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| Department of Software Engineering  Mehran University of Engineering and Technology, Jamshoro |

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| Course: SW321–Computer networks and management | | | |
| Instructor | Aisha Ashraf | **Practical/Lab No.** | 01 |
| Date |  | **CLOs** | CLO-3: P5& CLO-4: P3 |
| Signature |  | **Assessment Score** | 1 Mark |

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| Topic | To work with cable specification, installation and troubleshooting. |
| Objectives | * To learn about STP, UTP cables and their connectors |

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| Lab Discussion: Theoretical concepts and Procedural steps |

**What is Network Cabling?**

Cable is the medium through which information usually moves from one network device to another. There are several types of cable which are commonly used with LANs. In some cases, a network will utilize only one type of cable, other networks will use a variety of cable types. The type of cable chosen for a network is related to the network's topology, protocol, and size. Understanding the characteristics of different types of cable and how they relate to other aspects of a network is necessary for the development of a successful network.

The following sections discuss the types of cables used in networks and other related topics.

* Coaxial Cable
  + Thick coaxial Cable
  + Thin coaxial Cable
* Twisted-Pair Cable
  + Unshielded Twisted Pair (UTP) Cable
  + Shielded Twisted Pair (STP) Cable
* Fiber Optic Cable
* Cable Installation Guides

**Coaxial Cable**

Coaxial cabling has a single copper conductor at its center. A plastic layer provides insulation between the center conductor and a braided metal shield (See fig. 3). The metal shield helps to block any outside interference from fluorescent lights, motors, and other computers.

*http://fcit.usf.edu/network/chap4/pics/coaxial.gif*

*Fig. 3. Coaxial cable*

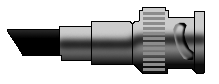
Although coaxial cabling is difficult to install, it is highly resistant to signal interference. In addition, it can support greater cable lengths between network devices than twisted pair cable. The two types of coaxial cabling are ***thick coaxial*** and ***thin coaxial***.

Thin coaxial cable is also referred to as thinnet. 10Base2 refers to the specifications for thin coaxial cable carrying Ethernet signals. The 2 refers to the approximate maximum segment length being 200 meters. In actual fact the maximum segment length is 185 meters. Thin coaxial cable has been popular in school networks, especially linear bus networks.

Thick coaxial cable is also referred to as thicknet. 10Base5 refers to the specifications for thick coaxial cable carrying Ethernet signals. The 5 refers to the maximum segment length being 500 meters. Thick coaxial cable has an extra protective plastic cover that helps keep moisture away from the center conductor. This makes thick coaxial a great choice when running longer lengths in a linear bus network. One disadvantage of thick coaxial is that it does not bend easily and is difficult to install.

**Coaxial Cable Connectors**

The most common type of connector used with coaxial cables is the Bayone-Neill-Concelman (BNC) connector (See fig. 4). Different types of adapters are available for BNC connectors, including a T-connector, barrel connector, and terminator. Connectors on the cable are the weakest points in any network. To help avoid problems with your network, always use the BNC connectors that crimp, rather screw, onto the cable.

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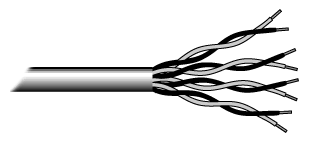
*Fig. 4. BNC connector*

**Twisted-Pair Cable**

In its simplest form, *twisted-pair cable* consists of two insulated strands of copper wire twisted around each other. Twisted pair cabling comes in two varieties: ***shielded and unshielded.***

***Unshielded twisted pair (UTP) Cable***

Unshielded twisted pair (UTP) is the most popular and is generally the best option for school networks (See fig. 1).

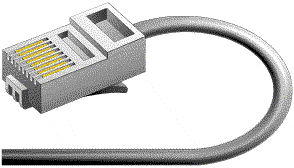
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*Fig.1. Unshielded twisted pair*

The quality of UTP may vary from telephone-grade wire to extremely high-speed cable. The cable has four pairs of wires inside the jacket. Each pair is twisted with a different number of twists per inch to help eliminate interference from adjacent pairs and other electrical devices. The tighter the twisting, the higher the supported transmission rate and the greater the cost per foot. The EIA/TIA (Electronic Industry Association/Telecommunication Industry Association) has established standards of UTP and rated six categories of wire (additional categories are emerging).

**Unshielded Twisted Pair Connector**

The standard connector for unshielded twisted pair cabling is an RJ-45 connector. This is a plastic connector that looks like a large telephone-style connector (See fig. 2). A slot allows the RJ-45 to be inserted only one way. RJ stands for Registered Jack, implying that the connector follows a standard borrowed from the telephone industry. This standard designates which wire goes with each pin inside the connector.

