IP Address, URL, Domain Names
SEC (Semester-1)

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IP Address (Internet Protocol Address)

Definition

An **IP Address** is a **unique numerical identifier assigned to every device connected to a network that uses the Internet Protocol for communication**.

It allows devices such as computers, smartphones, servers, and routers to **identify and communicate with each other over the Internet**.

Think of an IP address like a **postal address for a device on the internet**.

Example of an IP Address

- 192.168.1.1

Types of IP Addresses

1. IPv4 (Internet Protocol Version 4)

- IPv4 is the **most widely used version** of IP addressing.

Structure:

- 32-bit address
- Divided into **4 octets**
- Each octet ranges from **0 to 255**
- Written in **decimal format separated by dots**

Example:

- 192.168.0.1

Example breakdown:

Octet	Value
1	192
2	168
3	0
4	1

2. IPv6 (Internet Protocol Version 6)

Due to the shortage of IPv4 addresses, **IPv6 was introduced**.

Structure:

- 128-bit address
- Written in **hexadecimal**
- Divided into **8 groups**
- Example:
- 2001:0db8:85a3:0000:0000:8a2e:0370:7334

Advantages of IPv6

- Vast number of addresses
- Better security
- Improved routing efficiency
- Supports modern internet devices

Public IP Address

A **Public IP Address** is assigned by an **Internet Service Provider (ISP)** and is visible on the internet.

Example:

- 49.36.12.101

Used for:

- Web servers
- Internet communication
- Online services

Private IP Address

Private IP Address

A **Private IP Address** is used inside **local networks (LAN)** and is not directly accessible from the internet.

Common ranges:

Range	Usage
10.0.0.0 - 10.255.255.255	Large networks
172.16.0.0 - 172.31.255.255	Medium networks
192.168.00 - 192.168.255.255	Home networks
Example	192.168.1.5

Static vs Dynamic IP Address

Static IP

- Fixed address
- Does not change
- Used for **servers and websites**

Example:
A company web server.

Dynamic IP

- Changes periodically
- Assigned automatically by **DHCP server**
- Used for **home internet users**

Functions of an IP Address

Functions of an IP Address

- Device Identification
- Location Addressing
- Enabling communication between devices
- Routing data across networks

URL (Uniform Resource Locator)

Definition

A **URL (Uniform Resource Locator)** is the **complete address used to locate a resource on the internet** such as a webpage, file, image, or video.

It tells the browser:

- **Where the resource is located**
- **How to access it**

Example of a URL

- https://www.example.com/index.html

Structure of a URL

- A typical URL consists of several parts.
- Example:
- https://www.google.com/search?q=network

Components

Part	Meaning
Protocol	https
Domain Name	Google.com
Path	/search
Query	?q=network

Protocol	Purpose
HTTP	Hyper Text Transfer Protocol
HTTPS	Secure HTTP
FTP	File Transfer Protocol
SMTP	Email sending

Domain Name

Human-readable name representing the server.

Example:

- google.com

Path

- Specifies the **location of the resource on the server**.
- Example:
- /blog/article1

Query Parameters

- Extra information sent to the server.
- Example:
- ?q=computer+network

Types of URLs

Absolute URL

- Complete address including protocol.
- Example:
- https://www.wikipedia.org/wiki/Internet

Relative URL

- Used inside websites and **does not include full domain**.
- Example:
- /images/logo.png

Importance of URL

- Locates resources on the internet
- Enables browsers to retrieve web pages
- Supports navigation across websites
- Helps organize web content

Domain Name

A **Domain Name** is the **human-readable name used to identify a website on the internet**.

Since IP addresses are difficult to remember, domain names are used instead.

Example:

Instead of:

- 142.250.190.78

We use:

- google.com

Examples of Domain Names

- google.com
- facebook.com
- amazon.in
- wikipedia.org

Structure of a Domain Name

Example:

- www.example.com

1. Top-Level Domain (TLD)

The **last part of the domain name**.

Examples:

TLD	Meaning
.com	Commercial
.org	Organisation
.edu	Education
.gov	Government
.net	Network

Country Code TLD (ccTLD)

Represents **specific countries**.

Examples:

Country	Domain
India	.in
United Kingdom	.uk
Australia	.au
Japan	.jp

2. Second-Level Domain

The **main name of the website**.

- Example:
- google.com
- Here **google** is the second-level domain.

3. Subdomain

A **subdivision of a domain** used to organize sections of a website.

- Example:
- mail.google.com
- Here **mail** is the subdomain.

Domain Name System (DNS)

The **Domain Name System (DNS)** converts domain names into IP addresses.

Example process:

User enters:

- www.google.com

DNS server converts it to:

- 142.250.190.78
- Browser connects to the server.

Domain Name Registration

Domain names are registered through **domain registrars**.

Examples of registrars:

- GoDaddy
- Namecheap
- Google Domains

Registration steps:

- Choose domain name
- Check availability
- Register and pay fee
- Connect it to hosting server

Advantages of Domain Names

- Easy to remember
- User-friendly
- Helps in branding
- Simplifies website access

Difference Between IP Address, URL, and Domain Name

Feature	IP Address	Domain Name	URL
Definition	Numeric identifier	Human-readable name	Complete web address
Example	192.168.1.1	Google.com	https.//google.com/search
Purpose	Identifies device	Identifies	Locates specific resource
Used by	Computers	Humans	Browsers

✅ Summary

Summary

- **IP Address:** Unique numeric identifier of a device on a network.
- **Domain Name:** Human-friendly name representing an IP address.
- **URL:** Complete address used to access resources on the internet.