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LAB1

- Install Cisco Packet Tracer: <https://www.netacad.com/portal/resources/packet-tracer>
- The different parts of this lab session are correlated. Execute the different steps sequentially.
- All the questions marked with **Q** shall be answered and included in the report. Screenshot can be used in some cases.
- Each group (composed of **3 students** at most) shall submit a report **in campus**.
- The report (**only PDF format is accepted**) shall be uploaded on the campus page before the deadline.

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I. Part 1: Simple Router configuration:

Required Equipment:

- Generic router (Router-PT and not Router-PT-Empty)
- 2 Generic PCs
- Console cable (between serial port on PC and console port on router)
- Ethernet cable

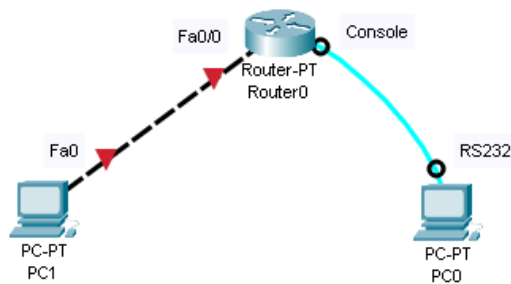


Figure 1 Scenario router configuration

Actions:

- Connect PC0 to Router-PT R1 with a serial cable (console) as shown in Figure 1:
- From PC0 desktop, start a terminal session to the router (equivalent to using Putty for example as shown in Figure 2)
- Skip the line by line wizard for configuring the router (select **NO** and **Ctrl+c**). You can also discover the configuration dialogue.
- You can Type “?” to show available commands in this mode

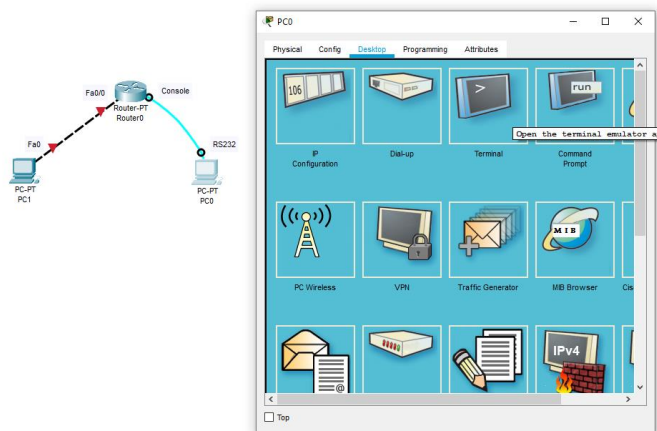


Figure 2 Terminal emulator of Packet Tracer

Q1.1: Is it possible to display the running configuration (using the command show) of the router in the current user EXEC mode?

```
- Router>show
```

- Enter the user privileged EXEC mode (command **enable** or **en**).

```
- Router>enable
```

- You can Type "?" to show available commands in this mode
- Enter the global configuration mode by using the command (**configure terminal** or just **conf t**)
In this mode, you can configure the router (name, IP, description, interfaces, routes)

Q1.2: Change the name of the router. Call it R1 (copy screenshot and the command lines)

- Go back to the privileged EXEC mode (type **exit**).
- Save the configuration to the NV RAM by copying the running configuration (in RAM) into the startup configuration. (Command: **copy running-config startup-config**).

```
- copy running-config startup-config
```

Hint: you can use the tabulation key to get the full word by typing a part of it.

- Display the running configuration.

Q1.3: How many network interfaces are present on R1 and how many are assigned IP addresses?

- Here you can use the following command:

```
- show ip interface brief
```

- brief is an option to reduce the information details about the interfaces
- Exit the opened PC terminal
- Click on the router and select the command line interface **CLI**

In the following, router configuration will be done directly from the CLI

- Enter the configuration of **line console 0**. (Just type it from the config mode).
- Set a password and activate it
- **Reload** the router configuration after saving it.

Q1.4: Comment and provide necessary screenshots in order to define a password for console and then for bash (enable mode). Find the command for password encryption.

- Set a password to the virtual terminals (**vty**) and enable it
- Save the configuration and restart the router (**reload**).