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*Fig. 2. RJ-45 connector*

***Shielded Twisted Pair (STP) Cable***

Although UTP cable is the least expensive cable, it may be susceptible to radio and electrical frequency interference (it should not be too close to electric motors, fluorescent lights, etc.). If you must place cable in environments with lots of potential interference, or if you must place cable in extremely sensitive environments that may be susceptible to the electrical current in the UTP, shielded twisted pair may be the solution. Shielded cables can also help to extend the maximum distance of the cables.

Shielded twisted pair cable is available in three different configurations:

1. Each pair of wires is individually shielded with foil.
2. There is a foil or braid shield inside the jacket covering all wires (as a group).
3. There is a shield around each individual pair, as well as around the entire group of wires (referred to as double shield twisted pair).

**Straight-Through Cable**

Workstation to Hub or Hub "OUT" port to Hub "IN" port

A straight-through cable is a type of twisted pair cable that is used in local area networks to connect a computer to a network hub such as a router.

This type of cable is also sometimes called a **patch cable.**

A straight -through cable maintains the pin connection all the way through the cable. Thus the wire connected to pin1 is the same at both ends of the cable.

|  |  |
| --- | --- |
| Transceiver End | Hub End |
| Pin 1 – W/O | Pin 1 – W/O |
| Pin 2 – O | Pin 2 – O |
| Pin 3 – W/G | Pin 3 – W/G |
| Pin 4 – Bl | Pin 4 – Bl |
| Pin 5 – W/Bl | Pin 5 – W/Bl |
| Pin 6 – G | Pin 6 – G |
| Pin 7 – W/Br | Pin 7 – W/Br |
| Pin 8 – Br | Pin 8 – Br |

Use a straight through cable to connect devices such as PCs or routers to devices like Switches or hubs.

Connection Tips:

Group 1: Router, Host, Server,

Group 2: Hub, Switch.

Use Straight-through cable to connect one device from Group 1 to Group 2.

**Crossover cable**

Workstation to Workstation or Hub "IN" to Hub "IN"

An Ethernet crossover cable is a type of Ethernet cable used to connect computing devices together directly.

A cross -through cable crosses the critical pairs in order to properly align, transmit and receive signals on the device with like connectors.

For a crossover cable, the transceiver end and the hub end are wired like the following:

|  |  |
| --- | --- |
| Transceiver End | Hub End |
| Pin 1 – W/O | Pin 3 - W/G |
| Pin 2 – O | Pin 6 – G |
| Pin 3 – W/G | Pin 1 – W/O |
| Pin 4 – Bl | Pin 4 – Bl |
| Pin 5 – W/Bl | Pin 5 – W/Bl |
| Pin 6 – G | Pin 2 – O |
| Pin 7 – W/Br | Pin 7 – W/Br |
| Pin 8 – Br | Pin 8 – Br |

Use cross-through cable for connecting similar devices like switch-to-switch, switch to hub, hub-to-hub, router-to-router, or PC-to-PC.

**TASK: Building Straight-Through and Crossover UTP Cables**

**EQUIPMENT**

* CAT 6 cable
* Rj-45 Connector
* RJ-45 crimping tool
* Ethernet cabling continuity tester
* Wire cutters /Cable Jacket stripper

**Patch Cable**

* Cut off the outer jacket for 2 inches.

Be careful when cutting the outer jacket, do not score the inner wires.

* Cut wires to 1st knuckle length of pointer finger (~3/4”).
* Separate the wires into four pairs each facing a different direction with all perpendicular to the cable jacket. (A good order is orange, blue, green, brown)
* Separate the individual pairs and begin placing the wires in the proper “pin-out” order one at a time starting with Pin 1. Make sure the wires are very straight.
* Wiggle wires every now and again while placing them in order. This will help to straighten them.
* Once the wires are in order and straight, hold the group of wires VERY tight at the place where the wires meet the jacket. While you hold the wires, make a perpendicular cut at the end of the wires, leaving around 1 “thumb width” of exposed wires. Make sure the cut leaves all the wire the EXACT same length.
* Holding the wires securely at the base, Push wires into the RJ-45 jack with clip facing down and pin 1 on the left.
* Be careful not to allow the wires to wiggle out. Hold the jackets very tight as u push wires in.
* Make sure you have all the wires in place and the cable jacket firmly in place:

1. You should be able to see the shiny copper material of each of the

wires at the connector’s end.

1. The cable jacket should be under the downward facing triangle of the connector.

* Crimp after pushing jacket into place.
* Test with tester.

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| Lab Tasks |
| Submission Date: |

Answer the following questions:

1. What is the difference between cross over cable and straight cable?
2. How many pins does an RJ-45 modular plug have?
3. Which type of connection should a straight-through cable is used for?

* Switch to Switch.
* Switch to Hub.
* Switch to Router.
* Hub to Hub.
* Router to PC

1. What type of cable would be used to make the connection between the console port of a router and a workstation?