INTERNET AND INTERNET SERVICES

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INTRODUCTION

- The internet is a global network of interconnected computer networks that enables communication and the sharing of information across geographical and organizational boundaries. It consists of millions of connected computing devices such as computers, smartphones, tablets, and servers, as well as the physical infrastructure that connects them together.

- The internet enables users to access a vast array of information, services, and applications, including email, messaging, video and voice communication, social networking, e-commerce, online gaming, and more. It also serves as a platform for innovation and entrepreneurship, allowing individuals and organizations to develop and launch new products and services.

INTRODUCTION

- The internet is powered by a variety of protocols and technologies, including the Transmission Control Protocol/Internet Protocol (TCP/IP), Domain Name System (DNS), Hypertext Transfer Protocol (HTTP), and many others. These protocols and technologies enable the efficient and secure transmission of data over the internet.

APPLICATION OF INTERNET

- Communication: The internet is widely used for communication, including email, instant messaging, voice and video calls, and social networking.
- Information sharing: The internet enables individuals and organizations to share and access vast amounts of information, including news, research, and educational resources.
- E-commerce: The internet has transformed the way we shop and do business, enabling e-commerce platforms like Amazon and eBay to connect buyers and sellers from around the world.

APPLICATION OF INTERNET

- Education: The internet has revolutionized education, with many schools and universities offering online courses and resources that can be accessed from anywhere in the world.
- Healthcare: The internet is increasingly being used in healthcare, enabling remote consultations, telemedicine, and the sharing of medical information and resources.
- Government services: The internet enables citizens to access government services and information, including tax forms, public records, and online voting.

APPLICATION OF INTERNET

- Entertainment: The internet provides a wide range of entertainment options, including streaming services for movies and TV shows, online gaming, and social media.

- Transportation: The internet is being used to revolutionize transportation, with the development of autonomous vehicles and smart traffic systems that use real-time data to optimize traffic flow.

APPLICATION OF INTERNET

- Smart homes and cities: The internet is being used to create smart homes and cities, with connected devices and sensors that can monitor and control various aspects of daily life, from lighting and temperature to traffic and public services.
- Overall, the internet has become an essential part of modern life, with countless applications that are transforming the way we live, work, and communicate

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HISTORY OF INTERNET

The history of the internet can be traced back to the 1960s, when J.C.R Licklider purposed the idea of networking computers that can talk to each other. And the U.S. Department of Defense's Advanced Research Projects Agency (ARPA) began researching ways to create a decentralized communication system that would be resilient in the event of a nuclear attack.

In the late 1960s (1969), ARPA's research resulted in the creation of the ARPANET, a network of four computers that were connected to each other using packet switching technology. Packet switching allowed data to be broken up into small packets and sent over a network, with each packet being routed individually based on the destination address.

HISTORY OF INTERNET

In the 1970s, ARPANET grew rapidly, connecting hundreds of universities and research institutions across the United States. The development of email and file transfer protocols made the network even more useful for sharing information.

In the 1980s, the National Science Foundation (NSF) created NSFNET, a faster and more reliable network that was open to all academic and research institutions. This led to the creation of the first internet service providers (ISPs), which provided commercial internet access to businesses and consumers.

The 1990s saw the rapid growth of the World Wide Web, which made it easy to access and share information on the internet using a graphical interface. The introduction of web browsers like Mosaic and Netscape made it easy for non-technical users to navigate the web and find information.

HISTORY OF INTERNET

In the early 2000s, social networking sites like Friendster and MySpace emerged, making it easy for users to connect and share information with each other online. The rise of mobile devices like smartphones and tablets led to a shift towards mobile-first web design, with websites and apps being optimized for small screens.

Today, the internet has become an essential part of modern life, with billions of people using it every day for everything from communication and entertainment to shopping and education.

INTERNET ARCHITECTURE

Network architecture is the logical and structural layout of the network, consisting of transmission equipment, software and communication protocols, and infrastructure (i.e. wired or wireless) transmission of data and connectivity between components.

