UNIVERSIDAD PRIVADA FRANZ TAMAYO

FACULTAD DE INGENIERÍA

INGENIERÍA DE SISTEMAS

Desarrollo De Proyecto

Hito 4

Docente:

- **Gustavo Adolfo Rivera Arteaga**

Estudiante:

- **Alejandro Valdivia Montalvo**
- **Erika Camila Veramendi Salcedo**
- **Alba Liria Gomez Montaño**

Asignatura:

- **Redes II**

Fecha:

- **06/06/25**

Cochabamba-Bolivia

2025

1. Introducción

Este proyecto tiene como propósito diseñar y simular una red de datos que interconecte todas las sedes de la universidad ubicadas en diferentes ciudades de Bolivia: La Paz, El Alto, Santa Cruz y dos sedes en Cochabamba. La simulación busca representar una red funcional que permita la comunicación eficiente entre todas las sedes, integrando servicios como VoIP y conectividad multiusuario. El desarrollo se realiza utilizando Cisco Packet Tracer como herramienta principal de simulación.

2. Objetivos

2.1. Objetivo General:

Diseñar una red institucional simulada que conecte todas las sedes de la universidad, permitiendo comunicación entre ellas mediante protocolos de enrutamiento y servicios de voz sobre IP (VoIP).

2.2. Objetivos Específicos:

- Simular la red completa utilizando routers, switches y terminales configurados adecuadamente.
- Configurar el servicio VoIP para permitir llamadas entre teléfonos IP en distintas sedes.
- Preparar la red para la implementación de multiusuarios y segmentación de tráfico mediante VLANs.
- Garantizar conectividad y comunicación dinámica utilizando protocolos como EIGRP.

3. Estructura General del Proyecto

La red está dividida por sedes, cada una con su propia LAN configurada. Todas las sedes están interconectadas mediante routers y enlaces simulados. Cada LAN incluye segmentos

separados por VLANs para distintas áreas (administrativa, docente, estudiantes y VoIP). El protocolo de enrutamiento EIGRP permite la comunicación entre ciudades de forma dinámica. Además, se han integrado teléfonos IP para probar llamadas internas.

4. Marco Teórico

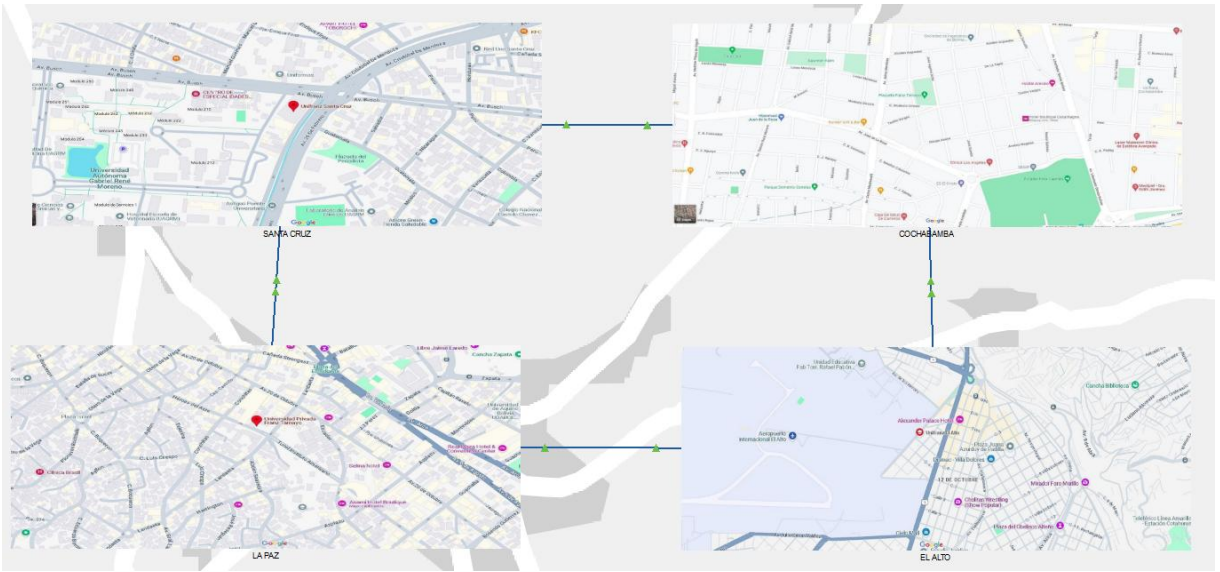
Una red de área amplia (WAN) conecta múltiples redes locales (LAN) distribuidas geográficamente. En este proyecto se implementa un modelo WAN simulado que une las distintas sedes universitarias. Se utiliza el protocolo EIGRP (Enhanced Interior Gateway Routing Protocol) para el enrutamiento dinámico entre routers, permitiendo una comunicación eficiente y automática.

El servicio VoIP (Voice over IP) permite realizar llamadas telefónicas a través de la red IP, utilizando teléfonos IP conectados a switches. Para lograr una administración eficiente, se pueden aplicar VLANs (Redes de Área Local Virtuales) que dividen la red física en subredes lógicas, mejorando el control del tráfico y la seguridad.

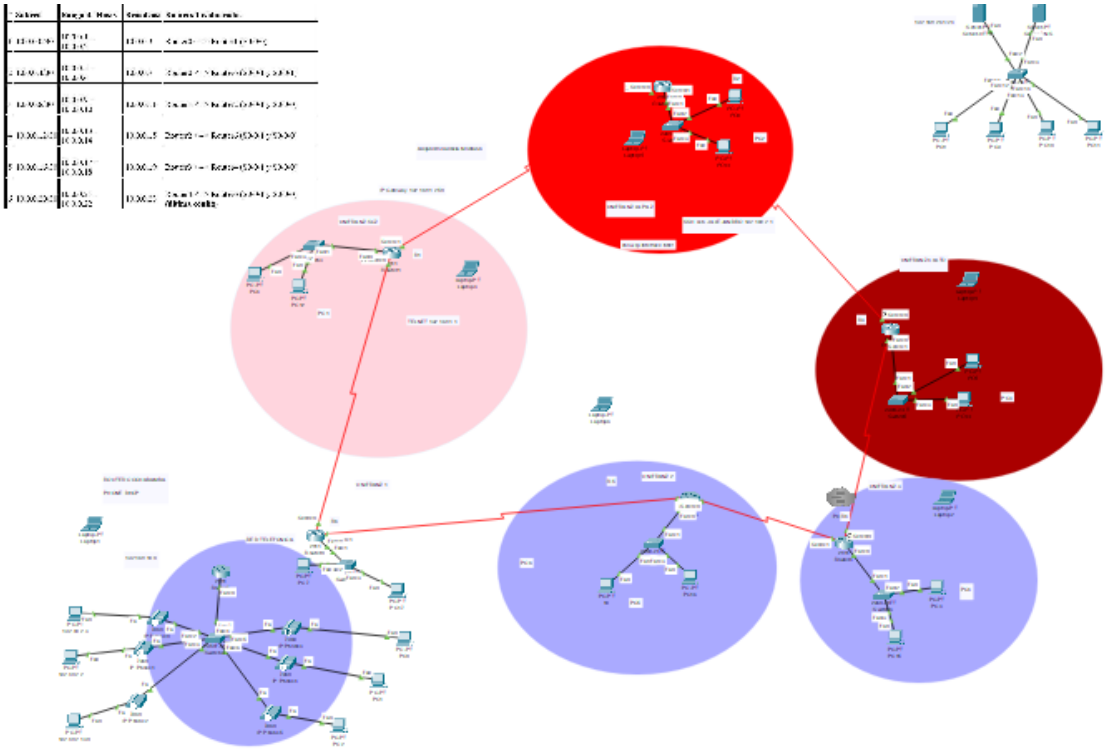
Todo el diseño y configuración se realiza en Cisco Packet Tracer, un simulador de redes que permite representar y probar redes antes de implementarlas físicamente.

