Laboratory No. 02 - OS Setup, Shell, and Network Support Software

Objective

- Continue the installation of base operating systems.
- Understand the operation of networking tools.
- Learn about operating system administration using Shell programs.

Tools to be Used

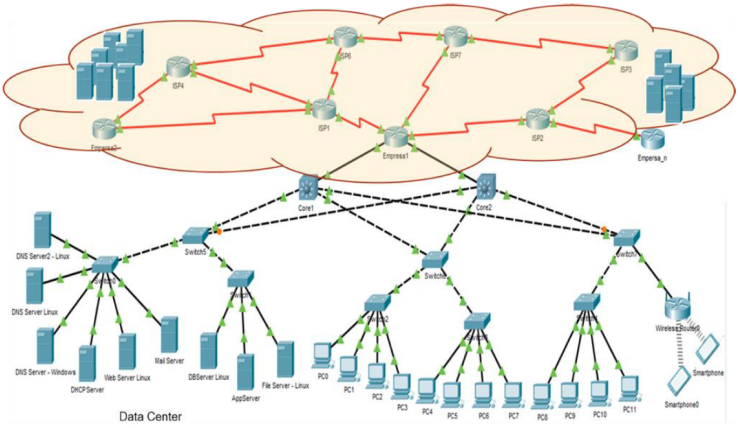
- Laboratory Computers
- Internet Access
- Virtualization Software
- Operating System Images
- Packet Tracer
- Wireshark

Introduction

As previously discussed, companies typically have multiple IT infrastructure services. These include wired and wireless user workstations, as well as physical and virtualized servers, all interconnected through switches (Layer 2 and Layer 3), wireless devices, and routers that provide internet connectivity. Additionally, it is common to have cloud infrastructures that provision resources according to the organization's needs.

Within these servers, various services can be hosted, such as web hosting, DNS, email, databases, storage, and applications, among others.

Below is a possible configuration:



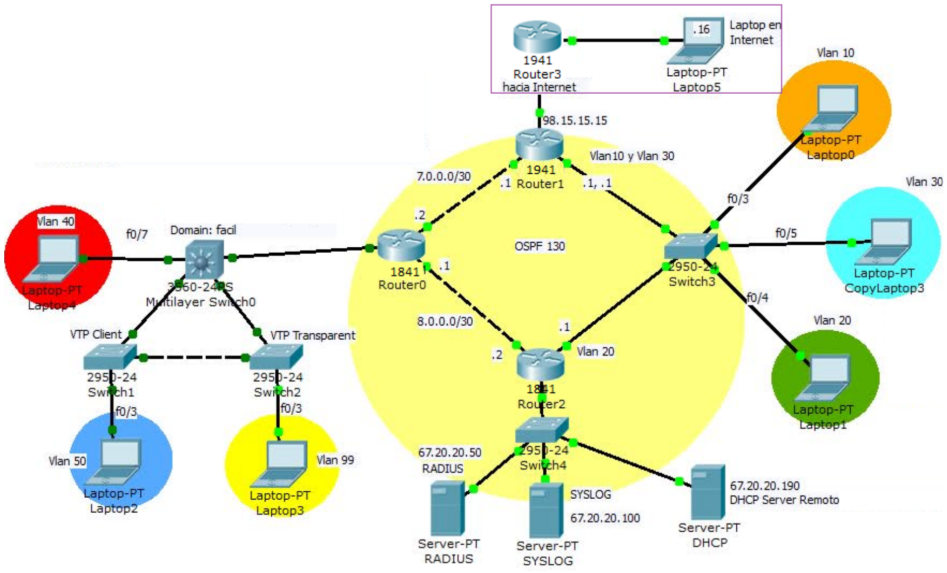
Experiments

To build a technological infrastructure like the one presented in the previous diagram, it is necessary to have computers and servers with an installed operating system. It is also important to understand their operation from the system administrator's perspective and support automation processes. Below, different activities are proposed to explore this structure.