There are two types of network architecture widely used:-

- Peer to peer
- Client server

CLIENT SERVER ARCHITECTURE

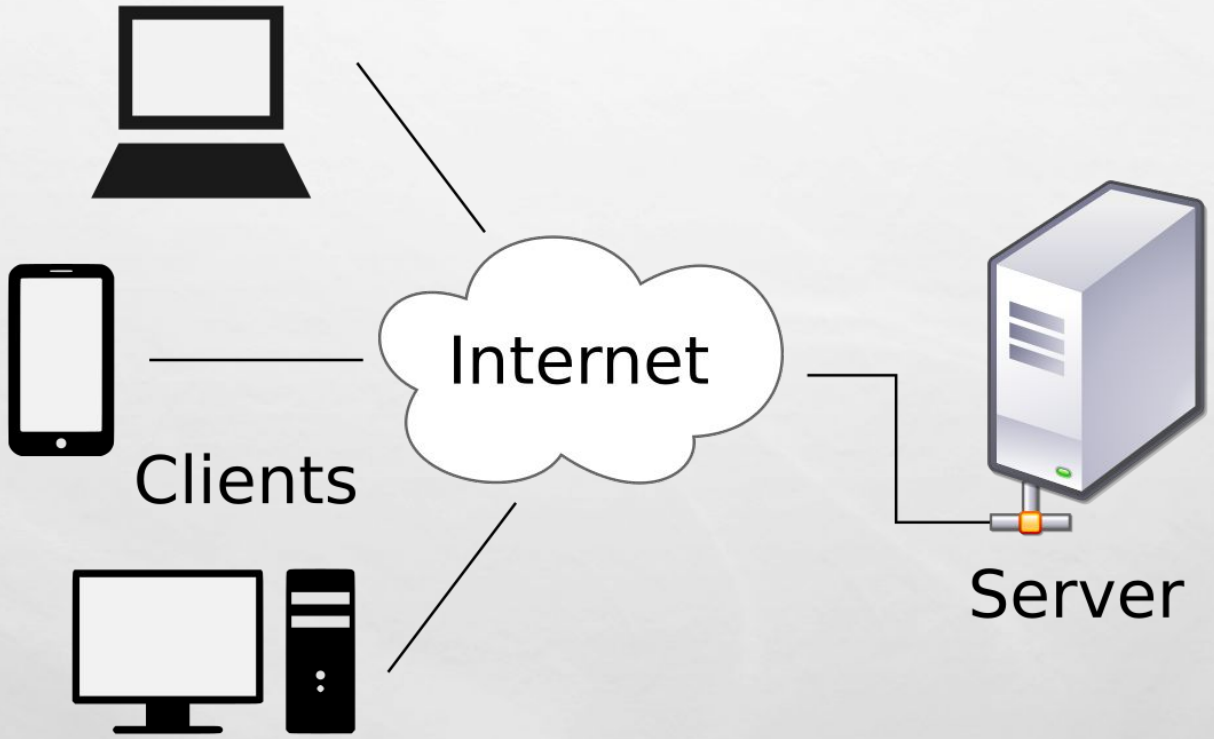
- Client-server architecture is a type of computing architecture that divides computing tasks between two distinct types of software: client software and server software. This architecture is widely used in modern computing systems, including web applications, email servers, and file-sharing systems.

- In a client-server architecture, the client software runs on the user's device and is responsible for user interaction and presentation. The client software communicates with the server software, which runs on a remote computer or server, to perform specific tasks or access resources.

CLIENT SERVER ARCHITECTURE

- The server software provides services to multiple client software instances simultaneously, enabling multiple users to access the same resources simultaneously. The server software is responsible for managing resources and performing tasks that require high processing power, storage, or specialized knowledge.

