

Universidad de Los Andes

Infraestructura de Comunicaciones – 202220

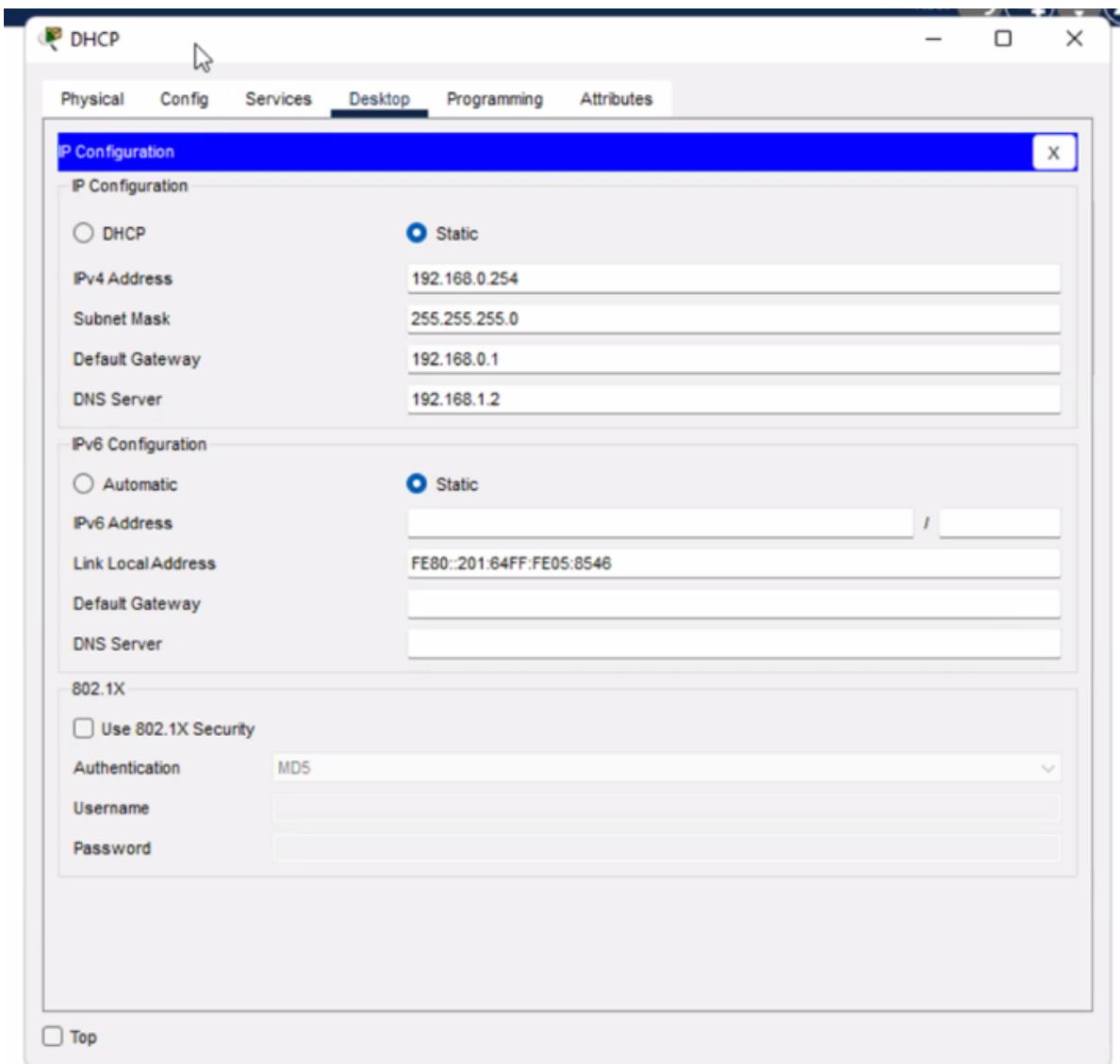
Laboratorio 1

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4.1 Configuración del Direccionamiento de la Red

4.1.1



WEB

Physical Config Services Desktop **Programming** Attributes

IP Configuration

IP Configuration

DHCP Static

IPv4 Address: 192.168.1.35

Subnet Mask: 255.255.255.0

Default Gateway: 192.168.1.1

DNS Server: 0.0.0.0

IPv6 Configuration

Automatic Static

IPv6 Address: /

Link Local Address: FE80::202:4AFF:FEEC:5B05

Default Gateway:

DNS Server:

802.1X

Use 802.1X Security

Authentication: MD5

Username:

Password:

Top

FTP

Physical Config Services Desktop **Programming** Attributes

IP Configuration

IP Configuration

DHCP Static

IPv4 Address: 192.168.1.33

Subnet Mask: 255.255.255.0

Default Gateway: 192.168.1.1

DNS Server: 0.0.0.0

IPv6 Configuration

Automatic Static

IPv6 Address: /

Link Local Address: FE80::20C:85FF:FE35:4871

Default Gateway:

DNS Server:

802.1X

Use 802.1X Security

Authentication: MD5

Username:

Password:

Top

DNS

Physical Config Services Desktop **Programming** Attributes

IP Configuration

IP Configuration

DHCP Static

IPv4 Address: 192.168.1.2

Subnet Mask: 255.255.255.0

Default Gateway: 192.168.1.1

DNS Server: 0.0.0.0

IPv6 Configuration

Automatic Static

IPv6 Address: /

Link Local Address: FE80::2E0:F7FF:FE51:1061

Default Gateway:

DNS Server:

802.1X

Use 802.1X Security

Authentication: MD5

Username:

Password:

Top

Email

Physical Config Services Desktop **Programming** Attributes

IP Configuration

IP Configuration

DHCP Static

IPv4 Address: 192.168.1.34

Subnet Mask: 255.255.255.0

Default Gateway: 192.168.1.1

DNS Server: 0.0.0.0

IPv6 Configuration

Automatic Static

IPv6 Address: /

Link Local Address: FE80::290:CFF:FE31:3D7

Default Gateway:

DNS Server:

802.1X

Use 802.1X Security

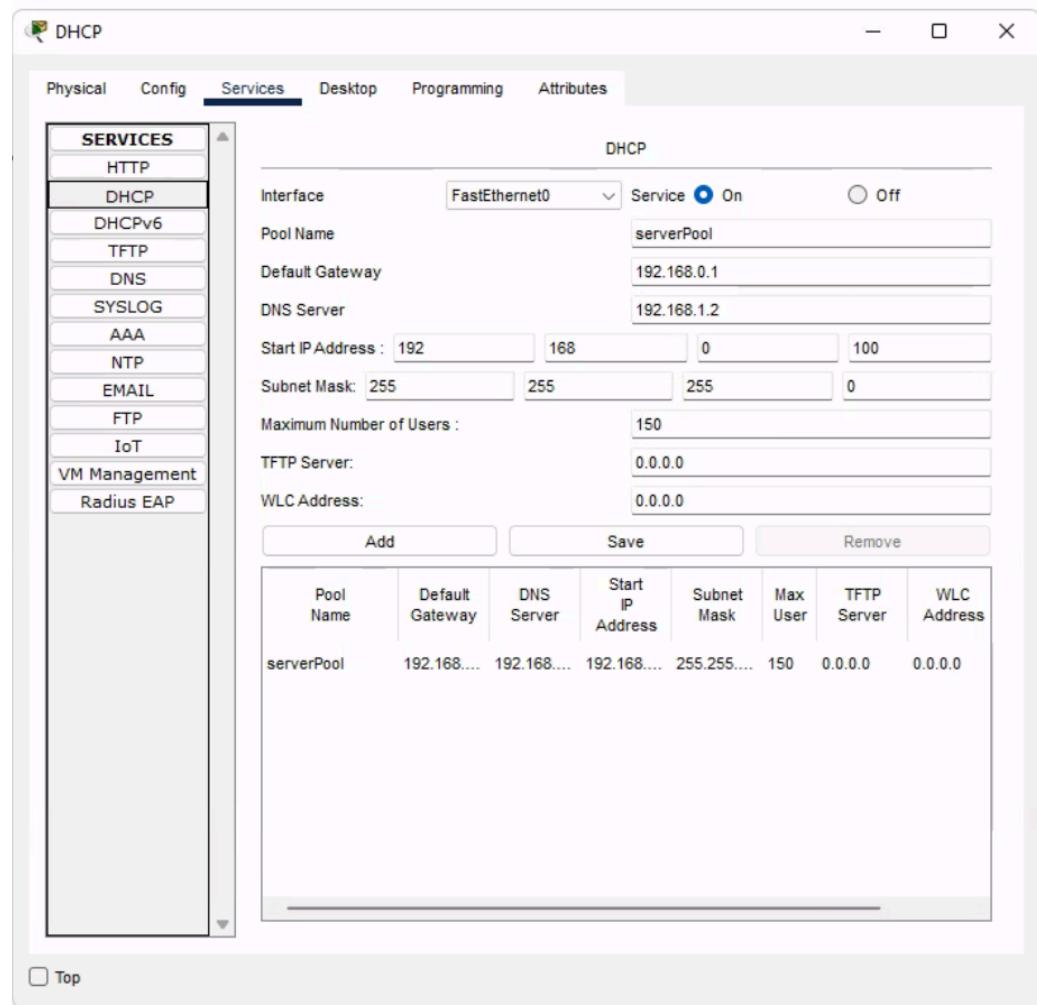
Authentication: MD5

Username:

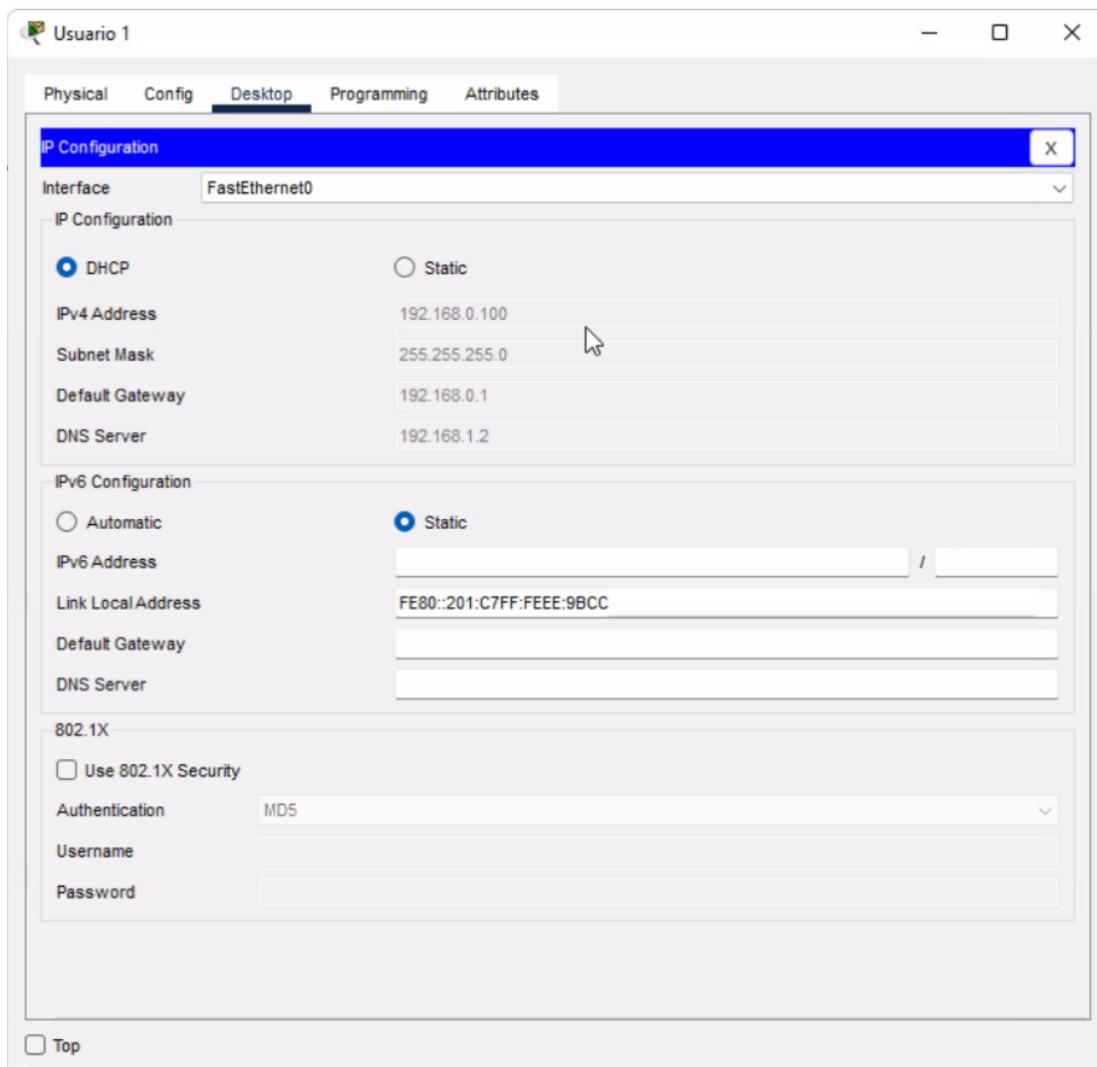
Password:

