Universidad San Carlos de Guatemala
Facultad de Ingeniería
Escuela de Ciencias y Sistemas
Grupo No. 5
Laboratorio de Redes de Computadoras 2
09/09/2022

Práctica 1

Manual Técnico

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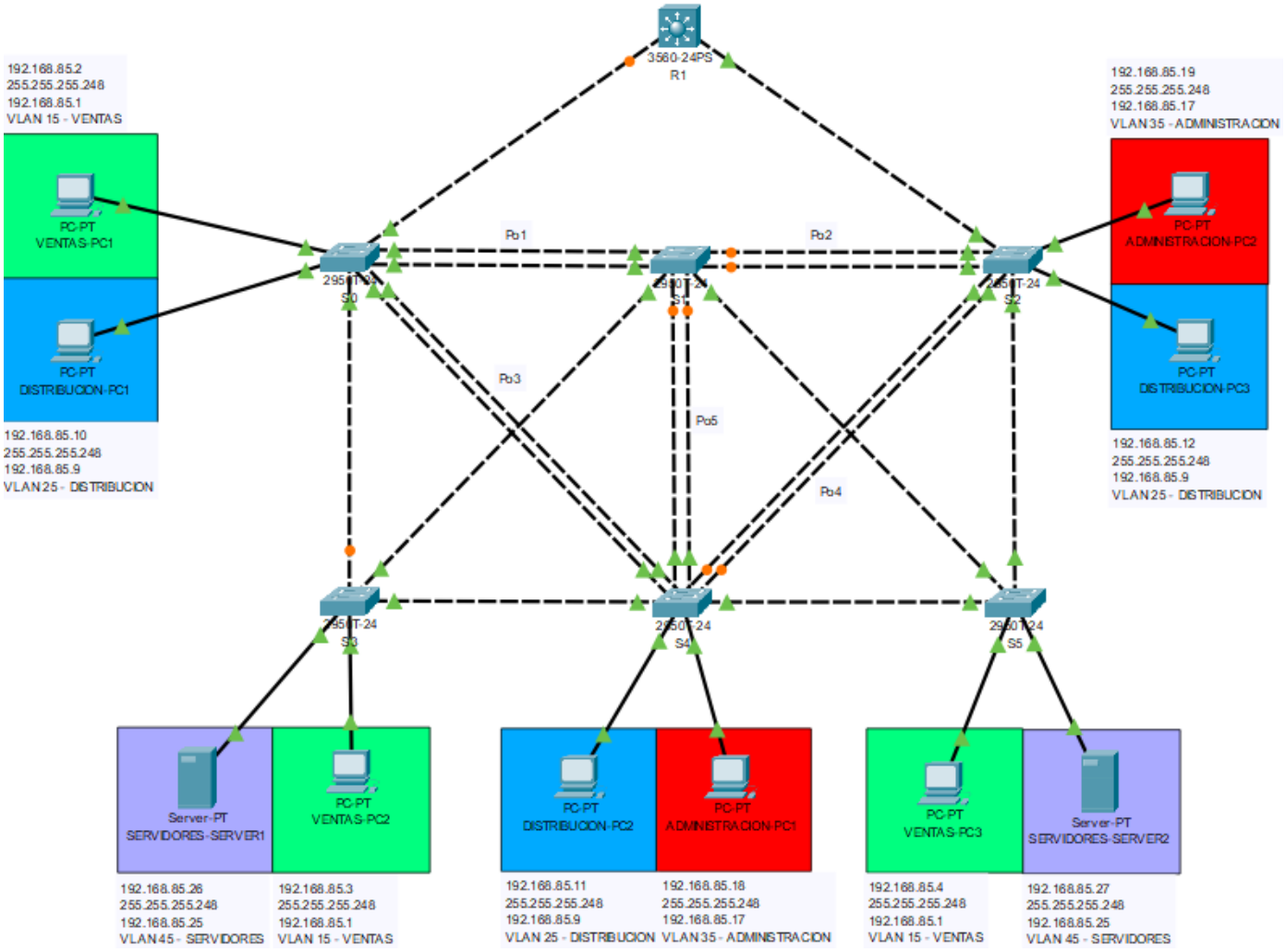
Contenido

Topología con todas las configuraciones aplicadas



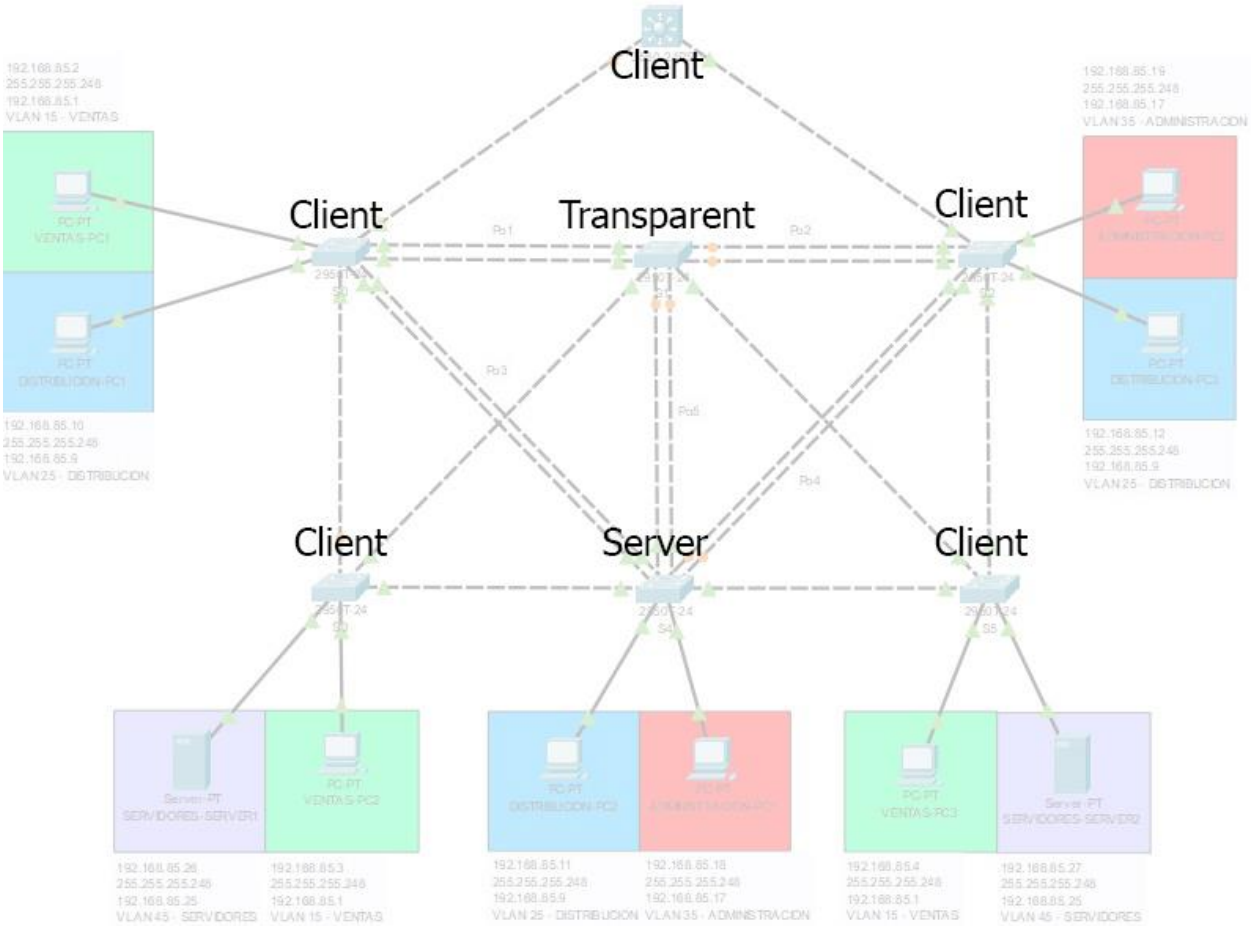
Definición de VLANs

Para la creación de las diferentes VLANs, se realizó el siguiente análisis, tomando como referencia nuestro número de grupo.

Definición	VLAN ID	Color
VENTAS 10 + 5	15	
DISTRIBUCION 20 + 5	25	
ADMINISTRACION 30 + 5	35	
SERVIDORES 40 + 5	45	
MANAGEMENT&NATIVE 99	99	
BLACKHOLE 999	999	

Configuración de VTP

Se decidió aplicar la siguiente distribución de modos VTP a los equipos Switch presentes en nuestra topología.



Equipo	Modo	Explicación
• S4	**SERVER**	Es uno de los equipos que centraliza la mayor cantidad de enlaces.
• S0 • S2 • S3 • S5	**CLIENT**	Son equipos que están directamente conectados al switch elegido como servidor y a su vez, conectados a hosts finales.
• S1	**TRANSPARENT**	Este equipo solamente es utilizado como un puente y no interactúa de manera directa con equipos finales, es decir, su función es solamente transmitir la información de las VLANs creadas.

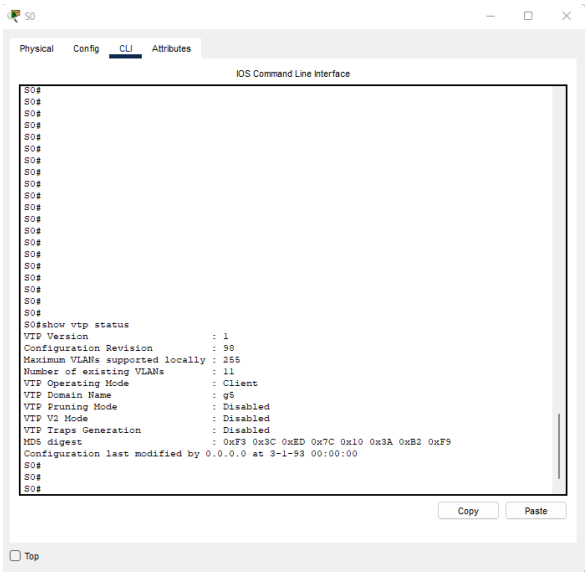
Los parámetros de configuración en cada uno de los equipos fueron determinados a través de las siguientes definiciones.

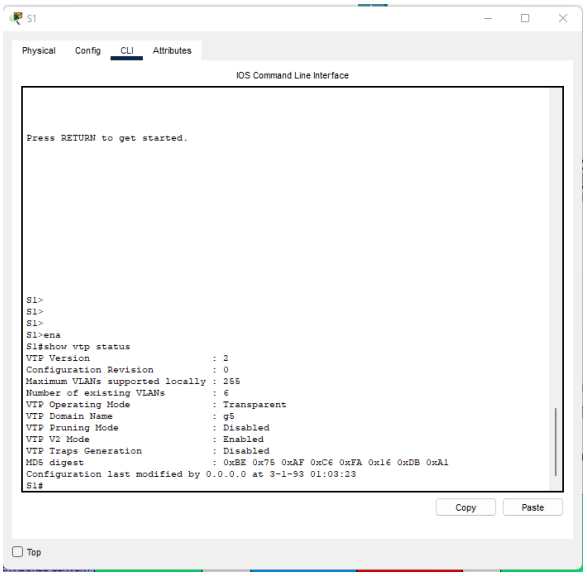
Parámetro	Definición	Valor
Dominio	g + número de grupo	g5
Password	g + número de grupo	g5

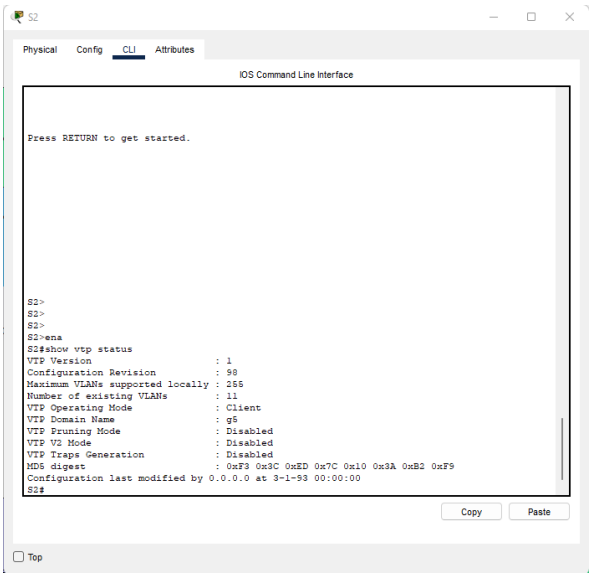
Comandos aplicados para configurar el protocolo VTP en nuestra topología.

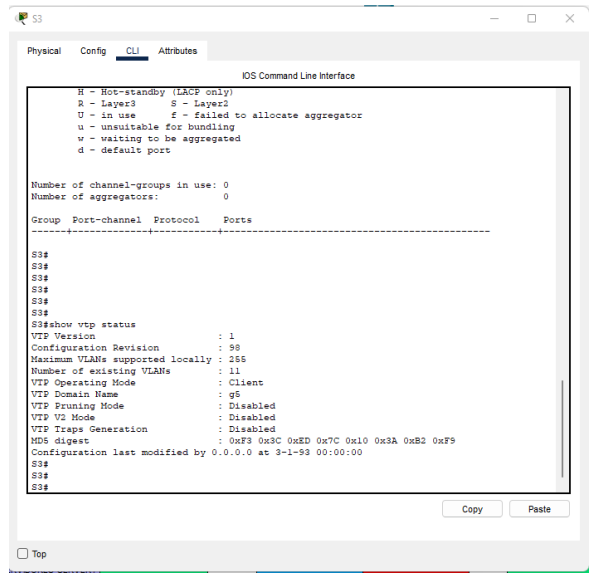
Equipo	Modo	Comandos
▪ S0 ▪ S2 ▪ S3 ▪ S5 ▪ R1	Client	▪ enable ▪ configure terminal ▪ vtp domain g5 ▪ vtp password g5 ▪ vtp mode CLIENT ▪ vtp version 2 ▪ end ▪ show vtp status
▪ S1	Transparent	▪ enable ▪ configure terminal ▪ vtp domain g5 ▪ vtp password g5 ▪ vtp mode TRANSPARENT ▪ vtp version 2 ▪ end ▪ show vtp status
▪ S4	Server	▪ enable ▪ configure terminal ▪ vtp domain g5 ▪ vtp password g5 ▪ vtp mode SERVER ▪ vtp version 2 ▪ end ▪ show vtp status

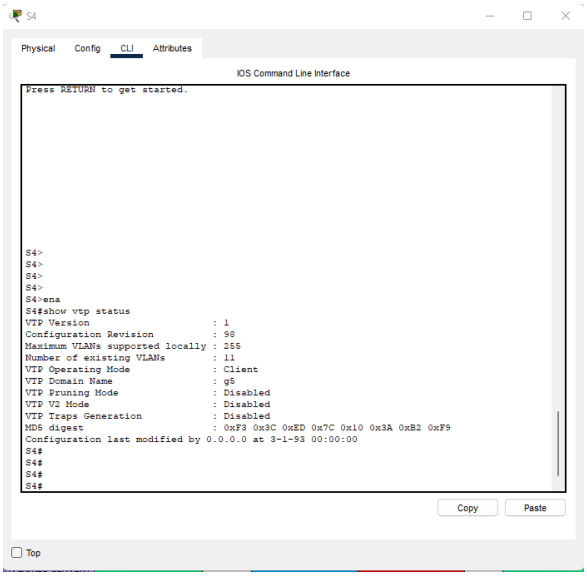
Resultado de la configuración del protocolo VTP

