

Exercise Sheet1 - Task1 – Group9

(Web Technologies Practicals)

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1.1. Please compare the topologies star, bus, and meshed. What are the main advantages and drawbacks of those options?

Answer:

1. Star Topology

- **Description:** All devices (nodes) are connected to a central hub or switch.
- **Advantages:**
 - Easy to install and manage.
 - Failure of one node does not affect the rest of the network.
 - Easy to detect faults and isolate them.
- **Drawbacks:**
 - The central hub/switch is a single point of failure.
 - Requires more cable than a bus topology.

2. Bus Topology

- **Description:** All devices share a single communication line (backbone).
- **Advantages:**
 - Easy and cheap to implement for small networks.
 - Requires less cabling than a star.
- **Drawbacks:**
 - If the main cable fails, the entire network goes down.
 - Performance degrades as more devices are added due to collisions.
 - Troubleshooting can be harder compared to star.

3. Mesh Topology

- **Description:** Every device is connected to every other device.
- **Advantages:**
 - High redundancy: network can still function if one link fails.
 - Excellent fault tolerance and reliability.
- **Drawbacks:**
 - Very expensive and complex due to the number of connections required.
 - Difficult to install and maintain for large networks.

1.2. Differences between Circuit-Switching and Packet-Switching

The main differences between circuit-switching and packet-switching networks lie in how they establish connections, allocate bandwidth, and transmit data.

Aspect	Circuit Switching	Packet Switching
Connection Type	Uses a fixed, dedicated path between sender and receiver.	No fixed path; packets take different routes.
Bandwidth	Reserved for the whole call, even when idle.	Shared and used only when sending data.
Data Transmission	Sent as one continuous and ordered stream.	Split into packets, sent separately, then reassembled.
Efficiency	Less efficient (unused bandwidth wasted).	More efficient (network shared by many users).
Use Case	Best for real-time calls or voice communication.	Best for emails, web browsing, and file transfer.
Example	Traditional landline telephone network (PSTN).	The Internet, VoIP, mobile data networks.

1.3. Scenario: Two companies exchanging messages with compliance checks.

Layer	Description	Protocol Example
Layer 4 – Application Layer (Bosses)	<ul style="list-style-type: none"> The bosses create and read the messages. They represent the <i>application users</i> communicating directly. 	HTTP or SMTP (used for web or email communication)
Layer 3 – Compliance Layer (Lawyers)	<ul style="list-style-type: none"> The lawyers check each message to ensure it follows the company's and legal rules before it is sent or read. This acts like a <i>security or presentation layer</i>, ensuring safe and rule-compliant communication. 	TLS/SSL (for secure and compliant data transfer).
Layer 2 - Transport Layer (Administrative Employees)	<ul style="list-style-type: none"> The administrative staff organize, send, and receive the messages properly. They make sure the entire message arrives correctly and in order. 	TCP (to ensure reliable delivery and correct order of messages.)
Layer 1 - Network / Physical Layer (Postal Carrier or Internet Network)	<ul style="list-style-type: none"> The postal carrier physically delivers the message to the other company. This represents the <i>actual data transmission</i> through cables, routers, or the postal system. 	IP or Ethernet.

Message Flow:

Boss → Lawyer (compliance check) → Administrative employee → Postal carrier/network → Other company's administration → Lawyer → Boss