CLIENT SERVER ARCHITECTURE

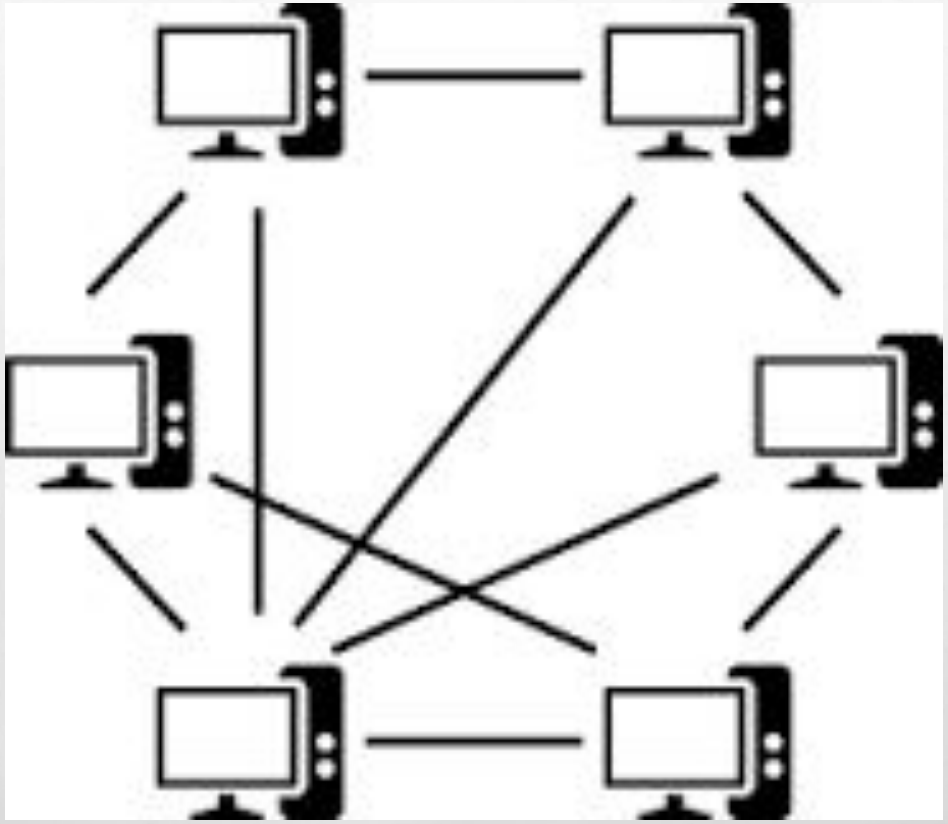


PEER TO PEER ARCHITECTURE

- In a peer-to-peer network, tasks are allocated to every device on the network. Furthermore, there is no real hierarchy in this network, all computers are considered equal and all have the same abilities to use the resources available on this network. Instead of having a central server which would act as the shared drive, each computer thats connected to this network would act as the server for the files stored on it.

- P2P architecture works best when there are lots of active peers in an active network, so newpeers joining the network can easily find other peers to connect to. If a large number ofpeers drop out of the network, there are still enough remaining peers to pick up the slack. Ifthere are only a few peers, there are less resources available overall. For example, in a P2Pfile-sharing application, the more popular a file is, which means that lots of peers are sharing the file, the faster it can be downloaded.

PEER TO PEER ARCHITECTURE



QUESTIONS

- Explain Client server architecture with advantage, disadvantages and block diagram.

OSI LAYER

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TCP/IP LAYER

- The OSI layer is just a reference model to understand the communication system by dividing the communication system into smaller and simpler components.
- TCP/IP was designed and developed by the Department of Defense (DoD) in the 1960s and is based on standard protocols. It stands for Transmission Control Protocol/Internet Protocol. The TCP/IP model is a concise version of the OSI model. It contains four layers, unlike the seven layers in the OSI model.
- TCP/IP helps to transfer the data from one device to another. The data needs to be kept accurate so that the receiver gets the same information that the sender originally sent. To ensure that each communication reaches its intended destination intact, the TCP/IP model breaks down data into packets and then reassembles the packets into the complete message on the other end. Sending the data in small packets makes it easier to maintain accuracy versus sending all the data at once.