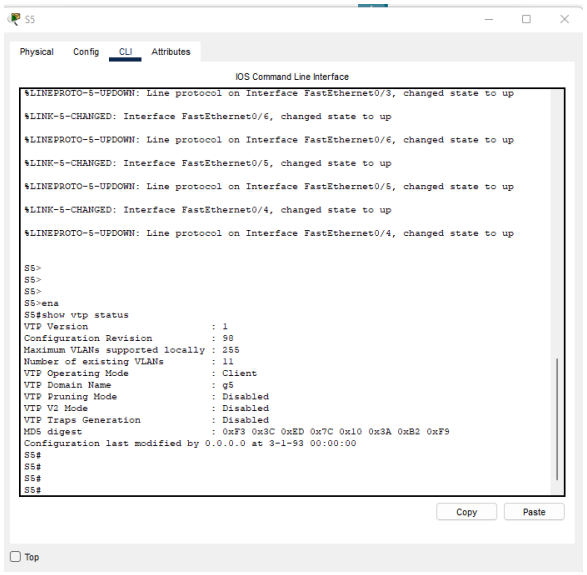

S0
Physical
Config
CLI
Attributes
IOS Command Line Interface
S0#
S0#
S0#
S0#
S0#
S0#
S0#
S0#
S0#
S0#
S0#
S0#
S0#
S0#
S0#
S0#
S0#
S0#
S0#
S0#show vtp status
VTP Version : 1
Configuration Revision : 98
Maximum VLANs supported locally : 255
Number of existing VLANs : 11
VTP Operating Mode : Client
VTP Domain Name : g5
VTP Pruning Mode : Disabled
VTP V2 Mode : Disabled
VTP Traps Generation : Disabled
MD5 digest : 0xF3 0x3C 0xED 0x7C 0x10 0x3A 0xB2 0xF9
Configuration last modified by 0.0.0.0 at 3-1-93 00:00:00
S0#
S0#
S0#
Copy
Paste
Top


S1
Physical
Config
CLI
Attributes
IOS Command Line Interface
Press RETURN to get started.
S1>
S1>
S1>
S1>ena
S1#show vtp status
VTP Version : 2
Configuration Revision : 0
Maximum VLANs supported locally : 255
Number of existing VLANs : 6
VTP Operating Mode : Transparent
VTP Domain Name : g5
VTP Pruning Mode : Disabled
VTP V2 Mode : Enabled
VTP Traps Generation : Disabled
MD5 digest : 0xBE 0x75 0xAF 0xC6 0xFA 0x16 0xDB 0xA1
Configuration last modified by 0.0.0.0 at 3-1-93 01:03:23
S1#
Copy
Paste
Top


S2
Physical
Config
CLI
Attributes
IOS Command Line Interface
Press RETURN to get started.
S2>
S2>
S2>
S2>ena
S2#show vtp status
VTP Version : 1
Configuration Revision : 98
Maximum VLANs supported locally : 255
Number of existing VLANs : 11
VTP Operating Mode : Client
VTP Domain Name : g5
VTP Pruning Mode : Disabled
VTP V2 Mode : Disabled
VTP Traps Generation : Disabled
MD5 digest : 0xF3 0x3C 0xED 0x7C 0x10 0x3A 0xB2 0xF9
Configuration last modified by 0.0.0.0 at 3-1-93 00:00:00
S2#
Copy
Paste
Top


S3
Physical
Config
CLI
Attributes
IOS Command Line Interface
H - Hot-standby (LACP only)
R - Layer3 S - Layer2
U - in use f - failed to allocate aggregator
u - unsuitable for bundling
w - waiting to be aggregated
d - default port
Number of channel-groups in use: 0
Number of aggregators: 0
Group Port-channel Protocol Ports
S3#
S3#
S3#
S3#
S3#
S3#
S3#show vtp status
VTP Version : 1
Configuration Revision : 98
Maximum VLANs supported locally : 255
Number of existing VLANs : 11
VTP Operating Mode : Client
VTP Domain Name : g5
VTP Pruning Mode : Disabled
VTP V2 Mode : Disabled
VTP Traps Generation : Disabled
MD5 digest : 0xF3 0x3C 0xED 0x7C 0x10 0x3A 0xB2 0xF9
Configuration last modified by 0.0.0.0 at 3-1-93 00:00:00
S3#
S3#
S3#
Copy
Paste
Top


S4
Physical
Config
CLI
Attributes
IOS Command Line Interface
Press RETURN to get started.
S4>
S4>
S4>
S4>
S4>ena
S4#show vtp status
VTP Version : 1
Configuration Revision : 98
Maximum VLANs supported locally : 255
Number of existing VLANs : 11
VTP Operating Mode : Client
VTP Domain Name : g5
VTP Pruning Mode : Disabled
VTP V2 Mode : Disabled
VTP Traps Generation : Disabled
MD5 digest : 0xF3 0x3C 0xED 0x7C 0x10 0x3A 0xB2 0xF9
Configuration last modified by 0.0.0.0 at 3-1-93 00:00:00
S4#
S4#
S4#
S4#
Copy
Paste
Top


S5
Physical
Config
CLI
Attributes
IOS Command Line Interface
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/3, changed state to up
%LINK-5-CHANGED: Interface FastEthernet0/6, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/6, changed state to up
%LINK-5-CHANGED: Interface FastEthernet0/5, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/5, changed state to up
%LINK-5-CHANGED: Interface FastEthernet0/4, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/4, changed state to up
S5>
S5>
S5>
S5>ena
S5#show vtp status
VTP Version : 1
Configuration Revision : 98
Maximum VLANs supported locally : 255
Number of existing VLANs : 11
VTP Operating Mode : Client
VTP Domain Name : g5
VTP Pruning Mode : Disabled
VTP V2 Mode : Disabled
VTP Traps Generation : Disabled
MD5 digest : 0xF3 0x3C 0xED 0x7C 0x10 0x3A 0xB2 0xF9
Configuration last modified by 0.0.0.0 at 3-1-93 00:00:00
S5#
S5#
S5#
S5#
Copy
Paste
Top

Direcciones de red

Por indicaciones del enunciado oficial, se contó con la siguiente red

192.168.85.0 /24

Esta red fue seccionada según el número de departamentos con los que cuenta la empresa, mismos que son representados por su VLAN correspondiente. De esta manera, mediante el uso de una herramienta, la cual es detallada en la sección de anexos, pudimos obtener las subredes correspondientes por medio de FLSM.

¿Por qué utilizamos FLSM?

Dados los requerimientos, decidimos utilizar **FLSM** ya que se indica que el número de equipos por departamento se encuentra entre 2 y 5, los cual nos da un número máximo de hosts por subred, el cual utilizamos como parámetro en la herramienta de calculo de subredes obteniendo la siguiente información. En conclusión, utilizamos FLSM debido a que consideramos el máximo de equipos por departamento como una constante que determina el número de hosts pertenecientes a la subred.

Administración de Subredes

Subred (VLAN)	Hosts	IP de red	Máscara	Primer Host	Último Host	Gateway
VENTAS (15)	6	192.168.85.0 /29	255.255.255.248	192.168.85.1	192.168.85.6	192.168.85.1
DISTRIBUCION (25)	6	192.168.85.8 /29	255.255.255.248	192.168.85.9	192.168.85.14	192.168.85.9
ADMINISTRACION (35)	6	192.168.85.16 /29	255.255.255.248	192.168.85.17	192.168.85.22	192.168.85.17
SERVIDORES (45)	6	192.168.85.24 /29	255.255.255.248	192.168.85.25	192.168.85.30	192.168.85.25

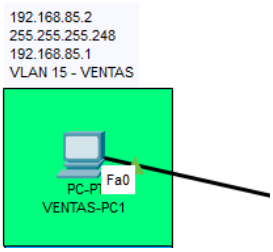
Como podemos observar, la máscara de subred se presenta constante en cada división de la red original, dando sentido a su nombre y definición.

Para configurar las direcciones obtenidas anteriormente, en cada uno de los equipos (PC), dentro del programa ***Cisco Packet Tracer,*** se realizó el siguiente procedimiento:

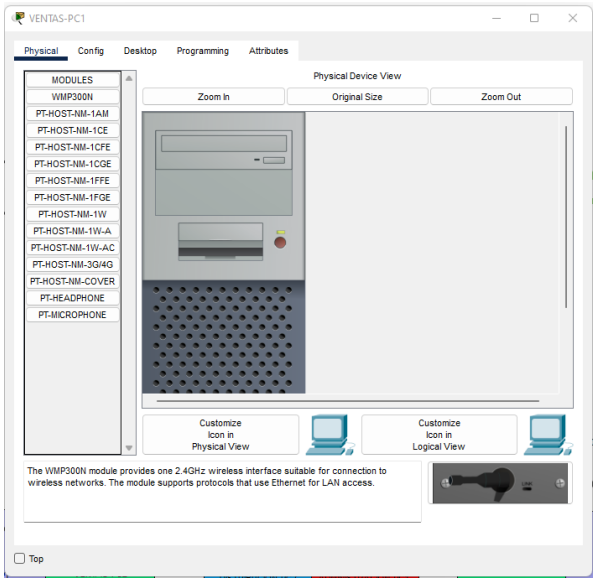
1. Acceder a la configuración del equipo
2. Apartado Desktop
3. Opción Command Prompt
4. Escribir en la consola el comando
   ipconfig [dirección IP] [máscara de subred] [gateway]

Así, por ejemplo, siguiendo los pasos descritos anteriormente y teniendo en cuenta la información proporcionada por la herramienta VLSM, para asignar la dirección IP correspondiente al primer equipo de la VLAN de VENTAS (15), el procedimiento es el que se muestra a continuación.

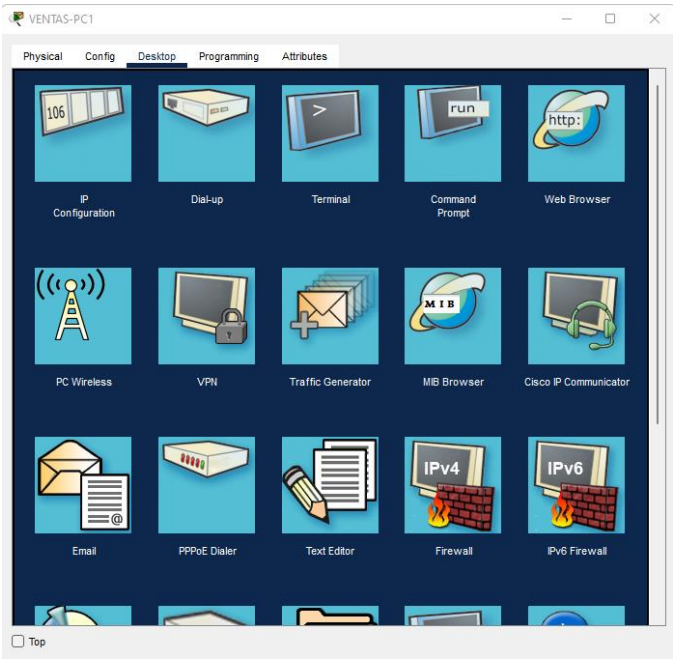
Representación del equipo dentro del programa Cisco Packet Tracer.