5. Diseño y desarrollo del proyecto

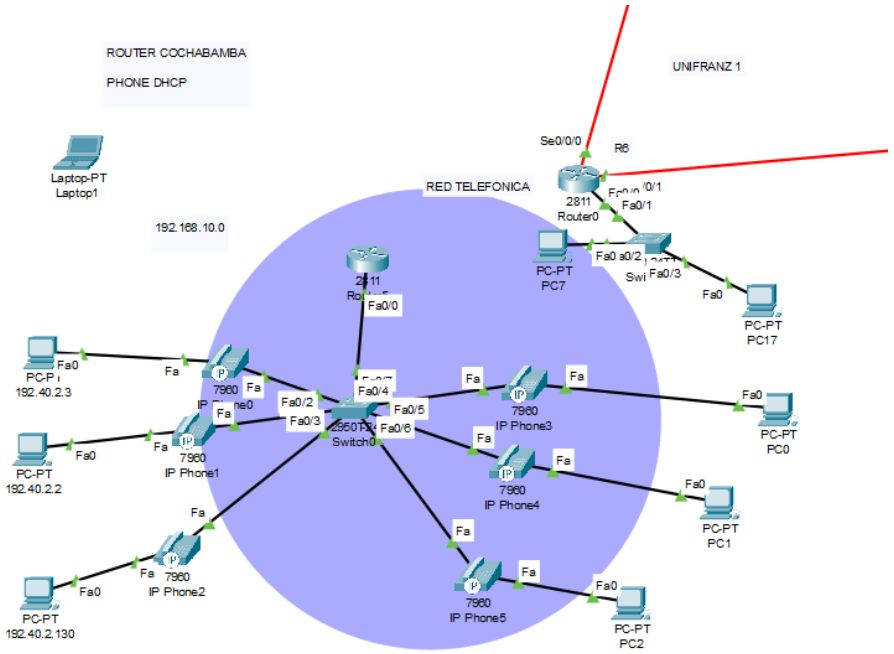
5.1. Esquema

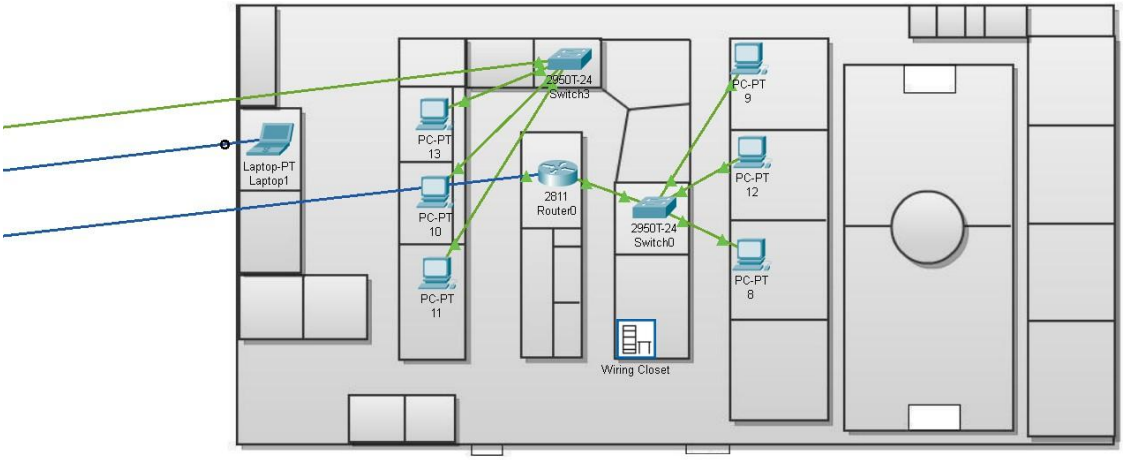


5.2. Conexión De Sedes

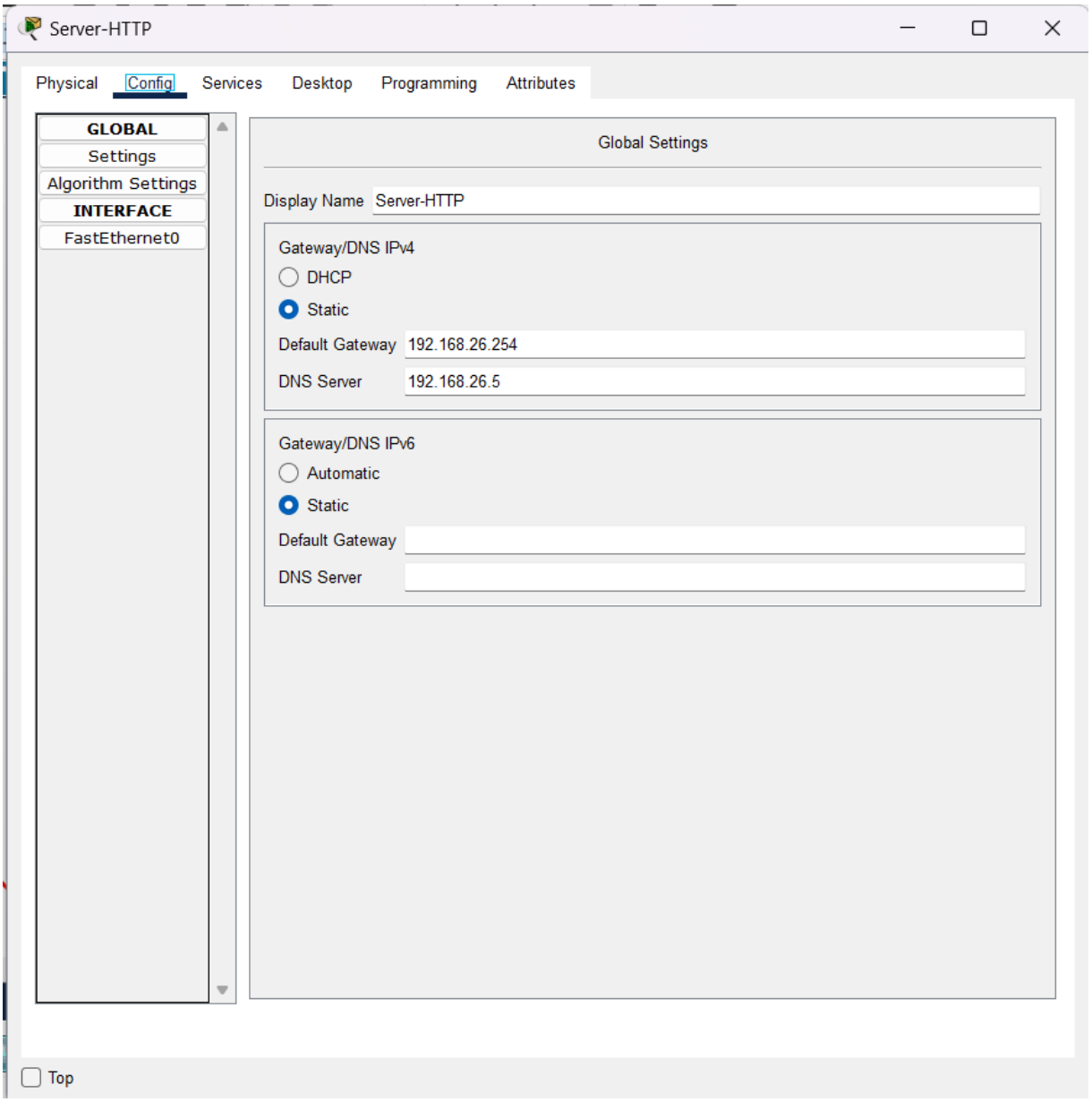


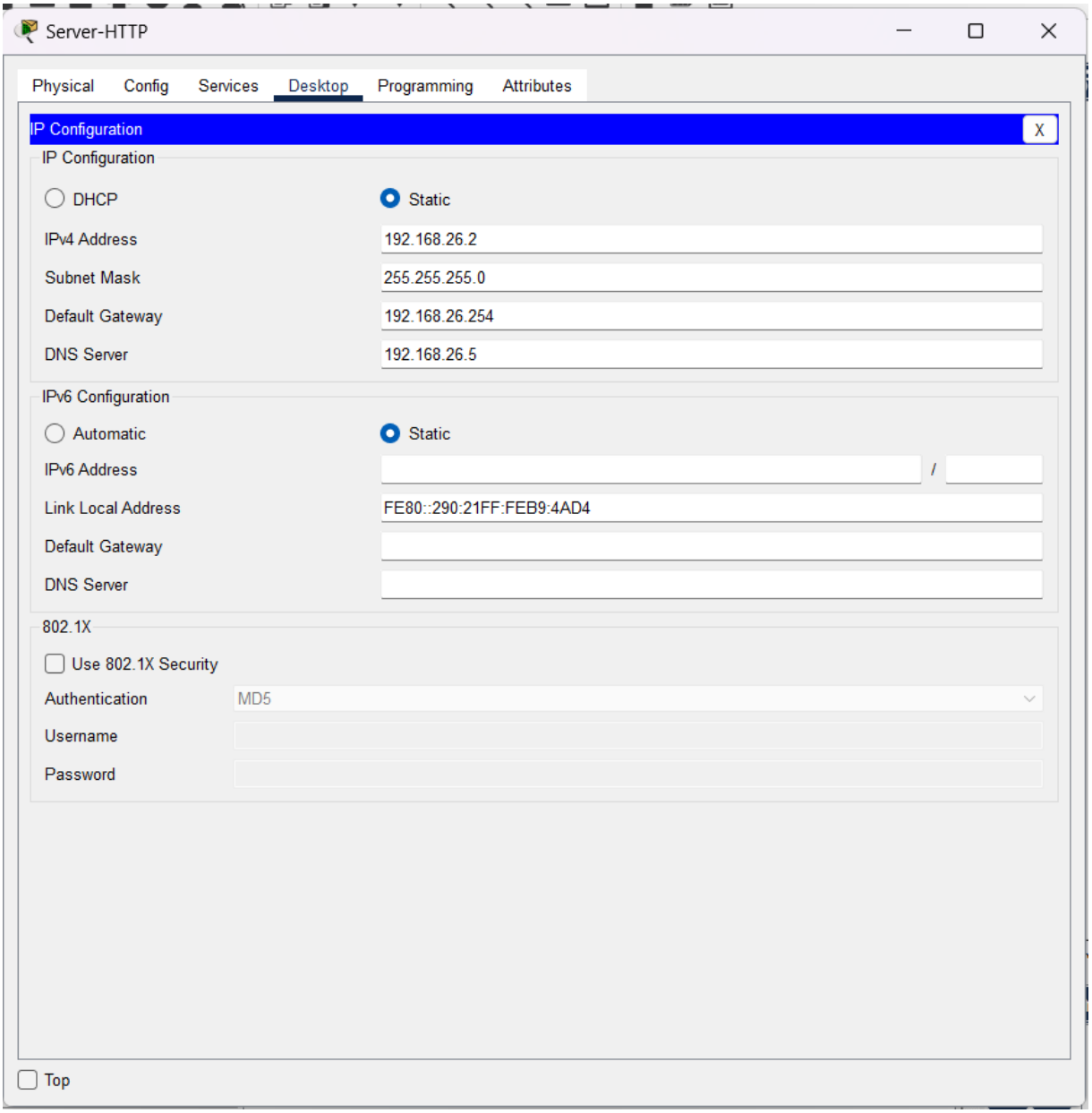
5.3. Telefonos Ip

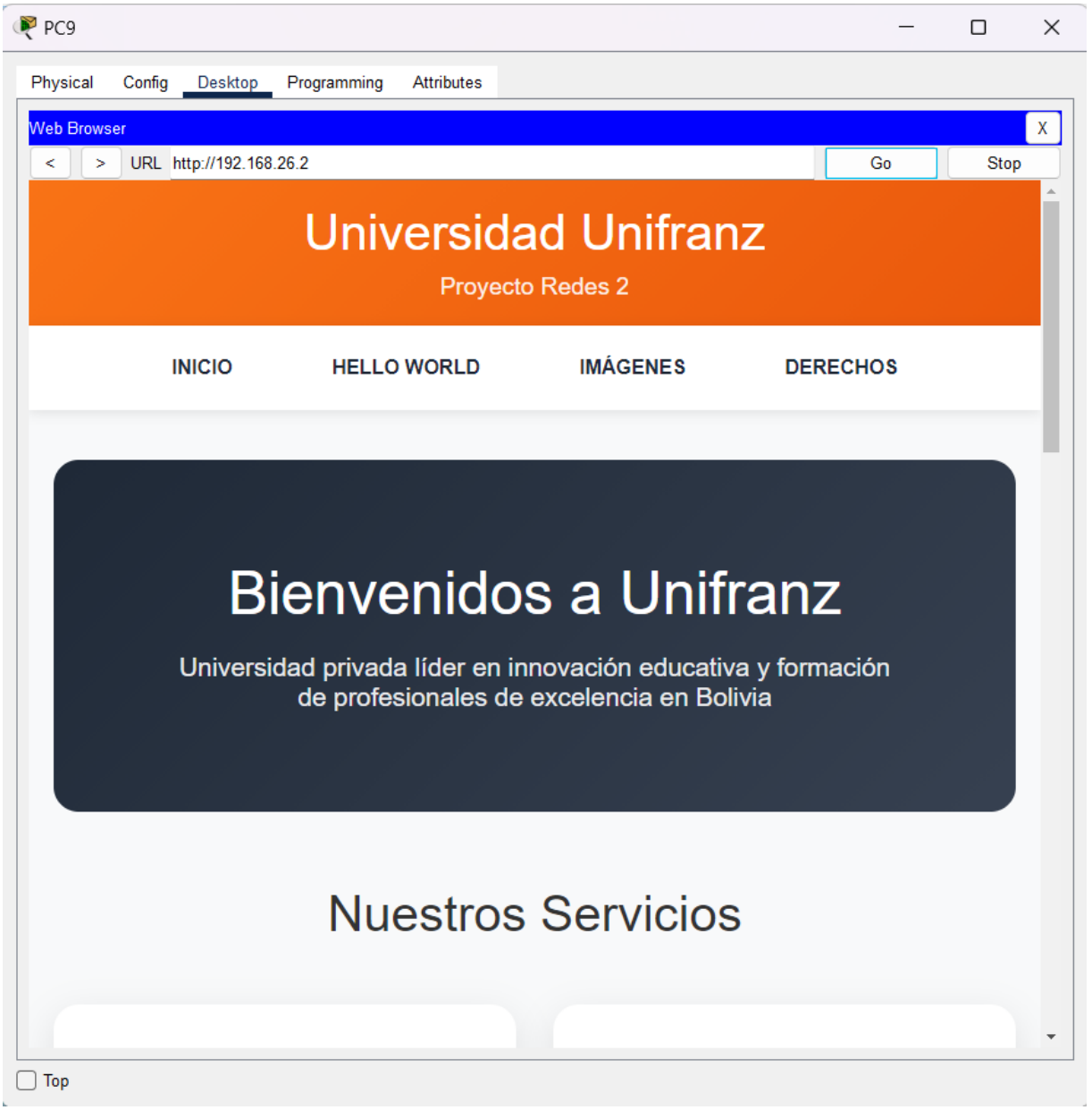