TCP/IP LAYER

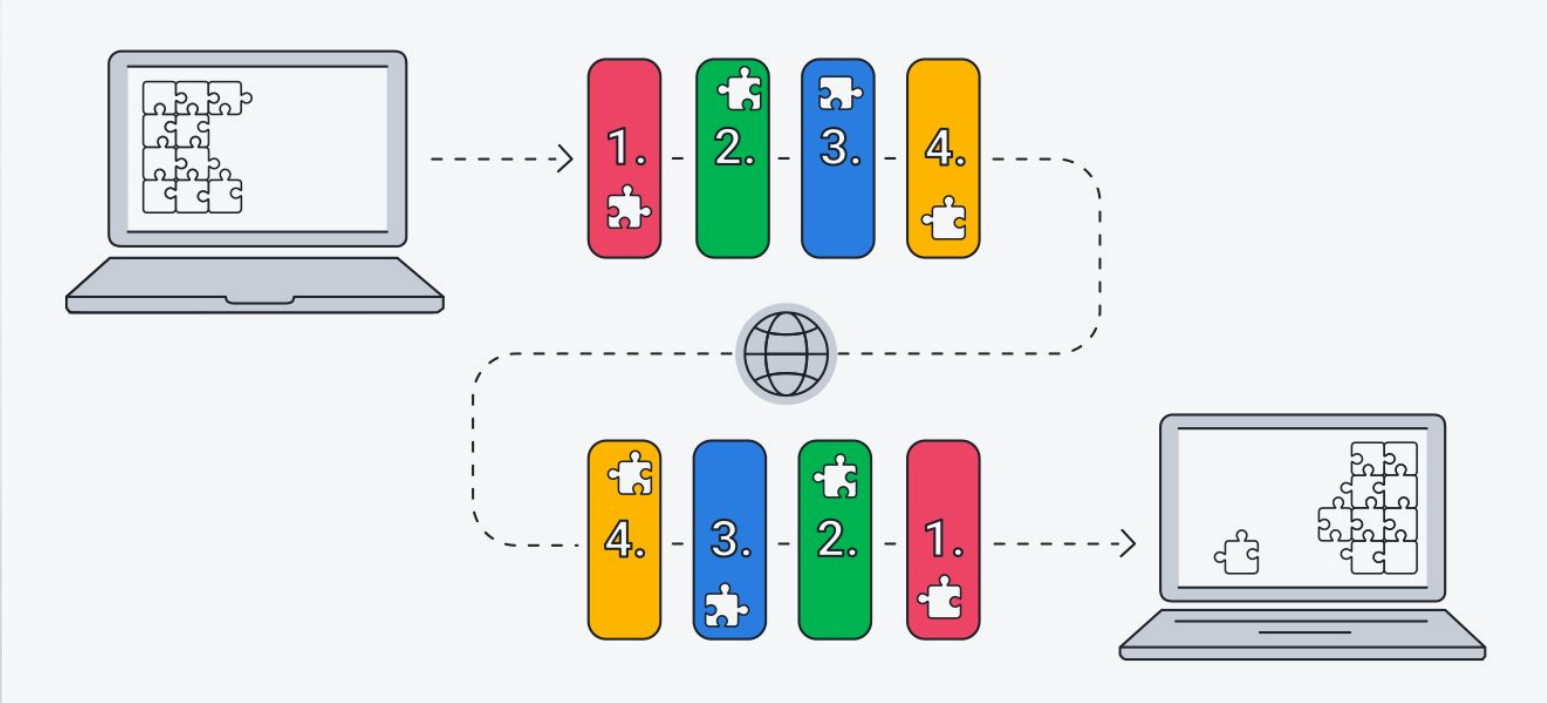
After a single message is split into packets, these packets may travel along different routes if one route is congested. It's like sending a few different birthday cards to the same household by mail. The cards begin their journey at your home, but you might drop each card into a different mailbox, and each card may take a different path to the recipient's address.

The number of layers is sometimes referred to as five or four. Here, we'll study four layers. The Physical Layer and Data Link Layer are referred to as one single layer as the 'Physical Layer' or 'Network Interface Layer' in the 4-layer reference.

HOW DOES IT WORK?

Whenever we want to send something over the internet using the TCP/IP Model, the TCP/IP Model divides the data into packets at the sender's end and the same packets have to be recombined at the receiver's end to form the same data, and this thing happens to maintain the accuracy of the data. TCP/IP model divides the data into a 5/4-layer procedure, where the data first go into this layer in one order and again in reverse order to get organized in the same way at the receiver's end.

