Practical No. 1: LAN Setup and Patch Cord Preparation

Name: Shivam Hippalgave
PRN: 202301040046

1. Aim

To prepare a T568B "Straight-Through" Ethernet patch cord, test its connectivity, and use it to help set up a wired Local Area Network (LAN) of four computers using a Layer 2 switch. The LAN's connectivity will be configured with static IP addresses and verified using the ping utility and Wireshark packet analyzer.

2. Requirements

Part A: Cable Preparation (Materials & Tools)

- Bulk UTP (Unshielded Twisted Pair) Cable (e.g., Cat 5e or Cat 6)
- RJ45 Connectors
- RJ45 Crimping Tool
- Cable Stripper (often built into the crimping tool)
- Flush Cutters or Networking Scissors
- Ethernet Cable Tester

Part B: LAN Setup (Hardware & Software)

- Layer 2 Switch (with at least 4 ports)
- Four computers, each with an Ethernet port
- Four working Ethernet patch cords (including the one prepared)
- Wireshark Packet Analyzer (software)

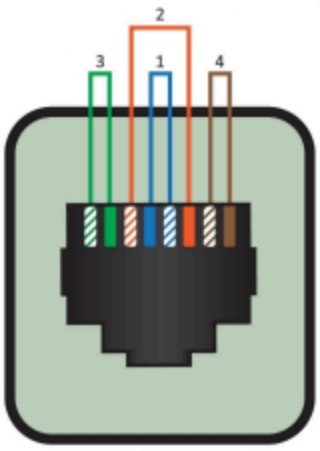
3. Theory

What is an Ethernet (UTP) Cable?
An Ethernet cable, or Unshielded Twisted Pair (UTP) cable, is used to connect devices in a wired LAN. It consists of 8 individual, color-coded wires grouped into 4 twisted pairs.
Why Twisted Pairs?

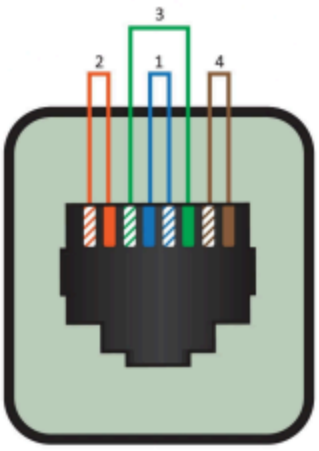
The "twisted" design is crucial for preventing signal interference:

- **Crosstalk:** Twisting prevents the signal from one pair from interfering with an adjacent pair inside the cable.
- **EMI (Electromagnetic Interference):** Twisting helps to cancel out interference from external sources like power cables or fluorescent lights.

Wiring Standards: T568A vs. T568B



T568A



T568B

To ensure cables are made consistently, two standards define the pin order: T568A and T568B. The only difference is the swapping of the green and orange pairs. T568B is the more common standard for new networks.

Pin	T568A Standard	T568B Standard
1	White/Green	White/Orange
2	Green	Orange
3	White/Orange	White/Green
4	Blue	Blue
5	White/Blue	White/Blue
6	Orange	Green
7	White/Brown	White/Brown
8	Brown	Brown

Straight-Through Cable:
A cable that has the same standard (e.g., T568B) on both ends. It is used to connect dissimilar devices, which is what we need for this lab.

- **Use Case:** PC to Switch, Router to Switch.

(Note: A "Crossover" cable uses T568A on one end and T568B on the other, used to connect *similar* devices like PC-to-PC, but modern devices can auto-detect and no longer require this.)

Layer 2 Switch:
A Layer 2 Switch is a network device that connects devices on a LAN. It operates at the Data Link Layer (Layer 2) and uses MAC addresses to intelligently forward data packets only to the intended recipient, unlike an old "hub" which would broadcast to everyone.
IP Addressing:
To communicate on a network, each computer needs a unique IP (Internet Protocol) address. For this LAN, we will use static IP configuration, where we manually assign an IP address to each machine.

