Lab Work No. 04
Network Configuration using Packet Tracer

1. Aim

The aim of this lab is to learn how to configure a network using the Packet Tracer network simulator. As an introduction to this tool, we will configure a simple LAN (Ethernet) network, study the ARP protocol, and study the collision problem managed by the CSMA/CD protocol.

2. PACKET TRACER

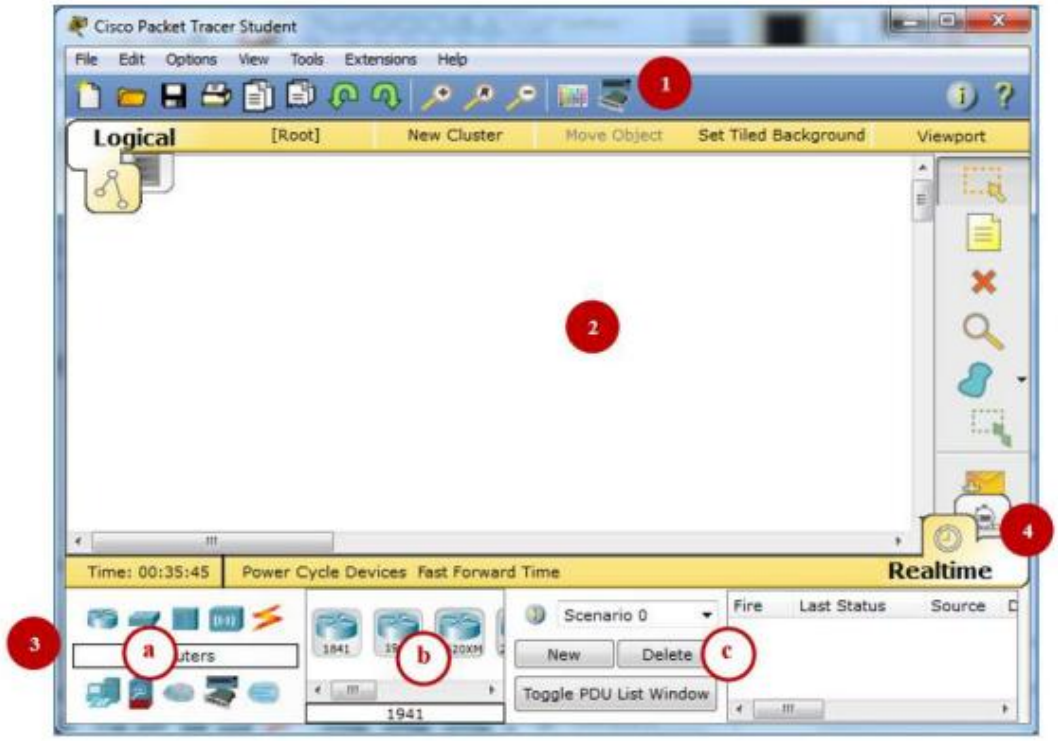
Packet Tracer is a network simulator developed by Cisco Systems. Its goal is to provide a tool for learning network principles and acquiring skills in network technologies solely through simulation, without the need to set up a real network.

2.1. Download and Installation

To download a full version of Packet Tracer, you need to log in to Cisco CCNA Netspace (a paid platform). We will use **Packet Tracer 6.2 Student Edition** provided by the instructor.
For installation, nothing special is required, just double-click the installer and follow the steps.

2.2. Packet Tracer Interface

The main interface is divided into four main zones:



- **Zone 01**: Contains a classic menu bar (File, Edit, etc.) and a main toolbar with basic functions (Open, Save, etc.).
- **Zone 02**: Workspace where the network is graphically defined, along with a right-side toolbar for basic tools (select, delete, etc.).

- **Zone 03**: Has three sub-areas used to:
  (a) Choose the type of hardware (computer, router, etc.).
  (b) Choose hardware depending on the selected type.
  (c) Display data exchange results and buttons for scenario control.
- **Zone 04**: Contains the **Realtime/Simulation** button to switch between real-time and simulation mode. The simulation mode allows capturing packet transfer in the network and examining PDU structures.

2.2.1. Choosing Network Equipment

To build a network architecture, use sub-zones (a) and (b) in Zone 03 to choose the network equipment. Clicking on a device type (router, switch, connections, etc.) in (a) displays a list (usually with Cisco references) in (b).