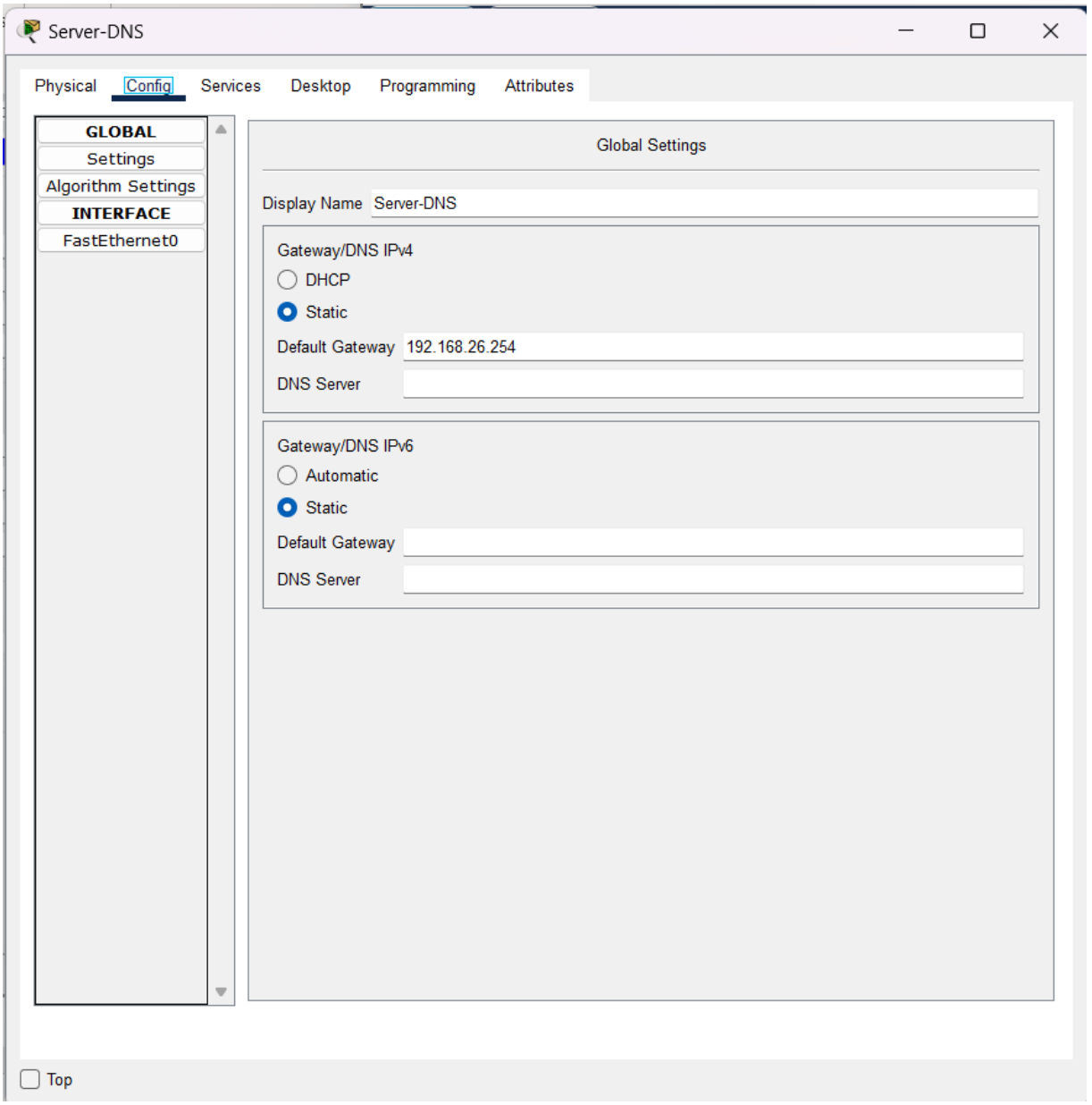


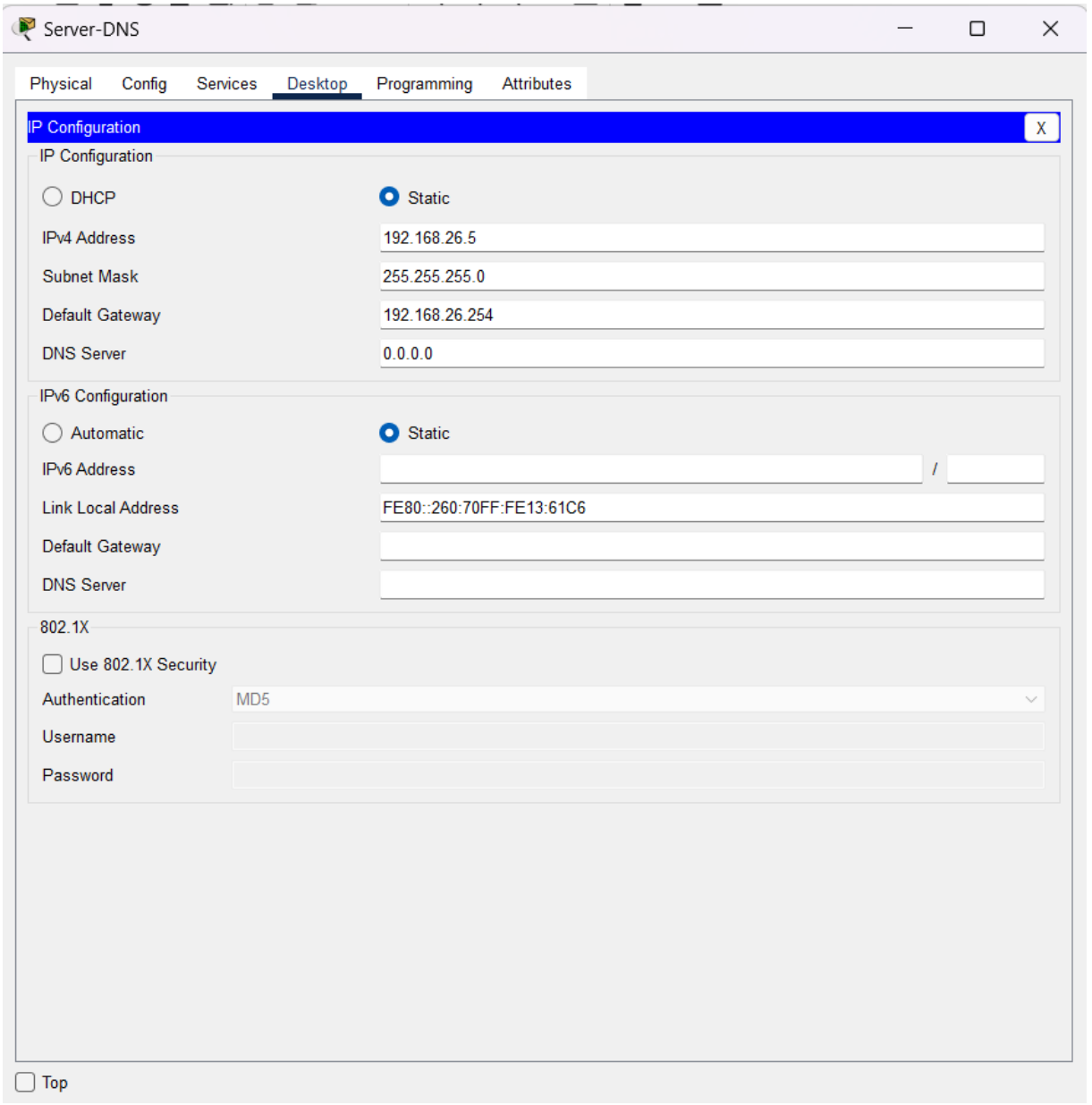
5.4. Servidores HTTP Y DNS

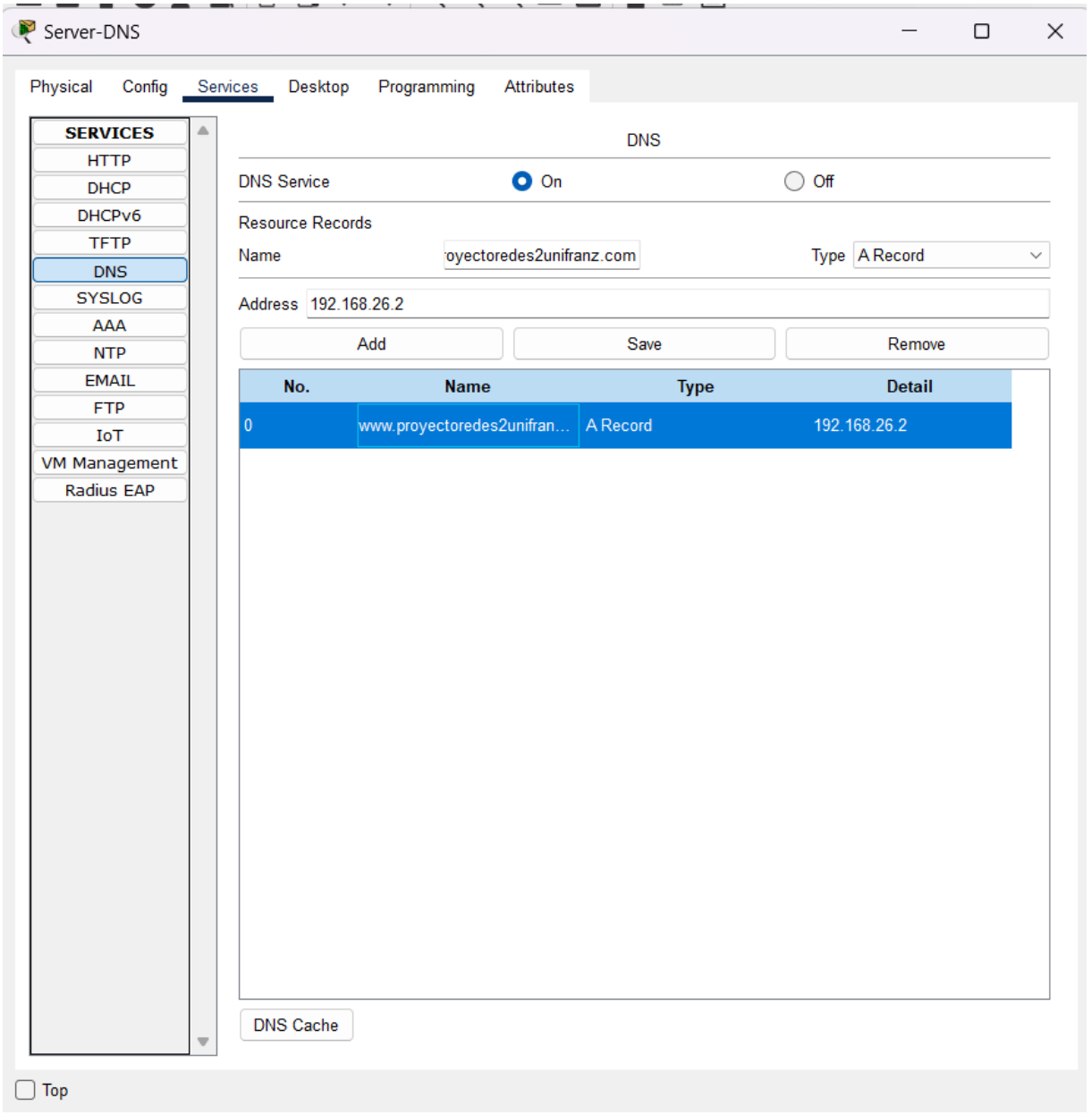


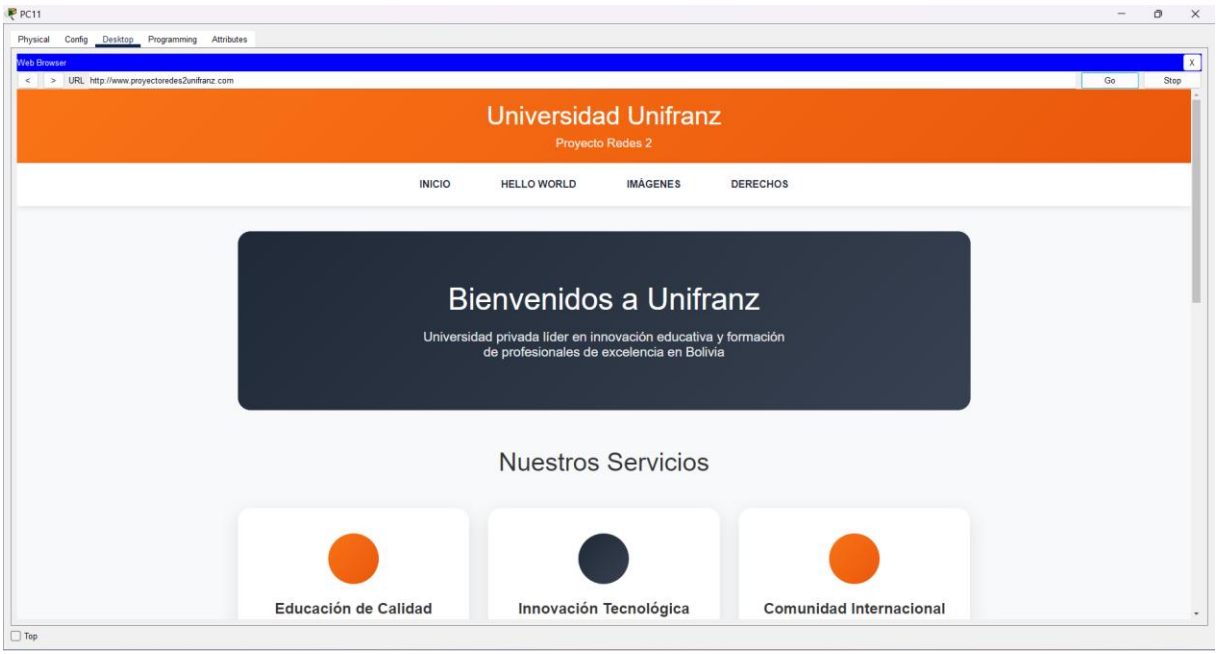

Server-HTTP
Physical
Config
Services
Desktop
Programming
Attributes
IP Configuration
X
IP Configuration
DHCP
Static
IPv4 Address
192.168.26.2
Subnet Mask
