

Internet

Definition

The **Internet** is a vast, global network of interconnected computers, servers, and devices that communicate with each other using a common set of protocols. Essentially, it's a network of networks, where billions of devices (such as computers, smartphones, tablets, and servers) are connected to exchange information.

- Think of the internet like a **massive highway system** where data travels from one computer to another. The main goal of the internet is to **facilitate communication** and the **sharing of resources** (data, files, websites, etc.) between devices across the world.

Working mechanism ?

The internet uses a set of rules and technologies, such as:

- **IP addresses:** Each device on the internet has a unique **IP address** (like a phone number or home address) to identify it.
- **Protocols:** Communication happens through protocols such as **TCP/IP** (Transmission Control Protocol/Internet Protocol) that define how data is broken down, routed, and reassembled.
- **DNS (Domain Name System):** When you type a website address like www.google.com, the **DNS** translates that into the correct **IP address** where Google's servers are located.
- **Routers and Switches:** Devices that direct and forward data packets across the internet from one computer to another, ensuring they take the most efficient route.

ISP

An **Internet Service Provider (ISP)** is a company or organization that provides individuals, businesses, and other entities with access to the internet. In simpler terms, ISPs are the companies that allow you to connect to the global network we call the **Internet**.

ISPs offer a variety of services including:

- **Broadband Internet** (DSL, cable, fiber optics)
 - **Dial-up** (legacy service)
 - **Mobile Data** (through mobile carriers)
 - **Satellite Internet**
 - **Hosting and Web Services**
- They connect the end-user to the internet by transmitting data, managing bandwidth, and maintaining a network infrastructure to ensure traffic flows smoothly.

Need of ISP

- **Infrastructure Management:** ISPs own and maintain the physical and virtual infrastructure (cables, data centers, routers) that allow us to connect to the internet. Without ISPs, this infrastructure wouldn't exist on a global scale.
- **Internet Connectivity:** To connect to the internet, your home or office must be linked to a network that has access to the global internet. ISPs provide that link, whether through broadband, fiber, wireless, or satellite.
- **Bandwidth and Speed:** ISPs offer different levels of **bandwidth** (the amount of data that can be transmitted) and **speed** (how fast data is transferred). They manage these resources to ensure users have reliable and efficient access.
- **Routing and Data Transit:** The internet is made up of millions of smaller networks. ISPs manage how data is **routed** between networks, ensuring packets of data travel from one place to another, even across continents.
- **DNS and IP Management:** ISPs provide important services like **Dynamic IP** (which can change over time) or **Static IP** addresses and also offer access to the **DNS** system, translating domain names into IP addresses.

Tier Structure of ISP

The internet is a massive, interconnected system that relies on many different companies and technologies to function. ISPs are grouped into **tiers** based on their role, the infrastructure they own, and their capacity to route traffic across the internet. The **tiered structure** helps us understand the **hierarchy of network traffic routing** and the relationship between various ISPs.

•The primary reason for this hierarchy is to ensure the **efficient flow of internet traffic** and the **reduction of data transmission costs** while maintaining **network performance**. The tier system divides ISPs into three categories:

- Tier 1 ISP
- Tier 2 ISP
- Tier 3 ISP

Tier 1 ISP : Backbone Provider

- **Definition: Tier 1 ISPs** are the **top-level providers** with global reach. These ISPs own and manage the **backbone infrastructure** that forms the core of the internet. They have vast, high-capacity networks that interconnect with other Tier 1 providers around the world, often through undersea cables, fiber-optic networks, and satellite links.
- **Characteristics:**
 - They **own large, high-capacity networks** and have **global routing capabilities**.
 - Tier 1 ISPs do not need to buy internet transit from anyone. Instead, they **peer** (directly exchange traffic) with other Tier 1 ISPs at **no cost**.
 - These ISPs provide the **foundation** for internet communication by connecting smaller networks (Tier 2 and Tier 3) to the global internet.
 - They may have **international points of presence (PoPs)** across many countries.

Tier 2 ISP : Regional & National Provider

- **Definition: Tier 2 ISPs** have significant networks but do not own the global infrastructure. They **peer** with Tier 1 ISPs for international traffic, and they may also have **private peering** arrangements with other Tier 2 providers to exchange data. However, they **purchase internet transit** from Tier 1 ISPs for any traffic that is beyond their reach or is not exchanged through peering.
- **Characteristics:**
 - Tier 2 ISPs typically serve **regional** or **national** customers (businesses, enterprises, large-scale consumers).
 - They have **local or national presence** with regional data centers and points of presence (PoPs).
 - Tier 2 ISPs **rent bandwidth** and network infrastructure from Tier 1 providers to reach the global network, but they are also capable of peering with other Tier 2 ISPs to improve performance and lower costs.

Tier 3 ISP : Local Providers

- **Definition: Tier 3 ISPs** are typically **local or small-scale providers** who offer internet connectivity to end-users. These ISPs **rely** entirely on Tier 1 and Tier 2 ISPs for **internet access**. Their primary function is to provide **last-mile connectivity** to homes, businesses, and other organizations.
- **Characteristics:**
 - Tier 3 ISPs often provide **residential internet services** like DSL, cable, fiber, or wireless broadband.
 - They typically serve **smaller geographic areas** (towns, cities, rural areas) and have **limited infrastructure**.
 - Tier 3 ISPs may operate **local fiber optics** or use leased infrastructure from Tier 1 or Tier 2 ISPs to connect to the larger network.