Common Fiber Technologies

Types of Cables :

1.Fiber Optic Cable :-

A **fiber optic cable** is a special type of network cable that uses **light** to send data **very fast** over **long distances**.

Instead of using **electricity** like copper cables (such as Ethernet), fiber optic cables use **tiny strands of glass or plastic** to carry **light signals**.

💡 **How It Works (Simple Version)**

* Inside the cable are **very thin glass fibers** (thinner than a human hair).

* A laser or LED light sends **flashes of light** through the fiber.

* Each flash of light = a piece of data (like part of a video or message).

* The light bounces inside the fiber until it reaches the other end.

🔁 It's like sending a message with **Morse code**, but using **light instead of sound**.

⚡ **Why Is Fiber So Fast?**

* **Light travels faster than electricity**.

* No interference from other devices (unlike copper).

* Can carry **a lot of data at once**, even over **very long distances** (many kilometers).

✅ **Advantages of Fiber Optic Cables**

Advantage	What it means
🚀 **Super fast speeds**	Great for streaming, gaming, large downloads
📶 **No interference**	Won't slow down near other electronics
📏 **Long-distance support**	Sends data miles away without losing speed
🔒 **Secure**	Harder to tap into than copper cables

❌ **Disadvantages**

Disadvantage	Why it matters
💰 **More expensive**	Costs more than regular cables
🔧 **Harder to install**	Glass fibers are delicate and require care

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🛍️ **Real-Life Examples**

* **Fiber internet** in homes: Fast internet up to 1 Gbps or more
* **Telecom companies**: Connecting cities and countries
* **Hospitals**: Sending large medical images quickly
* **Data centers**: Fast and stable connection between servers

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🧠 Simple Comparison: Fiber vs Copper (Ethernet)

Feature	Fiber Optic	Copper (Ethernet)
Speed	Much faster	Slower
Distance	Very long (km+)	Shorter (100 meters max)
Interference	No	Yes (can be affected)
Cost	Higher	Lower

2. **Coaxial Cable :-**

🔌 **What is a Coaxial Cable?**

A **coaxial cable** (or **coax cable**) is a type of wire used to send **TV signals**, **internet**, and **data**.

It has a special design that helps protect the signal from interference (noise).

🧱 **Structure – What's Inside a Coaxial Cable?**

Think of it like a **layered pipe**:

1. **Inner Copper Wire**

→ Carries the signal (TV, internet, etc.)

2. **Insulating Layer**

→ Keeps the signal from touching the next layer

3. **Metal Shield (Braided Wire or Foil)**

→ Blocks outside interference (like from other electronics)

4. **Outer Plastic Jacket**

→ Protects the whole cable

* Center = signal

* Wrapper = protection

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🧠 **What Is It Used For?**

* 📺 **Cable TV**

* 🌐 **Internet (via cable modem)**

* 📹 **CCTV/security cameras**

* 🏠 Connecting antennas or satellite dishes to TVs

✅ **Advantages of Coaxial Cable**

| Advantage | Meaning |

| ---------- - | ---------- |

| 🛡️ Shielded | Less affected by signal interference |

| 📏 Long distance | Can send signals over long cables |

| 🔌 Easy to use | Simple to install and connect |

❌ **Disadvantages**

| Disadvantage | Meaning |

| ---------- | ---------- |

| 🐢 Slower than fiber | Not as fast as modern fiber optic cables |

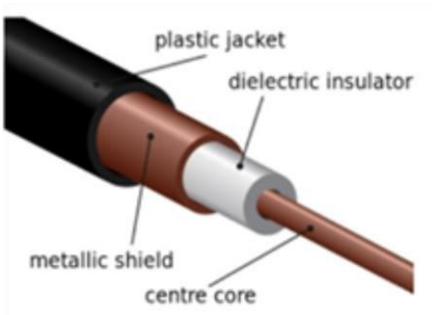
| 🧱 Thicker cable | Less flexible, harder to manage |

| 📉 Limited speed | Can handle less data than fiber or Ethernet |

🎁 **Real-Life Example**

* You plug one end of a coaxial cable into the **wall** and the other into your **TV or modem**.

* It carries the **TV channels** or **internet signal** into your device.



