Exercise Sheet1 - Task1 – Group9

(Web Technologies Pracicals)

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.

Extra Insight:
   - In real-world large networks, hybrid topologies (star + mesh) are often used to balance reliability and cost.

1.2. Differences between Circuit-Switching and Packet-Switching

Circuit-Switching:

- A dedicated path is established for the entire communication.
- **Example:** Traditional phone call (PSTN).
- Guarantees consistent connection and bandwidth.
- Inefficient if idle and fails if the line breaks.

Packet-Switching:

- Data is split into packets that travel independently.
- **Example:** Sending an email or browsing a website.
- Efficient use of network resources and scalable.
- Packets can be rerouted if a link fails; may arrive out of order.

Key Idea: Circuit-switching = fixed path, reliable but less flexible; packet-switching = shared path, efficient and robust.

1.3.

Scenario: Two companies exchanging messages with compliance checks.

Layer 4 – Application Layer (Bosses communicating)

- Boss sends or reads messages.
- Protocol: HTTP / SMTP

Layer 3 – Compliance Layer (Lawyer checks)

- Checks that messages follow rules before sending or receiving.
- Protocol: TLS / internal compliance system

Layer 2 – Transport Layer (Administrative employees)

- Admins manage sending and receiving messages reliably.
- Protocol: TCP

Layer 1 – Network / Physical Layer (Postal carrier or network)

- Message is physically or digitally delivered to the other company.
- Protocol: IP / Ethernet / postal service

Flow of communication:

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

Key Idea:

- Each layer represents a step in the communication process.
- Compliance checks act like a security/filter layer before messages move up or down the layers.