- **IP Address:** A unique address (e.g., 192.168.1.10).
- **Subnet Mask:** Defines the "network" part and "host" part of the IP (e.g., 255.255.255.0). All devices on our LAN must have the same subnet mask.

PING Utility:
ping is a command-line tool used to test connectivity. It sends an "ICMP Echo Request" packet to a target IP. If the target is reachable, it sends back an "ICMP Echo Reply" packet.

4. Procedure

Part 1: Creating the Patch Cord (T568B)

1. **Strip the Jacket:** Use the cable stripper to score and remove about 1 inch (2.5 cm) of the outer jacket from the end of the cable. Be careful not to nick the inner wires.
2. **Untwist and Align:** Untwist the 4 pairs. Following the **T568B** standard, arrange the 8 wires in a flat, straight ribbon: White/Orange, Orange, White/Green, Blue, White/Blue, Green, White/Brown, Brown.
3. **Trim the Wires:** Hold the wires flat and in order. Use the flush cutters to make a single, clean cut, leaving about 0.5 inches (1.25 cm) of wire exposed from the jacket.
4. **Insert Wires:** Hold the RJ45 connector with the clip facing down. Carefully insert the wires into the connector until they reach the very end. The outer jacket should be pushed inside the connector, past the strain relief tab.
5. **Crimp:** Visually double-check the wire order. Insert the connector into the RJ45 slot on the crimping tool and squeeze firmly. This pierces the wire insulation and secures the cable.
6. **Repeat:** Repeat steps 1-5 for the other end of the cable, using the same T568B standard.

Part 2: Testing the Cable

1. **Visual Inspection:** Check both ends to ensure the T568B wire order is correct and all wires are fully seated.
2. **Cable Tester:** Plug each end of the cable into the main and remote units of the cable tester. Turn it on. A correctly wired straight-through cable will show the lights blinking in sequence: 1-2-3-4-5-6-7-8. If the lights are out of order or do not light up, the cable is faulty and must be re-terminated.

Part 3: Setting up the LAN

1. **Placement:** Place the Layer 2 Switch in a central location.
2. **Connections:** Connect one end of a patch cord (including the new one you made) to an Ethernet port on each of the four computers.
3. **Connect to Switch:** Connect the other end of each patch cord to one of the ports on the Layer 2 switch.
4. **Power On:** Plug in and power on the switch and all four computers.

Part 4: Configuring Static IP Addresses

On each computer, navigate to the network adapter settings (e.g., "Network & Internet" > "Change adapter options" on Windows). Configure the static IPs as follows:

Device	IP Address	Subnet Mask
PC 1	192.168.1.10	255.255.255.0
PC 2	192.168.1.11	255.255.255.0
PC 3	192.168.1.12	255.255.255.0
PC 4	192.168.1.13	255.255.255.0

5. Testing and Verification

Part 1: PING Utility

1. On **PC 1**, open a Command Prompt (cmd) or Terminal.
2. Type the command to ping **PC 2**:
   ping 192.168.1.11

3. **Successful Result:** You should see replies:
   Reply from 192.168.1.11: bytes=32 time<1ms TTL=128
   Reply from 192.168.1.11: bytes=32 time<1ms TTL=128
   ...

4. Repeat this test from PC 1 to ping PC 3 (192.168.1.12) and PC 4 (192.168.1.13) to confirm full connectivity.

Part 2: Wireshark Packet Capture

1. On **PC 1**, open the Wireshark application.
2. Select your main Ethernet adapter (e.g., "Ethernet") and click the "Start" button (blue shark fin).
3. While Wireshark is capturing, go back to your Command Prompt on PC 1.
4. Run the ping command again:
   ping 192.168.1.11

5. After the ping is complete, stop the Wireshark capture (red square button).
6. In the Wireshark "Apply a display filter" bar, type icmp and press Enter.
7. **Analysis:** You will now see the ping packets. The list will show "Echo (ping) request" packets originating from 192.168.1.10 (PC 1) going to 192.168.1.11 (PC 2). You will also see the corresponding "Echo (ping) reply" packets from 192.168.1.11 back to 192.168.1.10. This visually confirms the network is working.

Thank you !