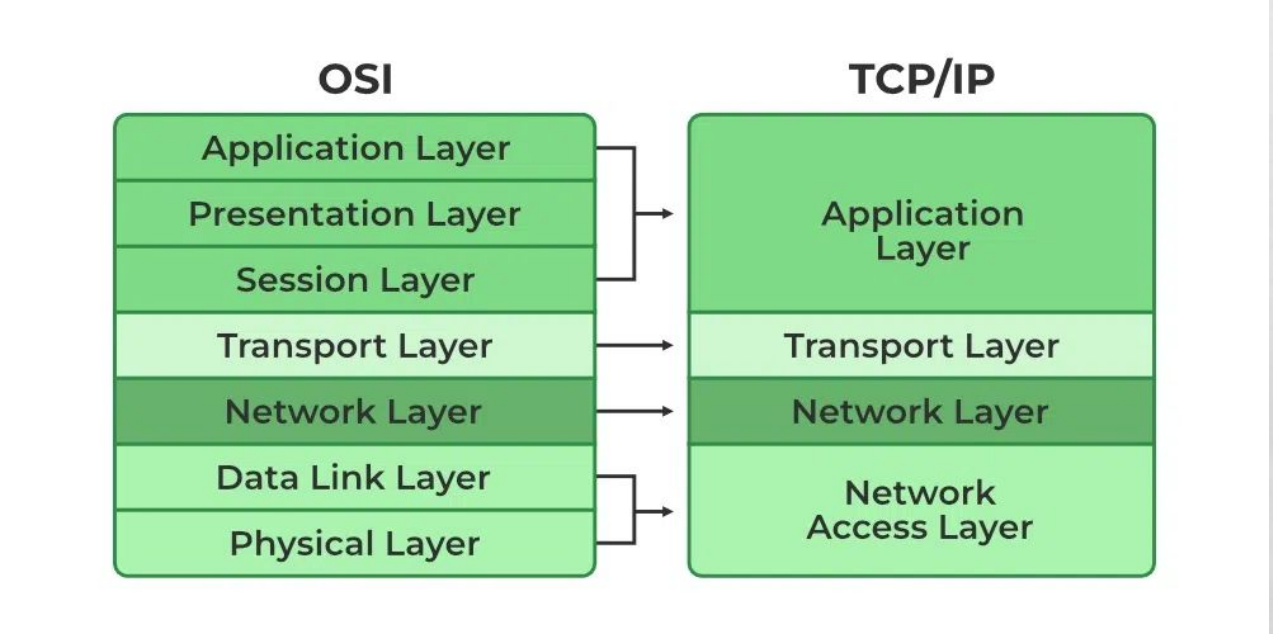
HOW DOES IT WORK?



HOW DOES IT WORK?

Layers of TCP/IP Model

- Application Layer
- Transport Layer(TCP/UDP)
- Network/Internet Layer(IP)
- Network Access Layer



Layers of TCP/IP Model

Layer 1: Application Layer

- The application layer is the group of protocols that let the user access the network through applications. For most of us that means email, messaging apps, and cloud storage programs that uses different protocols to help user activity. This is what the end-user sees and interacts with when sending and receiving data.

Layers of TCP/IP Model

Layer 2: Transport Layer

- The transport layer provides a reliable data connection between two communicating devices. It's like sending an insured package: The transport layer divides the data in packets, acknowledges the packets it has received from the sender, and ensures that the recipient acknowledges the packets it receives. TCP and UDP are the protocols at this level.

Layer 2: Transport Layer

- TCP: Applications can interact with one another using TCP as though they were physically connected by a circuit. TCP transmits data in a way that resembles character-by-character transmission rather than separate packets. A starting point that establishes the connection, the whole transmission in byte order, and an ending point that closes the connection make up this transmission.

- UDP: The datagram delivery service is provided by UDP, the other transport layer protocol. Connections between receiving and sending hosts are not verified by UDP. Applications that transport little amounts of data use UDP rather than TCP because it eliminates the processes of establishing and validating connections.

Layers of TCP/IP Model

Layer 3: Internet Layer

- The internet layer, also known as the network layer, controls the flow and routing of traffic to ensure data is sent speedily and accurately. This layer is also responsible for reassembling the data packet at its destination. If there's lots of internet traffic, the internet layer may take a little longer to send a file, but there will be a smaller chance of an error corrupting that file.