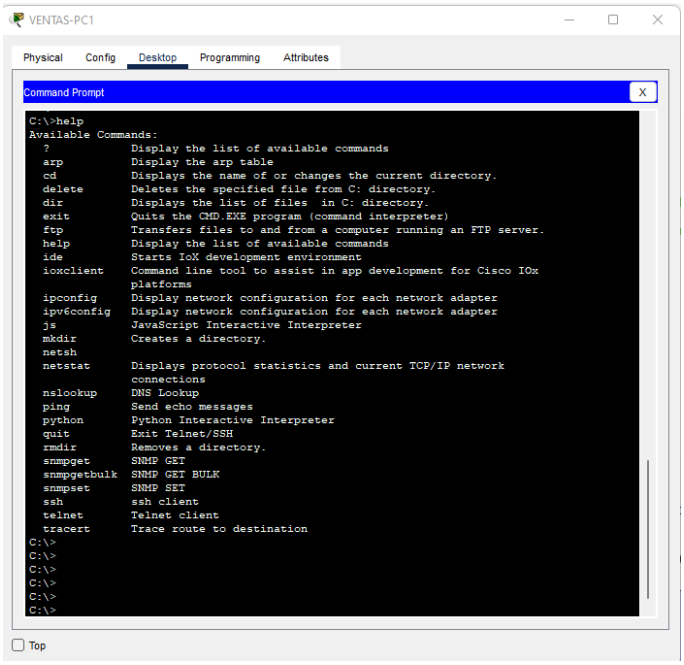
1. Configuración del equipo



2. Apartado Desktop



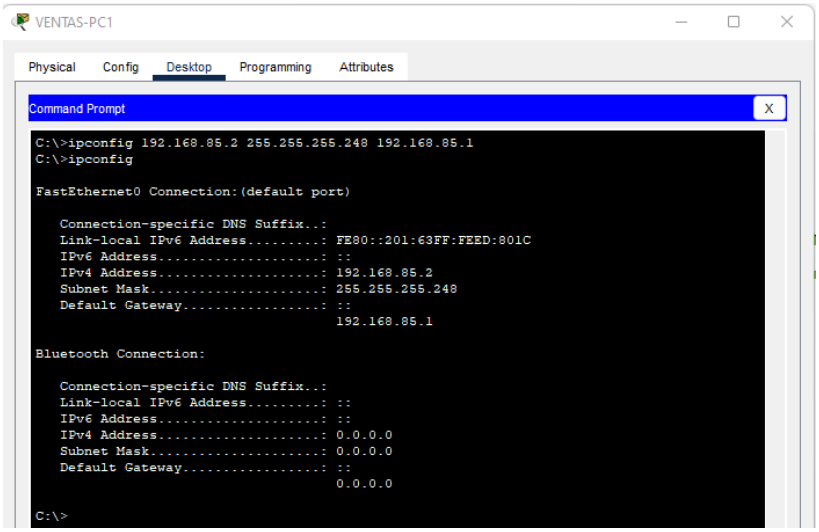
3. Opción Command Prompt



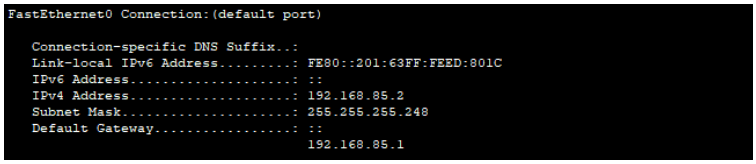
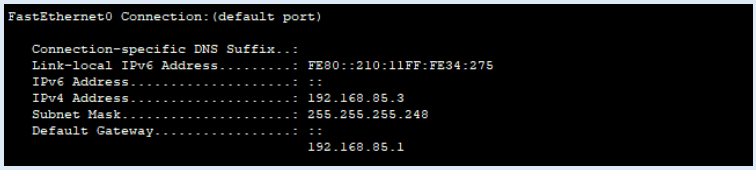
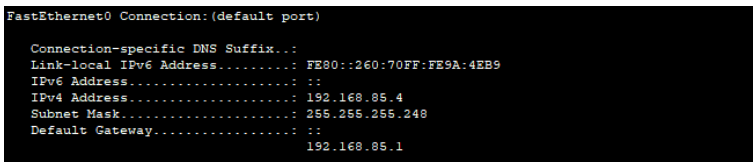
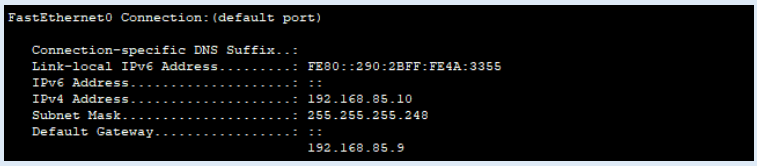
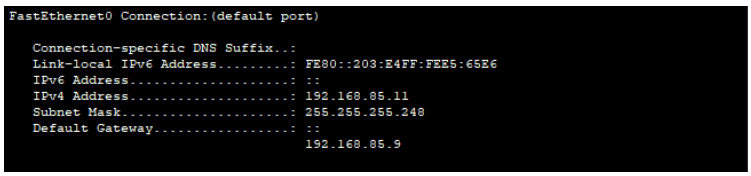
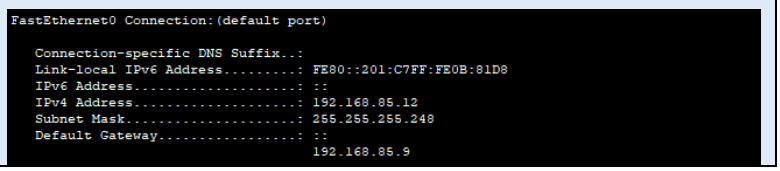
Ejecución de comando para asignación de la dirección IP.

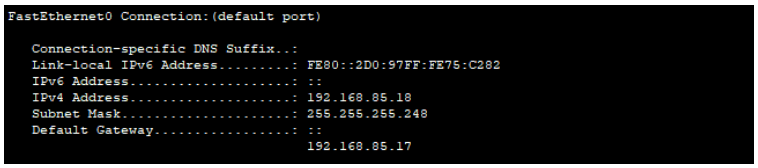
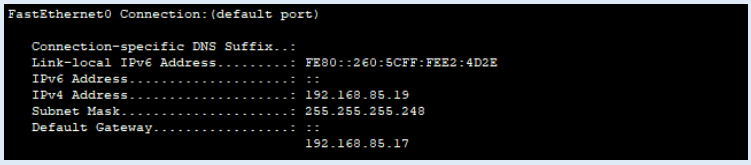
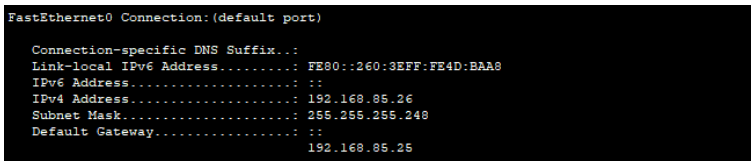
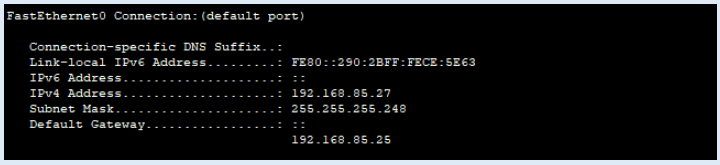
Ipconfig **192.168.85.2** **255.255.255.248** **192.168.85.1**

Dirección IP Máscara de Subred Gateway



Resumen de comando para asignar direcciones IP a los equipos.

Equipo	VLAN	Comando
Ventas - PC1	VENTAS 15	Ipconfig 192.168.85.2 255.255.255.248 192.168.85.1 
Ventas - PC2	VENTAS 15	Ipconfig 192.168.85.3 255.255.255.248 192.168.85.1 
Ventas - PC3	VENTAS 15	Ipconfig 192.168.85.4 255.255.255.248 192.168.85.1 
Distribución - PC1	DISTRIBUCION 25	Ipconfig 192.168.85.10 255.255.255.248 192.168.85.9 
Distribución - PC2	DISTRIBUCION 25	Ipconfig 192.168.85.11 255.255.255.248 192.168.85.9 
Distribución - PC3	DISTRIBUCION 25	Ipconfig 192.168.85.12 255.255.255.248 192.168.85.9 

Administración - PC1	ADMINISTRACION 35	Ipconfig 192.168.85.18 255.255.255.248 192.168.85.17 
Administración -PC2	ADMINISTRACION 35	Ipconfig 192.168.85.19 255.255.255.248 192.168.85.17 
Servidores - SERVER1	SERVIDORES 45	Ipconfig 192.168.85.26 255.255.255.248 192.168.85.25 
Servidores - SERVER2	SERVIDORES 45	Ipconfig 192.168.85.27 255.255.255.248 192.168.85.25 

Configuración de STP

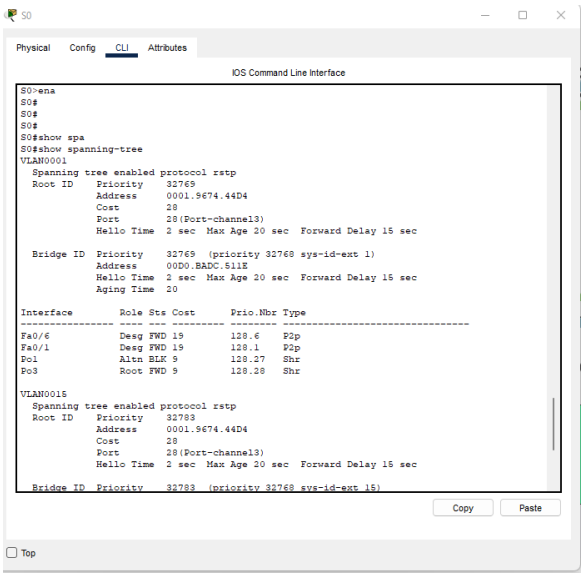
La configuración de STP realizada aplicando los dos modos de configuración requeridos.

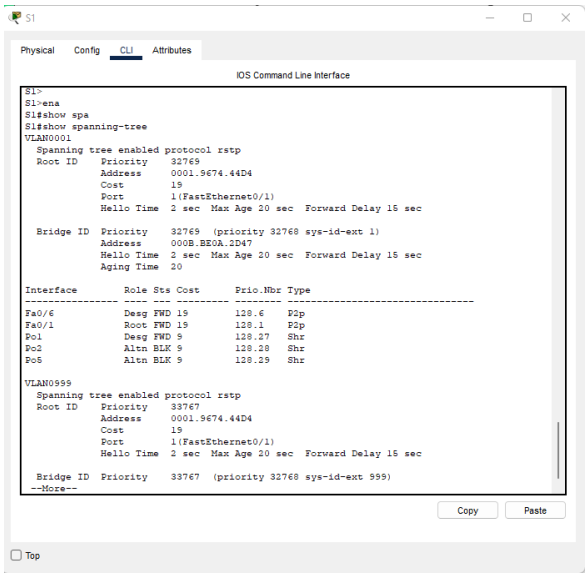
- **Modo PVST (Per-VLAN Spanning Tree)**
  Permite crear un árbol de expansión para cada VLAN
- **Modo RPVST (Rapid Per-VLAN Spannig Tree)**
  Es una mejora del modo PVST

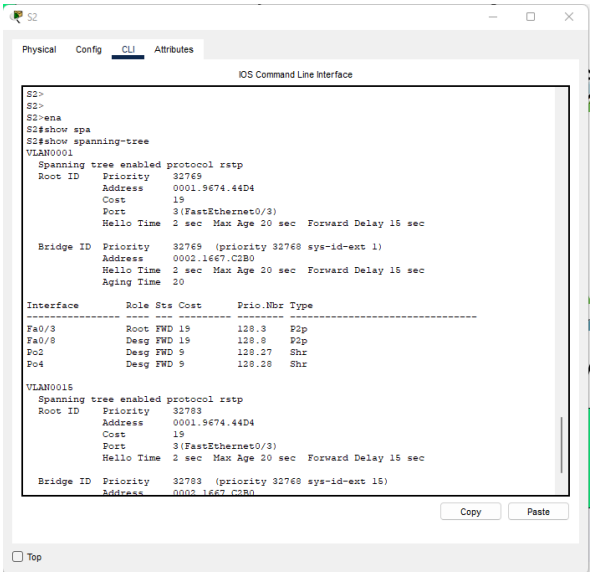
Comandos utilizados para la configuración de los diferentes modos del protocolo STP, estos comandos fueron aplicados en todos los equipos Switch.

Modo	Equipo	Comando
PVST	▪ S0 ▪ S1 ▪ S2 ▪ S3 ▪ S4 ▪ S5	enable configure terminal spanninng-tree mode pvst end show spannig-tree
RPVST	▪ S0 ▪ S1 ▪ S2 ▪ S3 ▪ S4 ▪ S5	enable configure terminal spanninng-tree mode rapid-pvst end show spannig-tree

Resultado de la configuración






S2
Physical
Config
CLI
Attributes
IOS Command Line Interface
S2>
S2>
S2>ena
S2#show spa
S2#show spanning-tree
VLAN0001
Spanning tree enabled protocol rstp
Root ID Priority 32769
Address 0001.9674.44D4
Cost 19
Port 3(FastEthernet0/3)
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Bridge ID Priority 32769 (priority 32768 sys-id-ext 1)
Address 0002.1667.C2B0
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Aging Time 20
Interface Role Sts Cost Prio.Nbr Type
Fa0/3 Root FWD 19 128.3 P2p
Fa0/8 Desg FWD 19 128.8 P2p
Po2 Desg FWD 9 128.27 Shr
Po4 Desg FWD 9 128.28 Shr
VLAN0015
Spanning tree enabled protocol rstp
Root ID Priority 32783
Address 0001.9674.44D4
Cost 19
Port 3(FastEthernet0/3)
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Bridge ID Priority 32783 (priority 32768 sys-id-ext 15)
Address 0002.1667.C2B0
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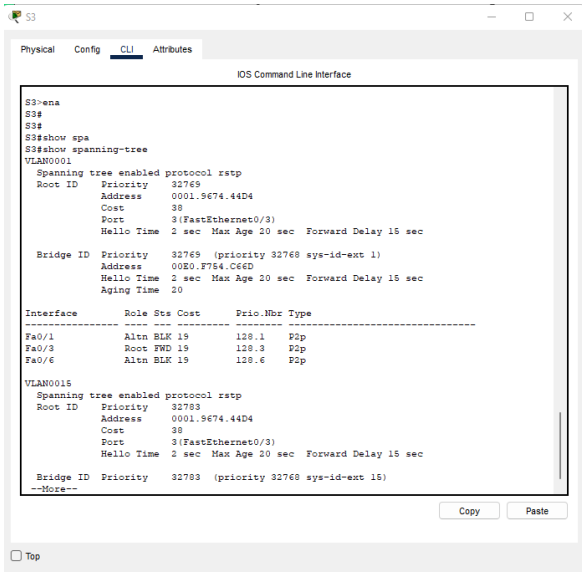
Top


S3
Physical
Config
CLI
Attributes
IOS Command Line Interface
S3>ena
S3#
S3#
S3#show spa
S3#show spanning-tree
VLAN0001
Spanning tree enabled protocol rstp
Root ID Priority 32769
Address 0001.9674.44D4
Cost 38
Port 3(FastEthernet0/3)
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Bridge ID Priority 32769 (priority 32768 sys-id-ext 1)
Address 00E0.F764.C6ED
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Aging Time 20
Interface Role Sts Cost Prio.Nbr Type
Fa0/1 Altn BLK 19 128.1 P2p
Fa0/3 Root FWD 19 128.3 P2p
Fa0/6 Altn BLK 19 128.6 P2p
VLAN0015
Spanning tree enabled protocol rstp
Root ID Priority 32783
Address 0001.9674.44D4
Cost 38
Port 3(FastEthernet0/3)
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Bridge ID Priority 32783 (priority 32768 sys-id-ext 15)
--More--
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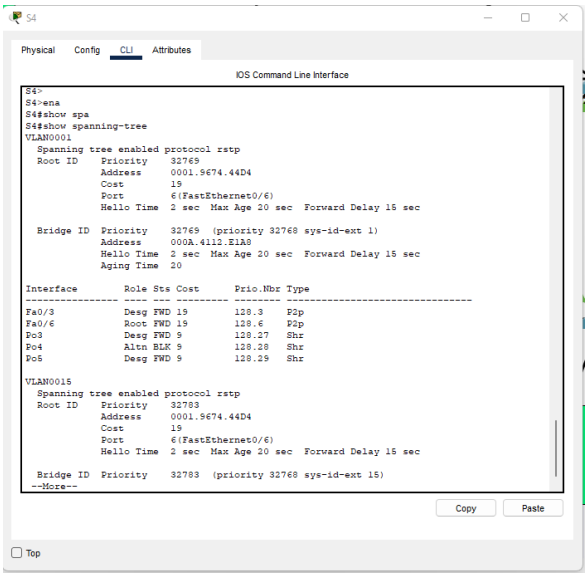
S4
Physical
Config
CLI
Attributes
IOS Command Line Interface
S4>
S4>ena
S4#show spa
S4#show spanning-tree
VLAN0001
Spanning tree enabled protocol rstp
Root ID Priority 32769
Address 0001.9674.44D4
Cost 19
Port 6(FastEthernet0/6)
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Bridge ID Priority 32769 (priority 32768 sys-id-ext 1)
Address 000A.4112.E1A8
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Aging Time 20
Interface Role Sts Cost Prio.Nbr Type
Fa0/3 Desg FWD 19 128.3 P2p
Fa0/6 Root FWD 19 128.6 P2p
Po3 Desg FWD 9 128.27 Shr
Po4 Altn BLK 9 128.28 Shr
Po5 Desg FWD 9 128.29 Shr
VLAN0015
Spanning tree enabled protocol rstp
Root ID Priority 32783
Address 0001.9674.44D4
Cost 19
Port 6(FastEthernet0/6)
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Bridge ID Priority 32783 (priority 32768 sys-id-ext 15)
--More--
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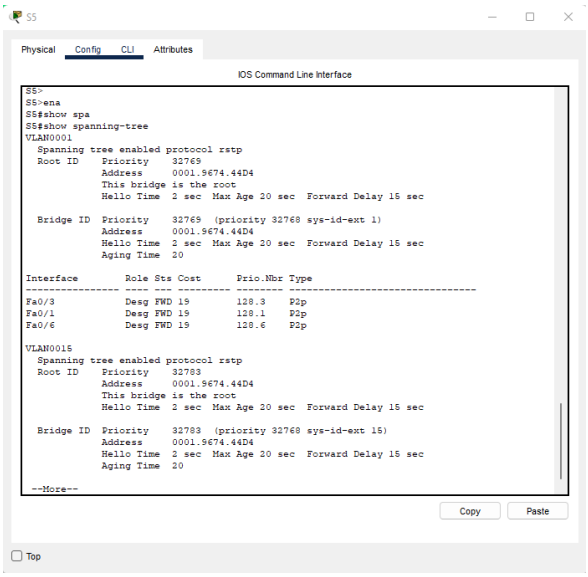
Top


