Hubs and Switches

Point-to-Point Networking

- **Definition:** Direct connection between two devices, with only one device at each end of the link.
- **Limitation:** Not practical in a world with billions of devices since it allows only two devices to communicate.

Hub (Physical Layer Device - Layer 1)

- **Function:** Connects multiple devices in a network so they can communicate.
- **How It Works:**
  - Sends data to **all devices** connected to the hub, regardless of the intended recipient.
  - Each device must determine if the incoming data is meant for it. If not, it ignores it.
- **Problem:**
  - Creates a **collision domain**, meaning only one device can send data at a time.
  - If multiple devices send data simultaneously, collisions occur, requiring systems to wait and resend their data.
  - This slows down the network significantly.
- **Status:** Hubs are now mostly **obsolete** and rarely used.

Switch (Datalink Layer Device - Layer 2)

- **Function:** Like a hub, it connects multiple devices, but it is much more efficient.
- **How It Works:**
  - **Inspects Ethernet protocol data** to determine the destination device.
  - Sends data **only** to the intended recipient instead of broadcasting it to all devices.
- **Advantages Over Hubs:**
  - Eliminates or reduces collision domains.
  - Fewer retransmissions, resulting in higher throughput and faster communication.
- **Current Use:** Switches are widely used in modern networks due to their efficiency and reliability.

Key Terms:

1. **Collision Domain:** A network segment where only one device can communicate at a time.
   - Hubs create large collision domains.
   - Switches reduce or eliminate collision domains.
2. **Layer 1 (Physical Layer):** Deals with physical connections and electrical signals (e.g., hubs).
3. **Layer 2 (Data Link Layer):** Handles data transmission between devices using protocols like Ethernet (e.g., switches).

Conclusion:

Hubs, once common, are now historical artifacts due to inefficiency. Switches, being smarter and more efficient devices, are the standard choice for connecting multiple devices in a network. They enhance network performance by eliminating collision domains and ensuring smoother communication.