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3. CAT 3

Cat 3 cable (short for Category 3 cable) is a type of twisted pair cable used primarily in telephone wiring and some older networking installations. Here's a quick overview:

>> 🔧 Basic Facts about Cat 3 Cable:

1. **Max Speed: Up to 10 Mbps**
2. **Max Bandwidth: 16 MHz**
3. Wiring: Typically 4 twisted pairs (8 wires)
4. Connector: Usually RJ-45 or RJ-11

Use Case:

1. Traditional telephone systems
2. 10BASE-T Ethernet (older standard)
3. Some early Token Ring networks

🛠️ **Common Applications (Now Mostly Obsolete):**

- 1. Early Ethernet networks (10 Mbps Ethernet)
- 2. Voice (POTS—Plain Old Telephone Service)

- 3. Alarm systems, intercoms, and legacy PBX systems
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4. CAT 4

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- Cat 4 cable (Category 4) is another older standard of twisted pair cable used for networking, though it's now obsolete. Here's a breakdown:
- 🖇️ Cat 4 Cable Overview
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- Feature | Details
- Speed | Up to 16 Mbps
- Bandwidth | 20 MHz
- Wiring | Typically 4 twisted pairs

CommonUses | Early networking (e.g., Token Ring, 10BASE-T, some 100BASE-T4 networks)

Connector | RJ-45

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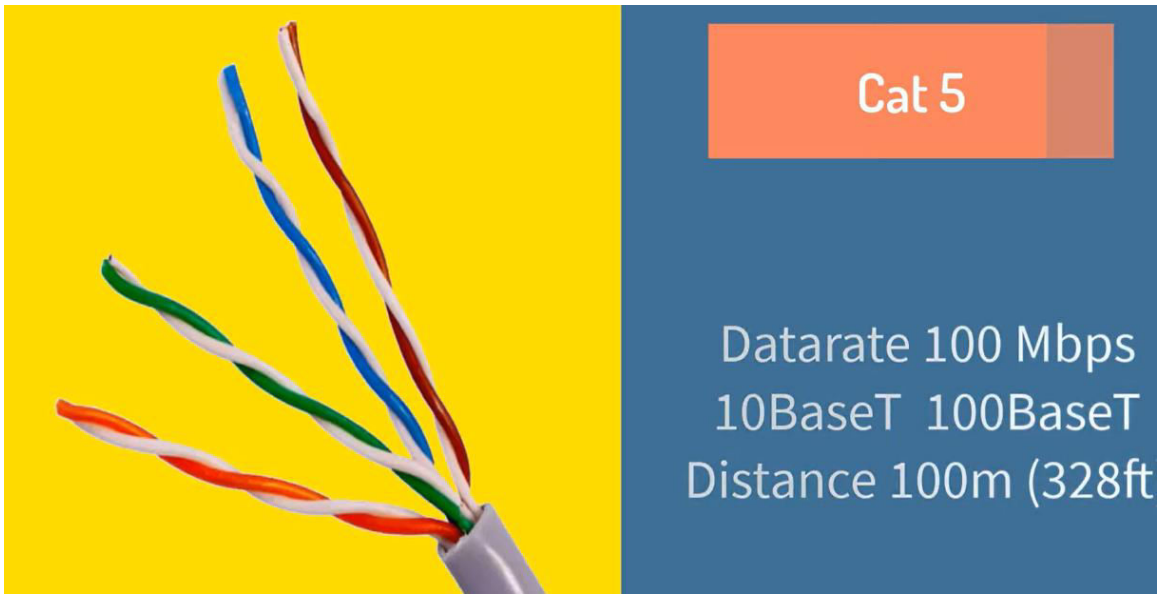
5. CAT 5



🔌 **Category 5 (Cat 5) Cable Overview**

Cat 5 is a type of **twisted pair cable** used widely in the **1990s and early 2000s** for Ethernet and telephone wiring. While largely replaced by **Cat 5e**, it's still important to understand its capabilities.