2.2.2. Viewing Network Operation

To visualize how the network operates, we need sub-area (c) to manage the scenarios, as well as the Realtime/Simulation button.

By clicking this button, we can switch between real-time mode and simulation mode (step-by-step), which allows us to observe the exchange between devices step by step.

2.3. Configuring a LAN with Packet Tracer

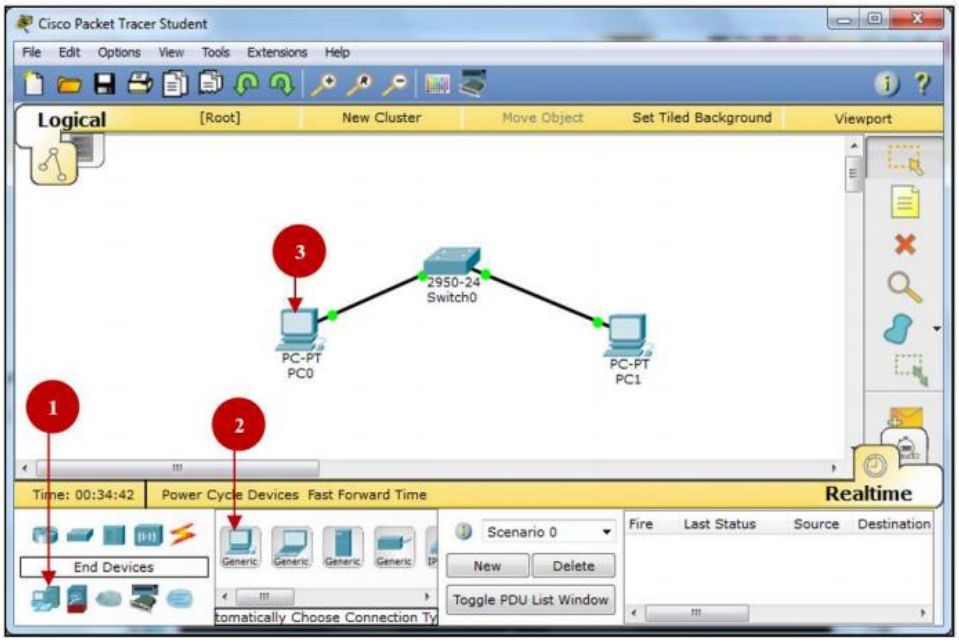
Suppose we want to build a simple local network with three desktop computers connected via a hub.

2.3.1. Adding Computers (Terminals)

In Zone 03:

1. Click the **"End Devices"** icon.
2. In the device list, click **"Generic"**.
3. Click an empty spot in the workspace (Zone 02).

To add three computers, repeat this task three times.



2.3.2. Adding a Hub

In Zone 03:

1. Click **"Hubs"** icon.
2. From the list, choose **"Generic"**.
3. Click an empty spot in the workspace.

2.3.3. Adding Connections

In Zone 03:

1. Click **"Connections"**.
2. Choose **"Auto cable"**.
3. Click on a PC, then the hub.

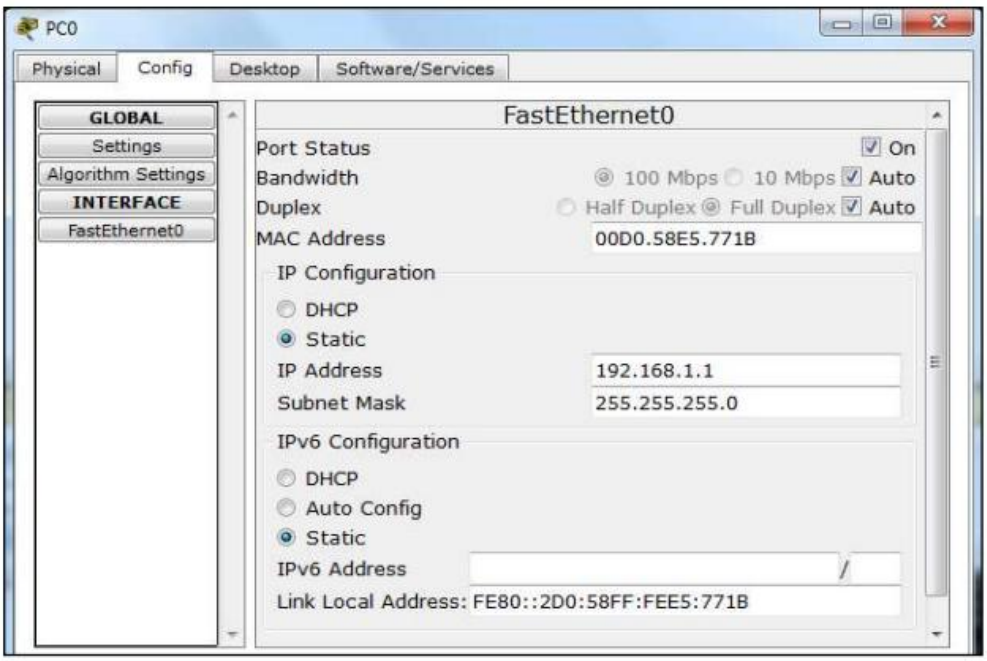
Repeat for other PCs.

2.3.4. Network Configuration

Every network device can be configured by clicking on its icon in the workspace. To configure the IP addresses of the computers, click on the computer, and in the window that appears, click on the **'Config'** tab, then click on the **'FastEthernet0'** button in the menu on the left.

For example, apply the following configuration:

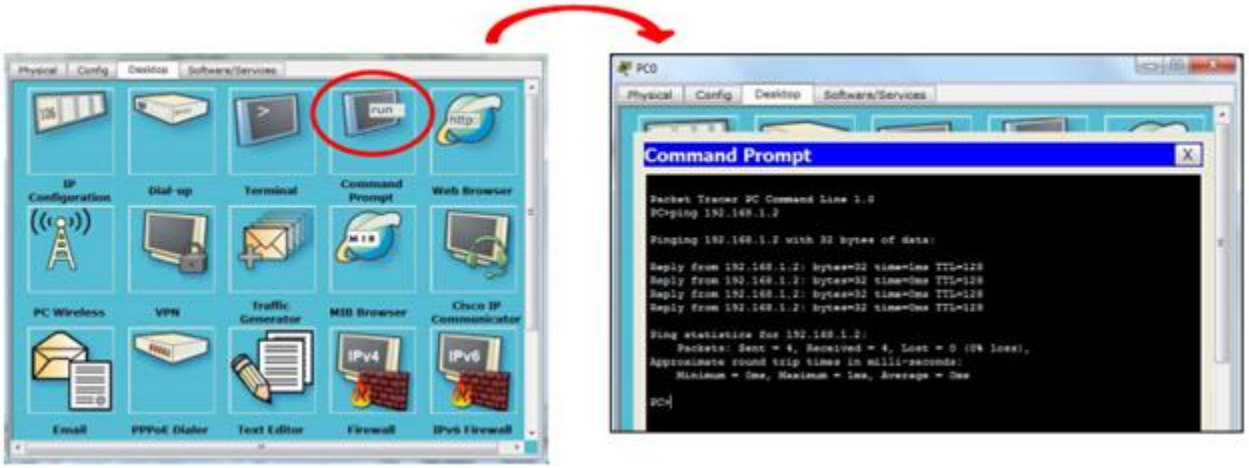
- **PC0**: IP: 192.168.1.1 / Subnet Mask: 255.255.255.0
- **PC1**: IP: 192.168.1.2 / Subnet Mask: 255.255.255.0
- **PC2**: IP: 192.168.1.3 / Subnet Mask: 255.255.255.0



2.3.5. Connection Test

To test connectivity, use the **"Ping"** command, For example:

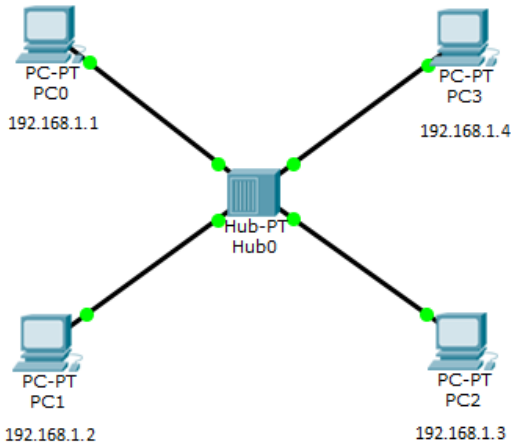
1. Click on **PC0**.
2. Go to the **"Desktop"** tab → **Command Prompt**.
3. Enter: ping 192.168.1.2