Q1.5: Display the router configuration and copy your screen here after (the passwords of the console and the virtual lines shall be displayed).

- Add a second computer (PC 1) and connect it to the router with an Ethernet cable through the first available Ethernet interface 'FastEthernet 0/0' as shown in Figure 1.
- Configure PC 1 with the following IP address: **192.168.0.2 /28**. Set the default gateway to **192.168.0.1**
- Configure the IP address of the router's interface (**FastEthernet0/0**) from the CLI.

Hints:

To enter into interface configuration; type in **interface interface_name**.

For example:

```
- interface FastEthernet 0/0
```

IP configuration example:

```
- ip address 192.168.0.1 255.255.255.240
```

To start/enable a router interface:

```
- no shutdown
```

- Do not forget to save the running configuration from time to time
- Ping the router from PC1.

Q1.6: Did it work? (Provide a screenshot)

- Now open a telnet session with router from a terminal on PC1.

Q1.7: Comment (which password should you enter to open the session?)

Q1.8: Copy the results here (screen shot)

- Enter the user privileged exec mode.

Q1.9: Do and provide the necessary configurations to make it work, otherwise provide the screenshot

Q1.10: Your virtual network can be saved on the name "Part1.pkt" and then it shall be included in the report folder.

Now you have learned how to configure the router from the CLI in 3 ways:

1. By using a serial connection (console)
2. By using a telnet session via the virtual line interfaces
3. Directly from the router (which actually is equivalent to the first method (from the console))

II. Part 2: Static Routing

This part would be done quickly; you have seen the major steps and questions in the last semester of your ING 3 at ECE Paris. If this part is new for you, ask your professor to give you the required elements.

subnet x

Network y

subnet z

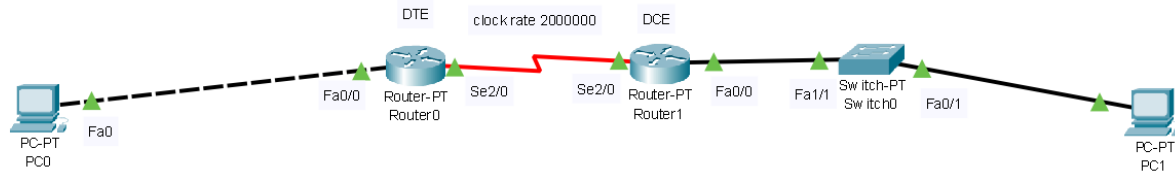


Figure 3 Virtual network scenario with static routing

- Construct the network shown in the following figure with following material:
 - 2 generic routers
 - 2 generic PCs
 - 1 generic switch
 - 3 straight Ethernet cables and 1 cross cable
 - One WAN router-to-router cable (Serial DCE/DTE)
- Assign the following addresses to the PCs and interfaces:

PC0	10.0.0.10
R0 interface Fa0/0	10.0.0.1
R0 interface Se2/0	200.200.200.1
PC1	156.12.0.10
R1 interface Fa0/0	156.12.0.1
R1 interface Se2/0	200.200.200.2

Table 1 IP addresses of hosts and interfaces

Q2.1: What is the maximum number of IP addresses for the two sub networks X and Z if we consider the masks \8 and \26 respectively?

Q2.2: Give the commands line to attribute the ip addresses to the routers. Then use the command line “show ip interface brief” to print the interfaces’ IP addresses (Screenshots are required).

Q2.3: Print the content of the routing table of the routers using “show ip route”

Q2.4: Ping Router 0 (use its IP on network x) from PC 0. Did you get a reply? (Provide a screenshot)

Q2.5: Ping Router 1 (use its IP on network y) from PC 1. Did you get a reply? (Provide a screenshot)

Q2.6: Ping Router 0 (use its IP on network y) from PC 1. Did you get a reply? (Provide a screenshot). If no, explain the reasons.

We recommend the screenshots for the questions Q2.4, Q2.5 and Q2.6.

