Computer Network Lab (3) - Cisco Packet Tracer

Overview: This lab will introduce you to network design and configuration using Cisco Packet Tracer. You will explore fundamental networking concepts through hands-on simulation exercises covering four parts:

Part1. Direct Communication Between Two Devices

Part2. Communication Through a Switch

Part3. Real-Time vs Simulation Mode

Part4. IPv4 Subnetting and Network Configuration

What to turn in for this lab:

Each part of the lab has a list of questions and tasks regarding your work. You are required to submit a report in **PDF format** including:

- Your answers to all questions given in each part

- Clearly labeled screenshots of your Packet Tracer configurations

- The Packet Tracer (.pkt) file for Part 4 (**you must submit your own Packet Tracer (.pkt) file. If no Packet Tracer (.pkt) file is submitted, or if the same (.pkt) file is shared with others, you will receive 0 marks for Part 4.**)

- Ping test results

Part 1: Direct Communication Between Two Devices

In this part, you will establish basic peer-to-peer communication between two computers without any intermediate networking devices.

Setup Instructions

Do the following:

1. Open Cisco Packet Tracer and create a new blank project.

2. Add two PCs to the workspace (PC0 and PC1).

3. Connect the two PCs directly using a **crossover cable** (Connections → select the crossover cable icon).

4. Configure the IP addresses manually:

    - PC0: IP address = 192.168.1.10, Subnet mask = 255.255.255.0
    - PC1: IP address = 192.168.1.20, Subnet mask = 255.255.255.0

5. Test connectivity by opening the Command Prompt on PC0 and pinging PC1.

Answer the following questions:

1. What type of cable did you use to connect the two PCs? Why is this specific cable type required for direct PC-to-PC communication?

2. Include a screenshot showing your Packet Tracer workspace with both PCs connected and their IP configurations visible.

3. What was the result of your ping test? Include a screenshot showing the command prompt output from PC0 pinging PC1.

4. Change PC1's IP address to 192.168.2.20 (different network). What happens when you try to ping now? Explain why.

Part 2: Communication Between Multiple Devices Through a Switch

In this part, you will expand your network by adding more devices and using a switch as a central connection point.

Setup Instructions

Do the following:

1. Create a new Packet Tracer project or modify your existing one.

2. Add one switch (2960 model) and four PCs to the workspace.

3. Connect each PC to the switch using **straight-through cables** (Copper Straight-Through).

4. Configure IP addresses for all PCs in the same subnet:

   - PC0: 192.168.10.1/24
   - PC1: 192.168.10.2/24
   - PC2: 192.168.10.3/24
   - PC3: 192.168.10.4/24

5. Perform ping tests between various PCs to verify connectivity.

Answer the following questions:

1. Why do you use straight-through cables when connecting PCs to a switch, unlike the crossover cable used in Part 1?

2. Include a screenshot of your complete network topology showing all four PCs connected to the switch.

3. What would happen if you connect two switches using a straight-through cable versus a crossover cable? (You may test this in Packet Tracer if you wish.)

Part 3: Real-Time vs Simulation Mode

Cisco Packet Tracer offers two modes of operation: Real-Time mode and Simulation mode. In this part, you will explore the differences between these modes and understand when to use each.

Instructions

Using your network from Part 2 (or create a simple network with 2 PCs and 1 switch):

1. Ensure your network is properly configured with all devices able to communicate.

2. **Real-Time Mode:**

   - Make sure you are in Real-Time mode (clock icon in bottom right corner).
   - Send a Simple PDU from PC0 to PC1 by clicking the envelope icon and selecting source and destination.
   - Observe how the packet travels.

3. **Simulation Mode:**

   - Switch to Simulation mode by clicking the stopwatch/simulation icon.
   - Delete any previous PDUs from the scenario.
   - Send a Simple PDU from PC0 to PC1 again.
   - Use the **Capture/Forward** button to step through packet transmission one event at a time.
   - Click on the PDU envelope at different stages to examine the OSI layer information.

Answer the following questions:

1. Describe the key differences between Real-Time mode and Simulation mode in Cisco Packet Tracer. When would you use each mode?

