Lab Work No. 01
Basic Network Configuration

1. Aim

The aim of this lab is to install and configure a local network while considering both hardware and software aspects. Additionally, we will use basic Windows commands to test our network and, finally, provide some examples of resource sharing on the network.

2. Local Network Installation

To set up a LAN, we need to install the necessary hardware and then configure it.

2.1. Hardware

To implement our network, we need:

a) Computers equipped with network cards

For a device, whether a terminal or an intermediary, to connect to a network and communicate with other devices, it must have a network card. The type of network card depends on the type of cables used to connect the network devices—either wired or wireless. Note that there are two major types of networks: wireless networks (e.g., WiFi) and traditional wired networks (e.g., Ethernet). In this lab, we will install and configure a wired Ethernet network, meaning that the computers are equipped with Ethernet network cards.

b) Hub or Switch

This is a device to which cables from different computers in the network are connected. It forwards data from one computer to another. The difference between a hub and a switch is that a hub sends received data to the entire network to reach the intended computer, while a switch sends data only to the intended computer, avoiding unnecessary network traffic.

- **Note:** The hub (or switch) is an intermediary device, while a computer is a terminal device. An intermediary device is useful when connecting more than two terminal devices. If only two computers are involved, they can be directly connected using a cable.

c) Connection cables

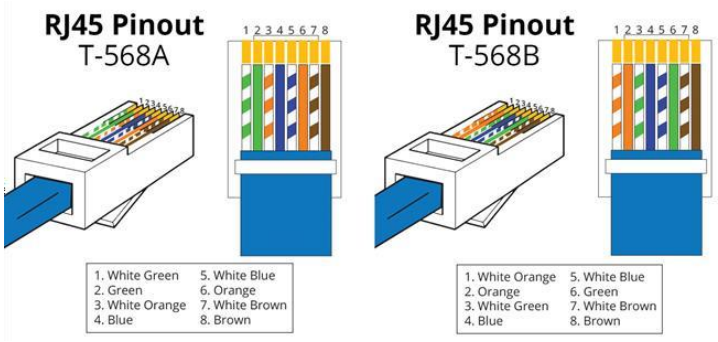
For wiring, we use unshielded twisted-pair copper cables. Twisted-pair cables come in various categories; for example, Category 5e cables provide a bandwidth of 125 MHz.

d) RJ45 Connectors

There are two types of connectors: the older BNC connector and the more commonly used RJ45 connector today.

e) Wiring scheme

A network cable is made by inserting an RJ45 connector at the end of a twisted-pair cable. To ensure the cable functions properly, the arrangement of the twisted-pair wires inside the RJ45 connector must follow a specific scheme. There are two standardized schemes: TIA/EIA 568A and TIA/EIA 568B.



- **Notes:**
  - Identical devices (e.g., computer-to-computer, switch-to-switch) are connected using a cross-wired cable (which swaps transmission and reception pairs).
  - Different types of devices (e.g., computer-to-switch) are connected using a straight through cable, as their transmission and reception positions are already inverted.
  - To determine if a cable is straight-through or crossover, compare both ends. If the internal wire arrangement is identical, it is a straight-through cable; otherwise, it is a crossover cable.
  - Modern Ethernet cards allow two identical devices to be connected using straight-through cables.

f) Crimping tool

The crimping tool is used to create the network cable. Once the wiring scheme is set, the wires are inserted into the connector and pressed with the tool to secure the connection.

2.2. Software Configuration

We will configure an RJ-45 local network on PCs (Personal Computers) running Windows.

To configure the network:

1. Ensure the Network Interface Card (NIC) is properly installed.
2. Configure each terminal's network connection (assign IP addresses).
3. Test connectivity between network devices.

2.2.1. Installing the network card

- Click on the **Start** button and select **Settings** then **Control Panel.**
- Double click on the **System** icon.
- Click on the **Hardware** tab.
- Click on **Device Manager**.
- You will see a list of devices installed in your computer.
- If necessary, click on the + sign next to Network Adapters to expand the list.
- Ensure that there is no yellow exclamation mark (!) next to the Network Adapter. This indicates a possible problem with the card or configuration.
- Double click on your network driver.
- In the Device Status box you should see the message: This Device is working correctly.
- If you do not see this message or if there is no Network Adapter displayed, then your Ethernet card will probably need configuring.

