Network Cabling Lab Session

What is a Network Medium?

In networking, a network medium is the physical material or wireless method used to transmit data between devices in a network.

🔌 Types of Network Media

Network media are broadly categorized into two types:

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1. 📦 Wired Media (Guided Media)

Data travels through physical cables.

Type	Description	Speed	Use Cases
Twisted Pair Cable	Pairs of wires twisted together to reduce interference. Comes in UTP and STP varieties.	Up to 10 Gbps (Cat6a)	LAN, Ethernet
Coaxial Cable	Single copper core with shielding.	Up to 10 Mbps – 1 Gbps	Cable TV, legacy networks
Fiber Optic Cable	Uses light to transmit data. Immune to EMI.	1 Gbps – 100+ Gbps	Backbone, long distance, ISPs

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2. 📡 Wireless Media (Unguided Media)

Data travels through air or space via electromagnetic waves.

Type	Description	Frequency	Use Cases
Radio Waves	Used for Wi-Fi and broadcast communication.	2.4 GHz, 5 GHz	WLAN, IoT
Microwaves	Used in point-to-point communication.	GHz range	Satellite, microwave links
Infrared	Short-range wireless; line-of-sight required.	<1 THz	Remote controls, indoor use
Satellite	Long-distance communication via orbiting satellites.	Varies	Remote area internet

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⚙ Comparison Table

Medium	Speed	Distance	Cost	Interference	Security
Twisted Pair	Up to 10 Gbps	100 m	Low	Moderate	Moderate
Coaxial Cable	Up to 1 Gbps	500 m	Medium	Low	Moderate
Fiber Optic	100+ Gbps	10+ km	High	Very Low	High
Wi-Fi	600 Mbps – 10 Gbps	~100 m (indoor)	Low	High	Low – Moderate
Satellite	100 Mbps+	Global	Very High	High (latency)	Moderate

What is IEEE in Networking?

IEEE stands for the Institute of Electrical and Electronics Engineers — a global organization that develops and maintains technical standards, including many that are crucial to computer networking.

In networking, IEEE standards define how devices communicate, connect, and maintain interoperability, especially for LANs (Local Area Networks), WANs, wireless, and data transmission protocols.

🌐 Common IEEE Standards in Networking

Here are some of the most important IEEE standards you should know:

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1. 📡 IEEE 802 Family — Local and Metropolitan Area Networks

This is the most relevant group of networking standards, and includes:

Standard	Description	Use Case
IEEE 802.3	Ethernet (wired LAN)	LANs using twisted pair/fiber optic
IEEE 802.11	Wireless LAN (Wi-Fi)	WLANs in homes, campuses, offices

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2. 🔌 IEEE 802.3 (Ethernet) — Wired LAN

Defines how data is transmitted over twisted-pair and fiber optic cables.

Subtype	Description
802.3u	Fast Ethernet (100 Mbps)
802.3ab	Gigabit Ethernet (1 Gbps over copper)

Subtype	Description
802.3z	Gigabit Ethernet (1 Gbps over fiber)
802.3ae	10 Gigabit Ethernet
802.3bt	Power over Ethernet (PoE++)

3. 📶 IEEE 802.11 (Wi-Fi) — Wireless LAN

Defines the physical and data link layers for Wi-Fi standards.

Standard	Speed	Frequency	Common Use
802.11a	54 Mbps	5 GHz	Obsolete
802.11b	11 Mbps	2.4 GHz	Obsolete
802.11g	54 Mbps	2.4 GHz	Old home networks
802.11n	600 Mbps	2.4 / 5 GHz	Common in offices
802.11ac	1+ Gbps	5 GHz	High-speed Wi-Fi
802.11ax (Wi-Fi 6/6E)	Up to 9.6 Gbps	2.4 / 5 / 6 GHz	Modern networks

4. IEEE 802.1 — LAN Bridging and Network Management

- 802.1D: Spanning Tree Protocol (STP)
- 802.1Q: VLAN tagging
- 802.1X: Port-based Network Access Control (used in enterprise authentication like WPA2-Enterprise)

Summary: Why IEEE Matters in Networking

- Ensures interoperability across different vendors and devices
- Defines standards for Ethernet, Wi-Fi, VLANs, and wireless personal networks
- Supports secure and efficient communication

Hands-on Training for Structured Cabling and Network Setup

1. Learning Objectives

- Understand the types of network cables and their applications.

- Learn how to terminate Ethernet cables (RJ45).

- Perform proper cable testing and troubleshooting.

- Gain hands-on experience with structured cabling setup.