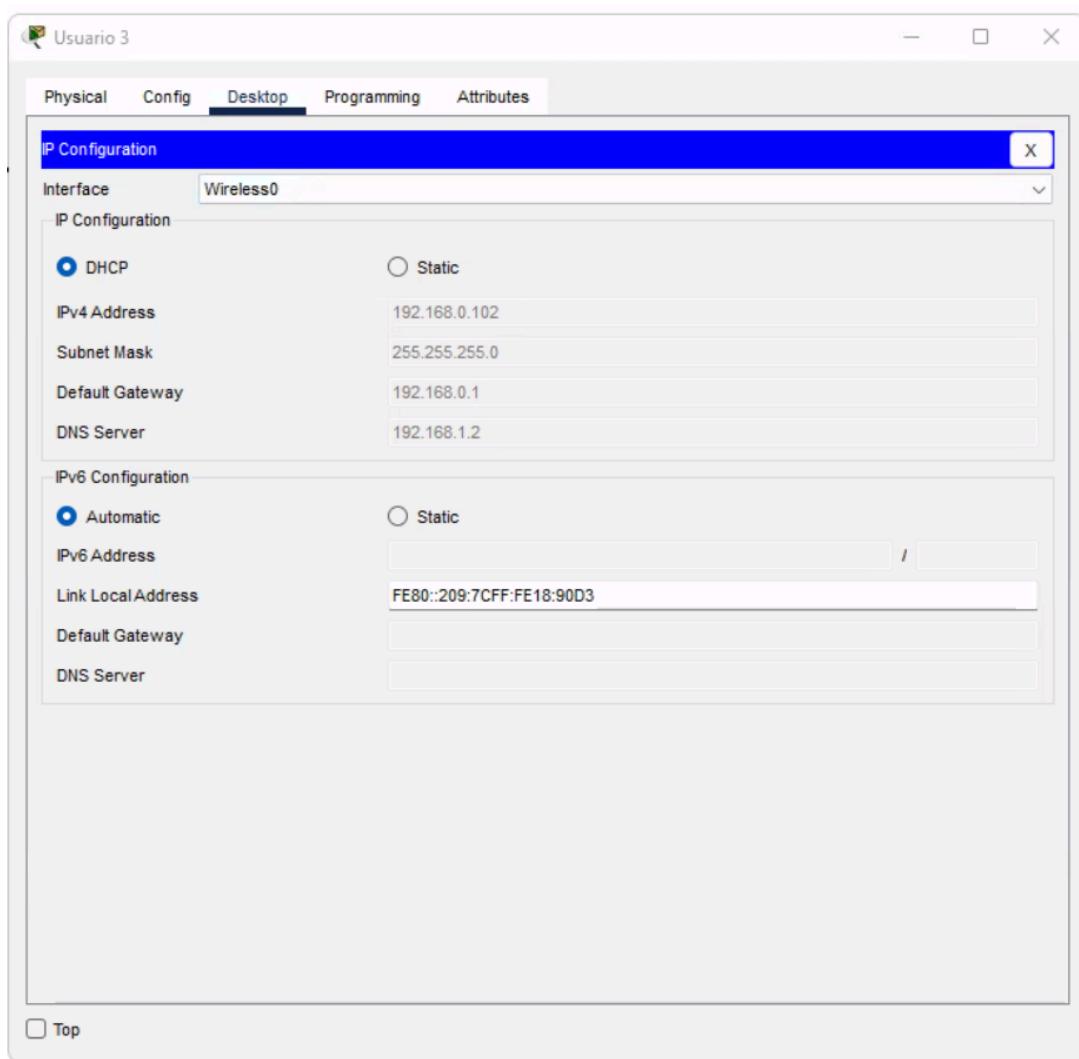
Top

4.1.2

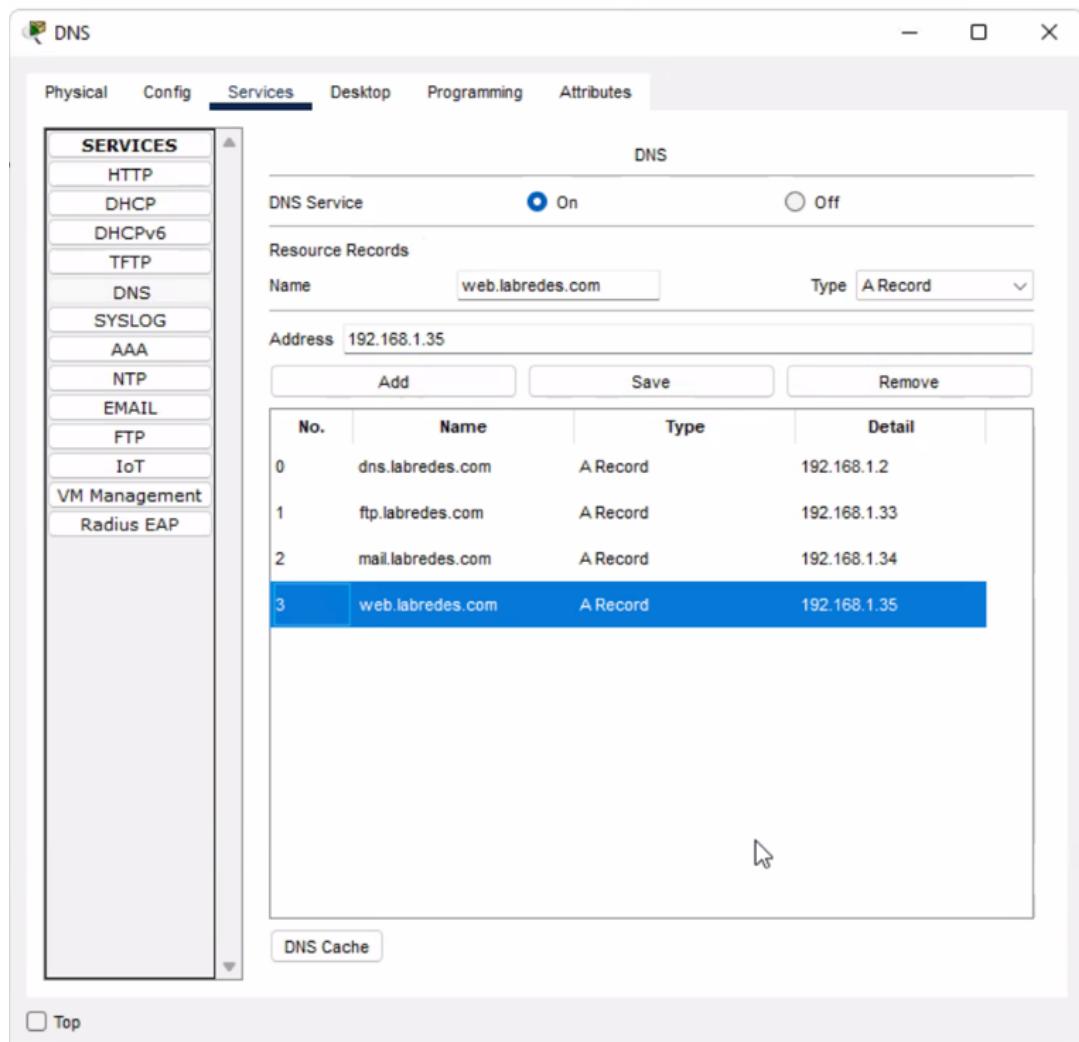


4.1.3



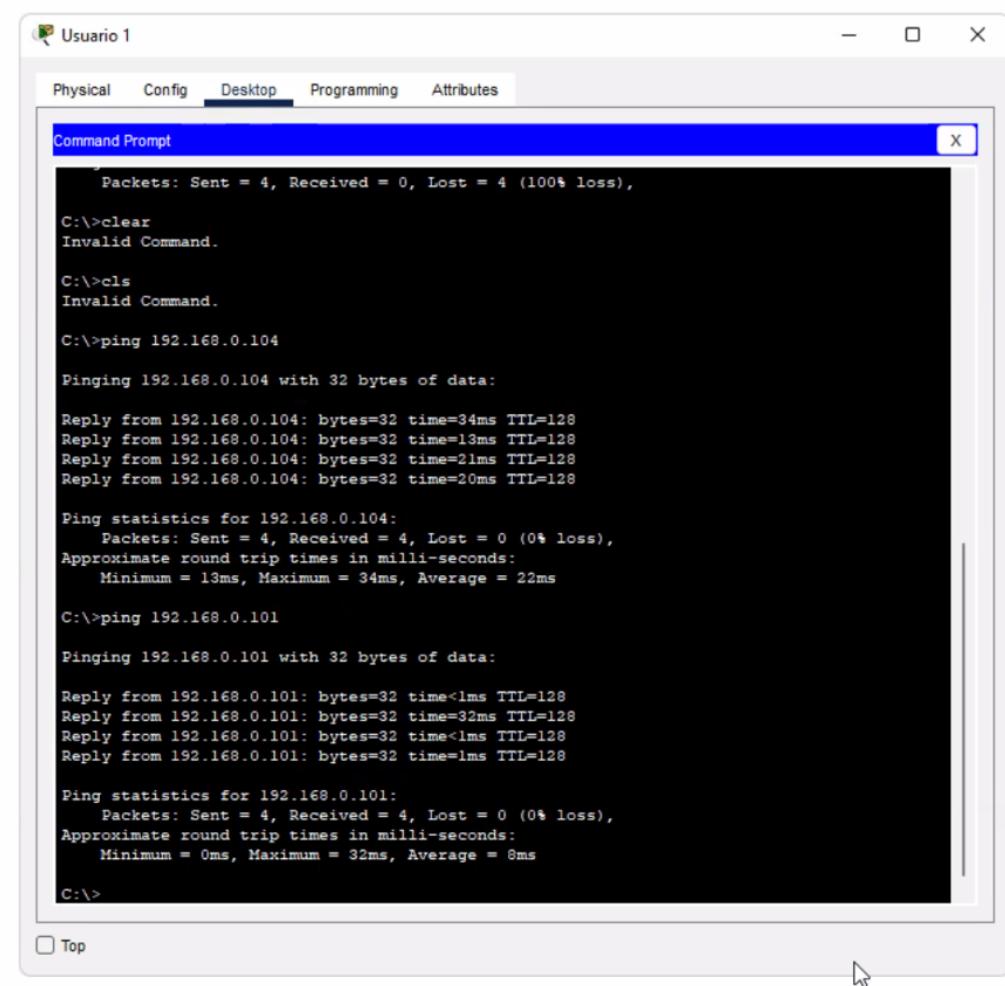


4.2 Configuración del servicio DNS



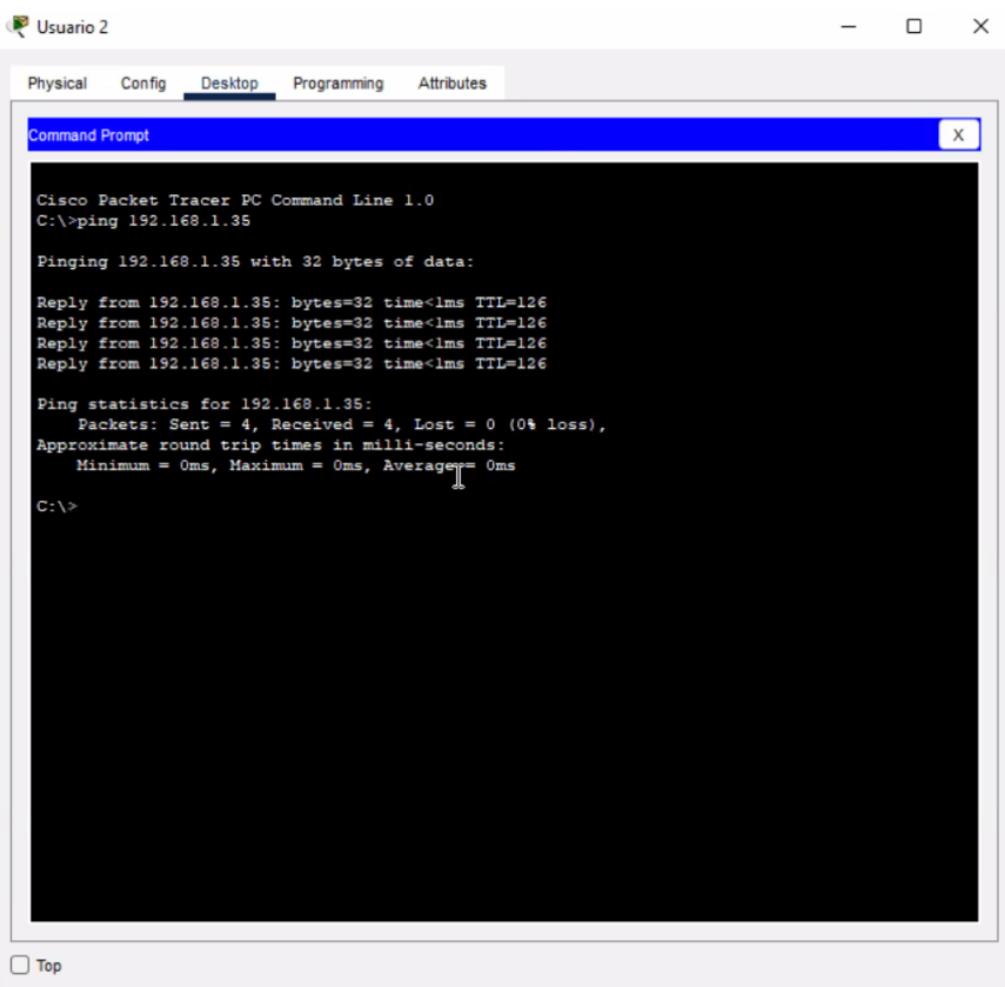
4.3 Pruebas de Conectividad y Exploración de Protocolo DNS

4.3.2



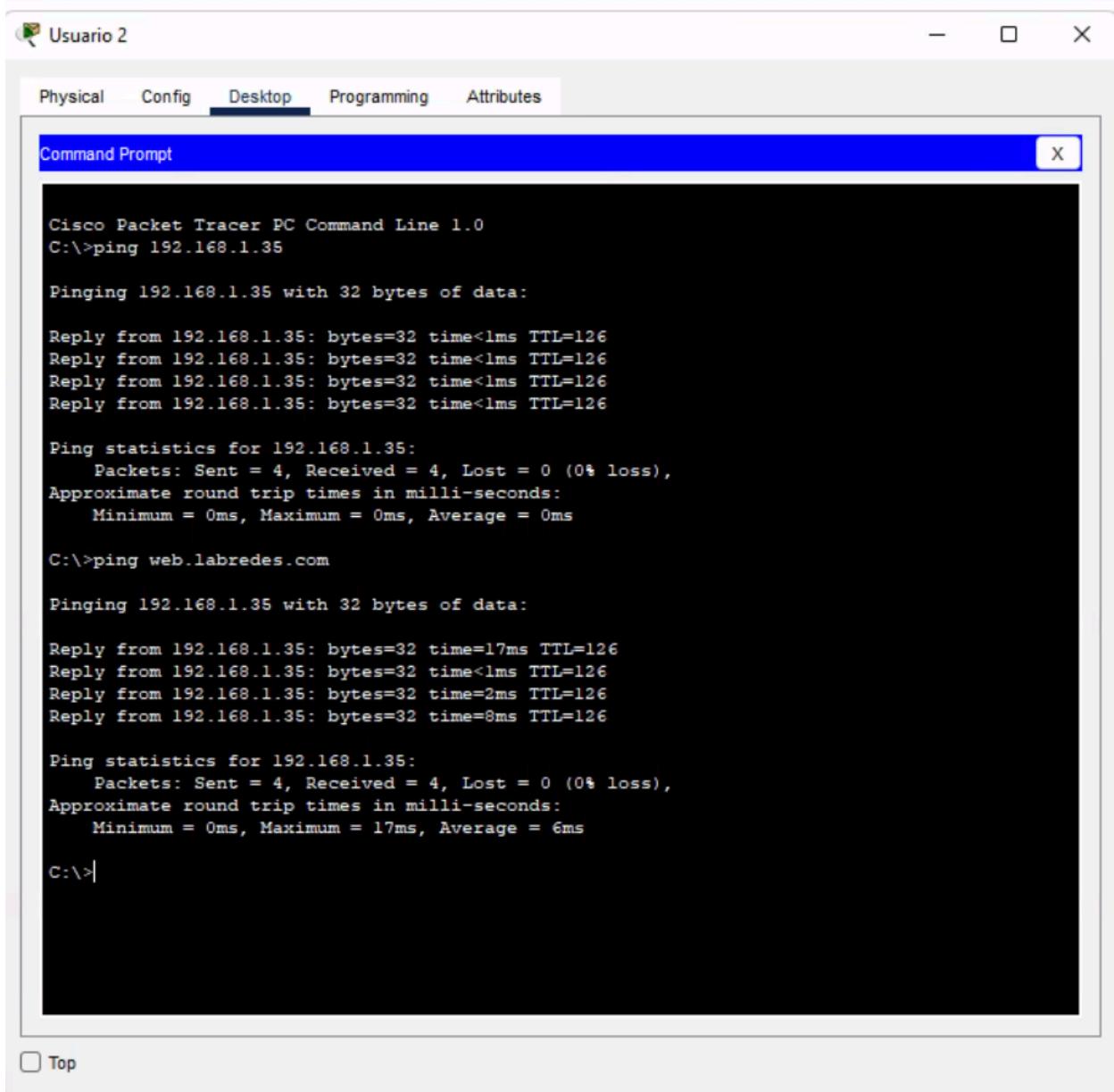
```
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),  
C:\>clear  
Invalid Command.  
C:\>cls  
Invalid Command.  
C:\>ping 192.168.0.104  
Pinging 192.168.0.104 with 32 bytes of data:  
Reply from 192.168.0.104: bytes=32 time=34ms TTL=128  
Reply from 192.168.0.104: bytes=32 time=13ms TTL=128  
Reply from 192.168.0.104: bytes=32 time=21ms TTL=128  
Reply from 192.168.0.104: bytes=32 time=20ms TTL=128  
Ping statistics for 192.168.0.104:  
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),  
    Approximate round trip times in milli-seconds:  
        Minimum = 13ms, Maximum = 34ms, Average = 22ms  
C:\>ping 192.168.0.101  
Pinging 192.168.0.101 with 32 bytes of data:  
Reply from 192.168.0.101: bytes=32 time<1ms TTL=128  
Reply from 192.168.0.101: bytes=32 time=32ms TTL=128  
Reply from 192.168.0.101: bytes=32 time<1ms TTL=128  
Reply from 192.168.0.101: bytes=32 time=1ms TTL=128  
Ping statistics for 192.168.0.101:  
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),  
    Approximate round trip times in milli-seconds:  
        Minimum = 0ms, Maximum = 32ms, Average = 8ms  
C:\>
```

4.3.3



```
Cisco Packet Tracer PC Command Line 1.0  
C:\>ping 192.168.1.35  
Pinging 192.168.1.35 with 32 bytes of data:  
Reply from 192.168.1.35: bytes=32 time<1ms TTL=126  
Ping statistics for 192.168.1.35:  
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),  
    Approximate round trip times in milli-seconds:  
        Minimum = 0ms, Maximum = 0ms, Average = 0ms  
C:\>
```

4.3.4



The screenshot shows a Cisco Packet Tracer interface titled "Usuario 2". A tab bar at the top includes "Physical", "Config", "Desktop" (which is selected), "Programming", and "Attributes". Below this is a "Command Prompt" window with the following text:

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.1.35

Pinging 192.168.1.35 with 32 bytes of data:

Reply from 192.168.1.35: bytes=32 time<1ms TTL=126

Ping statistics for 192.168.1.35:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>ping web.labredes.com

Pinging 192.168.1.35 with 32 bytes of data:

Reply from 192.168.1.35: bytes=32 time=17ms TTL=126
Reply from 192.168.1.35: bytes=32 time<1ms TTL=126
Reply from 192.168.1.35: bytes=32 time=2ms TTL=126
Reply from 192.168.1.35: bytes=32 time=8ms TTL=126

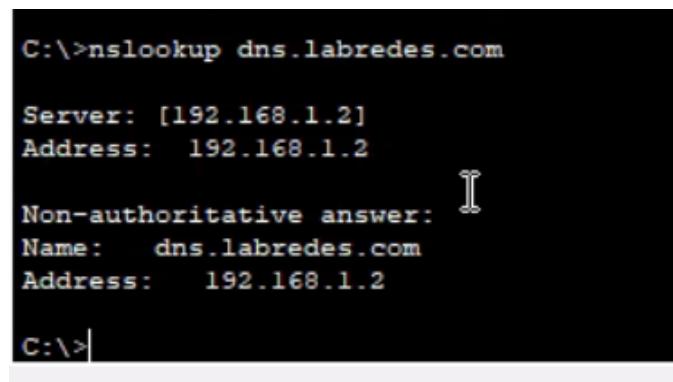
Ping statistics for 192.168.1.35:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 17ms, Average = 6ms

C:\>
```

Top

Se observa que tanto la conexión por IP como la de URL dan resultados satisfactorios similares, lo más destacable es que el ping por URL toma unos cuantos milisegundos más que por IP en el primer paquete, posiblemente a causa del sistema DNS.

4.3.5