S5
Physical
Config
CLI
Attributes
IOS Command Line Interface
S5>
S5>ena
S5#show spa
S5#show spanning-tree
VLAN0001
Spanning tree enabled protocol rstp
Root ID Priority 32769
Address 0001.9674.44D4
This bridge is the root
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Bridge ID Priority 32769 (priority 32768 sys-id-ext 1)
Address 0001.9674.44D4
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Aging Time 20
Interface Role Sts Cost Prio.Nbr Type
Fa0/3 Desg FWD 19 128.3 P2p
Fa0/1 Desg FWD 19 128.1 P2p
Fa0/6 Desg FWD 19 128.6 P2p
VLAN0015
Spanning tree enabled protocol rstp
Root ID Priority 32783
Address 0001.9674.44D4
This bridge is the root
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Bridge ID Priority 32783 (priority 32768 sys-id-ext 15)
Address 0001.9674.44D4
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Aging Time 20
--More--
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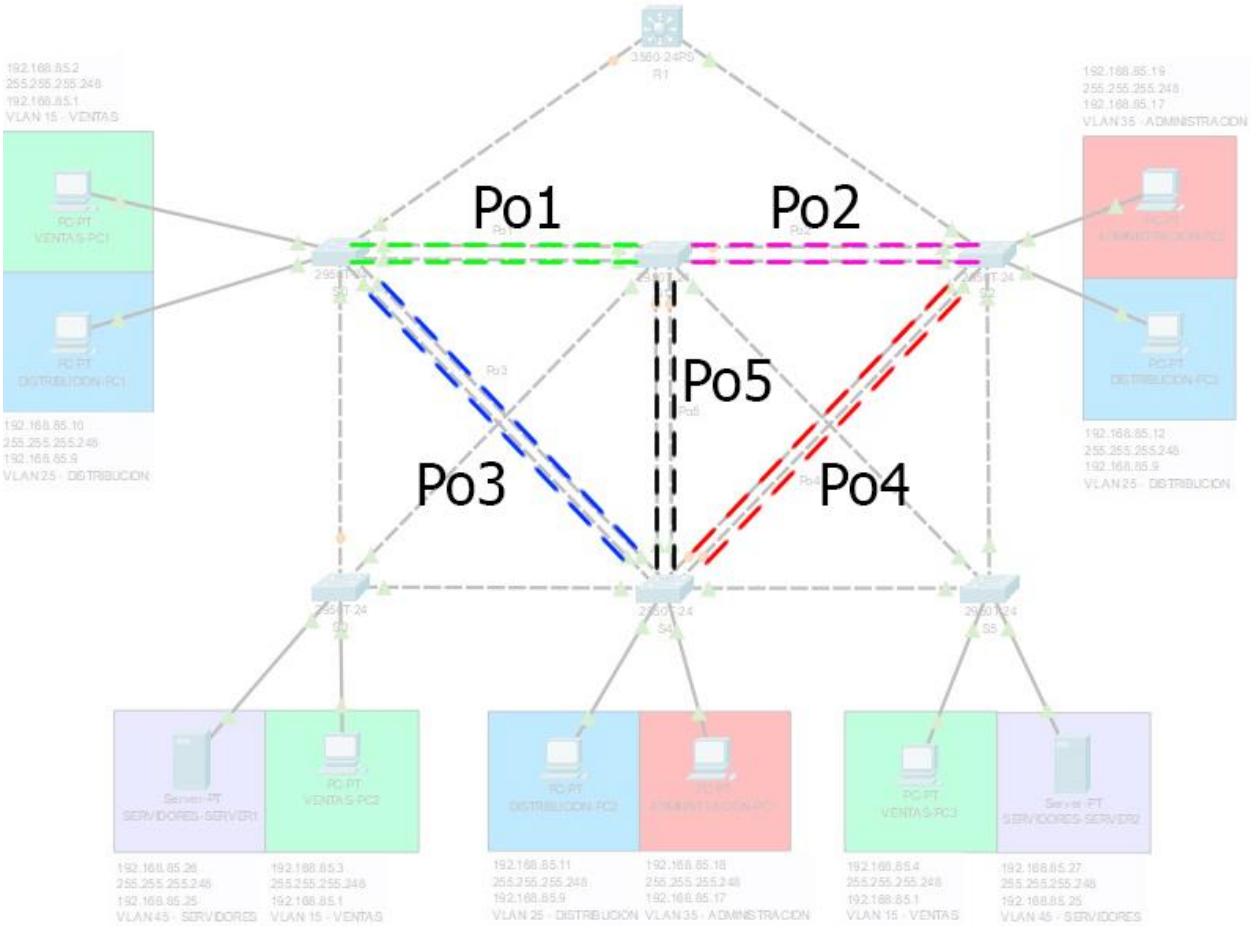
Top

Configuración de Ethernet Channel



Se configuraron los siguientes grupos de interfaces para formar las agrupaciones requeridas en los dos diferentes protocolos.

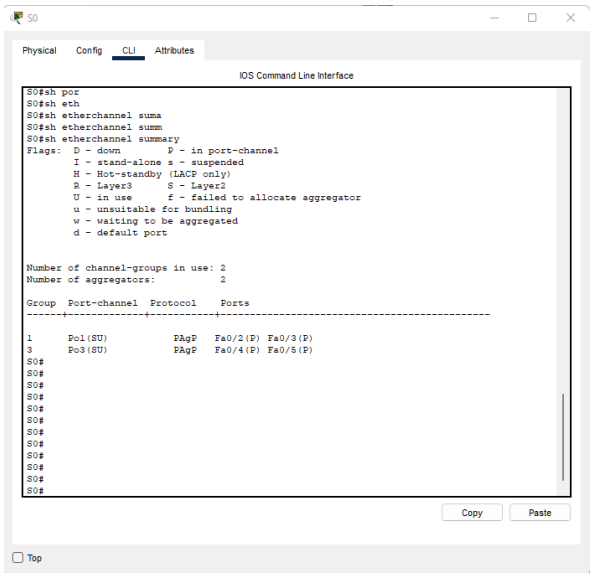
- **LAgP**
  Protocolo propietario de Cisco para gestionar agrupaciones de puertos.
- **LACP**
  Tiene la misma función que el protocolo anterior, aplicado a otros equipos de diferentes fabricantes.

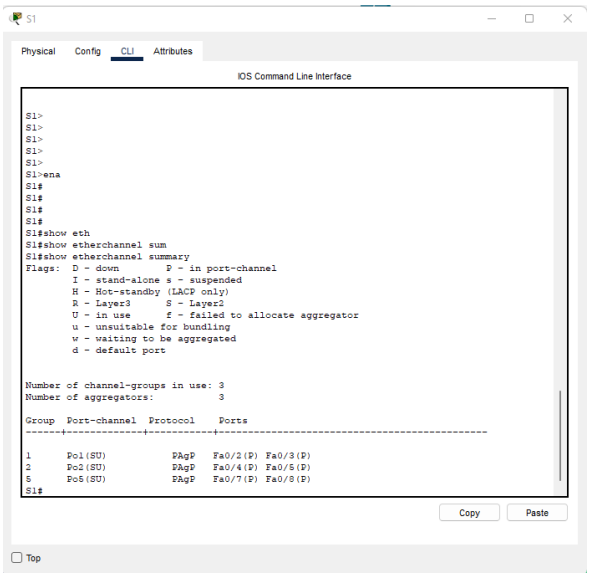
Grupo	Primer Switch	Segundo Switch	Comandos (En ambos switches)
Po1	S0	S1	**LACP:** ▪ enable ▪ configure terminal ▪ interface range f 0/2-3 ▪ channel-group 1 mode active ▪ end **PAGP:** ▪ enable ▪ configure terminal ▪ interface range f 0/2-3 ▪ channel-group 1 mode desirable ▪ end
Po2	S1	S2	**LACP:** ▪ enable ▪ configure terminal ▪ interface range f 0/4-5 ▪ channel-group 2 mode active ▪ end **PAGP:** ▪ enable ▪ configure terminal ▪ interface range f 0/4-5 ▪ channel-group 2 mode desirable ▪ end
Po3	S0	S4	**LACP:** ▪ enable ▪ configure terminal ▪ interface range f 0/4-5 ▪ channel-group 3 mode active ▪ end **PAGP:** ▪ enable ▪ configure terminal ▪ interface range f 0/4-5 ▪ channel-group 3 mode desirable ▪ end
Po4	S2	S4	**LACP:** ▪ enable ▪ configure terminal ▪ interface range f 0/1-2 ▪ channel-group 4 mode active ▪ end **PAGP:** ▪ enable ▪ configure terminal ▪ interface range f 0/1-2

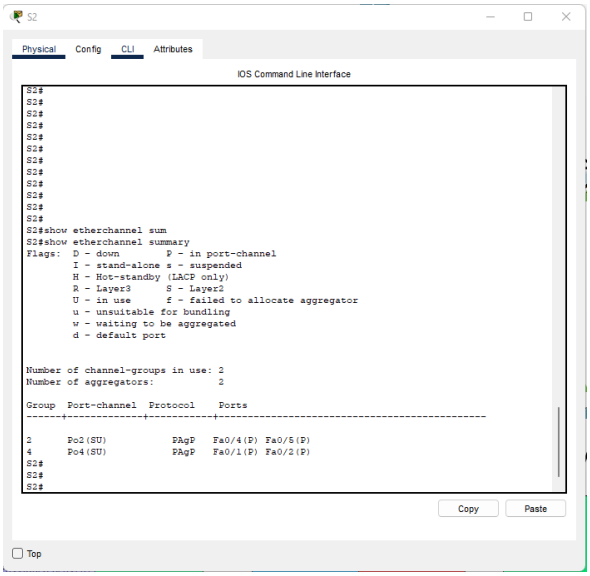
			▪ channel-group 4 mode desirable ▪ end
Po5	S1	S4	**LACP:** ▪ enable ▪ configure terminal ▪ interface range f 0/7-8 ▪ channel-group 5 mode active ▪ end **PAGP:** ▪ enable ▪ configure terminal ▪ interface range f 0/7-8 ▪ channel-group 5 mode desirable ▪ end

Nota: No se permite la creación de una agrupación de puertos con el número de canal **0**, el primer canal válido es el **1**.

Resultado de aplicar los comandos.






S2
Physical
Config
CLI
Attributes
IOS Command Line Interface
S2#
S2#
S2#
S2#
S2#
S2#
S2#
S2#
S2#
S2#
S2#
S2#show etherchannel sum
S2#show etherchannel summary
Flags: D - down P - in port-channel
I - stand-alone s - suspended
H - Hot-standby (LACP only)
R - Layer3 S - Layer2
U - in use f - failed to allocate aggregator
u - unsuitable for bundling
w - waiting to be aggregated
d - default port
Number of channel-groups in use: 2
Number of aggregators: 2
Group Port-channel Protocol Ports
2 Po2(SU) PAgP Fa0/4(P) Fa0/5(P)
4 Po4(SU) PAgP Fa0/1(P) Fa0/2(P)
S2#
S2#
S2#
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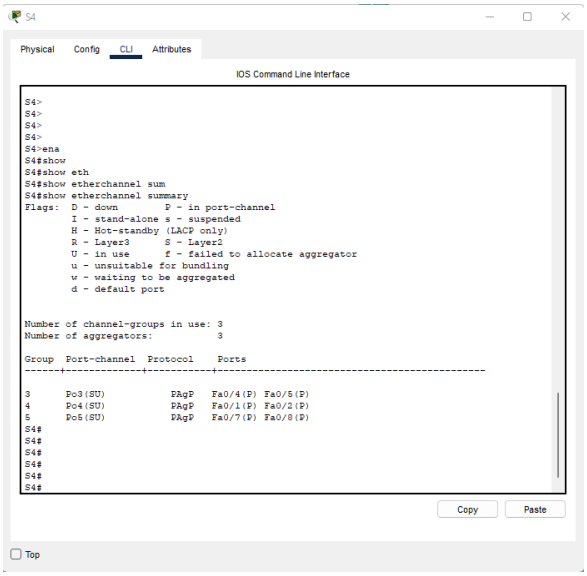

S4
Physical
Config
CLI
Attributes
IOS Command Line Interface
S4>
S4>
S4>
S4>
S4>ena
S4#show
S4#show eth
S4#show etherchannel sum
S4#show etherchannel summary
Flags: D - down P - in port-channel
I - stand-alone s - suspended
H - Hot-standby (LACP only)
R - Layer3 S - Layer2
U - in use f - failed to allocate aggregator
u - unsuitable for bundling
w - waiting to be aggregated
d - default port
Number of channel-groups in use: 3
Number of aggregators: 3
Group Port-channel Protocol Ports
3 Po3(SU) PAgP Fa0/4(P) Fa0/5(P)
4 Po4(SU) PAgP Fa0/1(P) Fa0/2(P)
5 Po5(SU) PAgP Fa0/7(P) Fa0/8(P)
S4#
S4#
S4#
S4#
S4#
S4#
Copy
Paste
Top

Seguridad de interfaces de red

La seguridad fue configurada en los equipos switch según los requerimientos, siendo aplicados los siguientes comandos.

Inicialmente, se configuraron los enlaces que conectan al equipo switch con un equipo final o PC en modo acceso.