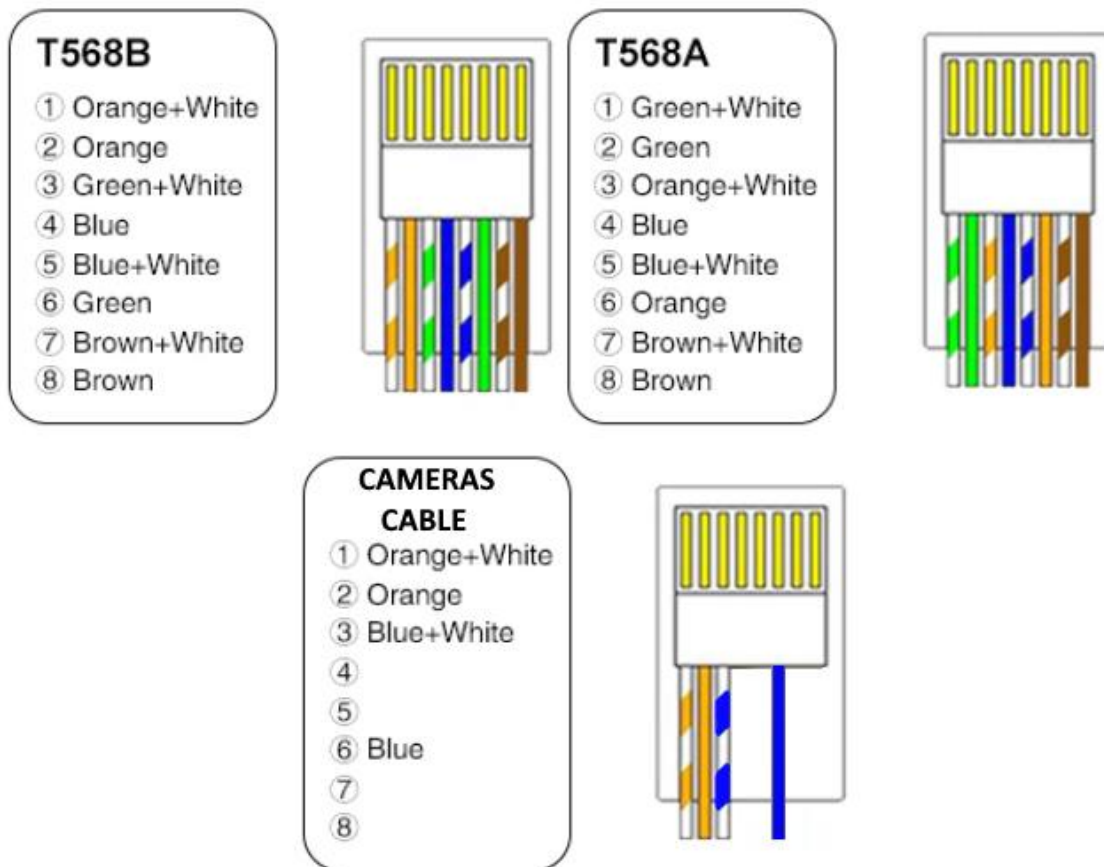2. Introduction to Network Cabling

- What is network cabling?

- Types of network cables:

  - Copper Cables: Cat5e, Cat6, Cat6a, Cat7.

  - Fiber Optic Cables: Single-mode, multi-mode.

- Importance of structured cabling.

3. Tools Required

- Cable crimper.

- RJ45 connectors.

- Cable tester.

- Wire stripper.

- Punch-down tool (for patch panels).

- Keystone jacks and faceplates.

- Patch cords.

4. Ethernet Cable Standards

- TIA/EIA Standards:

  - T568A vs. T568B wiring standards.

  - Explanation of color codes and pin assignments.

- Use cases for straight-through and crossover cables.

T568B
1 Orange+White
2 Orange
3 Green+White
4 Blue
5 Blue+White
6 Green
7 Brown+White
8 Brown

T568A
1 Green+White
2 Green
3 Orange+White
4 Blue
5 Blue+White
6 Orange
7 Brown+White
8 Brown

CAMERAS CABLE
1 Orange+White
2 Orange
3 Blue+White
4
5
6 Blue
7
8

5. Step-by-Step Cabling Process

- Cutting and Stripping the Cable:

  o Properly prepare the twisted pair cable.

- Arranging the Wires:

  o Match the correct sequence for T568A or T568B.

- Crimping the Connector:

  o Secure the wires into the RJ45 connector.

- Testing the Cable:

  o Using a cable tester to verify connections.

6. Hands-On Activity

- Activity 1: Terminate a Cat6 Ethernet cable using T568B standard.

- Activity 2: Test the terminated cable with a network cable tester.

- Activity 3: Set up a simple LAN using patch cords, switches, and patch panels.

7. Troubleshooting Tips

- Common cabling issues:
    - Loose connections.
    - Incorrect wiring sequence.
    - Damaged cables.
- How to resolve these issues:
    - Reseat connectors.
    - Re-crimp cables.

8. Safety Precautions

- Handle tools carefully.
- Avoid over-bending cables.
- Ensure proper insulation of cables.