Lab No. 07 - Basic Infrastructure and Network Layer

Objective

- Continue learning about the operation of operating systems and network services.

- Install network management tools.
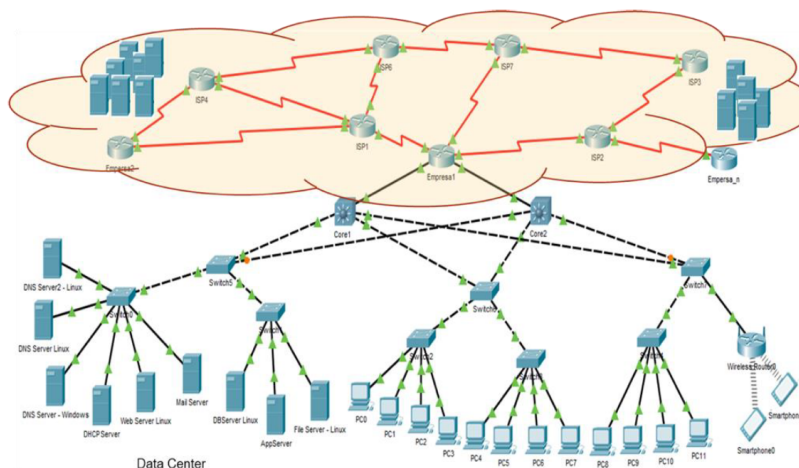
- Configure routers and static routing.

Tools to be Used

- Computers
- Internet access
- Virtualization software
- Packet Tracer and Wireshark
- Routers and switches

Introduction

A company typically has several IT infrastructure services. It includes wired and wireless user stations and servers (both physical and virtualized), all connected through switches (layer 2 and 3), wireless devices, and routers that connect it to the Internet. It is also common to have cloud infrastructures where resources are provisioned according to the organization's needs. Among the servers, there can be web services, DNS, email, database, storage, applications, and others.

The following is a possible configuration:

Base Software Installation

In the same groups as throughout this laboratory, perform the following activities.

1. Other Useful Commands
[For groups of 1, 2, and 3 students]

    a. Study the functionality of commands that provide network information, e.g., netstat, vnstat, route, and ethtool (or equivalents in Slackware, NetBSD, Centos, and PowerShell). Review different parameters that can be used and create a Shell program that uses them (create a menu with at least 5 different options that show different executions of the commands). Students should be able to understand the output of the commands and present it in an easy-to-understand format.

    b. Additionally, create a Shell program that indicates (yes or no) whether a port is open and which service is running on that port.

2. Network Management
[For groups of 1, 2, and 3 students]

On the other hand, part of an organization's technological platform is the monitoring server. Through it, administrators can check the status of the network equipment they manage. These platform management tools enable remote monitoring of disk space, CPU usage, network performance, memory usage, installed software, among other aspects of the network devices.

Each student must install a server to monitor the network (Groups of 2 students: one student should use Slackware and the other NetBSD. Groups of 3 students: additionally, the third student will use Windows) and document their work. They must enable monitoring of all their virtual machines and display it in real-time.

Show your professor the configurations, ports, and monitoring software installations.

Hint: Look for SNMP protocol implementations.

3. Network Administration - Azure
[For groups of 1, 2, and 3 students]

    1. Log in to the Azure portal.

    2. Navigate to the "Education" section.

    3. Go to the "Templates" section.

    4. Select the template named "Web App Deployment from GitHub."

    5. Deploy the selected template.

    6. Choose an existing resource or create a new one, then click "Review + create" and subsequently "Create."

    7. Navigate to the created resource and access the "Web App". Explore the website by clicking the "Default domain" at the "Overview" section.

    8. Now, go to the "Monitoring" section, then navigate to "Application Insights" and enable the service if it isn't already active. Once there, click on "View Application Insights data."

    9. Explore the "Overview" and "Live Metric" tabs in the "Investigate" section.

        – What do you observe when you refresh the website repeatedly?

        – What does each of the items displayed there represent?

- What other functionalities does the "Application Insights" system offer for web services, databases, and other cloud-deployed systems?
- How might this functionality be beneficial in a corporate environment?
- How does the network layer contribute to the transmission of data between the web app and clients in different geographic locations?
- In what ways do the application and transport layers ensure reliable data transfer and correct interpretation of web app responses?

Experiments

Perform the following tests in groups or individually, as instructed by the professor, and document the experience.

1. Use of ICMP Messages
[For groups of 1, 2, and 3 students]

a. Go to https://traceroute-online.com/ and search for the Computer Science Laboratory page and the Stanford University page. Show the results.

b. Using the tracert or traceroute command, search for a page in France and check the route.

c. Download and install software such as VisualRoute, Open Visual Traceroute, or similar. They can be free tools or demos.

   Note: Only install this type of software, do not include other utilities or toolbars suggested during installation. Use advanced mode during installation to check what is being installed.

d. Test the tool, get to know some of its features.

e. Document the tool's functionality by searching for 5 car manufacturers' websites around the world with the tool.

   Note: The websites should be located in different countries, preferably on different continents.