1. Getting to Know Packet Tracer

[For groups of 1, 2, and 3 students]

- Answer the following questions:
  1. What version of Packet Tracer is available on the Cisco platform?
  2. Through the Cisco platform, enroll in the course Getting Started with Cisco Packet Tracer. Create a video summarizing the first four chapters of the course. Maximum duration: 5 minutes.
  3. Complete the quiz "Introduction to Packet Tracer - PT Basics Quiz" from the course and take a screenshot of your quiz results.
     Note: Each student must complete the quiz individually.
- Using Packet Tracer, each student must create the network diagram shown below:



Note:

- Each student must build and submit the Packet Tracer file containing the network.
- Ignore the colors of the dots/rectangles that appear on the links (links refer to the connection lines between devices). The colors of these links will become important later, and we will review them at that time.
- The connections or links presented in the diagram are:
  - Black-colored links correspond to Ethernet cables (Ethernet, FastEthernet, or GigaEthernet).
    - What do the solid black connections represent?
    - What do the dashed black connections represent?
  - Modify the connection between Router0 and Router2 so that they use a serial cable for this connection (red-colored cables represent serial cables – typically used for WAN connections).

2. Tracking Messages with Packet Tracer

[For groups of 1, 2, and 3 students]

- Perform a ping from the RADIUS server to the DHCP server using Packet Tracer's simulation mode.
- Now, analyze the PDUs layer by layer (We have not yet covered the meaning of each one, but observe that they exist and that each layer adds information to the user data). Use the following guide as a reference:

> **Run the simulation and capture the traffic**
>
> – In the lower right corner of the PT interface, locate the toggle switch between Real-time and Simulation mode. Click on **Simulation mode**.
>
> – Click the **Edit Filters** button and select only **ICMP**.
>
> – Click on **Server-PT_RADIUS**. Go to the **Desktop** tab and open the **Command Prompt**. Enter the command `ping IP_SERVER-PT_DHCP`. Pressing the **Enter** key will initiate four ICMP echo requests. Minimize the PC configuration window. Two packets will appear in the **Event List**: the first **ICMP echo request** and an **ARP request**, which is needed to resolve the server's IP address to its hardware MAC address.
>
> – Click the **Auto Capture / Play** button to run the simulation and capture events. Click **OK** when the "No More Events" message appears.

- Examine the content of the captured packets. Observe how the PDUs are built layer by layer.

On the Real Network

Perform the following tests using the Wireshark tool.

1. Using Wireshark

[For groups of 1, 2, and 3 students]

Wireshark is a cross-platform tool used for analyzing network packets. Throughout this course, we will use it to observe real-time network traffic and examine how different protocols operate. For this reason:

- Install (if working from home) and run Wireshark on your computer.
- Watch videos and read documentation about Wireshark's operation. What is Wireshark?
- What does it mean for a network card to be in promiscuous mode?
- Create a video explaining the different components of the interface, how to create filters, and their purpose. Provide examples. The video should be approximately 5 minutes long.
- Perform a web query to http://www.scielo.org.co and capture the generated traffic. To do this, open your browser, start a Wireshark capture, visit the specified page, and then stop the capture.
- Analyze the data from one of the captured packets. Examine how each layer encapsulates the data, review the information displayed in different areas of the Wireshark interface, and take screenshots of the findings. (To facilitate the analysis, filter and locate a captured packet containing the word "GET").
- For groups of three students, analyze traffic from two additional web resources and compare the results. Check if the behavior is similar across all three queries.
- Present your findings in a video with a maximum duration of 7 minutes.

2. Network Cards

[For groups of 1, 2, and 3 students]

Explore the network cards of various devices. To do this, gather information on the network cards of the school's computers and at least three different devices (desktops, laptops, smartphones, tablets, gaming consoles, etc.) from each team member.

Include details such as the manufacturer, model, speed, MAC address, IPv4 address, IPv6 address, and the number of transmitted and received bytes. For wireless network cards, also include connection speed and SSID.

Next, retrieve the same information for two of your virtual machines and compare the results with the data from the host machines.

Base Software

In an infrastructure, it is also essential to have programs that support the management of various operating system tasks. We will carry out activities designed to help you better understand the operating system and its administration.

1. Shell Programming - Unix

[For groups of 1, 2, and 3 students]

Using a virtual machine running Linux Slackware, Solaris, or CentOS (depending on the number of group members), develop the following applications. (Remember to document your code).