Q2.7: Configure the routing tables of router 1 and router 2 so that PC 1 can communicate with PC2 and vice versa (explain). Then, print the ip state of the interfaces using the command line:

- show ip interface brief

NB: To add an entry in the routing table use the command:

- ip route <Network address> <subnet mask> <gateway><interface name>

Q2.8: Ping PC2 from PC1. Do you get a reply? Comment

Q2.9 : Extend your virtual network by adding a new switch and straight cable between Router 0 and the PC0 (see Figure 4). Try to ping the PC1 from PC0. If it works or not explain why.

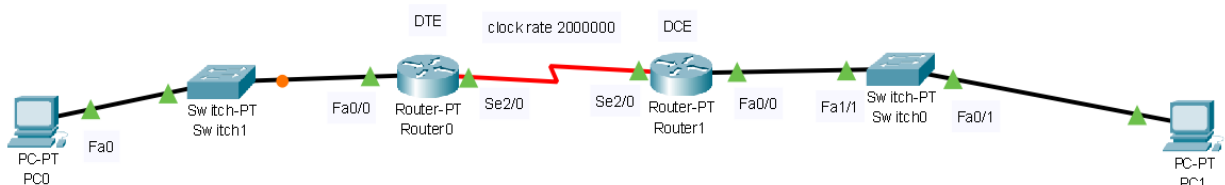


Figure 4 Scenario for a static routing

A new subnet is needed on the network shown in Figure 4. Assign the fifth subnet id to this new network (network t) and connect it to router 1 (to the first available Fast Ethernet interface).

- A switch shall be used inside this network to break collision domains in the purpose of improving performance. Add two PCs on this network (PC2 and PC3).

Q2.10: Configure and provide the IPs of Router 1 as well as PC2 and PC3 on this new network. Update the routing tables wherever necessary so that all the PCs can reach each other through Pings (explain).

III. Part 3 : DHCP server

1. DHCP server configuration on router

The objective here is to distribute dynamically an IP addresses to our devices.

- Create the (virtual) network shown in the Figure 5 following the IP addresses plan
 - The first available network address on each subnet is assigned to the router

- If many routers are connected on a sub-network, the router with lowest id is assigned the first available address
- Each time an address shall be assigned, the first available address is used.

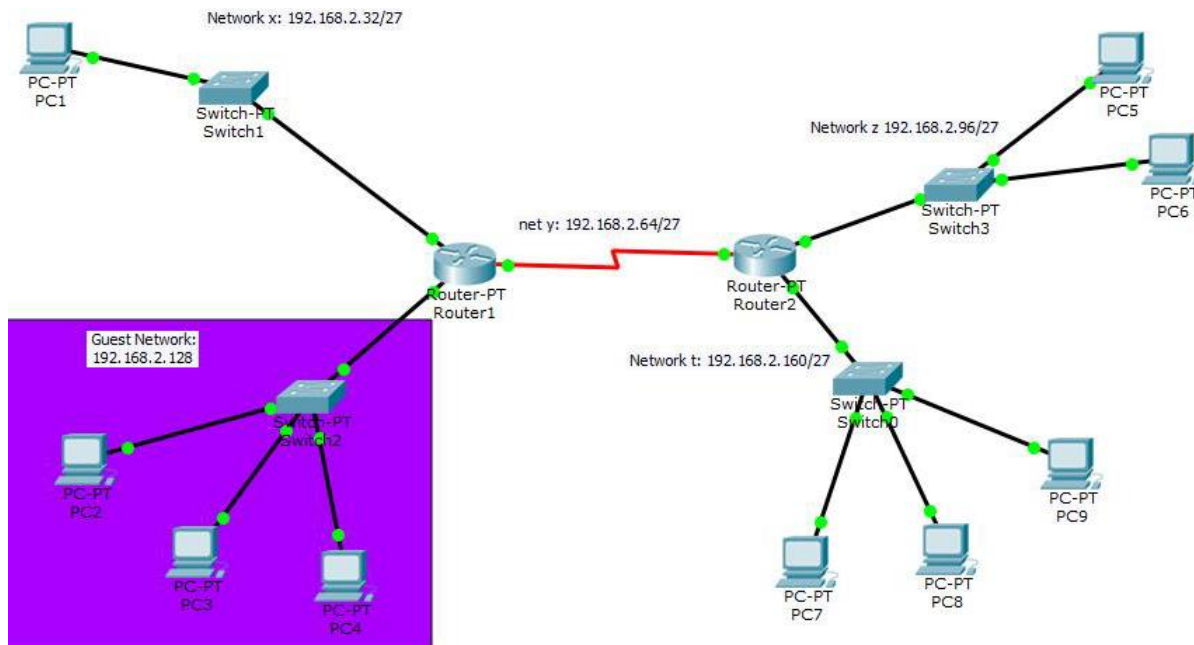


Figure 5 Scenario with DHCP server configuration

Q3.1 Give the IP address of PCs 7, 8 and 9 (provide screenshot of ipconfig)