Equipo	Interface	Comando
S0	F0/7	• Enable • Configure terminal • Interface f 0/7 • Switchport mode access • Switchport access vlan 15 • Shutdown • No Shutdown • end
S0	F0/8	• Enable • Configure terminal • Interface f 0/8 • Switchport mode access • Switchport access vlan 35 • Shutdown • No Shutdown • end
S2	F0/6	• Enable • Configure terminal • Interface f 0/6 • Switchport mode access • Switchport access vlan 15 • Shutdown • No Shutdown • end
S2	F0/7	• Enable • Configure terminal • Interface f 0/7 • Switchport mode access • Switchport access vlan 25 • Shutdown • No Shutdown • end
S3	F0/4	• Enable • Configure terminal • Interface f 0/4 • Switchport mode access • Switchport access vlan 45

		• Shutdown • No Shutdown • end
S3	F0/5	• Enable • Configure terminal • Interface f 0/5 • Switchport mode access • Switchport access vlan 15 • Shutdown • No Shutdown • end
S4	F0/9	• Enable • Configure terminal • Interface f 0/9 • Switchport mode access • Switchport access vlan 25 • Shutdown • No Shutdown • end
S4	F0/10	• Enable • Configure terminal • Interface f 0/10 • Switchport mode access • Switchport access vlan 35 • Shutdown • No Shutdown • end
S5	F0/4	• Enable • Configure terminal • Interface f 0/4 • Switchport mode access • Switchport access vlan 15 • Shutdown • No Shutdown • end
S5	F0/5	• Enable • Configure terminal • Interface f 0/5 • Switchport mode access • Switchport access vlan 45 • Shutdown • No Shutdown • end

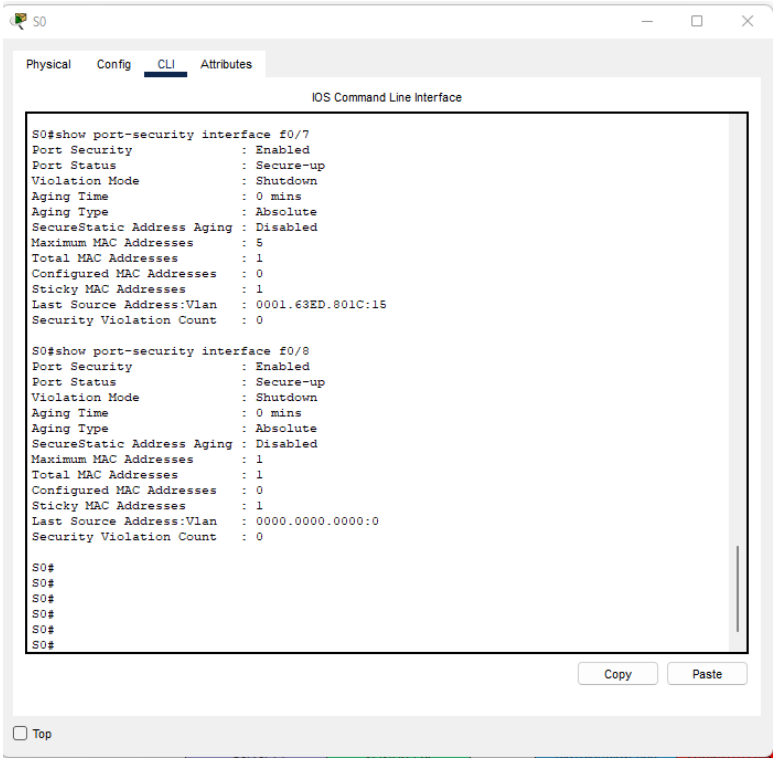
Posteriormente, se aplicaron los comandos para la seguridad.

Equipo	Configuración de seguridad
S0	**VLAN Ventas** • enable • configure terminal • interface f 0/7 • switchport port-security • switchport port-security mac-address sticky • switchport port-security maximum 5 • end **VLAN Distribución** • enable • configure terminal • interface f 0/8 • switchport port-security • switchport port-security mac-address sticky • switchport port-security maximum 1 • switchport port-security violation shutdown • end
S2	**VLAN Distribución** • enable • configure terminal • interface f 0/7 • switchport port-security • switchport port-security mac-address sticky • switchport port-security maximum 1 • switchport port-security violation shutdown • end **VLAN Administración** • enable • configure terminal • interface f 0/6 • switchport port-security • switchport port-security mac-address sticky • switchport port-security maximum 1 • switchport port-security violation shutdown • end
S3	**VLAN Ventas** • enable • configure terminal • interface f 0/5 • switchport port-security • switchport port-security mac-address sticky • switchport port-security maximum 5

	• end
S4	**VLAN Distribución** • enable • configure terminal • interface f 0/9 • switchport port-security • switchport port-security mac-address sticky • switchport port-security maximum 1 • switchport port-security violation shutdown • end **VLAN Administración** • enable • configure terminal • interface f 0/10 • switchport port-security • switchport port-security mac-address sticky • switchport port-security maximum 1 • switchport port-security violation shutdown • end
S5	**VLAN Ventas** • enable • configure terminal • interface f 0/4 • switchport port-security • switchport port-security mac-address sticky • switchport port-security maximum 5 • end

Resultado de las la configuración de port-security.

- S0


S0
Physical
Config
CLI
Attributes
IOS Command Line Interface
S0#show port-security interface f0/7
Port Security : Enabled
Port Status : Secure-up
Violation Mode : Shutdown
Aging Time : 0 mins
Aging Type : Absolute
SecureStatic Address Aging : Disabled
Maximum MAC Addresses : 5
Total MAC Addresses : 1
Configured MAC Addresses : 0
Sticky MAC Addresses : 1
Last Source Address:Vlan : 0001.63ED.801C:15
Security Violation Count : 0
S0#show port-security interface f0/8
Port Security : Enabled
Port Status : Secure-up
Violation Mode : Shutdown
Aging Time : 0 mins
Aging Type : Absolute
SecureStatic Address Aging : Disabled
Maximum MAC Addresses : 1
Total MAC Addresses : 1
Configured MAC Addresses : 0
Sticky MAC Addresses : 1
Last Source Address:Vlan : 0000.0000.0000:0
Security Violation Count : 0
S0#
S0#
S0#
S0#
S0#
S0#
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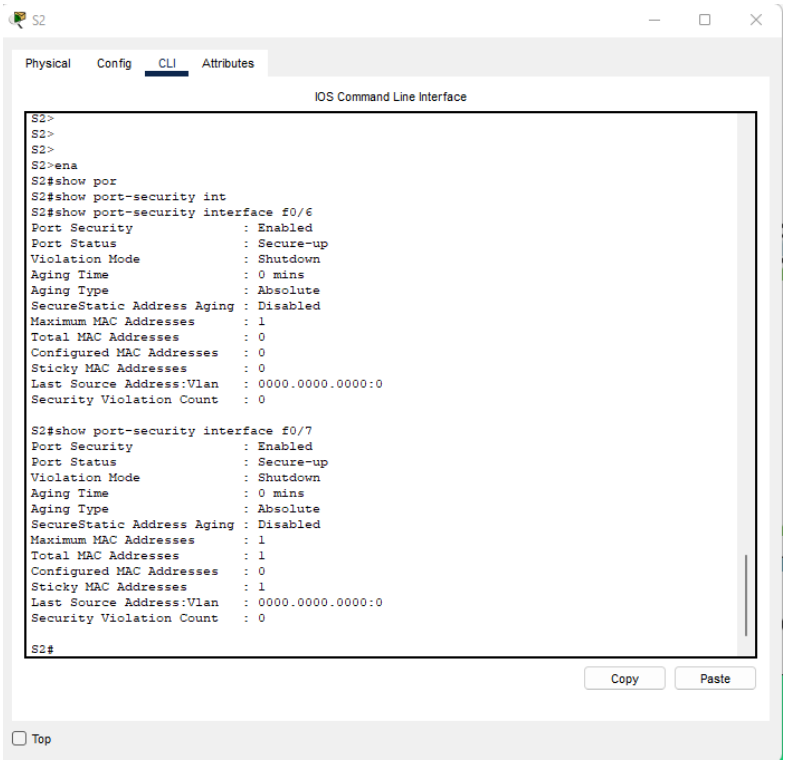
- S2


S2
Physical
Config
CLI
Attributes
IOS Command Line Interface
S2>
S2>
S2>
S2>ena
S2#show por
S2#show port-security int
S2#show port-security interface f0/6
Port Security : Enabled
Port Status : Secure-up
Violation Mode : Shutdown
Aging Time : 0 mins
Aging Type : Absolute
SecureStatic Address Aging : Disabled
Maximum MAC Addresses : 1
Total MAC Addresses : 0
Configured MAC Addresses : 0
Sticky MAC Addresses : 0
Last Source Address:Vlan : 0000.0000.0000:0
Security Violation Count : 0
S2#show port-security interface f0/7
Port Security : Enabled
Port Status : Secure-up
Violation Mode : Shutdown
Aging Time : 0 mins
Aging Type : Absolute
SecureStatic Address Aging : Disabled
Maximum MAC Addresses : 1
Total MAC Addresses : 1
Configured MAC Addresses : 0
Sticky MAC Addresses : 1
Last Source Address:Vlan : 0000.0000.0000:0
Security Violation Count : 0
S2#
Copy
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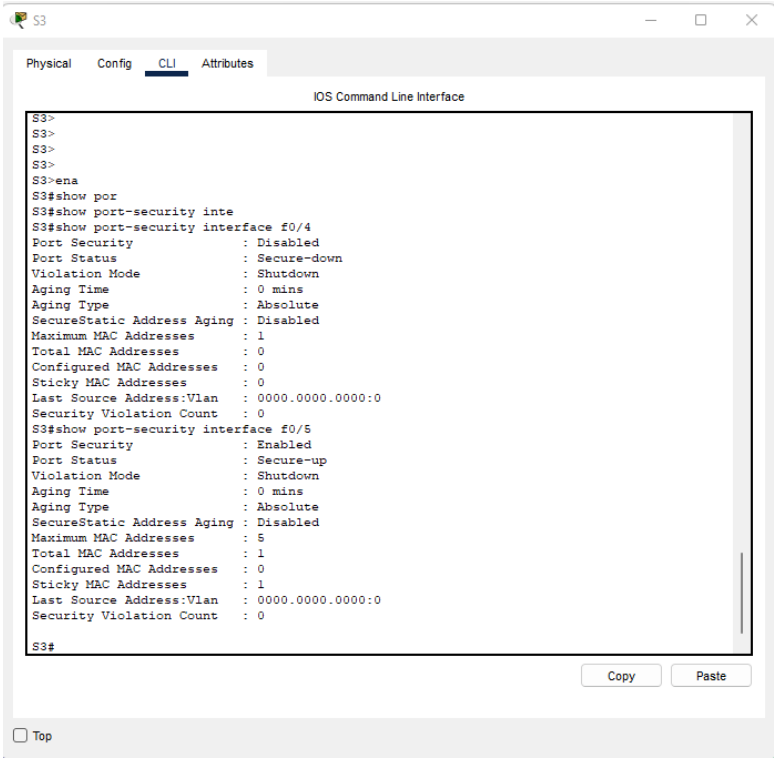
Top

- S3


S3
Physical
Config
CLI
Attributes
IOS Command Line Interface
S3>
S3>
S3>
S3>
S3>ena
S3#show por
S3#show port-security inte
S3#show port-security interface f0/4
Port Security : Disabled
Port Status : Secure-down
Violation Mode : Shutdown
Aging Time : 0 mins
Aging Type : Absolute
SecureStatic Address Aging : Disabled
Maximum MAC Addresses : 1
Total MAC Addresses : 0
Configured MAC Addresses : 0
Sticky MAC Addresses : 0
Last Source Address:Vlan : 0000.0000.0000:0
Security Violation Count : 0
S3#show port-security interface f0/5
Port Security : Enabled
Port Status : Secure-up
Violation Mode : Shutdown
Aging Time : 0 mins
Aging Type : Absolute
SecureStatic Address Aging : Disabled
Maximum MAC Addresses : 5
Total MAC Addresses : 1
Configured MAC Addresses : 0
Sticky MAC Addresses : 1
Last Source Address:Vlan : 0000.0000.0000:0
Security Violation Count : 0
S3#
Copy
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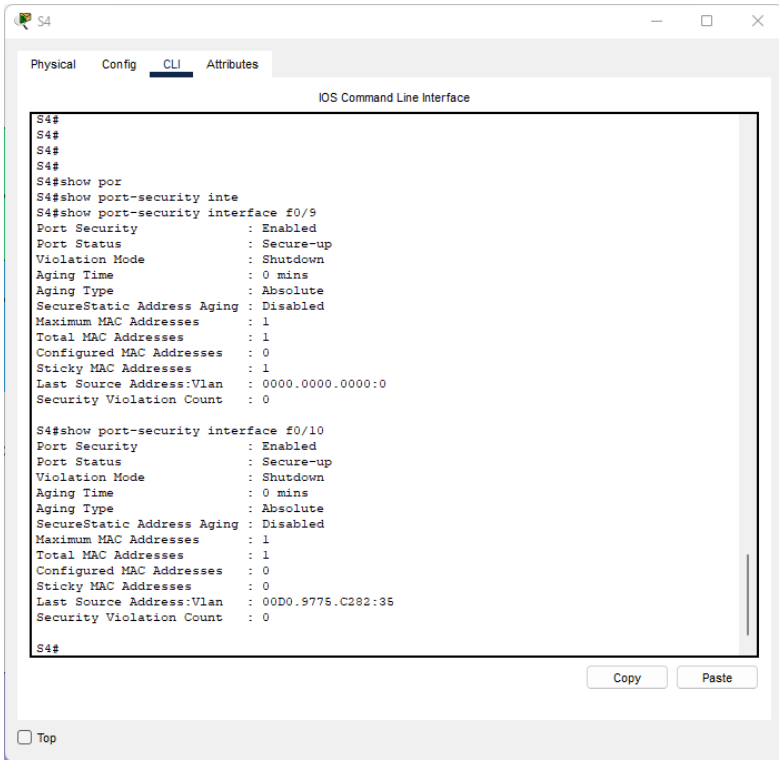
Top

- S4


S4
Physical
Config
CLI
Attributes
IOS Command Line Interface
S4#
S4#
S4#
S4#
S4#show por
S4#show port-security inte
S4#show port-security interface f0/9
Port Security : Enabled
Port Status : Secure-up
Violation Mode : Shutdown
Aging Time : 0 mins
Aging Type : Absolute
SecureStatic Address Aging : Disabled
Maximum MAC Addresses : 1
Total MAC Addresses : 1
Configured MAC Addresses : 0
Sticky MAC Addresses : 1
Last Source Address:Vlan : 0000.0000.0000:0
Security Violation Count : 0
S4#show port-security interface f0/10
Port Security : Enabled
Port Status : Secure-up
Violation Mode : Shutdown
Aging Time : 0 mins
Aging Type : Absolute
SecureStatic Address Aging : Disabled
Maximum MAC Addresses : 1
Total MAC Addresses : 1
Configured MAC Addresses : 0
Sticky MAC Addresses : 0
Last Source Address:Vlan : 00D0.9775.C282:35
Security Violation Count : 0
S4#
Copy
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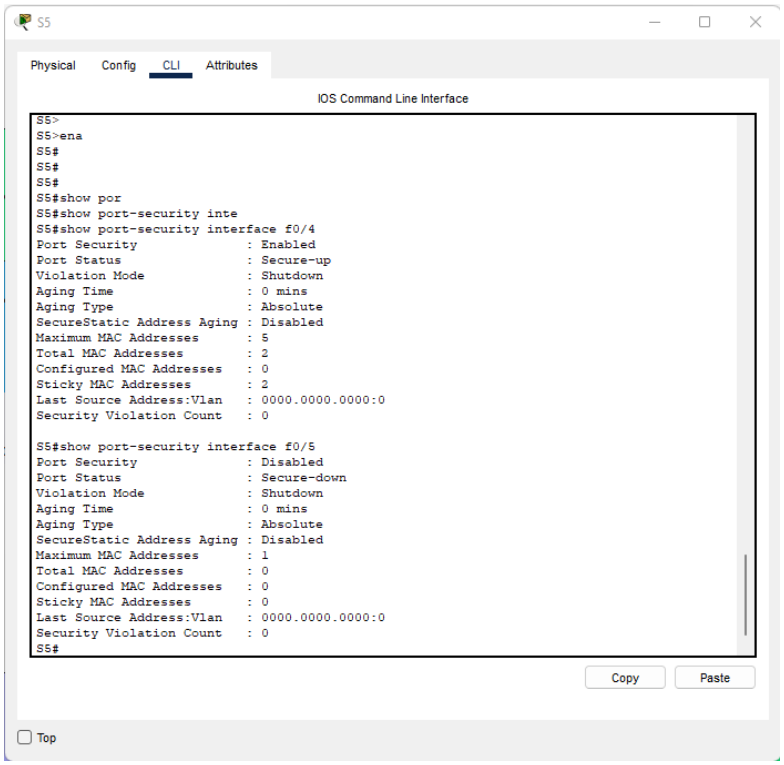
Top