2. Send one ping (ICMP Echo Request) from PC0 to PC1 in Simulation mode. Trace the complete path of this packet as it travels to PC1 and returns with an ICMP Echo Reply. How many events are listed in the Simulation Panel in total? Include a screenshot of the Event List showing all ICMP events.

3. Click on the PDU when it reaches the switch. What OSI layers are involved at the switch? Include a screenshot showing the PDU information at this stage.

4. In the Simulation Panel, what is the difference between the "Inbound PDU Details" and "Outbound PDU Details"? Provide an example from your trace.

5. Filter the simulation to show only ICMP packets. Send a ping and observe the Echo Request and Echo Reply. Include screenshots showing both messages and explain the difference between them.

6. Can Simulation mode be used to troubleshoot network problems? Give two specific examples of issues you could identify using this mode.

Part 4: IPv4 Subnetting and Network Configuration

In this part, you will practice subnetting by dividing a given network into four subnets, configuring devices in each subnet, and demonstrating inter-subnet communication through a router.

Subnetting Task

Given network: **172.16.0.0/22**
   Your task is to divide this network into **four equal-sized subnets**. For each subnet:

   • Calculate the new subnet mask

   • Determine the network address

   • Identify the usable host range

   • Determine the broadcast address

Network Design and Configuration

Do the following:

1. Create a network topology with:

      • 2 Router (2811 model)
      • 4 Switches (one for each subnet)
      • 2 PCs per subnet (8 PCs total)

2. Configure the router interfaces:

      • Connect each switch to a separate router interface (such as `GigabitEthernet0/0`, `GigabitEthernet0/1`, or others as needed). If inter-router communication is required, use the `Serial` interfaces. Set the **first router** as the **DCE** device and configure an appropriate `clock rate` (e.g., 64000) on its serial interface. *Hint: you may need to install the correct serial interface module before connecting the routers. To do this, open the router settings, go to the **Physical** tab, and insert the suitable module before attaching the serial cables.*

- Assign the first usable IP address of each subnet as the default gateway
- Enable each interface with the `no shutdown` command

3. For each subnet:

- Connect 2 PCs to the subnet's switch
- Assign appropriate IP addresses to each PC
- Configure the default gateway to point to the router interface IP
- Configure the subnet mask correctly

4. Test connectivity:

- Ping from each PC to its gateway
- Ping from each PC to all other PCs in the network
- Document all successful ping tests

Answer the following questions:

1. Show your subnetting calculations. For the network 172.16.0.0/22, provide a table with the following information for all four subnets:

Subnet	Network Address	Subnet Mask	Usable Range	Broadcast
1				
2				
3				
4				

2. Include a screenshot of your complete network topology showing all routers, switches, and PCs with proper labeling.

3. Provide the router configuration for all interfaces. Include a screenshot of the router's CLI showing the `show ip interface brief` command output.

4. Document your PC configurations. For each subnet, show the IP configuration of at least one PC (screenshot of Desktop → IP Configuration). Include screenshots showing successful ping tests:

- From a PC in Subnet 1 to the gateway
- From a PC in Subnet 1 to a PC in Subnet 3
- From a PC in Subnet 4 to a PC in Subnet 2

5. Explain the role of the default gateway in inter-subnet communication. What happens if you remove the default gateway from one of the PCs and try to ping a device in a different subnet?

6. Use Simulation mode to trace a packet from a PC in Subnet 1 to a PC in Subnet 4. Describe the path the packet takes and the routing decision made by the router. Include relevant screenshots.

7. What is the maximum number of usable hosts in each of your subnets? Show your calculation.

8. If you needed to create 8 subnets instead of 4 from the original 172.16.0.0/22 network, what would be the new subnet mask? How many usable hosts would each subnet have?

Deliverables for Part 4

In addition to answering the questions above, you must submit:

- Your Packet Tracer file (.pkt) with the complete configured network

- A comprehensive collection of screenshots showing ping connectivity from each PC to every other PC in the network

End of Lab (3)