Layers of TCP/IP Model

Layer 4: Network Access Layer

- The network access layer, also known as the data link layer, handles the physical infrastructure that lets computers communicate with one another over the internet. This covers ethernet cables, wireless networks, network interface cards, device drivers in your computer, and so on.
- The network access layer also includes the technical infrastructure — such as the code that converts digital data into transmittable signals — that makes network connection possible.

ASSIGNMENT

Write the differences between TCP and UDP.

HYPER TEXT TRANSFER PROTOCOL

- HTTP stands for Hypertext Transfer Protocol. It is the foundation of data communication on the World Wide Web. It is an application layer protocol used for transmitting hypermedia documents, such as HTML. HTTP defines how messages are formatted and transmitted, and how web servers and browsers should respond to various commands.

- When you type a website address into your browser's address bar and hit enter, your browser sends an HTTP request to the server hosting that website. The server then processes the request and sends back an HTTP response, which typically includes the requested web page along with any associated resources like images, stylesheets, or scripts.

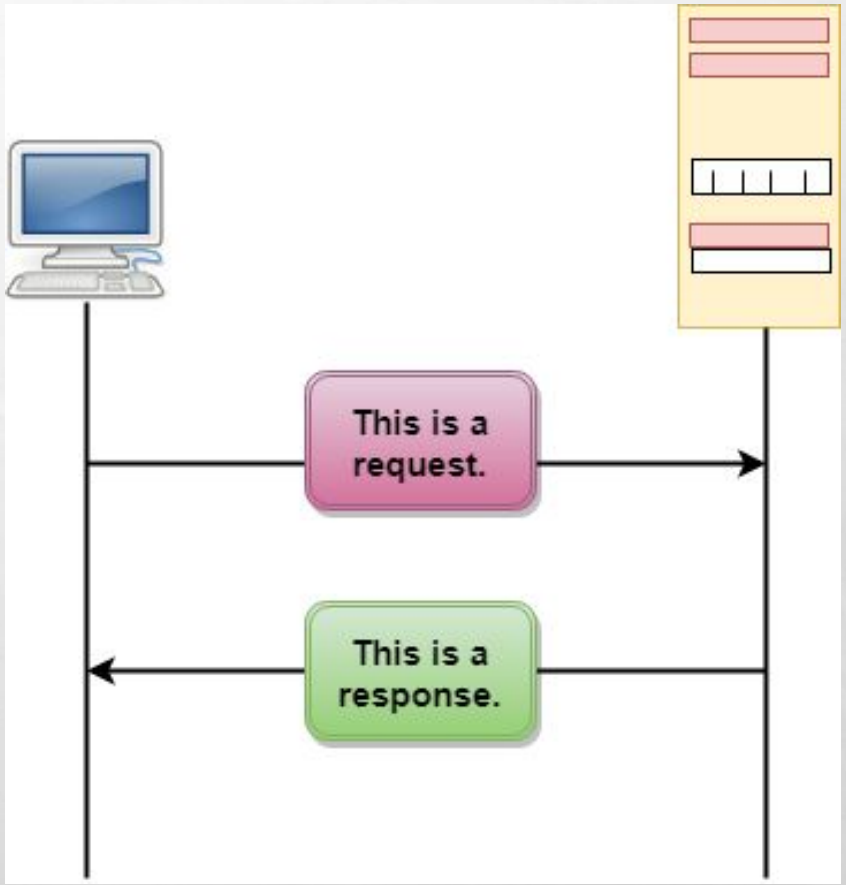
WHY IS HTTP CALLED STATELESS PROTOCOL?

- HTTP is called a stateless protocol because each request from a client to a server is completely independent of any previous requests. This means that the server does not retain any information about past requests from the same client. Once a request is processed and a response is sent back to the client, the server forgets about the request entirely.

- Statelessness in HTTP makes it easier to scale web applications because servers can handle requests from any client without needing to manage a persistent connection or state. It also allows for better fault tolerance, as servers can easily recover from failures without needing to restore client-specific state.

