

Network Hubs - Complete Study Notes

1. Introduction to Hubs

A **Hub** is a networking device that operates at the Physical Layer (Layer 1) of the OSI model. It is essentially a multiport repeater that connects multiple devices in a star topology network configuration.

2. Key Characteristics of Hubs

Physical Layer Operation

- Hubs work exclusively on the **Physical Layer** of the OSI model
- They are **purely hardware devices** - no software components
- Function as dedicated hardware with basic electrical signal processing

Multiport Capability

- Unlike repeaters (which are 2-port devices), hubs are **multiport devices**
- Available in various configurations: 4-port, 8-port, 16-port, 24-port hubs
- Enable multiple devices to connect in a **star topology**

3. Hub vs Repeater Comparison

Feature	Repeater	Hub
Ports	2-port device	Multiport device
Layer	Physical Layer	Physical Layer
Functionality	Basic signal amplification	Signal amplification + status indicators
Cost	Lower	Slightly higher
Status Indication	None	LED indicators for power/connectivity

4. Hub Functionalities

Forwarding

- **Yes, hubs perform forwarding**
- When device A sends data to device D, the hub forwards the signal
- All incoming signals are amplified and retransmitted

Filtering

- **No, hubs cannot perform filtering**
- Cannot distinguish between MAC addresses
- Cannot selectively send data to specific ports
- Being pure hardware, they lack the intelligence to make forwarding decisions

Broadcasting Behavior

- All data sent to a hub is **broadcast to all connected devices**
- If A sends data to B, it also reaches C, D, and all other connected devices
- This creates unnecessary network traffic
- Recipients must process and discard irrelevant data

5. Network Issues with Hubs

Collision Domain

- **Single collision domain** for all connected devices
- If multiple devices transmit simultaneously, signals collide within the hub
- **Collision probability increases** with the number of connected devices
- For N devices, maximum possible collisions = N

Traffic Problems

- **High network traffic** due to broadcasting
- Bandwidth is shared among all connected devices
- Network efficiency decreases as more devices are added
- No traffic optimization capabilities

6. Additional Features

Status Indicators

- **LED indicators** for power status
- **Connectivity LEDs** to show active ports
- **Problem detection** through visual indicators
- Basic troubleshooting assistance (unlike simple repeaters)

7. Comparison with Advanced Devices

Hubs vs Switches/Bridges/Routers

- **Hubs:** Pure hardware, Physical Layer only
- **Switches/Bridges/Routers:** Hardware + Software combination
- **Cost:** Hubs are cheaper due to simpler functionality
- **Intelligence:** Advanced devices can make intelligent forwarding decisions

8. Important Exam Points

Key Facts to Remember:

1. Hub = **Multiport Repeater**
2. **Physical Layer** device only
3. **No filtering capability**
4. **Forwarding capability** present
5. **Broadcasting** to all ports
6. **Single collision domain**
7. **Pure hardware** device
8. **Cheaper** than intelligent network devices

Common Exam Questions:

- "Which of the following is true about hubs?"
- "Can hubs perform filtering?" (Answer: No)
- "Can hubs perform forwarding?" (Answer: Yes)
- "At which OSI layer do hubs operate?" (Answer: Physical Layer)
- "What type of device is a hub?" (Answer: Multiport Repeater)

9. Summary

Hubs are simple, cost-effective networking devices suitable for small networks where advanced features like filtering and collision avoidance are not required. While they have limitations in terms of traffic management and collision handling, they serve as an important foundation for understanding more advanced networking concepts and devices.

Note: In modern networking, hubs have been largely replaced by switches due to their superior performance and intelligent packet handling capabilities.