📊 **Cat 5 Specifications**

Feature	Details
Max Speed	Up to **100 Mbps** (Fast Ethernet)
Bandwidth	**100 MHz**
Max Distance	**100 meters** (328 feet)
Wiring	**4 twisted pairs** (8 wires)

|

| **Connector** | **RJ-45**
|

| **Common Uses** | 10BASE-T, 100BASE-TX (Fast Ethernet), telephone, ISDN |

🛠️ **Use Cases**

* Small office/home networks (historically)

* Voice systems

* Legacy infrastructure

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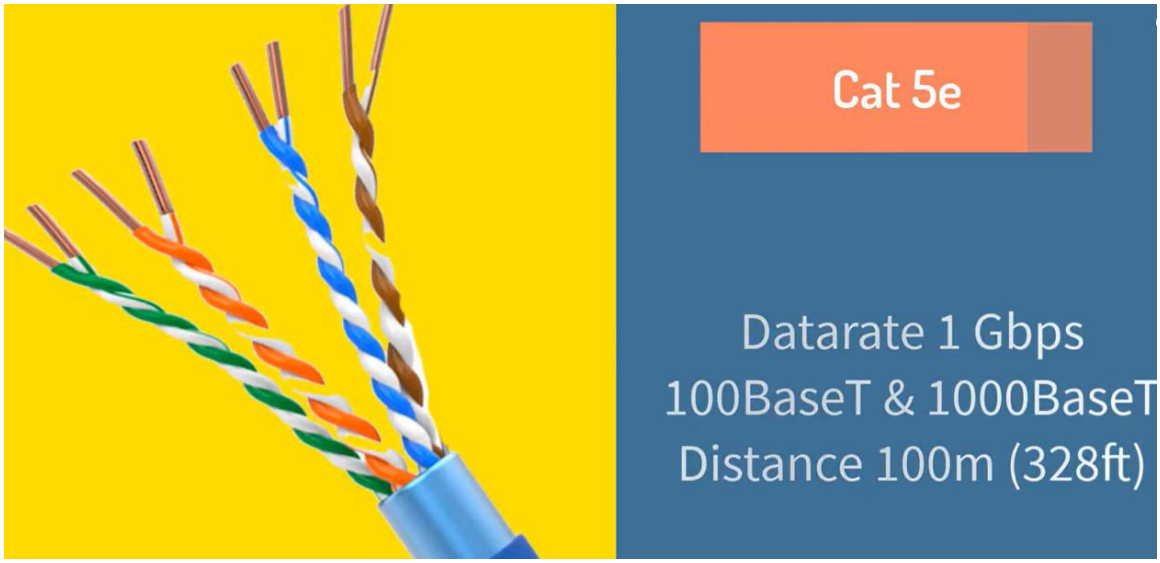
6. CAT 5e



Cat 5e (short for **Category 5 Enhanced**) is an **improved version of Cat 5**, and it remains one of the most commonly used Ethernet cables in homes and small businesses today.

📊 **Cat 5e Specifications**

Feature	Details
Max Speed	Up to **1 Gbps (1000 Mbps)**
Bandwidth	**100 MHz**
Max Distance	**100 meters (328 feet)**
Wiring	**4 twisted pairs** (8 wires)
Connector	**RJ-45**
Use Cases	Gigabit Ethernet, voice, video, home networking

🛠️ **Key Improvements Over Cat 5**

* **Tighter cable specs**: Less crosstalk and interference
* Supports **Gigabit Ethernet (1000BASE-T)**
* Fully backward-compatible with Cat 5 and Cat 3

✅ **Why Use Cat 5e Today?**

* **Reliable for 1 Gbps Ethernet**
* **Cost-effective**
* Widely available
* Easy to terminate and install

⚠ **Limitations**

* Not rated for **10 Gbps** (though may work for short runs)

* **No shielding**, which can lead to interference in electrically noisy environments

* **Being phased out** in favor of **Cat 6 and Cat 6a** for higher speeds and future-proofing

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7. CAT 6

🔌 **Category 6 (Cat 6) Cable Overview**

Cat 6 is a modern standard for Ethernet cables, designed to support **high-speed data transfer** and reduce interference. It's widely used in both residential and commercial networks.