- S5


S5
Physical
Config
CLI
Attributes
IOS Command Line Interface
S5>
S5>ena
S5#
S5#
S5#
S5#show por
S5#show port-security inte
S5#show port-security interface f0/4
Port Security : Enabled
Port Status : Secure-up
Violation Mode : Shutdown
Aging Time : 0 mins
Aging Type : Absolute
SecureStatic Address Aging : Disabled
Maximum MAC Addresses : 5
Total MAC Addresses : 2
Configured MAC Addresses : 0
Sticky MAC Addresses : 2
Last Source Address:Vlan : 0000.0000.0000:0
Security Violation Count : 0
S5#show port-security interface f0/5
Port Security : Disabled
Port Status : Secure-down
Violation Mode : Shutdown
Aging Time : 0 mins
Aging Type : Absolute
SecureStatic Address Aging : Disabled
Maximum MAC Addresses : 1
Total MAC Addresses : 0
Configured MAC Addresses : 0
Sticky MAC Addresses : 0
Last Source Address:Vlan : 0000.0000.0000:0
Security Violation Count : 0
S5#
Copy
Paste
Top

VLAN Nativa

Se configuró la VLAN 99 como nativa para las interfaces que unen los equipos Switch, es decir, en los enlaces en modo trunk.

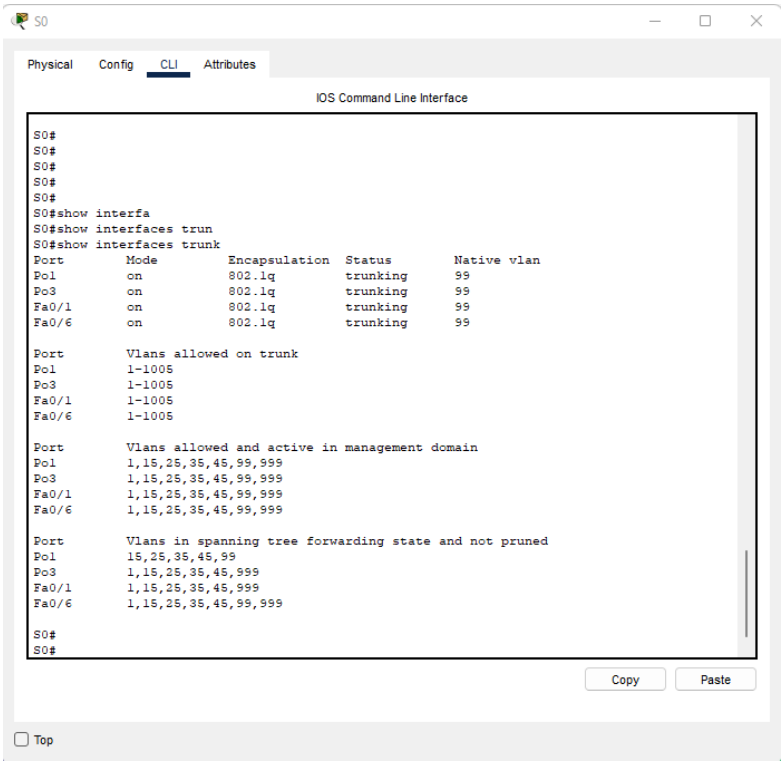
Equipo	Interface	Comandos
S0	F 0/1-6	• enable • configure terminal • interface range f 0/1-6 • switchport mode trunk • switchport trunk native vlan 99 • shutdow • no shutdown • end • show interfaces trunk
S1	F 0/1-8	• enable • configure terminal • interface range f 0/1-8 • switchport mode trunk • switchport trunk native vlan 99 • shutdow • no shutdown • end • show interfaces trunk
S2	F 0/1-5 F 0/8	• enable • configure terminal • interface range f 0/1-5 • switchport mode trunk • switchport trunk native vlan 99 • shutdow • no shutdown • end • show interfaces trunk • enable • configure terminal • interface f 0/8 • switchport mode trunk • switchport trunk native vlan 99 • shutdow • no shutdown • end • show interfaces trunk
S3	F 0/1	• enable • configure terminal • interface f 0/1

		• switchport mode trunk • switchport trunk native vlan 99 • shutdow • no shutdown • end • show interfaces trunk
	F 0/3	• enable • configure terminal • interface f 0/3 • switchport mode trunk • switchport trunk native vlan 99 • shutdow • no shutdown • end • show interfaces trunk
	F 0/6	• enable • configure terminal • interface f 0/6 • switchport mode trunk • switchport trunk native vlan 99 • shutdow • no shutdown • end • show interfaces trunk
S4	F 0/1-8	• enable • configure terminal • interface range f 0/1-8 • switchport mode trunk • switchport trunk native vlan 99 • shutdow • no shutdown • end • show interfaces trunk
S5	F 0/1	• enable • configure terminal • interface f 0/1 • switchport mode trunk • switchport trunk native vlan 99 • shutdow • no shutdown • end • show interfaces trunk
	F 0/3	• enable

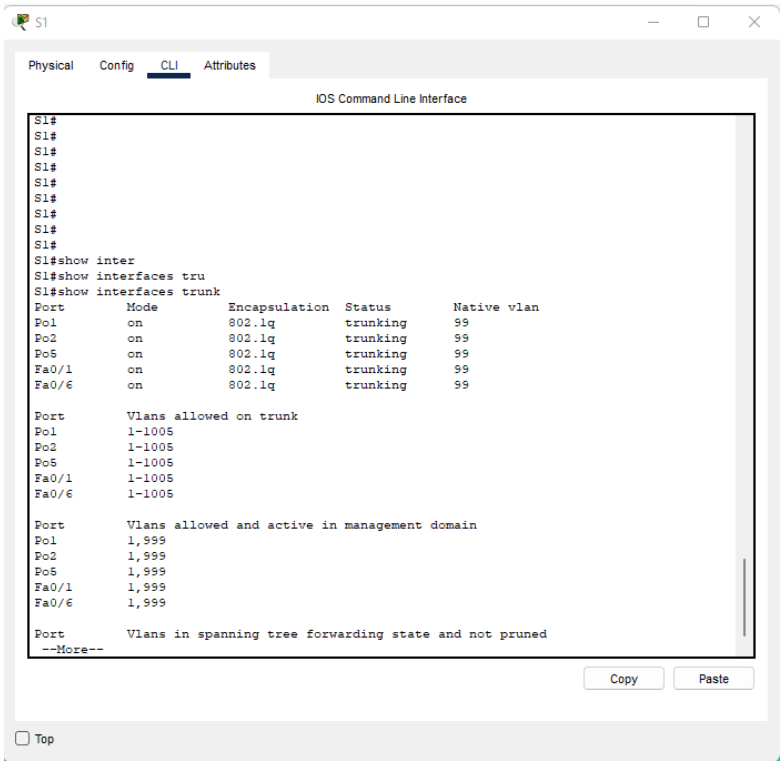
	F 0/6	• configure terminal • interface f 0/3 • switchport mode trunk • switchport trunk native vlan 99 • shutdow • no shutdown • end • show interfaces trunk • enable • configure terminal • interface f 0/6 • switchport mode trunk • switchport trunk native vlan 99 • shutdow • no shutdown • end • show interfaces trunk

Interfaces trunk en cada uno de los switches

S0



S1


S1
Physical
Config
CLI
Attributes
IOS Command Line Interface
S1#
S1#
S1#
S1#
S1#
S1#
S1#
S1#
S1#
S1#show inter
S1#show interfaces tru
S1#show interfaces trunk
Port Mode Encapsulation Status Native vlan
Po1 on 802.1q trunking 99
Po2 on 802.1q trunking 99
Po5 on 802.1q trunking 99
Fa0/1 on 802.1q trunking 99
Fa0/6 on 802.1q trunking 99
Port Vlans allowed on trunk
Po1 1-1005
Po2 1-1005
Po5 1-1005
Fa0/1 1-1005
Fa0/6 1-1005
Port Vlans allowed and active in management domain
Po1 1,999
Po2 1,999
Po5 1,999
Fa0/1 1,999
Fa0/6 1,999
Port Vlans in spanning tree forwarding state and not pruned
--More--
Copy
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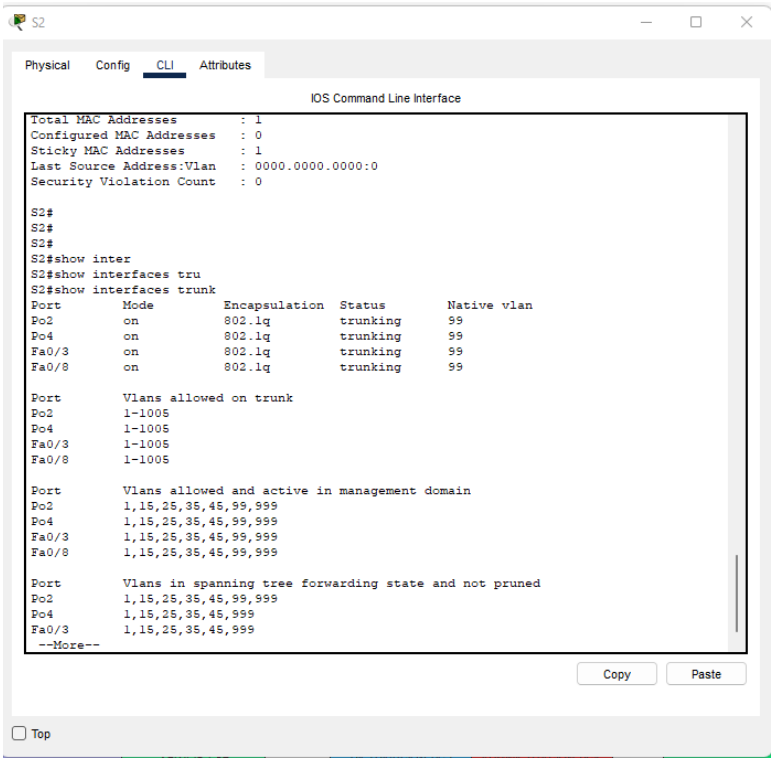
Top

S2


S2
Physical
Config
CLI
Attributes
IOS Command Line Interface
Total MAC Addresses : 1
Configured MAC Addresses : 0
Sticky MAC Addresses : 1
Last Source Address:Vlan : 0000.0000.0000:0
Security Violation Count : 0
S2#
S2#
S2#
S2#show inter
S2#show interfaces tru
S2#show interfaces trunk
Port Mode Encapsulation Status Native vlan
Po2 on 802.1q trunking 99
Po4 on 802.1q trunking 99
Fa0/3 on 802.1q trunking 99
Fa0/8 on 802.1q trunking 99
Port Vlans allowed on trunk
Po2 1-1005
Po4 1-1005
Fa0/3 1-1005
Fa0/8 1-1005
Port Vlans allowed and active in management domain
Po2 1,15,25,35,45,99,999
Po4 1,15,25,35,45,99,999
Fa0/3 1,15,25,35,45,99,999
Fa0/8 1,15,25,35,45,99,999
Port Vlans in spanning tree forwarding state and not pruned
Po2 1,15,25,35,45,99,999
Po4 1,15,25,35,45,999
Fa0/3 1,15,25,35,45,999
--More--
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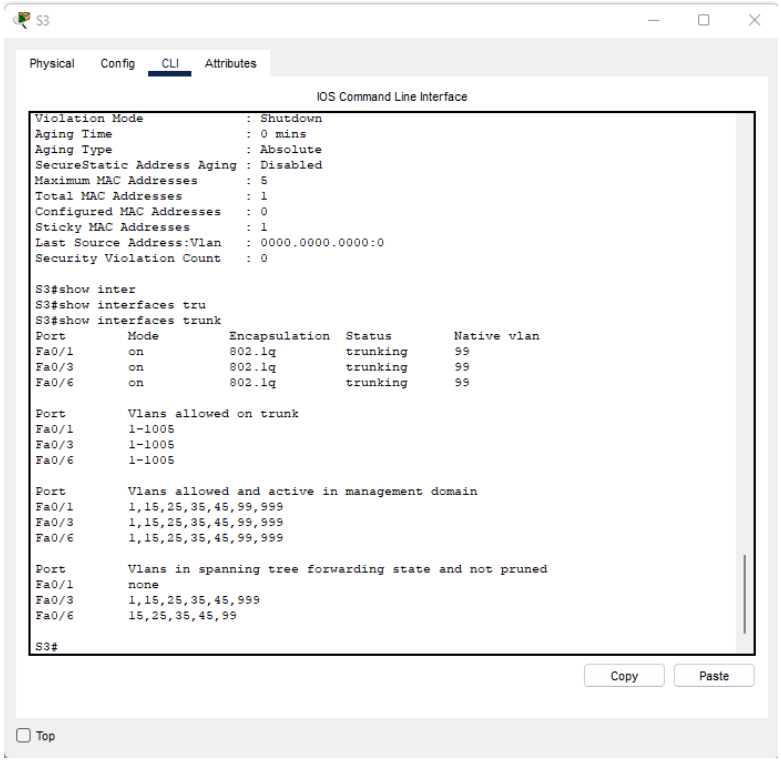
Top