```
C:\>nslookup dns.labredes.com

Server: [192.168.1.2]
Address: 192.168.1.2

Non-authoritative answer:  []
Name: dns.labredes.com
Address: 192.168.1.2

C:\>
```

Este comando nos permite identificar la dirección IP de una URL o realizar una búsqueda de DNS inversa (Dada una IP encontrar una URL).

4.4 Configuración y Exploración del servidor web

The screenshot shows the 'WEB' services configuration interface. The 'Services' tab is selected. On the left, a sidebar lists various services: HTTP, DHCP, DHCPv6, TFTP, DNS, SYSLOG, AAA, NTP, EMAIL, FTP, IoT, VM Management, and Radius EAP. The main panel displays the 'HTTP' configuration section, which includes two radio button groups: 'HTTP' (with 'On' selected) and 'HTTPS' (with 'On' selected). Below this is a 'File Manager' table listing ten files:

File Name	Edit	Delete
bootstrap.min.css	(edit)	(delete)
copyrights.html	(edit)	(delete)
cscoptlogo177x111.jpg		(delete)
helloworld.html	(edit)	(delete)
image.html	(edit)	(delete)
index.html	(edit)	(delete)
jalegria.html	(edit)	(delete)
jalegria.jpeg		(delete)
jromero.html	(edit)	(delete)
jromero.jpg		(delete)

At the bottom right of the main panel are 'New File' and 'Import' buttons.

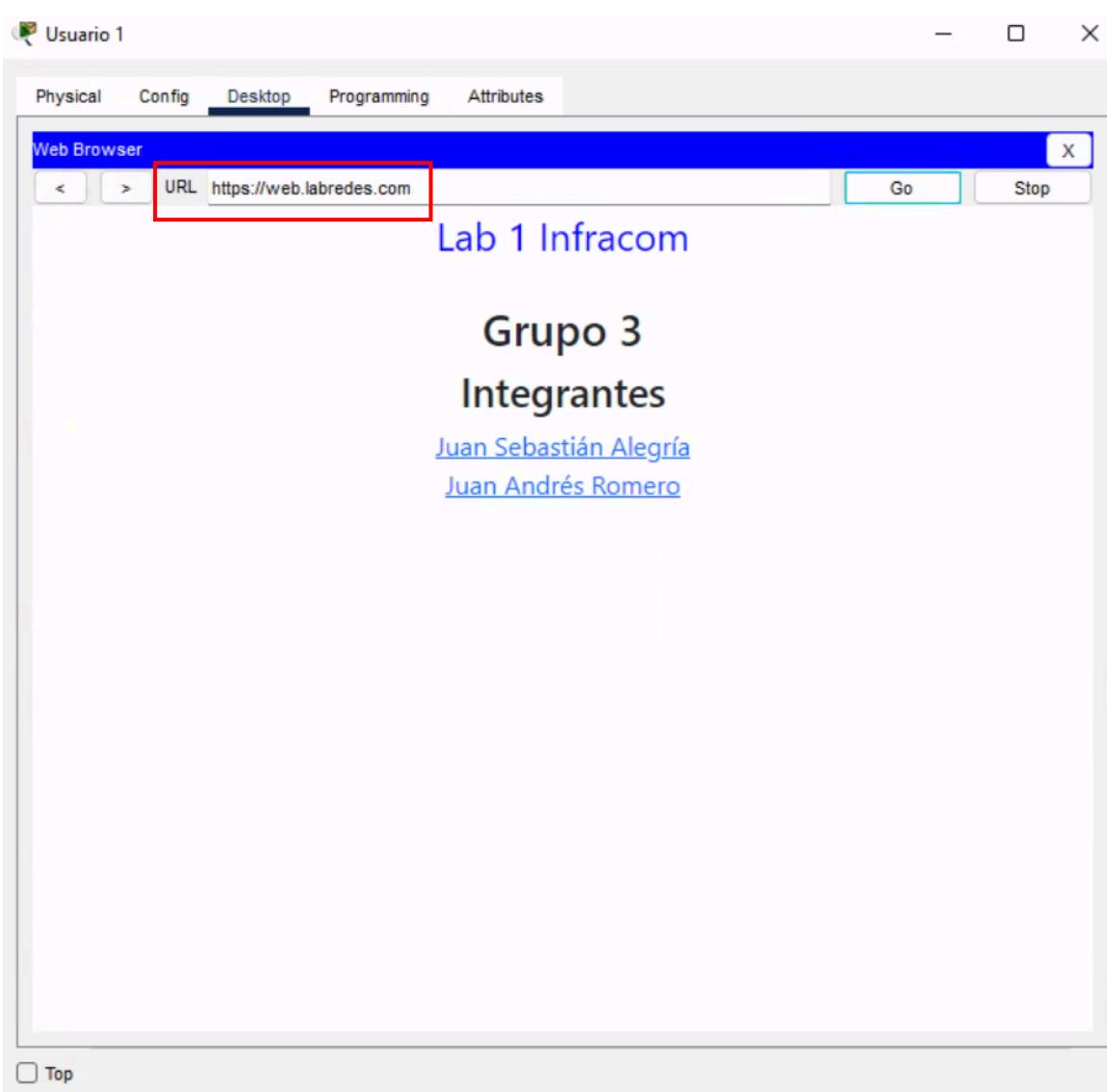
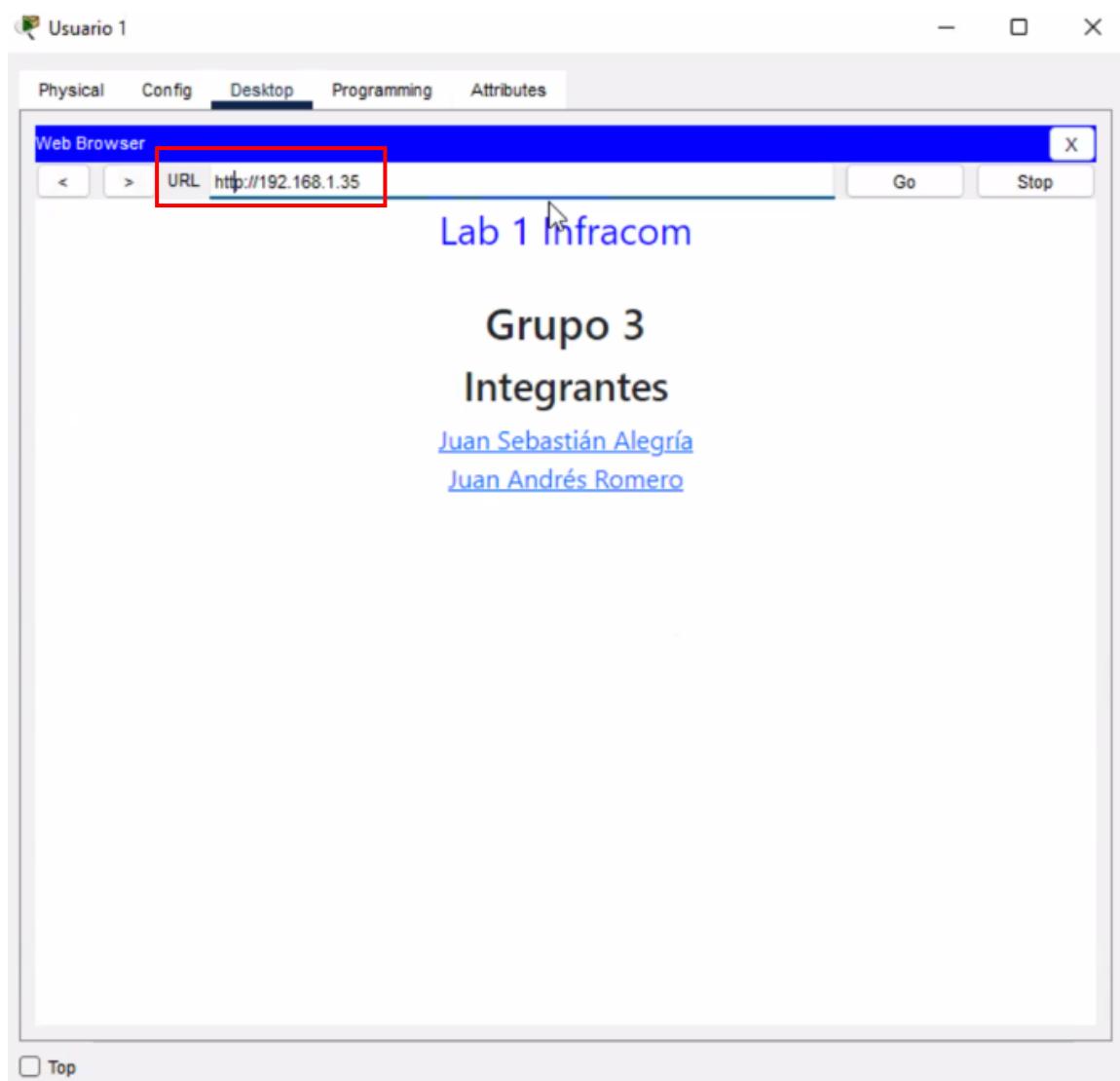
Top

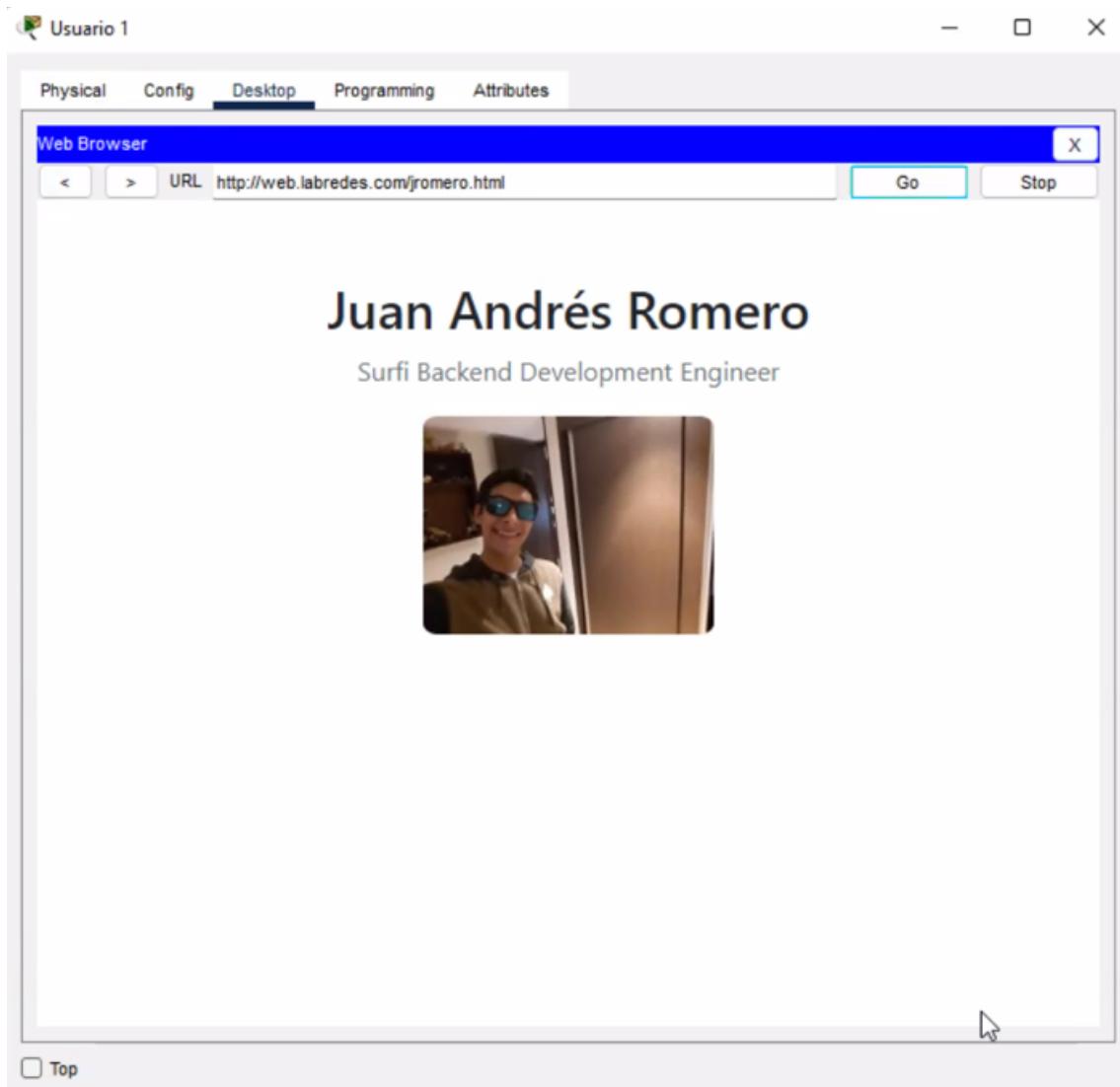
The screenshot shows the 'WEB' services configuration interface. The 'Services' tab is selected. On the left, a sidebar lists various services: HTTP, DHCP, DHCPv6, TFTP, DNS, SYSLOG, AAA, NTP, EMAIL, FTP, IoT, VM Management, and Radius EAP. The main panel displays the content of the 'index.html' file, which contains the following HTML code:

```
<html>
<head>
<link href='bootstrap.min.css' rel='stylesheet' >
</head>
<center><font size='+2' color='blue'>Lab 1 Infracom</font>
<br>
<br>
<h2>Grupo 3</h2>
<h3>Integrantes</h3>
<a href='jalegria.html'>Juan Sebastián Alegria</a>
<br><a href='jromero.html'>Juan Andrés Romero</a>
</center>
</html>
```

At the bottom right of the main panel are 'File Manager' and 'Save' buttons.

Top





WEB

Physical Config Services Desktop Programming Attributes

SERVICES

- HTTP
- DHCP
- DHCPv6
- TFTP
- DNS
- SYSLOG
- AAA
- NTP
- EMAIL
- FTP
- IoT
- VM Management
- Radius EAP

File Name: jromero.html

```
<!DOCTYPE html>
<html lang="es">

<head>
    <meta charset="UTF-8">
    <title>Juan Romero</title>
    <link href="bootstrap.min.css" rel="stylesheet">
</head>

