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PROBLEM STATEMENT

Introduction to Network:

ALGORITHM & CODE :

A computer network is a system that connects multiple independent computers to share information (data) and resources. The integration of computers and other different devices allow users to communicate more easily. A computer network is a collection of two or more computer systems that are linked together.

Types of Network:

- Local Area Network (LAN): A ^{LAN} is a network that covers an area of around 10 meters to 100 meters. Example: A college network or an office network.
- Metropolitan Area Network (MAN): MAN refers to a network that covers an entire city. Example: Cable television network.
- Wide Area Network (WAN): WAN refers to a network that connects countries or continents.

1. Network Components:

Basic hardware interconnecting network nodes, such as Network Interface cards (NICs), Bridges, Hubs, Switches, Routers and cables are used in all networks.

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ALGORITHM & CODE:

- NIC (Network Interface Card)
 - Repeaters
 - Hub
 - Bridges
 - Switches
 - Routers
 - Gateways
- Networking Operating System.

A Network Operating System (NOS) is a specialized software that controls and manages network resources, allowing different devices (Computers, Servers, Printers etc.) to communicate, share resources, and interact over a network.

Q. Links

Link are the ways information travels between devices, and they can be of two types.

• Wired : communication done in a wired medium. Copper wire, twisted pair, or fiber optic cable are all options.

A wired network employs wires to link devices to the internet or another network, such as

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ALGORITHM & CODE: laptop or desktops. PCs.

Wireless: Wireless means without wire, media that is made up of electromagnetic waves (EM waves) or infrared waves.

Antennas or Sensors will be present on all wireless devices. For data or voice communication, a wireless network uses radio frequency waves rather than wires.

3. Communication Protocols:

A communication protocol is a set of rules that all devices follow when they share information.

Some common protocols are TCP/IP, IEEE 802, Ethernet, wireless LAN, and cellular standards.

TCP/IP is a model that organizes how communication works in modern networks. It has four functional layers for these communication links.

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The OSI (Open Systems Interconnection) model and the TCP/IP model are both reference models used to describe how data travels across networks. They consists of different layers, each of which plays a specific roles in facilitating communication between devices.

OSI model (7 layers)

1. Physical Layer (Layer 1):

- Responsible for transmitting raw bits over a physical medium.
- Deals with hardware like cables, switches etc.
- Example : Ethernet cable, optical fiber, network adapters.

2. Data Link Layer (Layer 2):

- Responsible for node-to-node data transfer and error detection / correction.
- Example : MAC addresses, Ethernet, PPP (Point-to-Point Protocol).

3. Network Layer (Layer 3):

- Responsible for routing and forwarding data packets between devices across different networks.

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Example IP (Internet Protocol), routers.

4. Transport Layer (Layer 4):

- Ensures reliable data transfer between end systems and handles error detection and correction.
- Example: TCP, UDP (User Datagram Protocol).

5. Session Layer (Layer 5):

- Manages sessions between applications, i.e. establishing, maintaining, and terminating connections.
- Example: NETBIOS, RPC (Remote Procedure call).

6. Presentation Layer (Layer 6):

- Responsible for data translation, encryption and compression.
- Example: SSL/TLS, JPEG, ASCII.

7. Application Layer (Layer 7)

- The top layer that interacts directly with the end-user.
- Example: HTTP, FTP, SMTP, DNS.

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TCP/IP model (4 Layers)

The TCP/IP model, which is often used in modern networking, has 4 layers and is more practical for real-world implementations, especially for the internet.

1. Link Layer (or Network Interface Layer):
 - Corresponds to the OSI's Physical and Data link layers.
 - Example: Ethernet, Wi-Fi, ARP.
2. Internet layer:
 - Corresponds to the OSI's Network layer.
 - The key Protocol here is IP (Internet Protocol).
 - Example: IP, ICMP (Internet Control Message Protocol).
3. Transport Layer:
 - Corresponds to the OSI's Transport layer.
 - Example: TCP, UDP
4. Application Layer:
 - corresponds to the OSI's Session, Presentation, and Application layers.
 - Example: HTTP, FTP, DNS, SMTP, PDP3.

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Common Networking Commands for Windows:

1. ipconfig:

- Displays the current IP configuration of the computer, including IP address, Subnet mask, and default gateway.
- Common Usage : ipconfig or ipconfig /all
- Example : bash
copy
ipconfig

2. Ping:

- Sends ICMP Echo Requests packets to a target IP address or domain to test connectivity.
- Example : bash
copy
Ping google.com

3. traceroute:

- Traces the route that data packets take to a destination, showing each hop along the way.
- Example : bash
copy
traceroute ~~netbook~~.google.com

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4. nslookup:

- Queries DNS Servers to obtain domain name or IP address information.

- Example : bash
copy
nslookup google.com

5. netstat :

- Displays active connections and listening ports on the system, along with network statistics.

- Example : bash
copy
netstat -an

6. netsh:

- A command-line tool for network configuration and management in windows.

- Example : bash
copy

netsh interface ip set address "Ethernet" static 192.168.1.10
255.255.255.0 192.168.1.1

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7. route :

- Displays or modifies the routing table in windows.

- Example : bash
copy
routeprint

8. arp :

- Displays or modifies the ARP (Address Resolution Protocol) cache, mapping IP addresses to physical MAC addresses.

- Example : bash
copy
arp -a

9. ipconfig /flushdns :

- Clears the DNS resolver cache, useful for troubleshooting DNS issues.

- Example : bash
copy
ipconfig /flushdns

10. net use :

- connects or disconnects network drives or resources.

- Example : bash
copy
net use z: \\serverName \shareName

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General Troubleshooting and Network Diagnostic Network

1. Ping:

- Used in both windows and Linux/macOS to check if a network device or host is reachable.

2. traceroute (Linux/macOS) / tracert (Windows)

- Traces the route of packets to identify where delays or issues might be happening in the network.

3. netstat:

- Displays active network connections, listening ports, and other network statistics.

4. nslookup/dig:

- These are useful for checking DNS-related issues and getting information about domain names and IP addresses.

5. ipconfig/ifconfig:

- Displays IP Configuration details for troubleshooting network connectivity problems.

6. route:

- Useful for checking and modifying the network routing table, which is important when diagnosing routing issues.

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