S3


S3
Physical
Config
CLI
Attributes
IOS Command Line Interface
Violation Mode : Shutdown
Aging Time : 0 mins
Aging Type : Absolute
SecureStatic Address Aging : Disabled
Maximum MAC Addresses : 5
Total MAC Addresses : 1
Configured MAC Addresses : 0
Sticky MAC Addresses : 1
Last Source Address:Vlan : 0000.0000.0000:0
Security Violation Count : 0
S3#show inter
S3#show interfaces tru
S3#show interfaces trunk
Port Mode Encapsulation Status Native vlan
Fa0/1 on 802.1q trunking 99
Fa0/3 on 802.1q trunking 99
Fa0/6 on 802.1q trunking 99
Port Vlans allowed on trunk
Fa0/1 1-1005
Fa0/3 1-1005
Fa0/6 1-1005
Port Vlans allowed and active in management domain
Fa0/1 1,15,25,35,45,99,999
Fa0/3 1,15,25,35,45,99,999
Fa0/6 1,15,25,35,45,99,999
Port Vlans in spanning tree forwarding state and not pruned
Fa0/1 none
Fa0/3 1,15,25,35,45,999
Fa0/6 15,25,35,45,99
S3#
Copy
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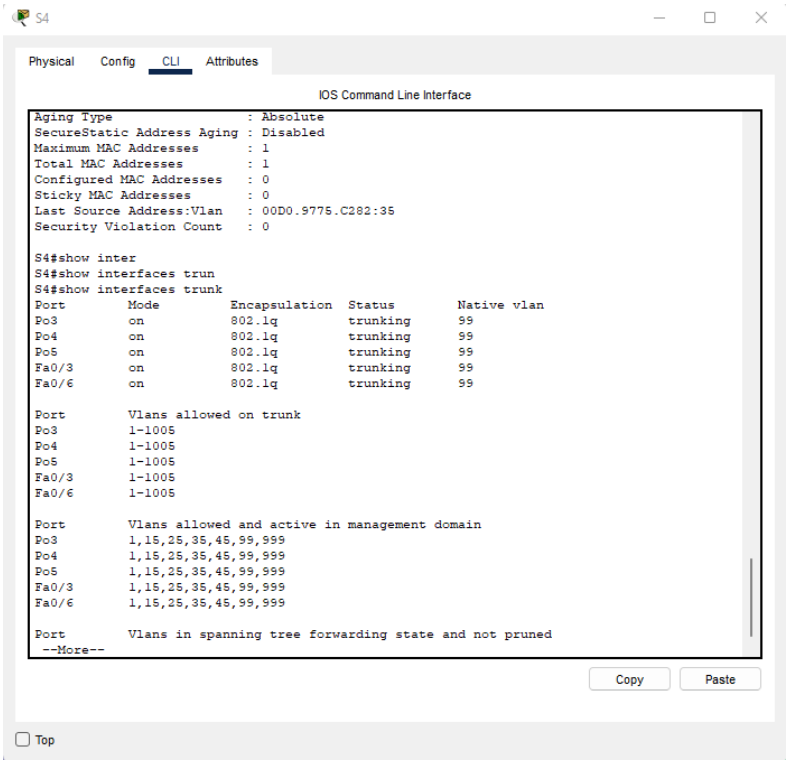
Top

S4


S4
Physical
Config
CLI
Attributes
IOS Command Line Interface
Aging Type : Absolute
SecureStatic Address Aging : Disabled
Maximum MAC Addresses : 1
Total MAC Addresses : 1
Configured MAC Addresses : 0
Sticky MAC Addresses : 0
Last Source Address:Vlan : 00D0.9775.C282:35
Security Violation Count : 0
S4#show inter
S4#show interfaces trun
S4#show interfaces trunk
Port Mode Encapsulation Status Native vlan
Po3 on 802.1q trunking 99
Po4 on 802.1q trunking 99
Po5 on 802.1q trunking 99
Fa0/3 on 802.1q trunking 99
Fa0/6 on 802.1q trunking 99
Port Vlans allowed on trunk
Po3 1-1005
Po4 1-1005
Po5 1-1005
Fa0/3 1-1005
Fa0/6 1-1005
Port Vlans allowed and active in management domain
Po3 1,15,25,35,45,99,999
Po4 1,15,25,35,45,99,999
Po5 1,15,25,35,45,99,999
Fa0/3 1,15,25,35,45,99,999
Fa0/6 1,15,25,35,45,99,999
Port Vlans in spanning tree forwarding state and not pruned
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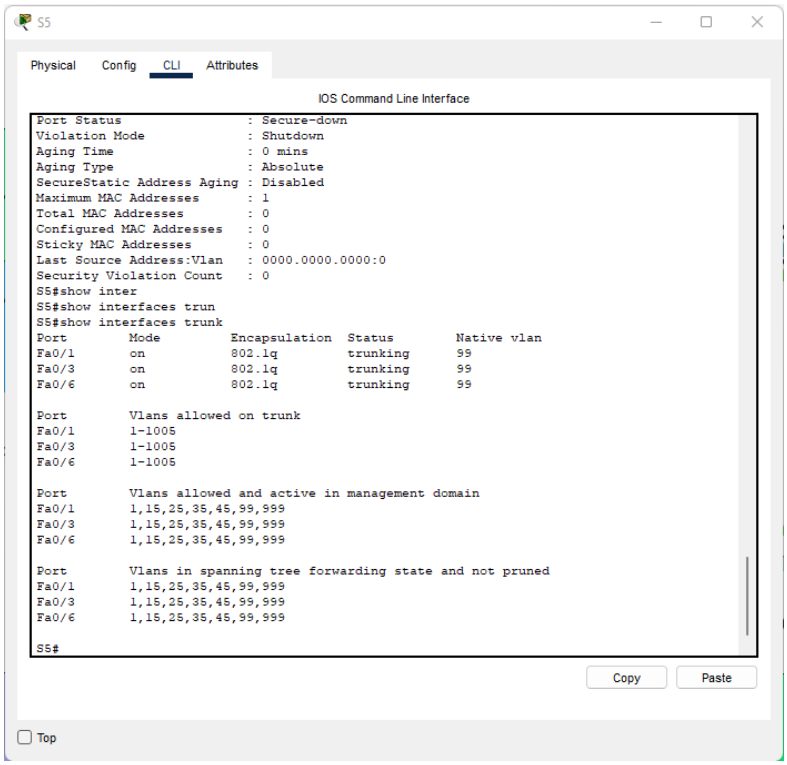
S5


S5
Physical
Config
CLI
Attributes
IOS Command Line Interface
Port Status : Secure-down
Violation Mode : Shutdown
Aging Time : 0 mins
Aging Type : Absolute
SecureStatic Address Aging : Disabled
Maximum MAC Addresses : 1
Total MAC Addresses : 0
Configured MAC Addresses : 0
Sticky MAC Addresses : 0
Last Source Address:Vlan : 0000.0000.0000:0
Security Violation Count : 0
S5#show inter
S5#show interfaces trun
S5#show interfaces trunk
Port Mode Encapsulation Status Native vlan
Fa0/1 on 802.1q trunking 99
Fa0/3 on 802.1q trunking 99
Fa0/6 on 802.1q trunking 99
Port Vlans allowed on trunk
Fa0/1 1-1005
Fa0/3 1-1005
Fa0/6 1-1005
Port Vlans allowed and active in management domain
Fa0/1 1,15,25,35,45,99,999
Fa0/3 1,15,25,35,45,99,999
Fa0/6 1,15,25,35,45,99,999
Port Vlans in spanning tree forwarding state and not pruned
Fa0/1 1,15,25,35,45,99,999
Fa0/3 1,15,25,35,45,99,999
Fa0/6 1,15,25,35,45,99,999
S5#
Copy
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Top

BLACKHOLE

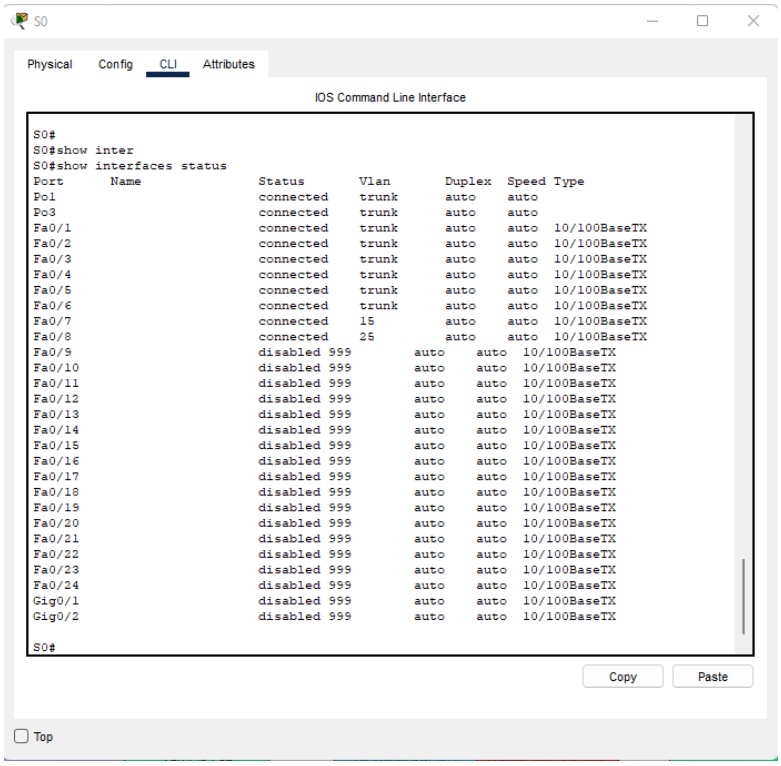
Las interfaces en desuso fueron asignadas a la VLAN 999 – BLACKHOLE y desactivadas en cada uno de los equipos.

Equipo	Interface	Comandos
S0	F0/9-24	• enable • configure terminal • interface range f 0/9-24 • switchport mode access • switchport access vlan 999 • shutdown • end
	G0/1-2	• enable • configure terminal • interface range g 0/1-2 • switchport mode access • switchport access vlan 999 • shutdown • end
S1	F0/9-24	• enable • configure terminal • interface range f 0/9-24 • switchport mode access • switchport access vlan 999 • shutdown • end
	G0/1-2	• enable • configure terminal • interface range g 0/1-2 • switchport mode access • switchport access vlan 999 • shutdown • end
S2	F0/9-24	• enable • configure terminal • interface range f 0/9-24 • switchport mode access • switchport access vlan 999 • shutdown • end
	G0/1-2	• enable • configure terminal

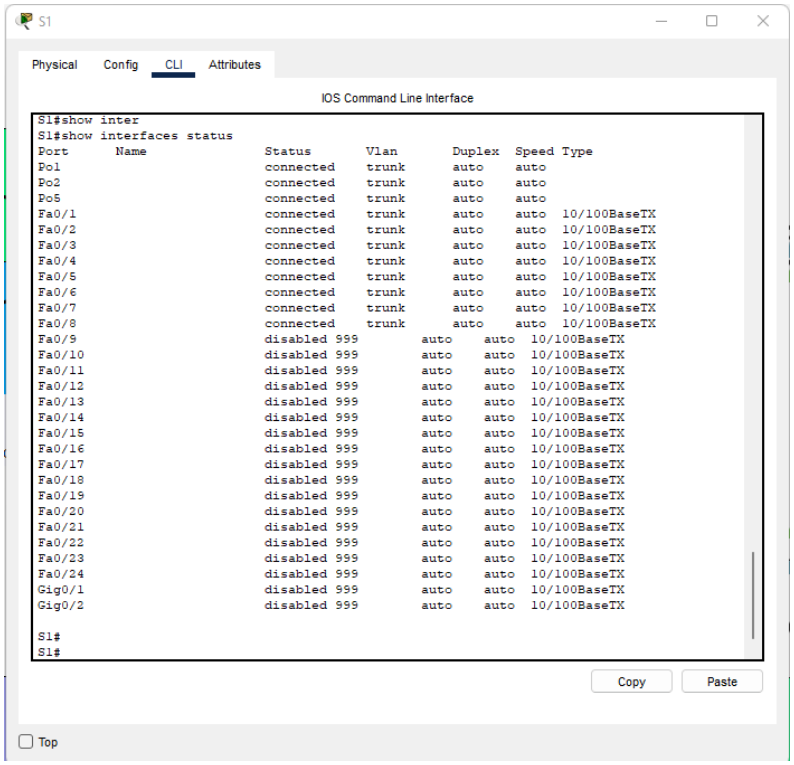
		• interface range g 0/1-2 • switchport mode access • switchport access vlan 999 • shutdown • end
S3	F0/7-24 G0/1-2	• enable • configure terminal • interface range f 0/7-24 • switchport mode access • switchport access vlan 999 • shutdown • end • enable • configure terminal • interface range g 0/1-2 • switchport mode access • switchport access vlan 999 • shutdown • end
S4	F0/11-24 G0/1-2	• enable • configure terminal • interface range f 0/11-24 • switchport mode access • switchport access vlan 999 • shutdown • end • enable • configure terminal • interface range g 0/1-2 • switchport mode access • switchport access vlan 999 • shutdown • end
S5	F0/2 F0/7-24	• enable • configure terminal • interface f 0/2 • switchport mode access • switchport access vlan 999 • shutdown • end • enable • configure terminal • interface range g 0/9-24

	G0/1-2	• switchport mode access • switchport access vlan 999 • shutdown • end • enable • configure terminal • interface range g 0/1-2 • switchport mode access • switchport access vlan 999 • shutdown • end