1.1. "ls" Command

Create a shell script that lists the files in a given directory, including hidden ones, and allows:

- Sorting based on different criteria and displaying the count for each group:
  - Most recent (should indicate how many files share the same date).
  - Oldest (should indicate how many files share the same date).
  - Size from largest to smallest (should indicate how many files share the same size).
  - Size from smallest to largest (should indicate how many files share the same size).
  - File type (File/Directory) (should indicate how many files belong to each type).
- Filtering options (allow selection of either the specified directory only or the directory along with its subdirectories):
  - Starts with a given string.
  - Ends with a given string.
  - Contains a given string.

After requesting the directory to analyze, create a menu with the options listed above. The script should remain in the menu until the user chooses to exit. It should also clear the screen before displaying results, and if the output is too extensive, it should be paginated.

1.2. File Search and Viewing Commands

Create a shell script that, through a menu (which will remain active until the user chooses to exit), allows the following actions:

- Search for a file or part of a filename within a specified directory. The output should display the locations and names of the found files, as well as the total number of occurrences.
- Search for a word or partial word within a given file. The output should show the found word, the lines where it appears, and the total number of occurrences.
- Search for a file or part of a filename within a given directory, and once found, search for a word or partial word within that file. The output should list, for each found file, the line number where the word appears and the total number of occurrences.

- Count the number of lines in a file.
- Display the first n lines of a given file.
- Display the last n lines of a given file.

1.3. Log File Review

Write a shell script that:

- Clears the screen.
- Displays a menu allowing the user to perform one of the following actions:
  - Show the last 15 lines of 3 log files that contain general system activity data.
  - Filter those 15 lines from the same log files to display only those containing a specific word.

Now, answer the following questions:

- What are log files?
- What types of logs are present in the operating systems you installed?
- What is syslog? What does this standard define? Do the logs you found in the operating systems follow this standard?

1.4. User Creation

Write a shell script that automates the user, group, and permission creation process from the previous lab. The script should prompt for all required information via the command line and follow this format:

```
$ newuser alice developers "Alice Developer" /home/alice /bin/bash 700 770 755
$ newgroup developers 1001
```

For groups of three students, perform the same exercises on Windows Server using PowerShell.

2. VI Editor in Linux/Unix

- Use the VI editor to create a file. Document the commands used.
- Enter the following text and document the commands used.
  Note: Each line of text should be on a separate line in the editor, meaning you must press the `ENTER` key at the end of each line.

HIMNO DE LA ESCUELA
Estudiante, maestro la conquista
Será hacer con amor nuestra labor
Cultores de espíritu humanista
Unidad de intelecto y corazón.

Escuela de ingenio es nuestra casa
Libro abierto a nuestra universidad
Aquí perdura mientras todo pasa
Cimiento de la fe y la integridad.

Ofrecemos la mano al que tropieza
La hidalguía del diálogo al rival
Ofrecemos la duda y la certeza
Mediamos entre hierro y el cristal.

Escuela de ingenio es nuestra casa
Libro abierto a nuestra universidad
Aquí perdura mientras todo pasa
Cimiento de la fe y la integridad.

- Save the work without exiting the editor.
- Replace all occurrences of the letter 'a' in the first paragraph with the symbol `-`.
- Replace every instance of the word "al" throughout the text with the symbols `##`.
- What command can be used to delete a word in VI?
- Delete the last four lines of the document using a single command.
- Undo the previous command.
- Convert the last line of the document to uppercase.
- Copy the last two lines of the second paragraph to the end of the file.
- Search for the word "Escuela" within the text.
- Move to line 5 of the text using a command.
- Create a summary table with VI commands.
- Save the work and exit the editor.
- Reopen the file and delete the first five lines.
- Exit the file without saving.

For groups of three students, perform the same exercise on CentOS. Is the process the same? If you found any differences, describe them.

3. Virtual Machine Deployment

For the semester project, two virtual machines of each installed operating system will be required, except for Windows Server without GUI and Android. Create the new virtual machines and verify that they can communicate with each other and access the internet.

4. File Sharing

One of the key services in a business environment is shared file systems, where employees can store files and share them with their workgroups.

The task for this session is to configure a file server on Solaris using SMB/SAMBA to enable file sharing between the three operating systems (Linux Slackware, Solaris, and Windows). For groups of three students, also include CentOS in the configuration.