2.2.2. Configuring the Network Connection

Each computer must be assigned a unique address, known as an **IP address**, within the network.
IP address assignment can be done automatically or manually. Automatic IP address management is handled by the DHCP protocol.
To assign an IP address manually:

- Click **Start**, and then click **Control Panel**.
- Click **Network and Internet Connections**.
- Click **Network Connections**.
- Right-click **Local Area Connection** and then click **Properties**.
- Click the **General** tab, click **Internet Protocol (TCP/IP)** in the **connection uses the following items** list, and then click **Properties**.
- In the **Internet Protocol (TCP/IP) Properties** dialog box, click **Use the following IP address** and enter the IP address manually.
- Once the IP address is assigned, click **OK**, then **Close**. The subnet mask is automatically set for all computers.

- **Note:** There is no need for a gateway as there are no other connected networks. Also, leave the DNS servers set to automatic.
- **Verifying Configuration**
  To check network settings, enter the command **ipconfig /all** in the **Command Prompt (cmd)**. This command displays network configuration details, including the IP and MAC addresses.

2.2.3. Testing Network Connectivity

Once IP addresses are configured, we must ensure that computers can communicate.
To test connectivity between PC1 (192.168.1.31) and PC2 (192.168.1.2):

- Open **Command Prompt (cmd)** (on PC1 for example).
- Enter the command:
  ping 192.168.1.2

If the connection is successful, there will be four positive responses. If not, an error message like **"Request timed out"** will appear which could indicate that the PCs are not in the same network.

- **Note:** To ensure optimal operation, verify that all computers belong to the same **workgroup**:
  - Go to **Control Panel** → **System** to view the computer name and workgroup.
  - Click **Change settings**, then **Change** to modify the workgroup name.

3. Resource Sharing on the Network

Networked PCs can share software or hardware resources. **File sharing** is one example.

- **To share a folder:**
  1. Right-click on the folder you want to share and click/tap on **Properties**.
  2. Click/tap on the **Sharing** tab, and click/tap on the **Share** button.
  3. Select a Click/tap on **name** of a user account on your PC or **everyone** you want to share with.
  4. Click/tap on **Add**.
  5. Select (check) the **permission level** you want for this user or everyone. (**Read** or **Read/Write**).
  6. Click/tap on the **Share** button at the bottom
  7. Click/tap on **Done**
  8. Click/tap on **Close**.
- **To view shared files:** open **Windows Explorer**, then click **Network** in the left panel.
- **Notes:**
  - **Network discovery** must be enabled to see other computers.
    - Go to **Network and Sharing Center → Advanced sharing settings**, then enable discovery and file sharing.
  - **Disable password-protected sharing** to allow access without credentials.
    - In **Advanced sharing settings**, select **Turn off password-protected sharing**.

4. Tasks

The lab PCs are connected to a switch via RJ45 cables, and the LAN is linked to the university's network.

1. Verify if your network card is installed and recognized.
2. Find your computer's name and workgroup.
3. Change the workgroup to **Group_x** (where x is your PC number).
4. Can you see other PCs? Justify.
5. Change all PCs' workgroup to **lab1**. Can you see other PCs now?
6. Identify your **IP address, subnet mask, default gateway, and DNS server**.
7. Reconfigure the network as follows:
   Each PC should have an IP in the **192.168.0.x** range, where x is its number:
   PC1 → 192.168.0.1
   PC2 → 192.168.0.2
   ...
   PCn → 192.168.0.n
8. Use **ipconfig /all** to verify changes.
9. What do you notice about the subnet mask? Explain.
10. Test connectivity using **ping**.
11. Create a shared folder named **Labwork1_x** and set it to **read-only**.
12. Verify access to shared folders.
13. Modify sharing settings to allow file modifications.
14. Verify the new permissions.