3. Assigned Work

3.1. Visualizing the operation of the ARP protocol

Using Packet Tracer, build and configure the network shown in the diagram (4 PCs connected via a hub):

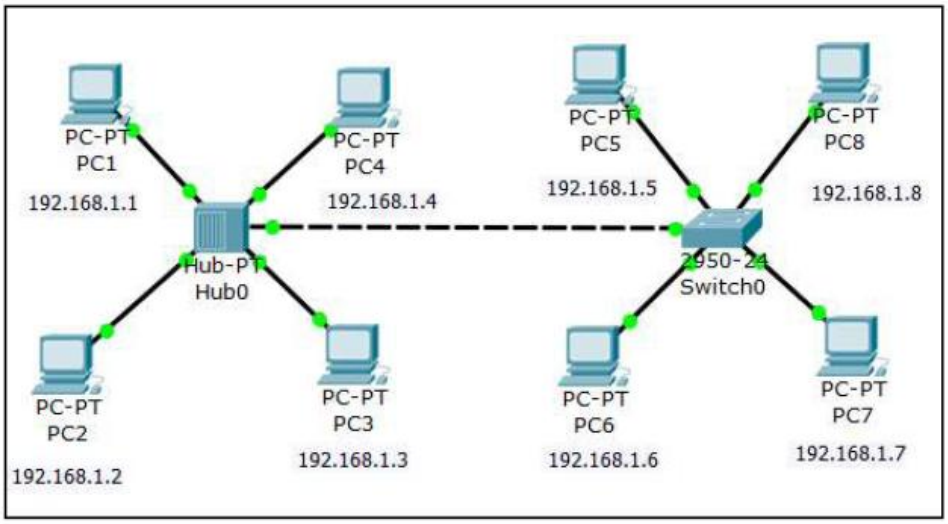


1. Check ARP tables on all PCs using **arp -a**. What do you observe?
2. Switch to **Simulation Mode**.
3. On **PC0**, open **Command Prompt** and run:
   ping 192.168.1.3 -n 2 (don't close the prompt).
   Note: ping @IP -n x sends x packets to the machine with address @IP.
4. In the **Event List** panel, what do you notice? What is the role of each packet?
5. Click **"Capture/Forward"**. What is the first packet sent to the hub? Why?
6. Click the packet received by the hub. In **"Inbound PDU Details"**, what is the ARP packet's destination MAC? Explain.
7. What is the Ethernet frame's destination MAC? Explain.
8. Click **"Capture/Forward"**, run arp -a on all PCs. What do you see?
9. Explain the changes in ARP tables for all PCs.
10. As simulation continues, PC0 sends two **ICMP packets** to PC2. What happens each time a packet is received by the hub (from PC0 to PC2 or vice versa)? Explain.
11. When simulation ends, check **PC0's ARP table**. What do you notice?
12. Configure a new network replacing the **hub** with a **switch**. Wait for cable lights to turn green. Ping from **PC0 to PC2** and use **Capture/Forward**.
    Why is the ARP Request broadcast to all PCs but the ARP Reply is not?
13. What do you observe when an ICMP packet is sent to the switch? Explain.

3.2. Collision Problem and CSMA/CD Protocol

Using the network configured in section 3.1:

1. In the command prompt of PC1, start a ping to PC3 and a ping from PC2 to PC1 (without closing the command windows).
2. Advance the simulation. What do you notice?
3. Click on the message received by the Hub. What information is retained by the Hub about this message?
4. Advance the simulation. Why did all the stations receive this message?
5. Configure the following network:



6. Start a ping from PC1 to PC5.
   - How many broadcast domains are there? Which ones?
   - How many collision domains are there? Which ones?

- **Note:** Do not forget to delete the previous scenario each time you use the network. To do this, simply select the scenario to be deleted in area (c) and click the "delete" button (in the same area).