255.255.255.0
Default Gateway
192.168.26.254
DNS Server
192.168.26.5
IPv6 Configuration
Automatic
Static
IPv6 Address
/
Link Local Address
FE80::290:21FF:FEB9:4AD4
Default Gateway
DNS Server
802.1X
Use 802.1X Security
Authentication
MD5
Username
Password
Top

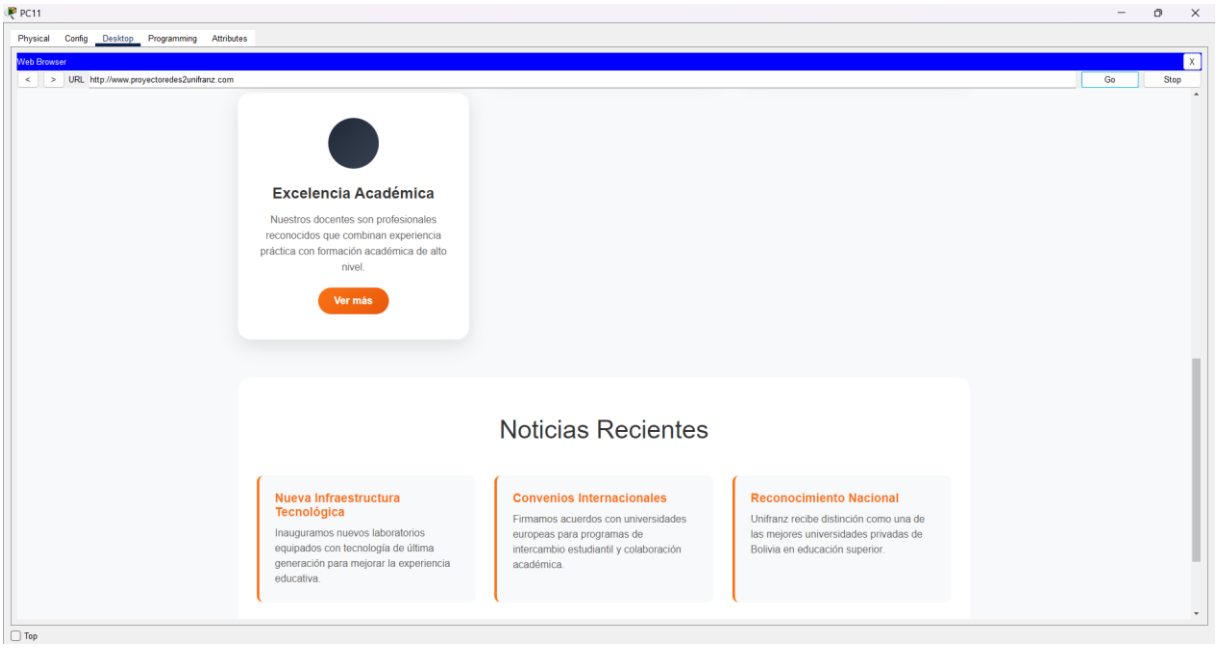

PC9
Physical
Config
