destination.

### Step 1: Send packet to router

Computers send the first packet to the nearest router.

### Step 2: Router receives packet

When the router receives a packet, it looks at its IP header. The most important field is the destination IP address, which tells the router where the packet wants to end up.

### Step 3: Router forwards packet

The router has multiple paths it could send a packet along, and its goal is to send the packet to a router that's closer to its final destination.

The router has a **forwarding table** that helps it pick the next path based on the destination IP address. That table does not have a row for every possible IP address; there are 2^{32}2322, start superscript, 32, end superscript possible IP addresses, and that's far too much to store. Instead, the table has rows for IP address prefixes.

IP addresses are hierarchical. When two IP addresses start with the same prefix, that often means they're on the same large network, like the Comcast SF network. Router forwarding tables take advantage of that fact so that they can store far less information.

### Step 4: Final router forwards message

If all goes well, the packet should eventually arrive at a router that knows exactly where to send it.