**DAY 1 Topic: Computer Architecture-Hardware, Network and Software**

**Assignment – 01**

**Task 1: Write network topologies with example**

**Network Topology:**

In computer networks, network topology is defined as a physical or logical arrangement of devices and connections in a network. In other ways, it defines how devices are connected and the flow of data through the network.

* Network topology describes the arrangement of networks and the relative location of traffic flows.
* Network topology plays a major role in how a network functions. The topology has a direct effect on network functionality. Choosing the right topology can help increase performance, maintaining network topology increases energy efficiency and data transfer rates.
* A well-defined network topology makes it easier for network admins to locate faults, troubleshoot issues, and allocate network resources.

**Components of Network Topology**

**Node:**

The point of connection in a network and the link that connects them.

**Links:**

Links are the transmission media that are used to send information between the nodes in your network.

* Network topologies are categorized into two types namely physical network topology and logical network topology.

**Physical Network Topology:**

The physical network topology of a network is the physical layout of nodes and connections, where connections include the lines in the diagram that connect nodes, fiber optics, microwaves, etc.

**Logical Network Topology:**

Logical topology defines how network devices appear to be connected and how data flows through the network. It also illustrates how data should be transferred and the number of links and nodes data travels through before it reaches its destination.

There are several types of topologies, including bus, ring, star, tree, and hybrid topologies.

**1.Bus Topology:**

In a bus network , each node is connected to a single cable, like bus stops branching off from a bus route. The data transmission all flows through that one central connection.

**Advantages:**

* It is easy to install and requires less cable than other types of network topologies.
* Bus topology can be used to connect many devices, making it ideal for small to medium-sized networks.

**Disadvantages:**

* It is vulnerable to cable failures. If the bus cable is damaged or severed, the entire network will be affected.
* Bus topology is not well suited for use in large networks, as the signal quality degrades over longer distances.

**Example:**

An example of bus topology is connecting two floors through a single line. Ethernet networks also use a bus topology. In bus topology, One computer in the network works as a server and the other computer behaves as a client.

1. **Star Topology:**

In star network topology, a central device connects to all other nodes through a central hub. Switched local area networks based on Ethernet switches and most wired home and office networks have a physical star topology.

**Advantages:**

* Easy management from one central point.
* Better performance because each device has its connection.
* If one device fails, it doesn’t affect the whole device and is easier to secure because of its centralized control.

**Disadvantages:**

* If the central device fails, the whole network goes down.
* Its more expensive to set up.
* High traffic can slow down the network because all data goes through the central device.

**Example:**

**Retail Store:**

1. Central Device: A point-of-sale system server
2. Nodes: Cash Register, bar code scanners, credit card readers.
3. Connections: Each device is wired to the POS server.

**3. Mesh Topology:**

A mesh topology is a network configuration where each node is interconnected with every other node. This creates a network with multiple pathways for data to travel, providing high redundancy and reliability.

**Advantages:**

* Multiple paths between bodes ensure that if one link fails, data can still be transmitted through other paths.
* High fault tolerance due to redundant connections.

**Disadvantages:**

* More connections require more cabling and can make the network setup complex.
* Higher cost due to extensive cabling and increased number of network interfaces.

Example:

Imagine a small company network setup with five devices:

Devices:Five computers named A1,A2,A3,A4,A5

Connections: Each computer is connected to every other computer which means:

Computer A1 is connected to A2,A3,A4, and A5.

Computer A2 is connected to A1,A3,A4, and A5.

Computer A3 is connected to A2,A1,A4, and A5.

Computer A4 is connected to A2,A3,A1, and A5.

Computer A5 is connected to A1,A2,A4, and A3.

1. **Tree Topology:**

Tree topology, also known as hierarchical topology, is a network configuration where nodes are arranged in a tree-like structure.

**Advantages:**

* It allows for easy expansion by adding additional nodes without disturbing the network.
* Problems in one branch do not necessarily affect other branches.

**Disadvantages:**

* The entire network's functionality can be compromised if the root node fails.
* Installation and configuration can be more complex compared to simpler topologies like star or bus.
* More cabling and equipment are required as the network grows.

**Example:**

Used in large organizations and institutions to manage complex networking requirements.

**5. Ring Topology:**

Ring topology is a network configuration where each node is connected to exactly two other nodes, forming a circular data path. In this data travels in one direction or both directions around the ring until it reaches its destination.

Advantages:

* Each node has equal access to resources, preventing data collisions.
* Adding or removing nodes can be relatively straightforward.

Disadvantages:

* Failure of a single node or connection can disrupt the entire network.
* Data must travel through multiple nodes, which can introduce delays.

**Example:**

Used in LANS and metropolitan area networks where a predictable, organized data flow is essential.

**5. Hybrid Topology:**

Hybrid topology is a network configuration that combines two or more different types of topologies, such as star, bus, ring, or tree, to leverage the advantages and mitigate the disadvantages of each.

**Advantages:**

* Offers greater flexibility in designing a network tailored to specific requirements.
* Easier to expand and modify as it can integrate various topologies as needed.

**Disadvantages:**

* More complex to design, install, and manage compared to a single topology
* Potentially higher costs due to the need for diverse networking equipment and expertise.

**Example:**

Ideal for large-scale, complex such as corporate environments, data centers, and large educational institutions.

**Task 2: Draw your Home network topology and explain how you are accessing the RPS lab environment**

ISP

Smartphone

Tablets,

smart TV

laptops

desktop

Wifi devices

Router

Modem

**ISP:**

Internet service provider provides internet service access to home.

**Modem:**

Connects to the ISP and translates the internet signal for use by network.

**Router:**

Connects to the modem and manages traffic between devices on network.

**Accessing the RPS lab environment**

1. I ensure that the RPS lab has remote desktop access enabled and configured to accept connections.
2. Next open the remote desktop on my laptop.
3. Now enter the IP address of the RPS lab server in the remote desktop.
4. Login using the credentials provided by the lab administrator.
5. Once connected, I can interact with the lab server interface and it is important to make sure network configuration allows outgoing connections on the port used by the desktop protocol.

**Task 3: Application for both parallel computing and networked systems, explain how these used**

Autonomous vehicles is one of the best real-world applications of both parallel computing and networked systems.

**Parallel Computing:**

Autonomous Vehicles use parallel computing primarily through onboard CPU’s and GPU’S that process large volumes of data from various sensors simultaneously. This data is crucial for real-time decision-making, such as object detection, traffic prediction, and route planning. The parallel processing capability allows the vehicle's computer system to execute complex algorithms and neural networks quickly, which are essential for safe navigation and driving decisions.

**Networked Systems:**

Autonomous Vehicles are also part of broader networked systems where they communicate with other vehicles and infrastructure to enhance driving decisions and safety. This includes sharing information about road conditions, traffic, and potential hazards with nearby vehicles and traffic management systems. This network connectivity is critical for optimizing route efficiency and improving overall traffic flow.