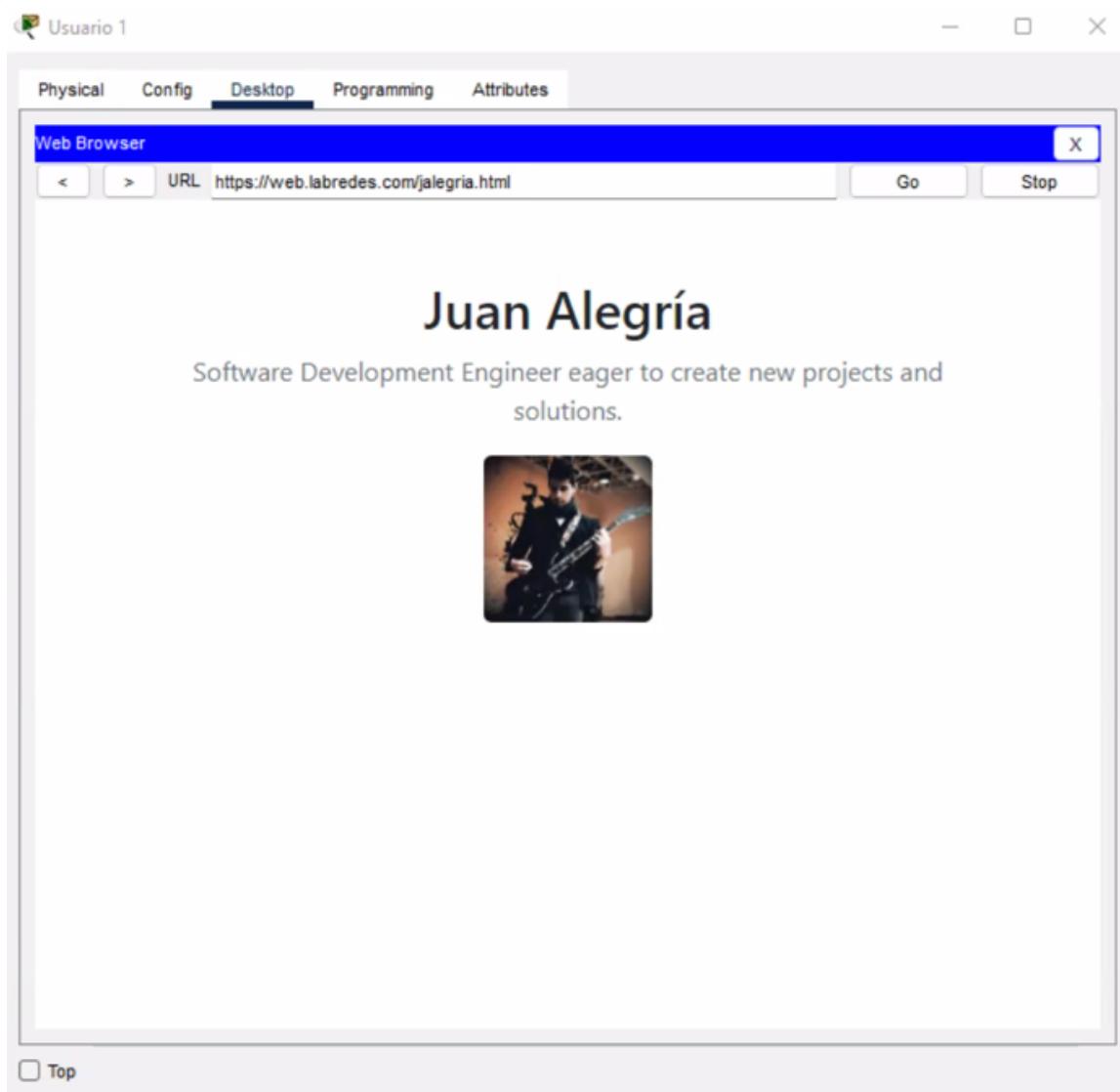
<body>
    <div class="container">
        <div class="row pt-5">
            <div class="col-12 col-md-6 center">
                <h1>Juan Andrés Romero</h1>
                <p class="text-muted">Surfi Backend Development Engineer</p>
                <p>
                    
                </p>
            </div>
        </div>
    </div>
</body>
<style>
    img,
    .btn {
        width: 35%;
        border-radius: 5%;
    }

    p,
    h1 {
        text-align: center;
    }
</style>
```

File Manager Save

Top

A screenshot of a configuration interface titled "WEB". The "Services" tab is selected. On the left is a sidebar with a list of services: HTTP, DHCP, DHCPv6, TFTP, DNS, SYSLOG, AAA, NTP, EMAIL, FTP, IoT, VM Management, and Radius EAP. On the right, there is a code editor window showing the HTML and CSS code for a file named "jromero.html". The code includes a title, a subtitle, a central image, and some CSS styles for alignment and button appearance. At the bottom of the code editor are "File Manager" and "Save" buttons.



WEB

Physical Config Services Desktop Programming Attributes

SERVICES

- HTTP
- DHCP
- DHCPv6
- TFTP
- DNS
- SYSLOG
- AAA
- NTP
- EMAIL
- FTP
- IoT
- VM Management
- Radius EAP

File Name: jalegria.html

```
<!DOCTYPE html>
<html lang="es">
<head>
    <meta charset="UTF-8">
    <title>Juan Alegria</title>
    <link href="bootstrap.min.css" rel="stylesheet">
</head>
<body>
    <div class="container">
        <div class="row pt-5">
            <div class="col-12 col-md-6 center">
                <h1>Juan Alegria</h1>
                <p class="text-muted">Software Development Engineer eager to create new projects and solutions.</p>
                <p>
                    
                </p>
            </div>
        </div>
    </div>
</body>
<style>
    img, .btn {
        width: 20%;
        border-radius: 5%;
    }

    p, h1 {
        text-align: center;
    }

    .footer {
        background-color: #242837;
    }
</style>
```

File Manager Save

Top

This screenshot shows a configuration interface for a service named 'WEB'. The 'Services' tab is selected. On the left, there is a sidebar with various service options. The main area displays the file content for 'jalegria.html', which contains HTML code for a personal website. At the bottom right, there are 'File Manager' and 'Save' buttons.

Usuario 1

Physical Config Desktop Programming Attributes

Command Prompt X

```
Reply from 192.168.1.35: bytes=32 time=11ms TTL=126
Reply from 192.168.1.35: bytes=32 time<1ms TTL=126

Ping statistics for 192.168.1.35:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 11ms, Average = 2ms

C:\>ping 192.168.1.35

Pinging 192.168.1.35 with 32 bytes of data:

Reply from 192.168.1.35: bytes=32 time<1ms TTL=126
Reply from 192.168.1.35: bytes=32 time<1ms TTL=126
Reply from 192.168.1.35: bytes=32 time=3ms TTL=126
Reply from 192.168.1.35: bytes=32 time<1ms TTL=126

Ping statistics for 192.168.1.35:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 3ms, Average = 0ms

C:\>ping web.labredes.com

Pinging 192.168.1.35 with 32 bytes of data:

Reply from 192.168.1.35: bytes=32 time<1ms TTL=126

Ping statistics for 192.168.1.35:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>
```

Top

4.5 Configuración y exploración de los protocolos de correo SMTP y POP3

Usuario 3

Physical Config Desktop Programming Attributes

Command Prompt X

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.1.34

Pinging 192.168.1.34 with 32 bytes of data:

Request timed out.
Reply from 192.168.1.34: bytes=32 time=16ms TTL=126
Reply from 192.168.1.34: bytes=32 time=25ms TTL=126
Reply from 192.168.1.34: bytes=32 time=25ms TTL=126

Ping statistics for 192.168.1.34:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 16ms, Maximum = 25ms, Average = 22ms

C:\>ping 192.168.1.34

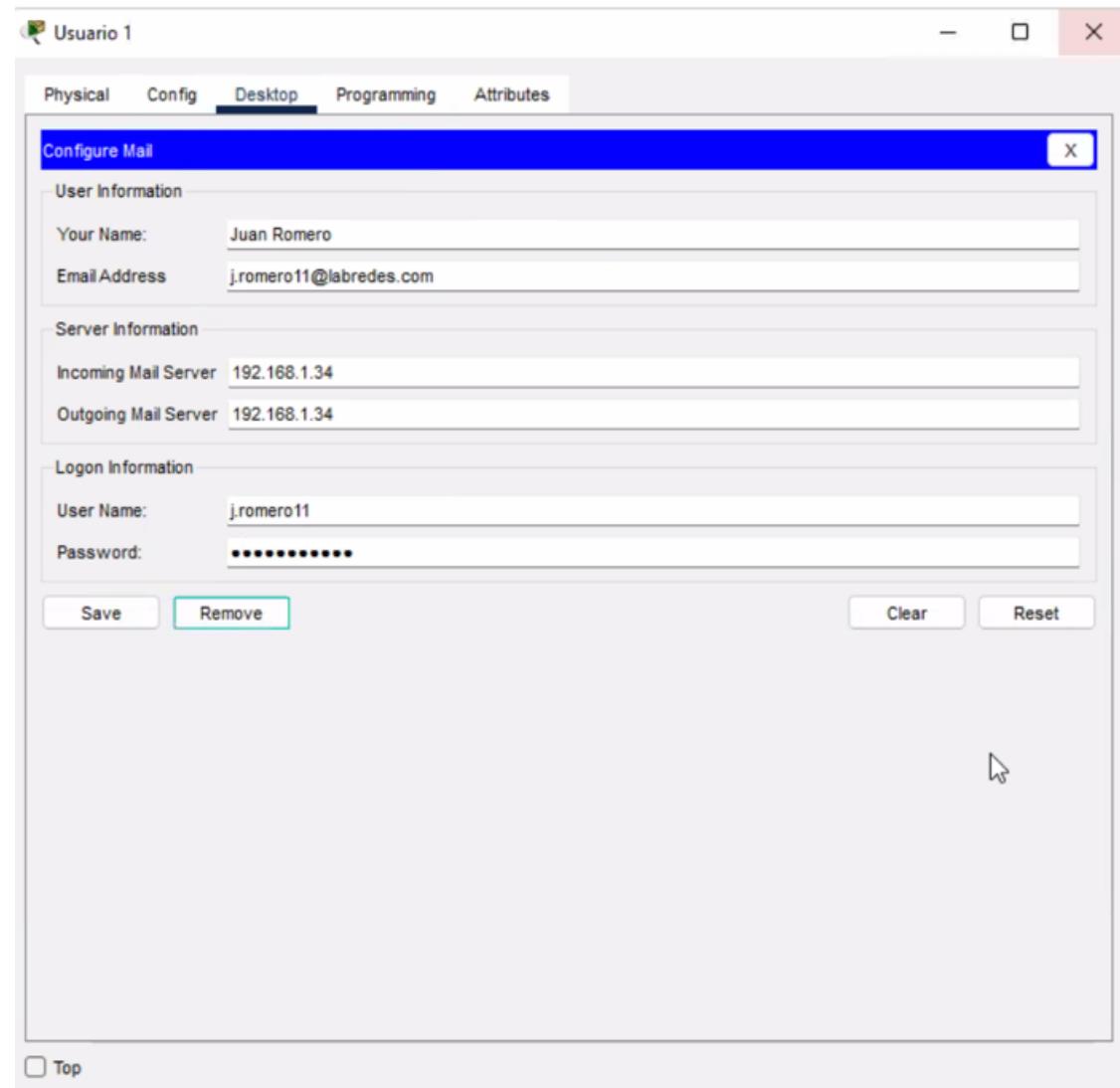
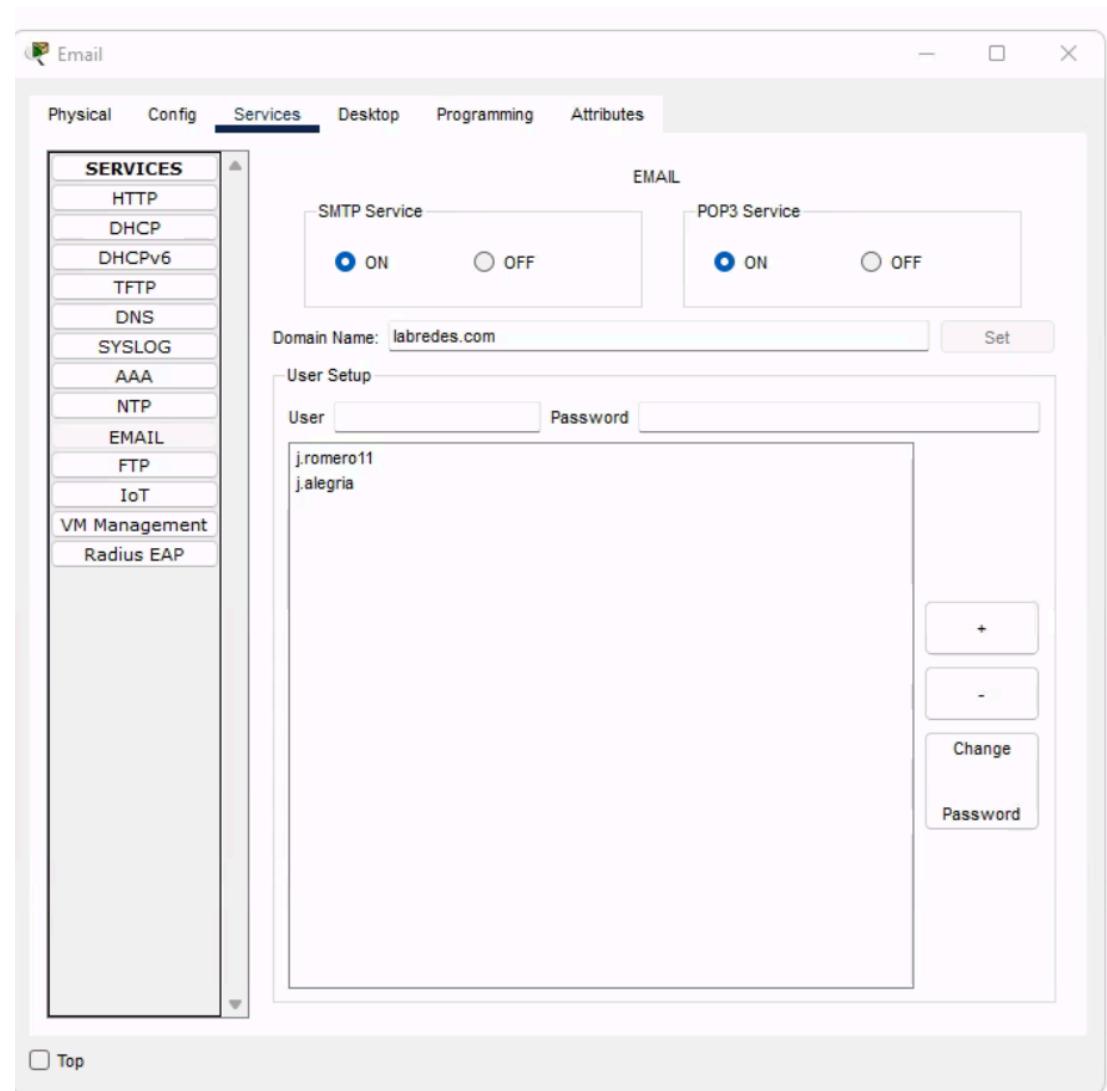
Pinging 192.168.1.34 with 32 bytes of data:

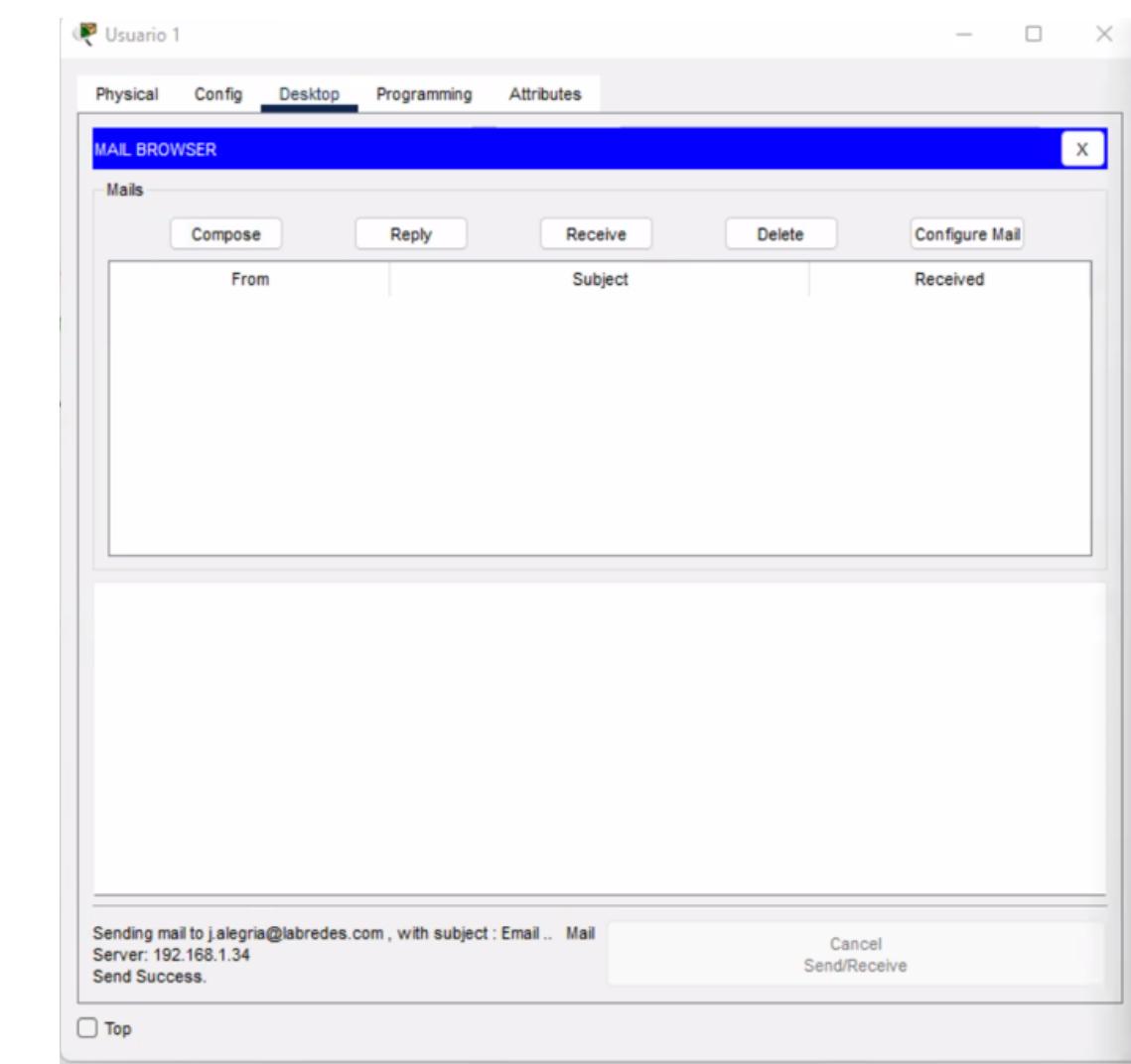
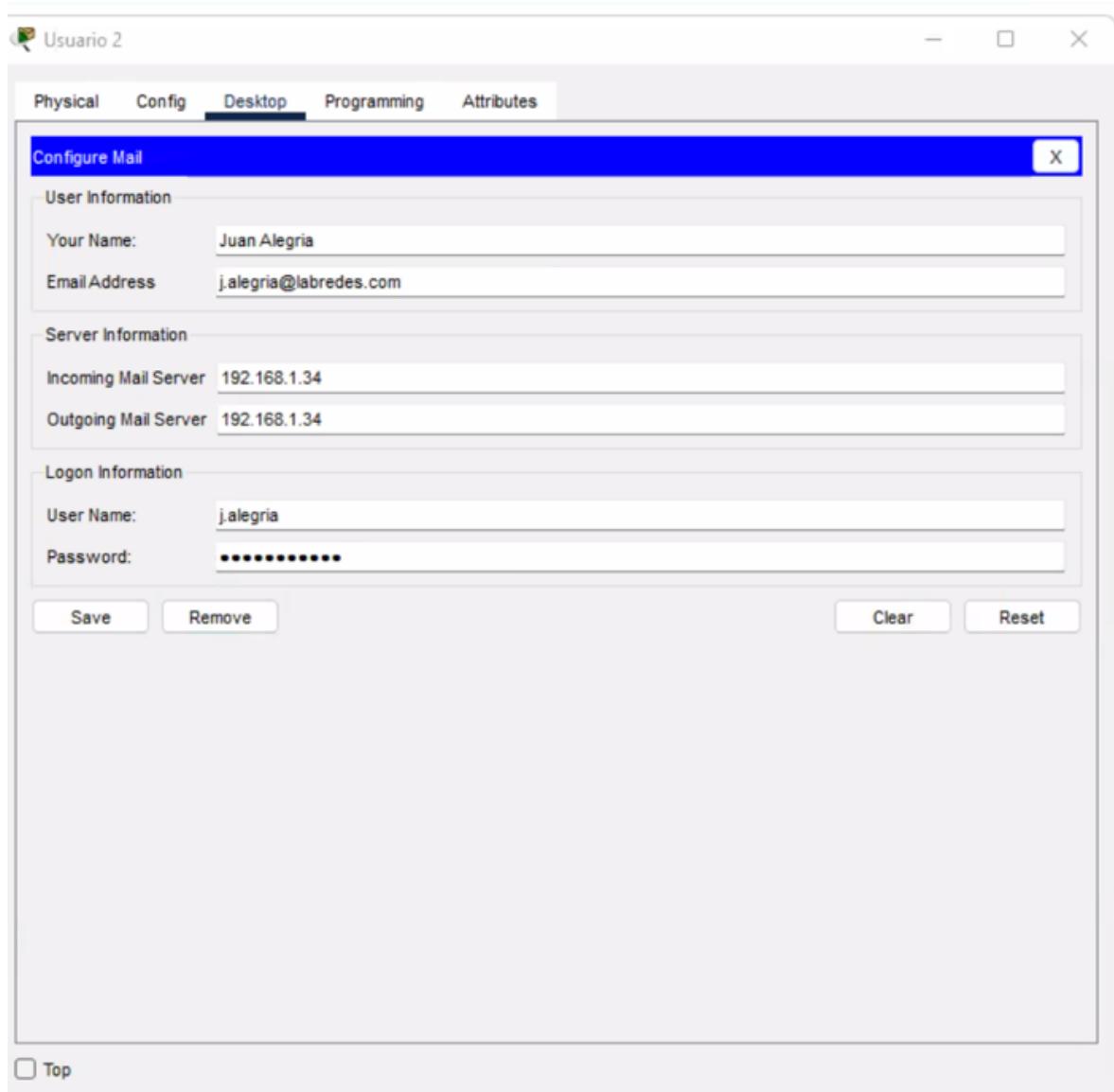
Reply from 192.168.1.34: bytes=32 time=16ms TTL=126
Reply from 192.168.1.34: bytes=32 time=16ms TTL=126
Reply from 192.168.1.34: bytes=32 time=26ms TTL=126
Reply from 192.168.1.34: bytes=32 time=16ms TTL=126

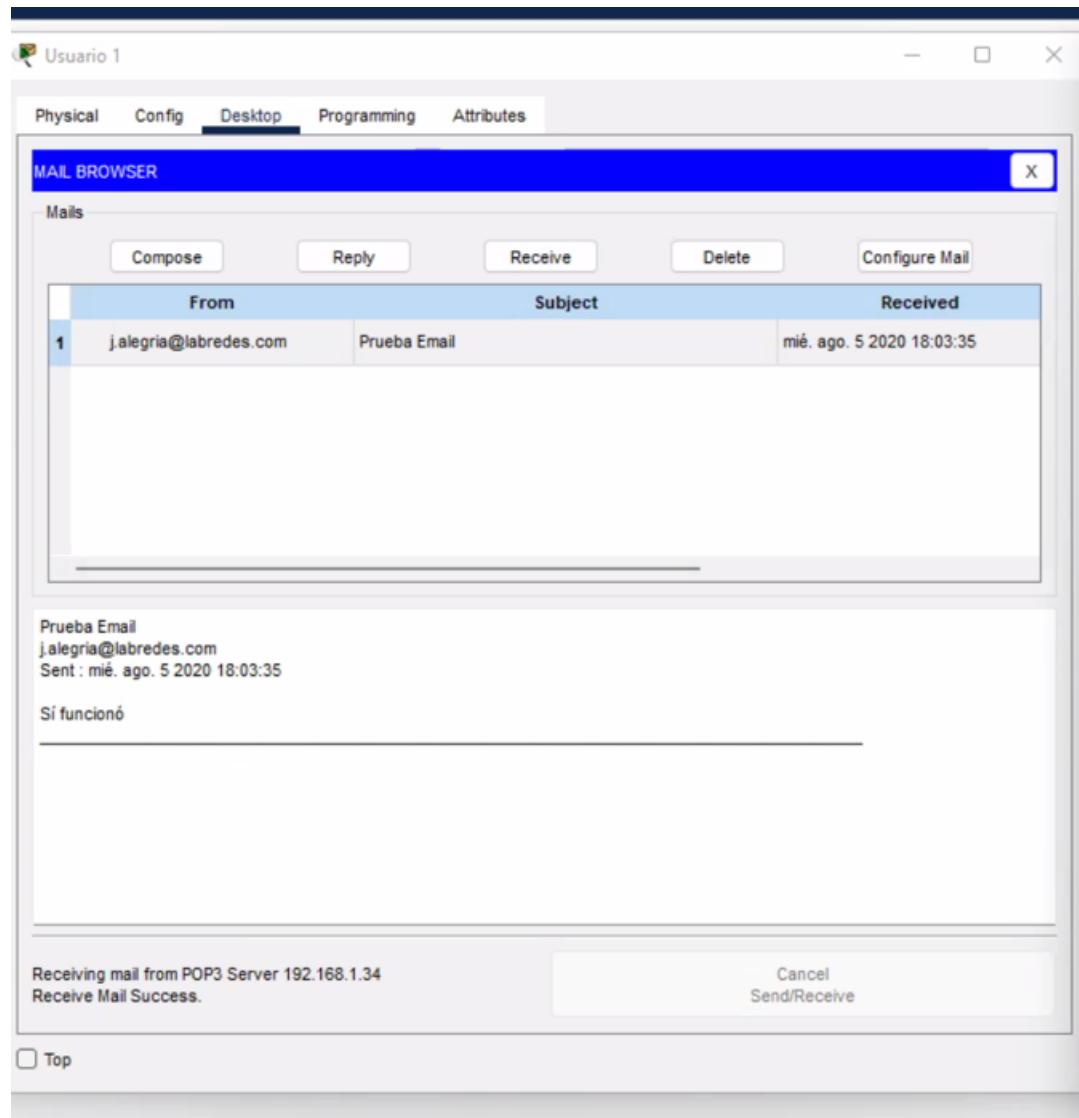
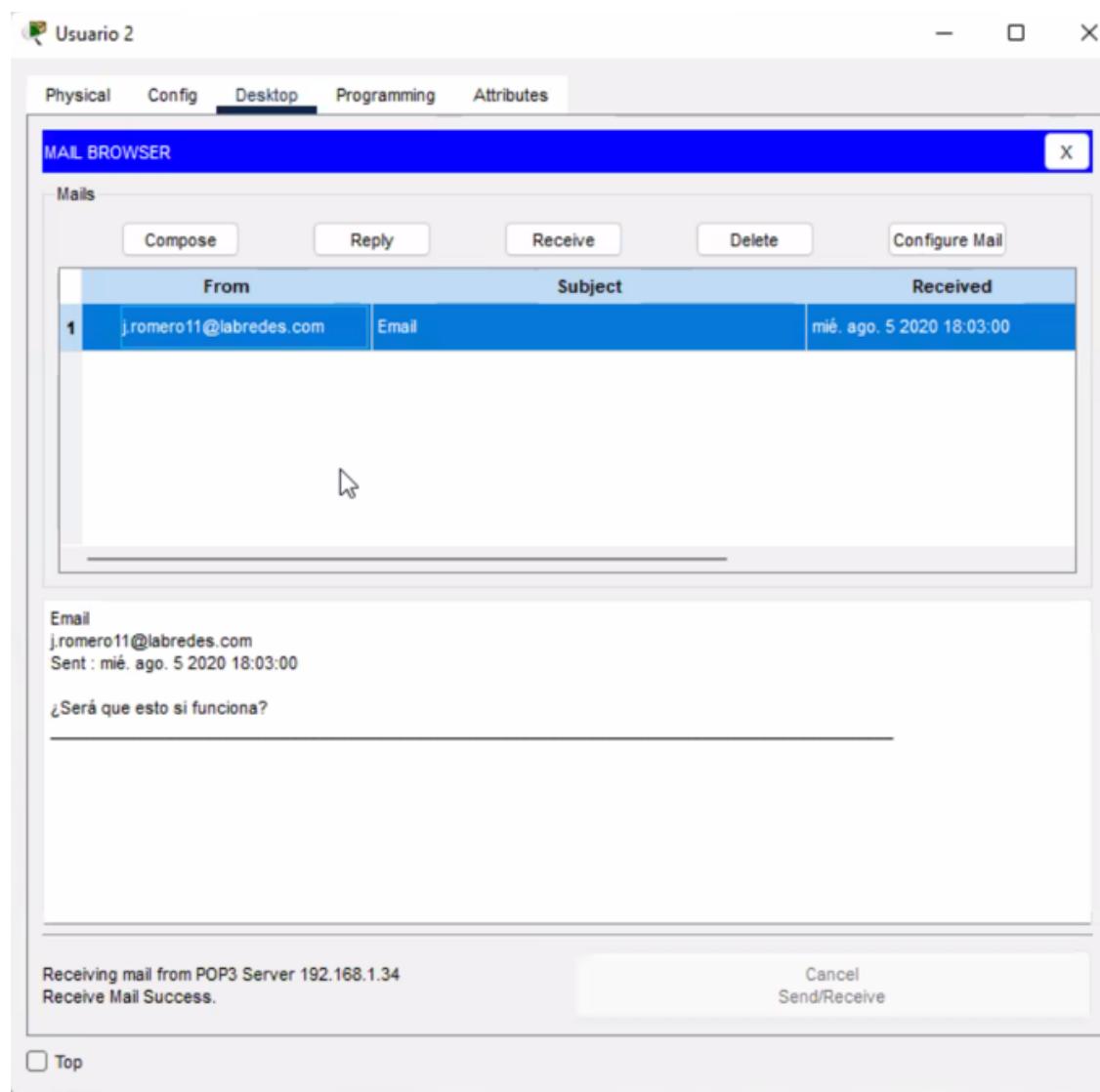
Ping statistics for 192.168.1.34:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 16ms, Maximum = 26ms, Average = 18ms

C:\>
```