HTTP (HYPER TEXT TRANSFER PROTOCOL)

The above figure shows the HTTP transaction between client and server. The client initiates a transaction by sending a request message to the server. The server replies to the request message by sending a response message.



HTTP MESSAGE

- HTTP messages are of two types: request and response. Both the message types follow the same message format.
  - Request
    - When a client (such as a web browser) wants to retrieve a resource from a server, it sends an HTTP request message. This message contains information such as the method (e.g., GET, POST, PUT), the URL of the resource being requested, headers (e.g., for specifying content type or authentication), and an optional message body (e.g., for sending form data).

HTTP MESSAGE

- Response
  - When the server receives an HTTP request, it processes the request and sends back an HTTP response message. This message includes information such as the status code (e.g., 200 for success, 404 for "not found"), headers (e.g., for specifying content type or caching directives), and an optional message body (e.g., the requested resource or an error message).

URL (UNIFORM RESOURCE LOCATOR)

- A client that wants to access the document in an internet needs an address and to facilitate the access of documents, the HTTP uses the concept of Uniform Resource Locator (URL).The Uniform Resource Locator (URL) is a standard way of specifying any kind of information on the internet.

- The URL defines four parts: method, host computer, port, and path.

  - Method: The method is the protocol used to retrieve the document from a server. For example, HTTP.

URL (UNIFORM RESOURCE LOCATOR)

- Host: The host is the computer where the information is stored, and the computer is given an alias name. Web pages are mainly stored in the computers and the computers are given an alias name that begins with the characters "www". This field is not mandatory.
- Port: The URL can also contain the port number of the server, but it's an optional field. If the port number is included, then it must come between the host and path and it should be separated from the host by a colon.
- Path: Path is the pathname of the file where the information is stored. The path itself contain slashes that separate the directories from the subdirectories and files.

FILE TRANSFER PROTOCOL

- FTP stands for File Transfer Protocol. It is a standard network protocol used to transfer files from one host to another over a TCP-based network, such as the Internet. FTP is often used for uploading files from a client computer to a server or for downloading files from a server to a client computer.

- Although transferring files from one system to another is very simple and straightforward, but sometimes it can cause problems. For example, two systems may have different file conventions. Two systems may have different ways to represent text and data. Two systems may have different directory structures. FTP protocol overcomes these problems by establishing two connections between hosts. One connection is used for data transfer, and another connection is used for the control connection.

FILE TRANSFER PROTOCOL

There are two types of connections in FTP:

- **Control Connection:**

The control connection uses very simple rules for communication. Through control connection, we can transfer a line of command or line of response at a time. The control connection is made between the control processes. The control connection remains connected during the entire interactive FTP session.

- **Data Connection:**

The Data Connection uses very complex rules as data types may vary. The data connection is made between data transfer processes. The data connection opens when a command comes for transferring the files and closes when the file is transferred.

WORLD WIDE WEB

- The World Wide Web -- also known as the web, WWW or W3 -- refers to all the public websites or pages that users can access on their local computers and other devices through the internet. These pages and documents are interconnected by means of hyperlinks that users click on for information. This information can be in different formats, including text, images, audio and video

