Group A- Assignment 1

Title:

Setup a wired LAN using Layer 2 Switch. It includes preparation of cable, testing of cable using line tester, configuration machine using IP addresses, testing using PING utility and demonstrating the PING packets captured traces using Wireshark Packet Analyzer Tool.

Problem Statement:

Setup a wired LAN using Layer 2 Switch. It includes preparation of cable, testing of cable using line tester, configuration machine using IP addresses, testing using PING utility and demonstrating the PING packets captured traces using Wireshark Packet Analyzer Tool.

Objectives:

1. To understand the structure and working of various networks including the interconnectingdevices used in them.

2. To get hands on experience of making and testing cables.

Outcomes:
Develop and demonstrate a wired LAN for four computers.

Tools Required:

Hardware: Computer, LAN Cards, RJ-45 Connectors, Switch, CAT-5 Cable, Cable tester,Crimping tool, etc.
Software: Open source O.S.and wireshark

Theory:

LAN - Local Area Network

A LAN connects network devices over a relatively short distance. A networked office building, school, or home usually contains a single LAN, though sometimes one building willcontain a few small LANs (perhaps one per room), and occasionally a LAN will span a groupof nearby buildings.

MAN-Metropolitan Area Network

A network spanning a physical area larger than a LAN but smaller than a WAN, such as a city. A MAN is typically owned and operated by a single entity such as a government body orlarge corporation.

WAN:

A **wide area network** (**WAN**) is a telecommunications network or computer network that extends over a large geographical distance. Wide area networks are often established with leased telecommunication circuits. Business, education and government entities use wide areanetworks to relay data to staff, students, clients, buyers, and suppliers from various locations

across the world. In essence, this mode of telecommunication allows a business to effectively carry out its daily function regardless of location. The Internet may be considered a WAN

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 relateto 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.

- Unshielded Twisted Pair (UTP) Cable
- Shielded Twisted Pair (STP) Cable
- Coaxial Cable
- Fiber Optic Cable
- Cable Installation Guides
- Wireless LANs
- Unshielded Twisted Pair (UTP) Cable

Twisted pair cabling comes in two varieties: shielded and unshielded. Unshielded twistedpair (UTP) is the most popular and is generally the best option for school networks (See fig. 1).
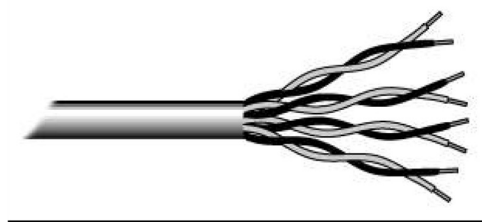

Fig.1. Unshielded twisted pair

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).

Categories of Unshielded Twisted Pair

Category	Speed	Use
1	1 Mbps	Voice Only (Telephone Wire)
2	4 Mbps	Local Talk & Telephone (Rarely used)
3	16 Mbps	10BaseT Ethernet
4	20 Mbps	Token Ring (Rarely used)
5	100Mbps(2 pair)	100BaseT Ethernet
6	10,000 Mbps	Gigabit Ethernet

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 thatthe connector follows a standard borrowed from the telephone industry. This standard designates which wire goes with each pin inside the connector.

Fig.   2.   RJ-45

connectorShielded 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 toextend 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 ofwires (referred to as double shield twisted pair).

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 metalshield helps to block any outside interference from fluorescent lights, motors, and other computers.

Fig. 3. Coaxialcable

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.
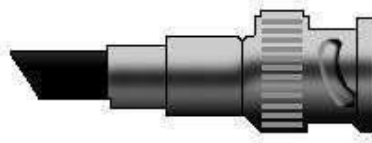

Fig:4 BNC
Connector

Fiber Optic Cable

Fiber optic cabling consists of a center glass core surrounded by several layers of protective materials (See fig. 5). It transmits light rather than electronic signals eliminating the problem of electrical interference. This makes it ideal for certain environments that contain a large amount of electrical interference. It has also made it the standard for connecting networks between buildings, due to its immunity to the effects of moisture and lighting.

Fiber optic cable has the ability to transmit signals over much longer distances than coaxial and twisted pair. It also has the capability to carry information at vastly greater speeds. This capacity broadens communication possibilities to include services such as video conferencingand interactive services. The cost of fiber optic cabling is comparable to copper cabling; however, it is more difficult to install and modify. 10BaseF refers to the specifications for fiber optic cable carrying Ethernet signals.
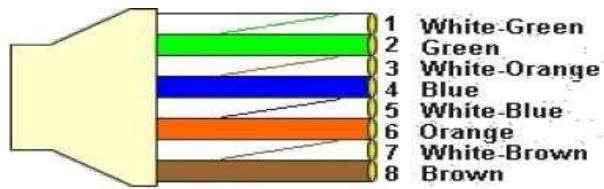
The center core of fiber cables is made from glass or plastic fibers (see fig 5). A plastic coating then cushions the fiber center, and kevlar fibers help to strengthen the cables and prevent breakage. The outer insulating jacket made of teflon or PVC.
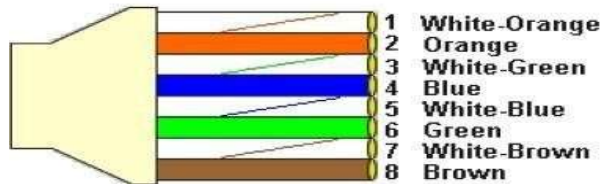