Desktop
Programming
Attributes
Web Browser
X
<
>
URL
http://192.168.26.2
Go
Stop
Universidad Unifranz
Proyecto Redes 2
INICIO
HELLO WORLD
IMÁGENES
DERECHOS
Bienvenidos a Unifranz
Universidad privada líder en innovación educativa y formación de profesionales de excelencia en Bolivia
Nuestros Servicios
Top

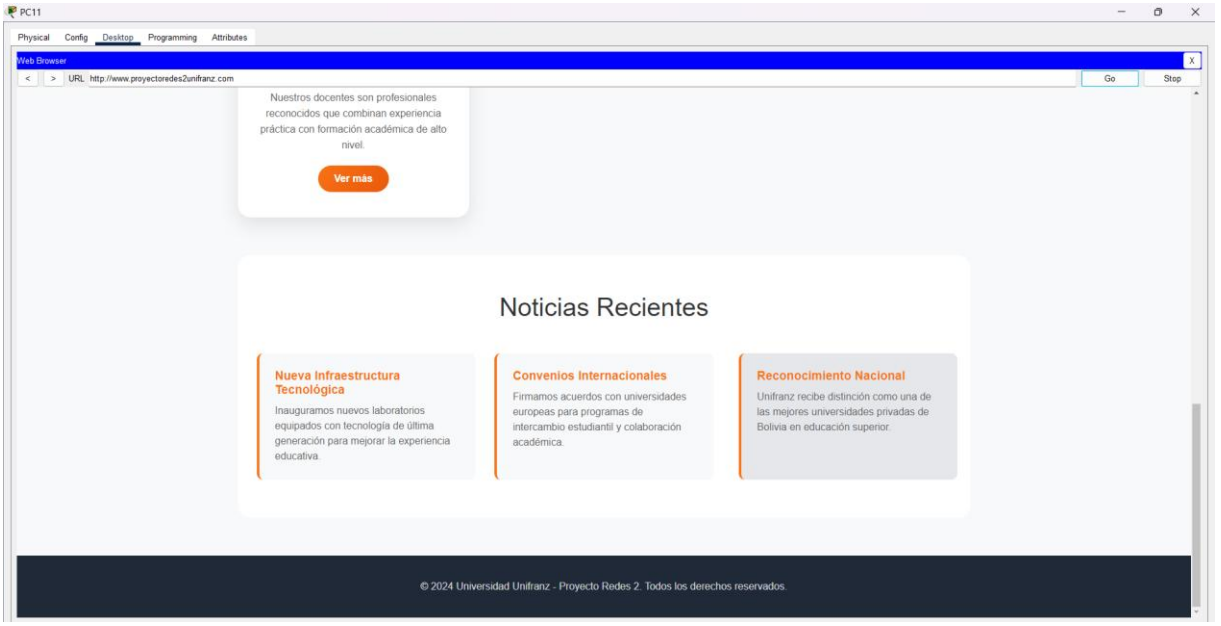

Server-DNS
Physical
Config
Services
Desktop
Programming
Attributes
GLOBAL
Settings
Algorithm Settings
INTERFACE
FastEthernet0
Global Settings
Display Name
Server-DNS
Gateway/DNS IPv4
DHCP
Static
Default Gateway
192.168.26.254
DNS Server
Gateway/DNS IPv6
Automatic
Static
Default Gateway
DNS Server
Top