Q3.2 Configure the routing tables of routers 1 and 2 statically so that every single PC can ping all others. You provide the screenshot of the result of the command line “show ip route static”

Q3.3 Ping PC1 from PC8 (copy ping result screenshot below)

Q3.4 Ping PC6 from PC2 (bring the result of the ping)

We want now to assign IP addresses dynamically on network **192.168.2.96/27** and network **192.168.2.160/27**. For this purpose, you need to configure a DHCP server on router 2 as follows:

- create an IP DHCP pool for each network
 - **IPNet4** for 192.168.2.96/27 network
 - **IPNet5** for 192.168.2.160/27 network
- Define the IP addresses interval for each pool
- On each of these 2 networks reserve (exclude) the first 10 addresses for each pool for specific manual and future use.
- Define the default router on each network.

Useful commands:

- `ip dhcp pool IPNet5` (for creating a dhcp pool)
- `network 192.168.2.160 255.255.255.224` (to define the IP addresses in one pool)
- `ip dhcp excluded-address [..]` (to exclude some addresses from being assigned automatically by the DHCP server).
- `show ip dhcp binding` (display the IP_MAC mappings)

Q3.5: Show the dhcp binding on router 2 (DHCP server)

- Change the IP configuration of PC 5, PC 7 to DHCP instead of static

Q3.6: What is the new IP address of PC 5 (provide screenshot)

Q3.7: What is the new IP address of PC 7 (provide screenshot)

Q3.8: Show the dhcp binding on router 2 (DHCP server)

2. Stand-alone DHCP server

Now, we want to add a stand-alone DHCP server. The server's role is to assign IP addresses to hosts in guest network.

- Extend the network by adding a router, a switch and a generic server as shown in Figure 5.
- Configure the IP addresses of router 2, router 3 and the DHCP server.

Q3.9: Configure an IP address pool for the Guests network (Call it guestsPool) on the DHCP server (guests network address 192.168.2.128 255.255.255.224). Exclude the first 10 addresses.

Q3.10: Ping the DHCP server from PC 2 and comment the results

- Add the necessary IP routes on router 1, router 2 and router 3 so that the DHCP server can be pinged from PC 1, PC 2, PC 7, PC 8.