2. Some Questions About Router Commands
[For groups of 1, 2, and 3 students]

1. What is the difference between enable password and enable secret? If both are configured, which one takes precedence?

2. What is the difference between console and VTY?

3. What is the boot process of the routers in the Network Laboratory?

4. What types of memory do the routers in the Network Laboratory have?

5. What is the difference between the startup-configuration and running-configuration files?

3. Setup: Access and Basic Configuration of Routers
[For groups of 1, 2, and 3 students]

- Review and document the different routers available in the Laboratory and the network interfaces they have.
- To connect to the routers through the console, use a console cable and the hyperterminal or putty application, similar to how you connected to the switches.
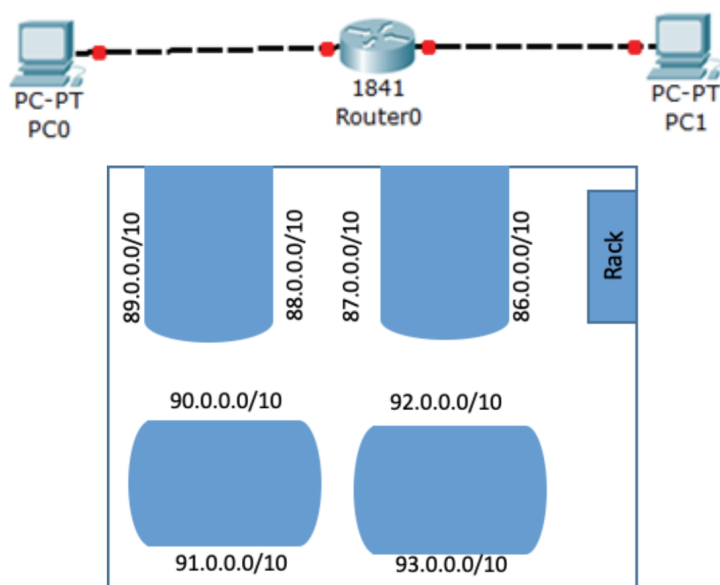

- When starting the router, messages similar to those appearing on the switches or in the simulator (Packet Tracer) will be displayed. Try to log into the router and enter privileged mode. If successful, you can begin configuring the network indicated later. If access to the router or its privileged mode is password-protected, you will need to remove that configuration to start working with the device.

  When using a router for the first time, you may need to recover the router's password if necessary.

  - For the 1841 series router, review the following guide links:
    * Cisco Documentation
    * Guide
  - For the 2800 series router, review the following guide links:
    * Cisco Documentation
    * Guide
  - For the 1941 series router, review the following guide links:
    * Cisco Documentation
    * Guide
  - For the 2900 series router, review the following guide links:
    * Cisco Documentation
    * Guide

- For Cisco routers, explain the process the router goes through on boot when configured in modes 0x2142 and 0x2102.
- Perform the following configuration using physical devices and document the process. The basic configuration of a router should include:
  - Access keys for privileged mode, console, and remote access. The privileged mode key should be "cisco", the console key "claveC", and the remote access (telnet) key "claveT".
  - Router name. Assign the router the last name of one of the students in the group.
  - Console and remote access screen synchronization.
  - Description of the interfaces used.
  - Disable remote command server lookup.
  - Message of the day.

- For the network on the left, use the range that allows addressing 4000 hosts, and for the network on the right, a range that allows addressing 600 hosts. Use the IP address range according to the location of the Network Laboratory desk diagram.

Recommendation: First configure the router through the console cable, then proceed with configuration and connection to the PCs.
- Test connectivity between computers.
- Show the setup to your professor.

4. Setup - Serial Interconnection

Join another group of students and interconnect the routers used in the previous step. For the interconnection, use the serial cards on the devices. For serial connections, agree on the network with your groupmates (do not use the same as other classmates—check with the professor). Use a subnet of the network 100.0.0.0/24

- Using the ping command, verify communication from router 0 and router 1.

Note: Computer-to-computer interconnection will not work yet!
- What is a null modem?
- What is the clock rate command used for in routers, and why is it needed?
- What does DTE and DCE mean? What is the relationship with the routers in the Network Laboratory?

5. Static Routing

- Configure the routers with static routes so that you can ping all devices on the network.

```
Router(config)#ip route network-address subnet-mask
          {ip-address | exit-interface }
```

Parameter	Description
network-address	Destination network address of the remote network to be added to the routing table.
subnet-mask	Subnet mask of the remote network to be added to the routing table. The subnet mask can be modified to summarize a group of networks.
ip-address	Commonly referred to as the next-hop router's IP address.
exit-interface	Outgoing interface that is used to forward packets to the destination network.

Para borrar la ruta: no ip route ....

Note: Each router must include routes (output interface) to reach networks that are not directly connected.

- Using the ICMP traceroute command, try to verify the communication between the two computers.
- Now, configure static routes to see the networks of your groupmates in the other group.
- Verify operation with ping and traceroute commands.
- Interconnect all course group networks and configure the routers so they can see all networks. Define IP ranges for the new serial connections between all.
- Verify operation with ping and traceroute commands.
- Show the setup to your professor.

6. Closure

Erase and organize the routers and equipment used so that they are ready for a new practice session.