Fig. 5: Fiber optic cable
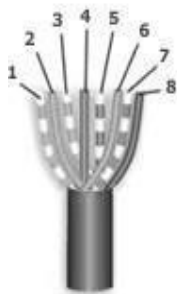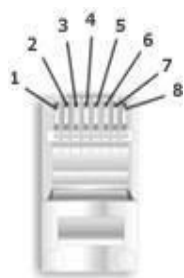
Paring Rules and Color Code:-

Colour Code

568A CABLE END

The CAT 6 Cable consist of 8 wires which comes pares of White/Blue, Blue, White/Orange, Orange, White/Green, Green, White/Brown, Brown and they are coded for **Straight** and **Cross** combinations respectively.

Straight:-

Pair #	Wire	Pin #
1-White/Blue	White/Blue	5
	Blue	4
2-Wht./Orange	White/Orange	1
	Orange	2
3-White/Green	White/Green	3
	Green	6
4-White/Brown	White/Brown	7
	Brown	8

Cross
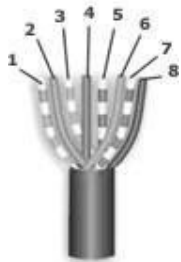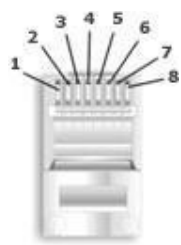
Pair #	Wire	Pin #
1-White/Blue	White/Blue	5
	Blue	4
2-White/Green	White/Green	1
	Green	2
3-White/Orange	White/Orange	3
	Orange	6
4-White/Brown	White/Brown	7
	Brown	8

Connections among devices:-

Node to Node   -Straight   -Cross,
Switch to Node   -Straight   –
Straight,Switch to Switch   -
Straight

How to Crimp a Cat 5 cable with RJ 45 Connector:-

1. Skin off the cable jacket approximately 1" or slightly more.

2. Un-twist each pair, and straighten each wire between the fingers.

3. Place the wires in the order of one of the two diagrams shown above .Bring all of the wires together, until they touch.

4. At this point, recheck the wiring sequence with the diagram.

5. Optional: Make a mark on the wires at 1/2" from the end of the cable jacket.

6. Hold the grouped (and sorted) wires together tightly, between the thumb, and the forefinger.

7. Cut all of the wires at a perfect 90 degree angle from the cable at 1/2" from the end of the cable jacket. This is a very critical step. If the wires are not cut straight, they may not all make contact. We suggest using a pair of scissors for this purpose.

8. Conductors should be at a straight 90 degree angle, and be 1/2" long, prior to insertion into the connector.

9. Insert the wires into the connector (pins facing up).

10. Push moderately hard to assure that all of the wires have reached the end of the connector. Be sure that the cable jacket goes into the back of the connector by about 3/16".

11. Place the connector into a crimp tool, and squeeze hard so that the handle reaches its

fullswing.

12. Repeat the process on the other end. For a straight through cable, use the same wiring.

13. Use a cable tester to test for proper continuity.

PING Command:

A ping (Packet Internet or Inter-Network Groper) is a basic <u>Internet</u> program that allows a user to test and verify if a particular destination <u>IP address</u> exists and can accept requests incomputer network administration.

Ping is a computer network administration software utility used to test the reachability of a host on an Internet Protocol (IP) network. It measures the round-trip time for messages sent from the originating host to a destination computer that are echoed back to the source .Ping operates by sending Internet Control Message Protocol (ICMP/ICMP6) Echo Request packetsto the target host and waiting for an ICMP Echo Reply.

The program reports errors, packet loss, and a statistical summary of the results, typically including the minimum, maximum, the mean round-trip times, and standard deviation of the mean. The command-line options of the ping utility and its output vary between the numerous implementations.

```
PS C:\> ping google.com

Pinging google.com [216.58.195.142] with 32 bytes of data:
Reply from 216.58.195.142: bytes=32 time=61ms TTL=128
Reply from 216.58.195.142: bytes=32 time=61ms TTL=128
Reply from 216.58.195.142: bytes=32 time=56ms TTL=128
Reply from 216.58.195.142: bytes=32 time=63ms TTL=128

Ping statistics for 216.58.195.142:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 56ms, Maximum = 63ms, Average = 60ms
```

Conclusion: Thus, we have studied wired LAN setup and connection.
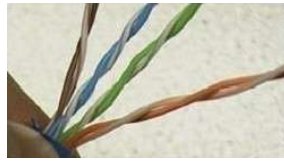
Orange - 1 & 2 Green - 3 & 0
Blue- 4 & 5 Brown- 7 & 8

Frequently Asked Question

1. What is Network?
2. What is Computer Network?
3. What is Communication Media?
4. Explain the STP and UTP
5. What is Ping Command?