Server-DNS
Physical
Config
Services
Desktop
Programming
Attributes
IP Configuration
X
IP Configuration
DHCP
Static
IPv4 Address
192.168.26.5
Subnet Mask
255.255.255.0
Default Gateway
192.168.26.254
DNS Server
0.0.0.0
IPv6 Configuration
Automatic
Static
IPv6 Address
/
Link Local Address
FE80::260:70FF:FE13:61C6
Default Gateway
DNS Server
802.1X
Use 802.1X Security
Authentication
MD5
Username
Password
Top


Server-DNS
Physical
Config
Services
Desktop
Programming
Attributes
SERVICES
HTTP
DHCP
DHCPv6
TFTP
DNS
SYSLOG
AAA
NTP
EMAIL
FTP
IoT
VM Management
Radius EAP
DNS
DNS Service
On
Off
Resource Records
Name
oyectoredes2unifranz.com
Type
A Record
Address
192.168.26.2
Add
Save
Remove
No.
Name
Type
Detail
0
www.proyectoredes2unifran...
A Record
192.168.26.2
DNS Cache
Top


PC11
Physical
Config
Desktop
Programming
Attributes
Web Browser
URL
http://www.proyectoredes2unifranz.com
Go
Stop
Universidad Unifranz
Proyecto Redes 2
INICIO
HELLO WORLD
IMÁGENES
DERECHOS
Bienvenidos a Unifranz
Universidad privada líder en innovación educativa y formación de profesionales de excelencia en Bolivia
Nuestros Servicios
Educación de Calidad
Innovación Tecnológica
Comunidad Internacional
Top


PC11
Physical
Config
Desktop
Programming
Attributes
Web Browser
URL
http://www.proyectoredes2unifranz.com
Go
Stop
Excelencia Académica
Nuestros docentes son profesionales reconocidos que combinan experiencia práctica con formación académica de alto nivel.
Ver más
Noticias Recientes
Nueva Infraestructura Tecnológica
Inauguramos nuevos laboratorios equipados con tecnología de última generación para mejorar la experiencia educativa.
Convenios Internacionales
Firmamos acuerdos con universidades europeas para programas de intercambio estudiantil y colaboración académica.
Reconocimiento Nacional
Unifranz recibe distinción como una de las mejores universidades privadas de Bolivia en educación superior.
Top


PC11
Physical
Config
Desktop
Programming
Attributes
Web Browser
URL
http://www.proyectoredes2unifranz.com
Go
Stop
Nuestros docentes son profesionales reconocidos que combinan experiencia práctica con formación académica de alto nivel.
Ver más
Noticias Recientes
Nueva Infraestructura Tecnológica
Inauguramos nuevos laboratorios equipados con tecnología de última generación para mejorar la experiencia educativa.
Convenios Internacionales
Firmamos acuerdos con universidades europeas para programas de intercambio estudiantil y colaboración académica.
Reconocimiento Nacional
Unifranz recibe distinción como una de las mejores universidades privadas de Bolivia en educación superior.
© 2024 Universidad Unifranz - Proyecto Redes 2. Todos los derechos reservados.

Conexion de Routers:

PROTOCOLO RIP

Router 0:

```
enable
configure terminal
hostname Router0
interface Serial0/0/0
ip address 10.0.0.1 255.255.255.252
clock rate 64000
no shutdown
exit
interface Serial0/0/1
ip address 10.0.0.5 255.255.255.252
no shutdown
exit
```

RIP:

```
Router0(config)# router rip
Router0(config-router)# version 2
Router0(config-router)# network 10.0.0.0
Router0(config-router)# network 192.168.10.0
Router0(config-router)# network 192.168.40.0
Router0(config-router)# no auto-summary
Router0(config-router)# exit
```

Router 1:

```
Router1> enable
```

```
Router1# configure terminal
Router1(config)# hostname Router1
Router1(config)# interface Serial0/0/0
Router1(config-if)# ip address 10.0.0.2 255.255.255.252
Router1(config-if)# no shutdown
Router1(config-if)# exit
Router1(config)# interface Serial0/0/1
Router1(config-if)# ip address 10.0.0.9 255.255.255.252
Router1(config-if)# clock rate 64000
Router1(config-if)# no shutdown
Router1(config-if)# exit
```

RIP:

```
Router1(config)# router rip
Router1(config-router)# version 2
Router1(config-router)# network 10.0.0.0
Router1(config-router)# network 192.168.1.0
Router1(config-router)# no auto-summary
Router1(config-router)# exit
```

Router 2:

```
Router2> enable
Router2# configure terminal
Router2(config)# hostname Router2
Router2(config)# interface Serial0/0/0
Router2(config-if)# ip address 10.0.0.10 255.255.255.252
Router2(config-if)# no shutdown
Router2(config-if)# exit
Router2(config)# interface Serial0/0/1
Router2(config-if)# ip address 10.0.0.13 255.255.255.252
Router2(config-if)# clock rate 64000
Router2(config-if)# no shutdown
Router2(config-if)# exit
```

RIP:

```
Router2(config)# router rip
Router2(config-router)# version 2
```

```
Router2(config-router)# network 10.0.0.0
Router2(config-router)# network 192.168.10.0
Router2(config-router)# no auto-summary
Router2(config-router)# exit
```

```
Router2>enable
Router2#conf ter
Enter configuration commands, one per line. End with CNTL/Z.
Router2(config)#interface Serial0/0/1
Router2(config-if)#ip address 10.0.0.9 255.255.255.252
% 10.0.0.8 overlaps with Serial0/0/0
Router2(config-if)#clock rate 64000
This command applies only to DCE interfaces
Router2(config-if)#no shutdown
Router2(config-if)#exit
Router2(config)#router rip
Router2(config-router)#version 2
Router2(config-router)#network 10.0.0.0
Router2(config-router)#network 192.168.10.0
Router2(config-router)#no auto-summary
Router2(config-router)#exit
Router2(config)#exit
Router2#
%SYS-5-CONFIG_I: Configured from console by console

Router2#write
Building configuration...
[OK]
Router2#
```

Router 3:

```
Router>enable
Router#conf ter
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#hostname Router3
Router3(config)#interface Serial0/0/0
Router3(config-if)#ip address 10.0.0.10 255.255.255.252
Router3(config-if)#no shutdown
Router3(config-if)#exit
Router3(config)#interface Serial0/0/1
Router3(config-if)#ip address 10.0.0.17 255.255.255.252
Router3(config-if)#clock rate 64000
This command applies only to DCE interfaces
Router3(config-if)#no shutdown
Router3(config-if)#exit
Router3(config)#router rip
Router3(config-router)#version 2
Router3(config-router)#network 10.0.0.0
Router3(config-router)#network 192.168.2.0
Router3(config-router)#no auto-summary
Router3(config-router)#exit
Router3(config)#exiit
^
% Invalid input detected at '^' marker.
Router3(config)#exit
Router3#
%SYS-5-CONFIG_I: Configured from console by console

Router3#write
```

Building configuration...

[OK]

Router3#

Router 4:

Router>enable

Router#conf ter

Enter configuration commands, one per line. End with CNTL/Z.