📊 **Cat 6 Specifications**

Feature	Details

| ---------- | ---------- |

| **Max Speed** | **10 Gbps** (up to 55 meters)
|

| **Bandwidth** | **250 MHz**
|

| **Max Distance** | **100 meters (328 feet)** total (10 Gbps up to 55m)
|

| **Wiring** | **4 twisted pairs**, 23 AWG wires
|

| **Connector** | **RJ-45**
|

| **Use Cases** | Gigabit and 10-Gigabit Ethernet, streaming, gaming, PoE, VoIP |

🛠️ **Advantages Over Cat 5e**

* **Less crosstalk and interference** thanks to tighter specs and internal spline separator (in many versions)

* Supports **10 Gbps Ethernet** over short distances

* **Improved shielding** (sometimes, depending on cable type: UTP, STP, or FTP)

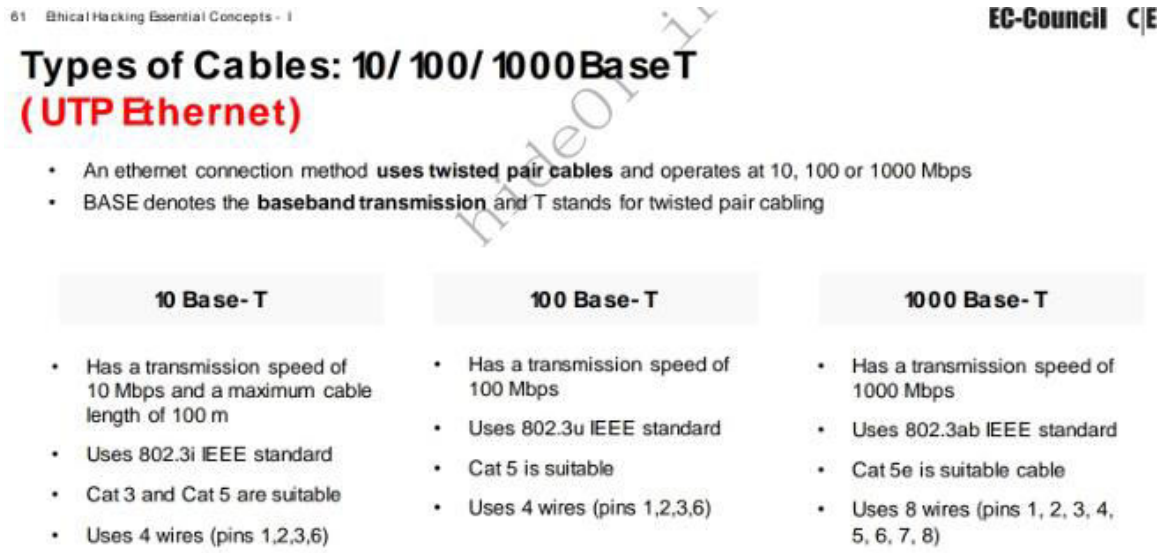
⚠️ **Limitations**

* **10 Gbps performance limited to \~55 meters** (for longer 10G runs, use **Cat 6a**)

* Slightly **thicker and less flexible** than Cat 5e

* **More expensive** than Cat 5e (but typically worth it for speed and future-proofing)

10/ 100 /1000 Base T



🧵 **Types of Ethernet Cables (10/100/1000 Base-T)**

These cables are used to connect computers and devices to a network (like the internet). They use **UTP (Unshielded Twisted Pair)** cables.

🔟 **10 Base-T**

* **Speed**: 10 Mbps (Megabits per second)

* **Max Cable Length**: 100 meters

* **Standard**: Follows **802.3i** rules

* **Cables**: You can use **Cat 3** or **Cat 5**

* **Wires Used**: 4 wires (pins **1, 2, 3, 6**)

💯 **100 Base-T**

* **Speed**: 100 Mbps

* **Max Cable Length**: 100 meters

* **Standard**: Follows **802.3u** rules

* **Cables**: Use **Cat 5**

* **Wires Used**: 4 wires (same pins **1, 2, 3, 6**)

💿 **1000 Base-T (Gigabit Ethernet)**

* **Speed**: 1000 Mbps (1 Gbps)

* **Max Cable Length**: 100 meters

* **Standard**: Follows **802.3ab** rules

* **Cables**: Use **Cat 5e**

* **Wires Used**: All 8 wires (pins **1 to 8**)

📝 Summary:

* As **speed increases**, better quality cables are needed.

* **Cat 3 → Cat 5 → Cat 5e** as you go from 10 Mbps to 1000 Mbps.

* **Gigabit Ethernet (1000 Mbps)** uses **all 8 wires**, while the slower types use only **4 wires**.