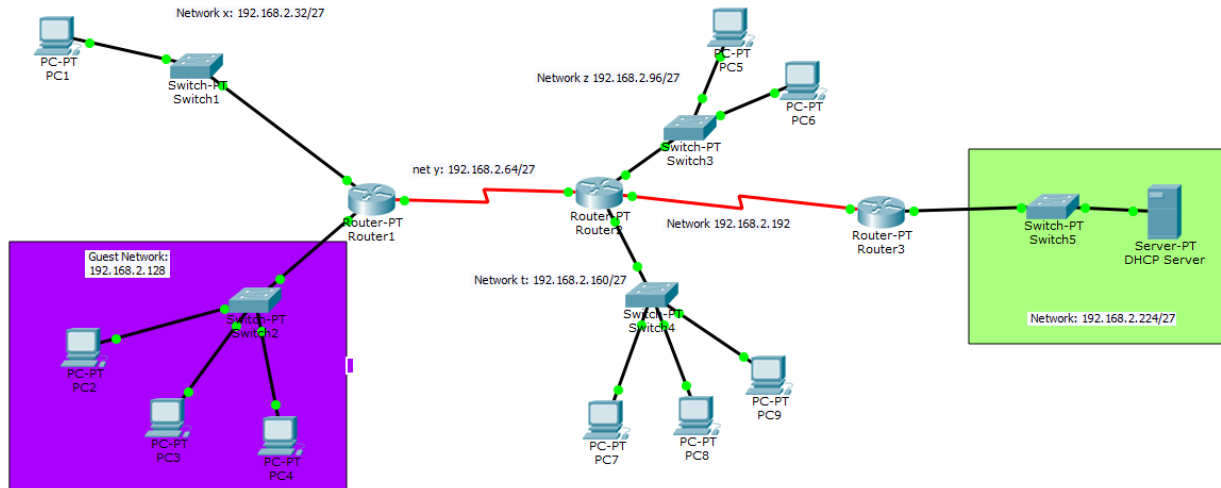


Figure 6 Stand-alone DHCP server

Q3.11: ping the DHCP server from PC 2. (copy the ping result)

- Now change PC 2 IP address configuration from static to DHCP.

Q3.12: Could PC 2 obtain an IP address? Comment

- Add the IP address of the remote DHCP server on the necessary routers

To achieve that, enter interface configuration on the necessary routers and type:
 - `ip helper-address [DHCP server address]`

3. Traceroute simulation

The objective of this part is to see the simulation of packets routing through the network.

Q3.13: Trace the route between router 1 and the DHCP server. Copy the traceroute result and comment the simulation results.

- Activate the simulation mode and edit the filters by enabling only ICMP (see Figure 7)

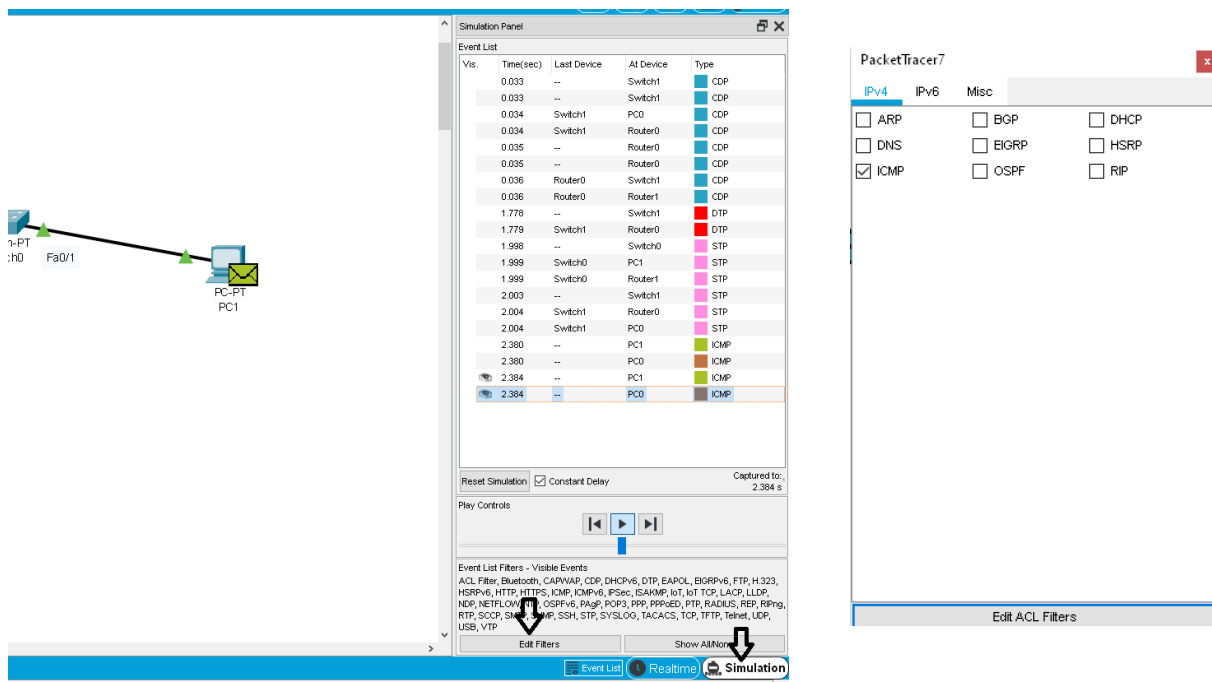


Figure 7 Simulation tool and filter