CCNA: Introduction to Network

**Module 4 – 4.3: Coper Cabling (Cáp đồng)**

**A. Characteristics of Copper Cabling**

- Copper cabling is the most common type of cabling used in networks today.

- Networks use copper media because it is inexpensive, easy to install, and has low resistance to electrical current. However, copper media is limited by distance and ***signal interference (nhiễu tín hiệu)***.

- Data is transmitted on copper cables as ***electrical pulses (xung điện).***

- the farther the signal travels, the more it ***deteriorates (suy giàm).*** This is referred to as ***signal attenuation (suy giảm tín hiệu).***

=> All copper media must follow strict distance limitations as specified by the guiding standards.

- Electrical signals are vulnerable to interference:

* **EMI (Electromagnetic interference) /RFI (radio frequency interference):** Distortion from radio waves and electromagnetic devices (e.g., lights, motors).
* **Crosstalk:** Interference between signals in adjacent wires.

A diagram of a signal

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- To counter the negative effects of EMI and RFI, some types of copper cables are wrapped in ***metallic shielding (lớp chắn kim loại)*** and require proper grounding connections.

- To counter the negative effects of ***crosstalk (nhiễu xuyên âm),*** some types of copper cables have opposing circuit wire pairs twisted together, which effectively cancels the crosstalk.

- The susceptibility of copper cables to electronic noise can also be limited using these recommendations:

* Selecting the cable type or category most suited to a given networking environment
* Designing a cable infrastructure to avoid known and potential sources of interference in the building structure
* Using cabling techniques that include the proper handling and termination of the cables

**B. Types of Copper Cabling**

Several different types of cables

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**B. Unshielded Twisted-Pair (UTP) Cable**

- UTP is ***common***: Unshielded twisted-pair cable is the **most popular networking cable**.

- RJ-45 connectors: UTP cables use **RJ-45** connectors to connect devices.

- LAN use: UTP connects computers to network devices like **switches and routers** in local area networks (LANs).

- Four twisted pairs: UTP cable contains four pairs of twisted wires inside a protective sheath.

- Twisting reduces interference: The twisting of the wires helps prevent signal interference.

A diagram of a cable

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The numbers in the figure identify some key characteristics of unshielded twisted-pair cable:

1. The outer jacket protects the copper wires from physical damage.
2. Twisted-pairs protect the signal from interference.
3. Color-coded plastic insulation electrically isolates wires from each other and identifies each pair.

**C. Shielded Twisted-Pair (STP) Cable**

- STP offers better protection: Shielded twisted-pair cable (STP) provides better protection against EMI and RFI than UTP.

- More expensive and harder to install: STP is more **costly and complex** to install than UTP.

- Uses RJ-45 connectors: Like UTP, STP also uses RJ-45 connectors (though shielded versions exist).

- Shielding and twisting: STP uses both shielding (foil or braid) and wire twisting to minimize interference.

- Proper grounding is crucial: Shielding needs proper grounding to work effectively; otherwise, it can worsen interference.

- Four shielded pairs: STP typically contains four wire pairs, each individually shielded and then wrapped together.

A close-up of a cable

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The numbers in the figure identify some key features of shielded twisted-pair cable:

1. Outer jacket
2. Braided or foil shield
3. Foil shields
4. Twisted pairs

**D. Coaxial Cable**

- **Coax Structure:** Coaxial cable has two conductors sharing the same axis: a central copper conductor and a surrounding metallic shield (braid or foil), separated by insulation.

- **Shielding:** The shield protects the signal from electromagnetic interference.

- **Connectors:** Coax uses different connectors like BNC, N type, and F type.

- **Modern Use Cases:** While less common for Ethernet, coax is still used for:

* **Wireless:** Connecting antennas to wireless devices.
* **Cable Internet:** Delivering internet service to homes (though fiber is replacing some segments).

A close-up of several types of coaxial connectors

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The numbers in the figure identify some key features of coaxial cable:

1. Outer jacket
2. Braided copper shielding
3. Plastic insulation
4. Copper conductor