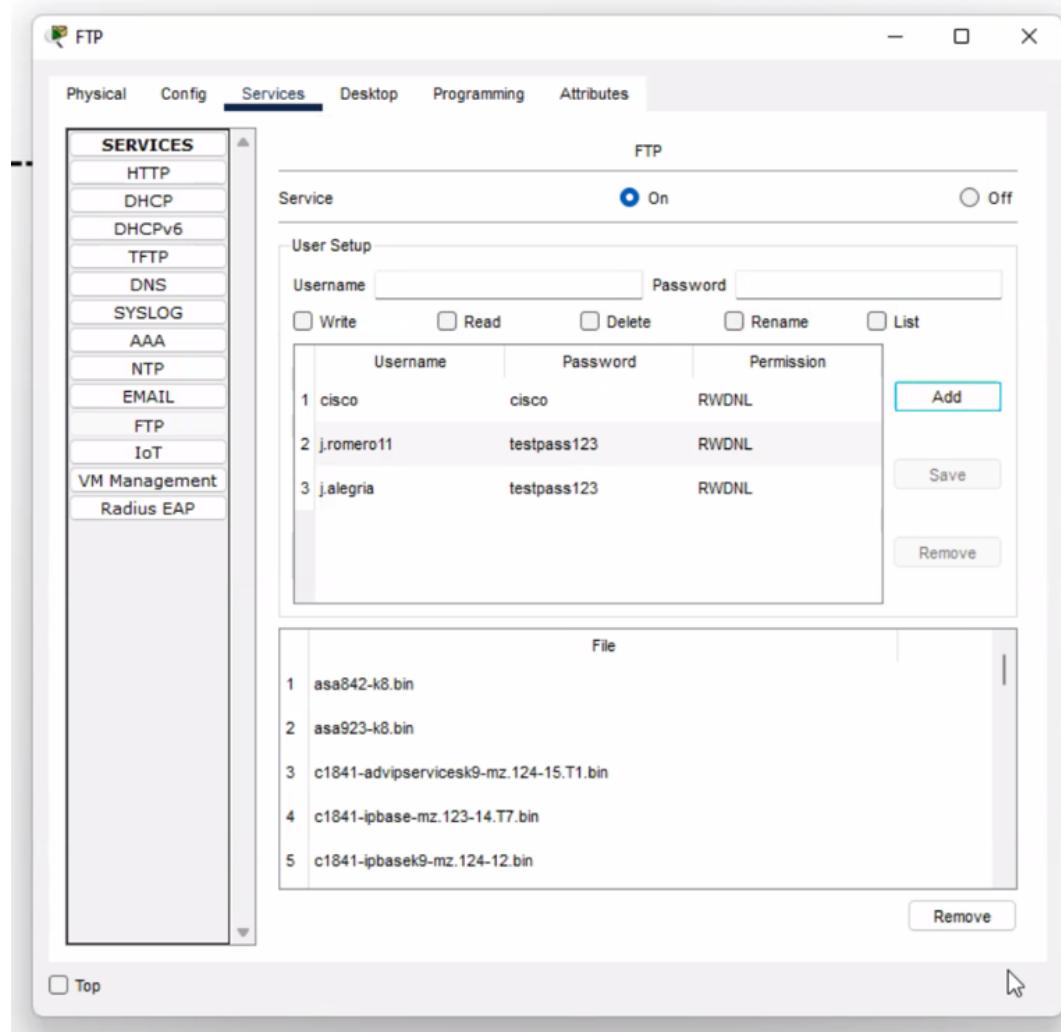
Top







4.6 Configuración y exploración de protocolo FTP



The screenshot shows the 'Command Prompt' window in Cisco Packet Tracer. The user has run the command `C:\>ping 192.168.1.33`. The output shows the ping results for the first attempt:

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.1.33

Pinging 192.168.1.33 with 32 bytes of data:

Request timed out.
Reply from 192.168.1.33: bytes=32 time=22ms TTL=126
Reply from 192.168.1.33: bytes=32 time=28ms TTL=126
Reply from 192.168.1.33: bytes=32 time=17ms TTL=126

Ping statistics for 192.168.1.33:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 17ms, Maximum = 28ms, Average = 22ms

C:\>ping 192.168.1.33

Pinging 192.168.1.33 with 32 bytes of data:

Reply from 192.168.1.33: bytes=32 time=20ms TTL=126
Reply from 192.168.1.33: bytes=32 time=13ms TTL=126
Reply from 192.168.1.33: bytes=32 time=16ms TTL=126
Reply from 192.168.1.33: bytes=32 time=6ms TTL=126

Ping statistics for 192.168.1.33:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 6ms, Maximum = 20ms, Average = 13ms

C:\>
```

Usuario 4

Physical Config Desktop Programming Attributes

Command Prompt X

```
C:\>ftp ftp.labredes.com
Trying to connect...ftp.labredes.com
Connected to ftp.labredes.com
220- Welcome to PT Ftp server
Username:j.romeroll
331- Username ok, need password
Password:
230- Logged in
(passive mode On)
ftp>dir

Listing /ftp directory from ftp.labredes.com:
0 : asa842-k8.bin 5571584
1 : asa923-k8.bin 30468096
2 : c1841-advipsericesk9-mz.124-15.T1.bin 33591768
3 : c1841-ipbase-mz.123-14.T7.bin 13832032
4 : c1841-ipbasek9-mz.124-12.bin 16599160
5 : c1900-universalk9-mz.SPA.155-3.M4a.bin 33591768
6 : c2600-advipsericesk9-mz.124-15.T1.bin 33591768
7 : c2600-i-mz.122-28.bin 5571584
8 : c2600-ipbasek9-mz.124-8.bin 13169700
9 : c2800nm-advipsericesk9-mz.124-15.T1.bin 50938004
10 : c2800nm-advipsericesk9-mz.151-4.M4.bin 33591768
11 : c2800nm-ipbase-mz.123-14.T7.bin 5571584
12 : c2800nm-ipbasek9-mz.124-8.bin 15522644
13 : c2900-universalk9-mz.SPA.155-3.M4a.bin 33591768
14 : c2950-i6q4l2-mz.121-22.EA4.bin 3058048
15 : c2950-i6q4l2-mz.121-22.EA8.bin 3117390
16 : c2960-lanbase-mz.122-25.FX.bin 4414921
17 : c2960-lanbase-mz.122-25.SE1.bin 4670455
18 : c2960-lanbasek9-mz.150-2.SE4.bin 4670455
19 : c3560-advipsericesk9-mz.122-37.SE1.bin 8662192
20 : c3560-advipsericesk9-mz.122-46.SE.bin 10713279
21 : c800-universalk9-mz.SPA.152-4.M4.bin 33591768
22 : c800-universalk9-mz.SPA.154-3.M6a.bin 83029236
23 : cat3k_caa-universalk9.16.03.02.SPA.bin 505532849
24 : cgr1000-universalk9-mz.SPA.154-2.CG 159487552
```

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```
ftp>get asa842-k8.bin

Reading file asa842-k8.bin from ftp.labredes.com:
File transfer in progress...

[Transfer complete - 5571584 bytes]

5571584 bytes copied in 68.046 secs (18761 bytes/sec)
ftp>
```

Top

Preguntas

1. ¿Defina con sus palabras qué es el protocolo ICMP y cuál es su función? Basado en su respuesta, explicar por qué se suele perder el primer paquete del comando ping.