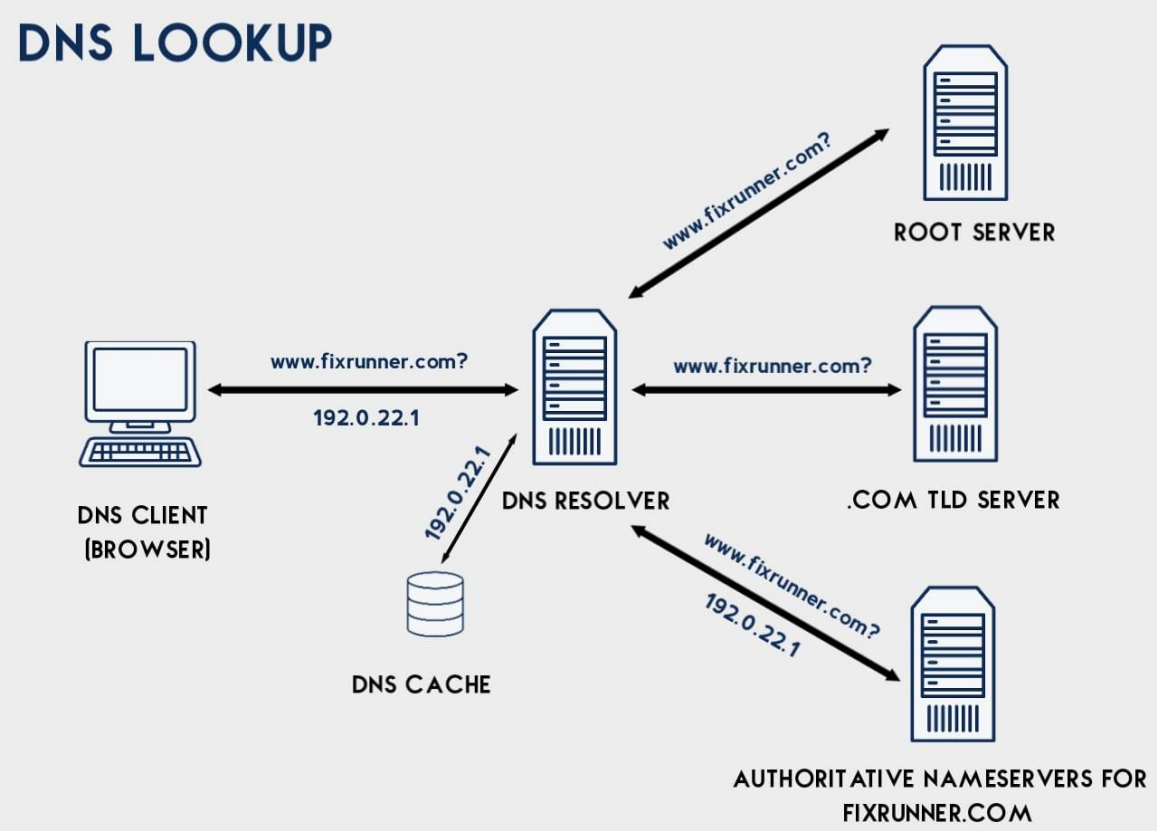
IP ADDRESS

- An IP address, or Internet Protocol address, is a unique identifier assigned to every device connected to the internet. It is a numerical label assigned to each device that is connected to a computer network using the Internet Protocol for communication.
- There are two versions of IP addresses: IPv4 and IPv6. IPv4 is the most widely used version and consists of four sets of numbers separated by dots (e.g., 192.168.0.1). IPv6, on the other hand, consists of eight sets of alphanumeric characters separated by colons (e.g., 2001:0db8:85a3:0000:0000:8a2e:0370:7334).
- IP addresses are used to identify and locate devices on the internet, and they are crucial for sending and receiving data over the internet. When you connect to a website or a service on the internet, your device's IP address is sent to the server to establish a connection and exchange data.

DOMAIN NAME SYSTEM

- The Domain Name System (DNS) is a decentralized system that translates domain names (like www.example.com) into IP addresses (like 192.0.2.1) that are used to locate resources on the internet.
- DNS provides a hierarchical naming system for computers, services, or any resource participating in the internet, organized in a tree-like structure.
- DNS plays a critical role in the functioning of the internet, allowing users to access websites and other resources using easy-to-remember domain names, rather than complex IP addresses.

DOMAIN NAME SYSTEM



DOMAIN NAME SYSTEM

- DNS works by using a distributed database system, which is made up of millions of DNS servers around the world. When a user types a domain name into their web browser, the browser sends a request to the local DNS resolver, which is typically provided by the Internet Service Provider (ISP). If the local resolver does not have the IP address for the requested domain name in its cache, it sends a request to one of the root DNS servers to start the resolution process.

- The root DNS server responds to the request with a referral to the appropriate Top-Level Domain (TLD) DNS server, such as .com, .org, .edu, or .gov. The TLD DNS server responds with a referral to the DNS server for the specific domain name, which then provides the IP address for the domain name to the local resolver. The local resolver caches the IP address for a certain amount of time to speed up future requests.

ASSIGNMENT

- Explain about electronic mail.
- Write the difference between IPV6 and IPV4 IP addresses.