Router(config)#hostname Router4

Router4(config)#interface Serial0/0/0

Router4(config-if)#ip address 10.0.0.18 255.255.255.252

Router4(config-if)#no shutdown

Router4(config-if)#exit

Router4(config)#interface Serial0/0/1

Router4(config-if)#ip address 10.0.0.21 255.255.255.252

Router4(config-if)#clock rate 64000

Router4(config-if)#no shutdown

%LINK-5-CHANGED: Interface Serial0/1/0, changed state to down

Router4(config-if)#exit

Router4(config)#router rip

Router4(config-router)#version 2

Router4(config-router)#network 10.0.0.0

Router4(config-router)#network 192.168.1.0

Router4(config-router)#no auto.summary

^

% Invalid input detected at '^' marker.

Router4(config-router)#no auto-summary

Router4(config-router)#exit

Router4(config)#exut

^

% Invalid input detected at '^' marker.

Router4(config)#exit

Router4#
%SYS-5-CONFIG_I: Configured from console by console

Router4#write
Building configuration...
[OK]
Router4#

Router 6:

```
Router6> enable
Router6# configure terminal
Router6(config)# hostname Router6
Router6(config)# interface Serial0/0/0
Router6(config-if)# ip address 10.0.0.14 255.255.255.252
Router6(config-if)# no shutdown
Router6(config-if)# exit
Router6(config)# interface Serial0/0/1
Router6(config-if)# ip address 10.0.0.6 255.255.255.252
Router6(config-if)# clock rate 64000
Router6(config-if)# no shutdown
Router6(config-if)# exit
```

RIP:

```
Router6(config)# router rip
Router6(config-router)# version 2
Router6(config-router)# network 10.0.0.0
Router6(config-router)# network 192.168.1.0
Router6(config-router)# no auto-summary
Router6(config-router)# exit
```

Router6>enable
Router6#conf ter

Enter configuration commands, one per line. End with CNTL/Z.
Router6(config)#hostname Router6
Router6(config)#interface Serial0/0/0
Router6(config-if)#ip address 10.0.0.22 255.255.255.252
Router6(config-if)#no shutdown
Router6(config-if)#exit
Router6(config)#router rip
Router6(config-router)#version 2
Router6(config-router)#network 10.0.0.0
Router6(config-router)#network 192.168.1.0
Router6(config-router)#no auto-summary
Router6(config-router)#exit
Router6(config)#exit
Router6#
%SYS-5-CONFIG_I: Configured from console by console

Router6#write
Building configuration...
[OK]
Router6#

Ping:

Router0>ping 192.168.1.250

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.250, timeout is 2 seconds:
.!.!.
Success rate is 40 percent (2/5), round-trip min/avg/max = 16/16/17 ms

Router0>ping 192.168.10.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.10.2, timeout is 2 seconds:
.!!!!
Success rate is 80 percent (4/5), round-trip min/avg/max = 0/0/1 ms

Router0>ping 192.168.2.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.2.1, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)

Router0>ping 192.168.2.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.2.1, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)

Router0>ping 192.168.1.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.1, timeout is 2 seconds:
.!.!.
Success rate is 40 percent (2/5), round-trip min/avg/max = 1/9/18 ms

Router0>

Router1>ping 192.168.10.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.10.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/11/27 ms

Router1>ping 192.168.10.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.10.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/6/13 ms

Router1>ping 192.168.2.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.2.1, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)

Router1>ping 192.168.1.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.1, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)

Router1>

Router2>ping 192.168.10.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.10.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 2/14/34 ms

Router2>ping 192.168.1.250

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.250, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/10/21 ms

Router2>ping 192.168.2.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.2.1, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)

Router2>ping 192.168.1.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.1, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)

Router2>

Router3>ping 192.168.10.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.10.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 3/25/52 ms

```
Router3>ping 192.168.1.250

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.250, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)

Router3>ping 192.168.10.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.10.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 3/12/21 ms

Router3>ping 192.168.1.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 2/15/39 ms

Router3>



Router4>ping 192.168.10.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.10.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 2/19/29 ms

Router4>ping 192.168.1.250
```

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.250, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)

Router4>ping 192.168.10.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.10.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 3/12/19 ms

Router4>ping 192.168.2.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.2.1, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)

Router4>ping 192.168.1.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/7/25 ms

Router4>

Router6>ping 192.168.10.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.10.1, timeout is 2 seconds:
!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 1/9/27 ms

Router6>ping 192.168.1.250

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.250, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)

Router6>ping 192.168.10.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.10.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/7/20 ms

Router6>ping 192.168.2.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.2.1, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)

Router6>ping 192.168.1.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/7/15 ms

Router6>

Tabla de Subneteos (Enlaces Seriales /30)

#	Subred	Rango de Hosts	Broadcast	Routers Involucrados
1	10.0.0.0/30	10.0.0.1 – 10.0.0.2	10.0.0.3	Router0 <--> Router1 (S0/0/0)
2	10.0.0.4/30	10.0.0.5 – 10.0.0.6	10.0.0.7	Router0 <--> Router6 (S0/0/1 y S0/0/1)
3	10.0.0.8/30	10.0.0.9 – 10.0.0.10	10.0.0.11	Router1 <--> Router2 (S0/0/1 y S0/0/0)
4	10.0.0.12/30	10.0.0.13 – 10.0.0.14	10.0.0.15	Router2 <--> Router6 (S0/0/1 y S0/0/0)
5	10.0.0.16/30	10.0.0.17 – 10.0.0.18	10.0.0.19	Router3 <--> Router4 (S0/0/1 y S0/0/0)
6	10.0.0.20/30	10.0.0.21 – 10.0.0.22	10.0.0.23	Router4 <--> Router6 (S0/0/1 y S0/0/0) **(última config)**

TELNET

R-1>enable
R-1#conf ter
Enter configuration commands, one per line. End with CNTL/Z.
R-1(config)#enable password REDES
R-1(config)#line vty 0 4
R-1(config-line)#password 727776
R-1(config-line)#login

SSH

Router2>
Router2>enable
Router2#conf ter
Enter configuration commands, one per line. End with CNTL/Z.
Router2(config)#hostname R-2
R-2(config)#enable password REDES2
R-2(config)#username ALEJANDRO secret VALDIVIA
R-2(config)#ip domain-name redes.net
R-2(config)#crypto key generate rsa
The name for the keys will be: R-2.redes.net
Choose the size of the key modulus in the range of 360 to 4096 for your
General Purpose Keys. Choosing a key modulus greater than 512 may take

a few minutes.

How many bits in the modulus [512]:
% Generating 512 bit RSA keys, keys will be non-exportable...[OK]

R-2(config)#line vty 0 1
*Mar 1 1:50:54.109: RSA key size needs to be at least 768 bits for ssh version 2
*Mar 1 1:50:54.109: %SSH-5-ENABLED: SSH 1.5 has been enabled
R-2(config-line)#transport input ssh
R-2(config-line)#login local
R-2(config-line)#end
R-2#
%SYS-5-CONFIG_I: Configured from console by console

R-2#write

6. Conclusiones

Se logró simular exitosamente una red básica que conecta todas las sedes de la universidad, con enrutamiento dinámico funcional y llamadas VoIP operativas. El diseño actual permite una comunicación fluida entre ciudades y establece una base sólida para futuras mejoras como la segmentación por VLANs y la incorporación de múltiples usuarios. El proyecto demuestra que, con una buena planificación y configuración, es posible simular una red amplia, eficiente y funcional en un entorno educativo.