R// ICMP es un protocolo de soporte diseñado especialmente para que los dispositivos de red permitan intercambiar mensajes de error e información operativa entre ellos.

El primer paquete del comando ping se suele perder ya que los dispositivos necesitan identificarse entre sí para comunicarse. Cuando se envía el primer paquete, el router lo atrapa y lo deja en espera mientras envía un ARP broadcast e intenta mapear la dirección MAC del otro dispositivo, luego espera a la respuesta del dispositivo remoto y finalmente envía el paquete al destinatario. Esta demora, por lo general es demasiado larga y sobrepasa el límite de tiempo del ping, lo cual hace que aparezca como perdido.

Los siguientes paquetes, durante los próximos 5 minutos, no fallarán dado que las direcciones MAC entre dispositivos quedarán en el ARP cache de los routers.

2. Escriba las diferencias que pudieron percibir al realizar las pruebas de conectividad utilizando la URL y la dirección IP.

R// En las pruebas de conectividad, se nota una leve demora adicional de tiempo cuando se utilizaba la URL. Esto puede ser dado que la conexión por IP es directa mientras que al utilizar una URL, se debía de consultar la DNS para asociar la URL con su respectiva IP, por lo que son pasos adicionales que aumentan un poco el tiempo de respuesta en la red.

3. ¿Qué es una PDU?

R// PDU (Protocol Data Unit) es una unidad básica de intercambio de datos entre entidades que se comunican utilizando un protocolo de red específico. Cada protocolo define sus propios PDUs, los cuales son usados por las máquinas que se quieren comunicar a través de él.

4. ¿Cuáles son las PDU de las capas de aplicación, transporte, red y enlace de datos?

R// Las PDU de cada capa son:

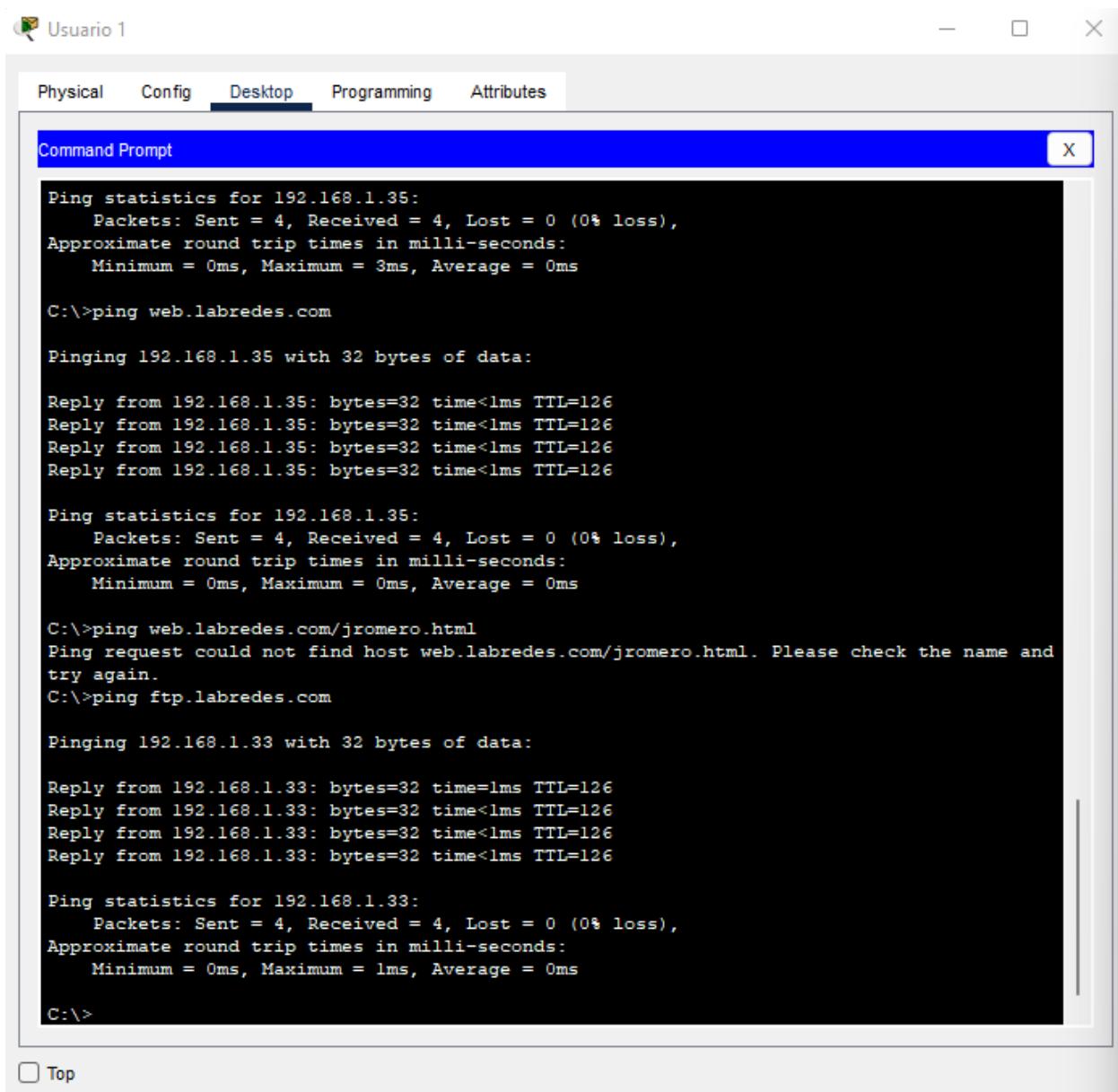
- PDU Capa de aplicación: Datos (APDU)
- PDU Capa de transporte: Segmento (TPDU)
- PDU Capa de red: Paquete
- PDU Capa de enlace: Trama

5. ¿Una aplicación puede usar más de un esquema de comunicación, ejemplo Cliente-servidor y P2P?

R// Sí, una aplicación puede usar más de un esquema de comunicación si su arquitectura lo permite. En general, los microservicios manejan esquemas diferentes para realizar las distintas tareas. Un ejemplo de esto puede ser un juego en línea, donde las partidas entre jugadores utilicen P2P, mientras que el almacenamiento del progreso y los datos del personaje utilicen cliente-servidor.

6. Realice una prueba de ping al servidor ftp.labredes.com desde el equipo del Usuario 1 y el equipo del Usuario 3. ¿A qué atribuye que los resultados de las pruebas difieran tanto?

R//



The screenshot shows a Windows desktop environment. A window titled "Command Prompt" is open, running under the user "Usuario 1". The window contains the following command-line output:

```
Ping statistics for 192.168.1.35:
  Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
  Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 3ms, Average = 0ms

C:\>ping web.labredes.com

Pinging 192.168.1.35 with 32 bytes of data:

Reply from 192.168.1.35: bytes=32 time<1ms TTL=126

Ping statistics for 192.168.1.35:
  Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
  Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>ping web.labredes.com/jromero.html
Ping request could not find host web.labredes.com/jromero.html. Please check the name and
try again.

C:\>ping ftp.labredes.com

Pinging 192.168.1.33 with 32 bytes of data:

Reply from 192.168.1.33: bytes=32 time=1ms TTL=126
Reply from 192.168.1.33: bytes=32 time<1ms TTL=126
Reply from 192.168.1.33: bytes=32 time<1ms TTL=126
Reply from 192.168.1.33: bytes=32 time<1ms TTL=126

Ping statistics for 192.168.1.33:
  Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
  Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>
```

The screenshot shows a network configuration interface titled "Usuario 3". At the top, there are tabs: Physical, Config, Desktop, Programming, and Attributes. The "Desktop" tab is selected. Below the tabs is a "Command Prompt" window with a blue header bar containing the title "Command Prompt" and a close button "X". The main area of the window displays the output of several ping commands:

```
Reply from 192.168.1.34: bytes=32 time=25ms TTL=126
Reply from 192.168.1.34: bytes=32 time=25ms TTL=126

Ping statistics for 192.168.1.34:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 16ms, Maximum = 25ms, Average = 22ms

C:\>ping 192.168.1.34

Pinging 192.168.1.34 with 32 bytes of data:

Reply from 192.168.1.34: bytes=32 time=16ms TTL=126
Reply from 192.168.1.34: bytes=32 time=16ms TTL=126
Reply from 192.168.1.34: bytes=32 time=26ms TTL=126
Reply from 192.168.1.34: bytes=32 time=16ms TTL=126

Ping statistics for 192.168.1.34:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 16ms, Maximum = 26ms, Average = 18ms

C:\>ping ftp.labredes.com

Pinging 192.168.1.33 with 32 bytes of data:

Reply from 192.168.1.33: bytes=32 time=34ms TTL=126
Reply from 192.168.1.33: bytes=32 time=25ms TTL=126
Reply from 192.168.1.33: bytes=32 time=45ms TTL=126
Reply from 192.168.1.33: bytes=32 time=22ms TTL=126

Ping statistics for 192.168.1.33:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 22ms, Maximum = 45ms, Average = 31ms

C:\>
```

Top

Es posible que las pruebas sean así de diferentes porque el usuario 1 está conectado por Ethernet a la red, mientras que la conexión del usuario 3 es inalámbrica.

Al realizar la misma prueba con el resto de usuarios, se puede apreciar que el usuario 2 (conectado a Ethernet) también tiene una latencia promedio de 1ms, mientras que el usuario 4 (Wireless) tiene un promedio de 26ms, lo cual confirma el argumento anterior.

7. Desde su equipo utilice por consola de comandos la herramienta tracert (Windows) o traceroute (Linux - MAC) apuntando a www.google.com ¿Qué información obtiene?, ¿Cuál es la utilidad de esta herramienta?

The screenshot shows a terminal window with the command "C:\Users\Juan PC>tracert www.google.com" entered at the prompt. The output shows the traceroute path to Google's website:

```
C:\Users\Juan PC>tracert www.google.com

Traza a la dirección www.google.com [2800:3f0:4005:409::2004]
sobre un máximo de 30 saltos:

 1      1 ms      2 ms      2 ms  2800:484:4e83:e520:1682:5bff:fe00:20
 2     28 ms     28 ms     22 ms  2800:485:0:42::1
 3     23 ms     24 ms     24 ms  2800:483:100:a8::1
 4     21 ms     25 ms     21 ms  2001:4860:1:1::2002
 5     26 ms     28 ms     24 ms  2800:3f0:804e::1
 6     29 ms      *       *      2001:4860:0:1::4da0
 7     59 ms     20 ms      *      2001:4860:0:1::4d95
 8     28 ms     31 ms     30 ms  2800:3f0:4005:409::2004

Traza completa.

C:\Users\Juan PC>
```

De tracert obtengo resultados de todos los saltos que dieron los paquetes enviados para llegar a su destino (que en este caso es www.google.com) De cada salto se obtiene la latencia de ir y volver de cada paquete y la dirección IP del router al que llegó. Cuando aparecen asteriscos, quiere decir que el paquete no llegó satisfactoriamente al router. Esta herramienta es bastante útil para diagnosticar una red mostrando en qué lugares de ella puede haber inconvenientes o en dónde hay cuellos de botella.