S0



S1


S1
Physical
Config
CLI
Attributes
IOS Command Line Interface
S1#show inter
S1#show interfaces status
Port Name Status Vlan Duplex Speed Type
Po1 connected trunk auto auto
Po2 connected trunk auto auto
Po5 connected trunk auto auto
Fa0/1 connected trunk auto auto 10/100BaseTX
Fa0/2 connected trunk auto auto 10/100BaseTX
Fa0/3 connected trunk auto auto 10/100BaseTX
Fa0/4 connected trunk auto auto 10/100BaseTX
Fa0/5 connected trunk auto auto 10/100BaseTX
Fa0/6 connected trunk auto auto 10/100BaseTX
Fa0/7 connected trunk auto auto 10/100BaseTX
Fa0/8 connected trunk auto auto 10/100BaseTX
Fa0/9 disabled 999 auto auto 10/100BaseTX
Fa0/10 disabled 999 auto auto 10/100BaseTX
Fa0/11 disabled 999 auto auto 10/100BaseTX
Fa0/12 disabled 999 auto auto 10/100BaseTX
Fa0/13 disabled 999 auto auto 10/100BaseTX
Fa0/14 disabled 999 auto auto 10/100BaseTX
Fa0/15 disabled 999 auto auto 10/100BaseTX
Fa0/16 disabled 999 auto auto 10/100BaseTX
Fa0/17 disabled 999 auto auto 10/100BaseTX
Fa0/18 disabled 999 auto auto 10/100BaseTX
Fa0/19 disabled 999 auto auto 10/100BaseTX
Fa0/20 disabled 999 auto auto 10/100BaseTX
Fa0/21 disabled 999 auto auto 10/100BaseTX
Fa0/22 disabled 999 auto auto 10/100BaseTX
Fa0/23 disabled 999 auto auto 10/100BaseTX
Fa0/24 disabled 999 auto auto 10/100BaseTX
Gig0/1 disabled 999 auto auto 10/100BaseTX
Gig0/2 disabled 999 auto auto 10/100BaseTX
S1#
S1#
Copy
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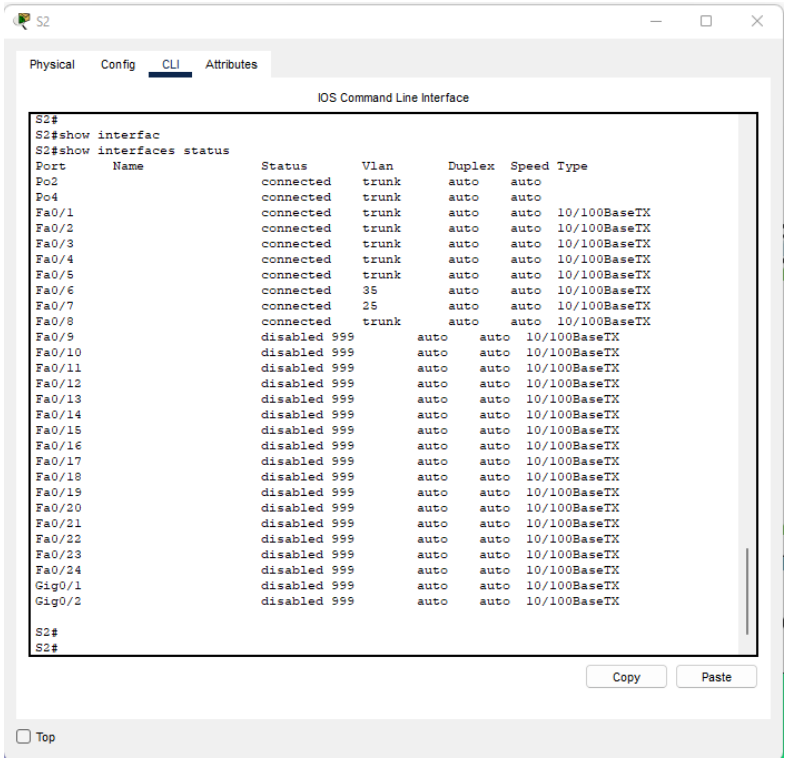
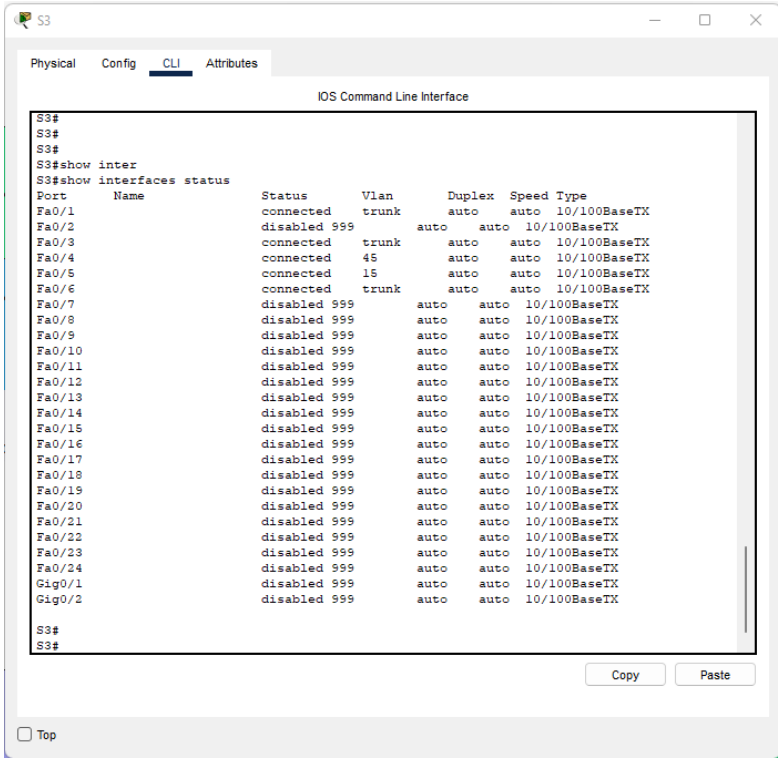
Top

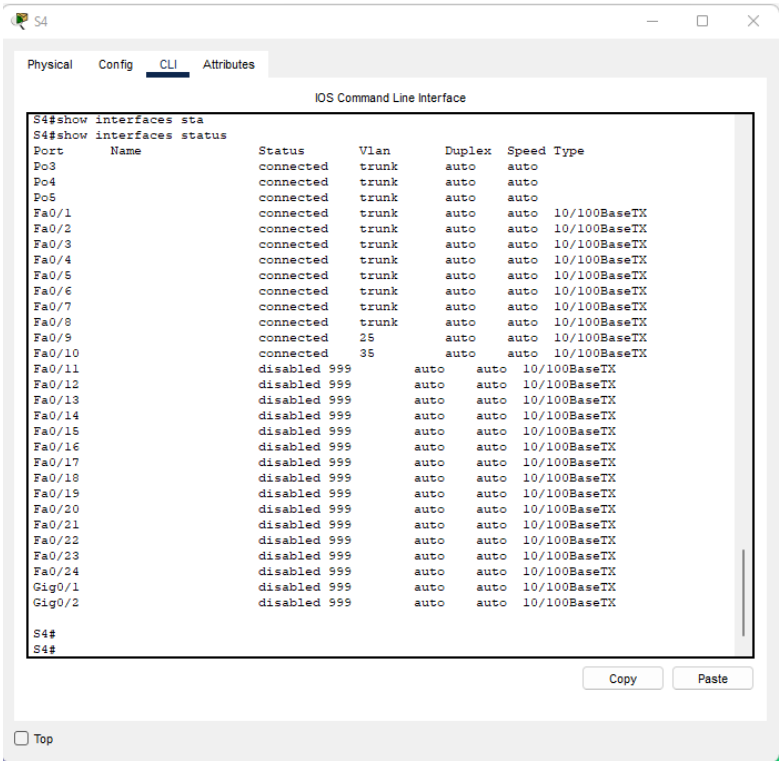
S2


S2
Physical
Config
CLI
Attributes
IOS Command Line Interface
S2#
S2#show interfac
S2#show interfaces status
Port Name Status Vlan Duplex Speed Type
Po2 connected trunk auto auto
Po4 connected trunk auto auto
Fa0/1 connected trunk auto auto 10/100BaseTX
Fa0/2 connected trunk auto auto 10/100BaseTX
Fa0/3 connected trunk auto auto 10/100BaseTX
Fa0/4 connected trunk auto auto 10/100BaseTX
Fa0/5 connected trunk auto auto 10/100BaseTX
Fa0/6 connected 35 auto auto 10/100BaseTX
Fa0/7 connected 25 auto auto 10/100BaseTX
Fa0/8 connected trunk auto auto 10/100BaseTX
Fa0/9 disabled 999 auto auto 10/100BaseTX
Fa0/10 disabled 999 auto auto 10/100BaseTX
Fa0/11 disabled 999 auto auto 10/100BaseTX
Fa0/12 disabled 999 auto auto 10/100BaseTX
Fa0/13 disabled 999 auto auto 10/100BaseTX
Fa0/14 disabled 999 auto auto 10/100BaseTX
Fa0/15 disabled 999 auto auto 10/100BaseTX
Fa0/16 disabled 999 auto auto 10/100BaseTX
Fa0/17 disabled 999 auto auto 10/100BaseTX
Fa0/18 disabled 999 auto auto 10/100BaseTX
Fa0/19 disabled 999 auto auto 10/100BaseTX
Fa0/20 disabled 999 auto auto 10/100BaseTX
Fa0/21 disabled 999 auto auto 10/100BaseTX
Fa0/22 disabled 999 auto auto 10/100BaseTX
Fa0/23 disabled 999 auto auto 10/100BaseTX
Fa0/24 disabled 999 auto auto 10/100BaseTX
Gig0/1 disabled 999 auto auto 10/100BaseTX
Gig0/2 disabled 999 auto auto 10/100BaseTX
S2#
S2#
Copy
Paste
Top

S3


S3
Physical
Config
CLI
Attributes
IOS Command Line Interface
S3#
S3#
S3#
S3#show inter
S3#show interfaces status
Port Name Status Vlan Duplex Speed Type
Fa0/1 connected trunk auto auto 10/100BaseTX
Fa0/2 disabled 999 auto auto 10/100BaseTX
Fa0/3 connected trunk auto auto 10/100BaseTX
Fa0/4 connected 45 auto auto 10/100BaseTX
Fa0/5 connected 15 auto auto 10/100BaseTX
Fa0/6 connected trunk auto auto 10/100BaseTX
Fa0/7 disabled 999 auto auto 10/100BaseTX
Fa0/8 disabled 999 auto auto 10/100BaseTX
Fa0/9 disabled 999 auto auto 10/100BaseTX
Fa0/10 disabled 999 auto auto 10/100BaseTX
Fa0/11 disabled 999 auto auto 10/100BaseTX
Fa0/12 disabled 999 auto auto 10/100BaseTX
Fa0/13 disabled 999 auto auto 10/100BaseTX
Fa0/14 disabled 999 auto auto 10/100BaseTX
Fa0/15 disabled 999 auto auto 10/100BaseTX
Fa0/16 disabled 999 auto auto 10/100BaseTX
Fa0/17 disabled 999 auto auto 10/100BaseTX
Fa0/18 disabled 999 auto auto 10/100BaseTX
Fa0/19 disabled 999 auto auto 10/100BaseTX
Fa0/20 disabled 999 auto auto 10/100BaseTX
Fa0/21 disabled 999 auto auto 10/100BaseTX
Fa0/22 disabled 999 auto auto 10/100BaseTX
Fa0/23 disabled 999 auto auto 10/100BaseTX
Fa0/24 disabled 999 auto auto 10/100BaseTX
Gig0/1 disabled 999 auto auto 10/100BaseTX
Gig0/2 disabled 999 auto auto 10/100BaseTX
S3#
S3#
Copy
Paste
Top

S4


S4
Physical
Config
CLI
Attributes
IOS Command Line Interface
S4#show interfaces sta
S4#show interfaces status
Port Name Status Vlan Duplex Speed Type
Po3 connected trunk auto auto
Po4 connected trunk auto auto
Po5 connected trunk auto auto
Fa0/1 connected trunk auto auto 10/100BaseTX
Fa0/2 connected trunk auto auto 10/100BaseTX
Fa0/3 connected trunk auto auto 10/100BaseTX
Fa0/4 connected trunk auto auto 10/100BaseTX
Fa0/5 connected trunk auto auto 10/100BaseTX
Fa0/6 connected trunk auto auto 10/100BaseTX
Fa0/7 connected trunk auto auto 10/100BaseTX
Fa0/8 connected trunk auto auto 10/100BaseTX
Fa0/9 connected 25 auto auto 10/100BaseTX
Fa0/10 connected 35 auto auto 10/100BaseTX
Fa0/11 disabled 999 auto auto 10/100BaseTX
Fa0/12 disabled 999 auto auto 10/100BaseTX
Fa0/13 disabled 999 auto auto 10/100BaseTX
Fa0/14 disabled 999 auto auto 10/100BaseTX
Fa0/15 disabled 999 auto auto 10/100BaseTX
Fa0/16 disabled 999 auto auto 10/100BaseTX
Fa0/17 disabled 999 auto auto 10/100BaseTX
Fa0/18 disabled 999 auto auto 10/100BaseTX
Fa0/19 disabled 999 auto auto 10/100BaseTX
Fa0/20 disabled 999 auto auto 10/100BaseTX
Fa0/21 disabled 999 auto auto 10/100BaseTX
Fa0/22 disabled 999 auto auto 10/100BaseTX
Fa0/23 disabled 999 auto auto 10/100BaseTX
Fa0/24 disabled 999 auto auto 10/100BaseTX
Gig0/1 disabled 999 auto auto 10/100BaseTX
Gig0/2 disabled 999 auto auto 10/100BaseTX
S4#
S4#
Copy
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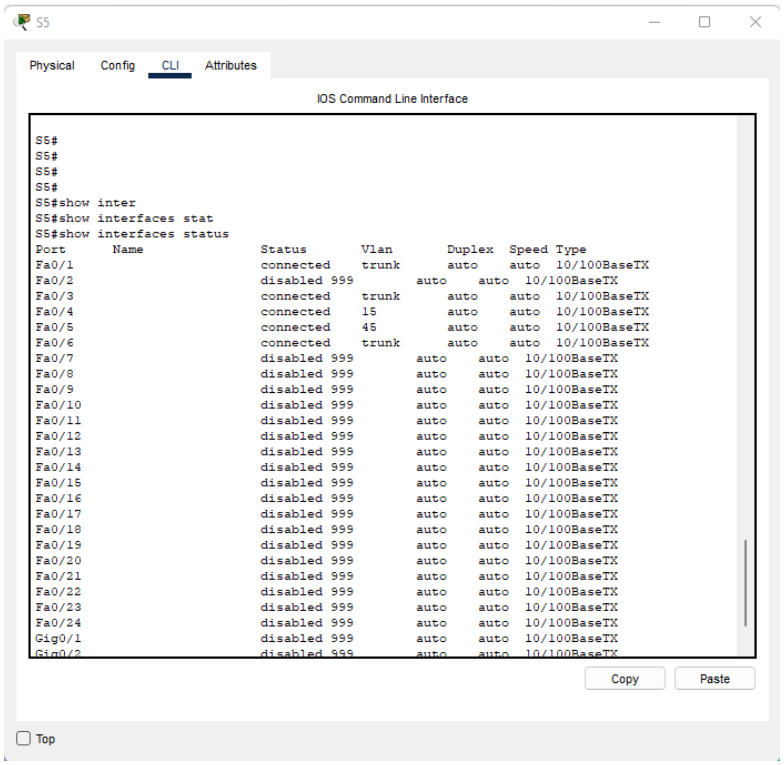
Top

S5


S5
Physical
Config
CLI
Attributes
IOS Command Line Interface
S5#
S5#
S5#
S5#
S5#show inter
S5#show interfaces stat
S5#show interfaces status
Port Name Status Vlan Duplex Speed Type
Fa0/1 connected trunk auto auto 10/100BaseTX
Fa0/2 disabled 999 auto auto 10/100BaseTX
Fa0/3 connected trunk auto auto 10/100BaseTX
Fa0/4 connected 15 auto auto 10/100BaseTX
Fa0/5 connected 45 auto auto 10/100BaseTX
Fa0/6 connected trunk auto auto 10/100BaseTX
Fa0/7 disabled 999 auto auto 10/100BaseTX
Fa0/8 disabled 999 auto auto 10/100BaseTX
Fa0/9 disabled 999 auto auto 10/100BaseTX
Fa0/10 disabled 999 auto auto 10/100BaseTX
Fa0/11 disabled 999 auto auto 10/100BaseTX
Fa0/12 disabled 999 auto auto 10/100BaseTX
Fa0/13 disabled 999 auto auto 10/100BaseTX
Fa0/14 disabled 999 auto auto 10/100BaseTX
Fa0/15 disabled 999 auto auto 10/100BaseTX
Fa0/16 disabled 999 auto auto 10/100BaseTX
Fa0/17 disabled 999 auto auto 10/100BaseTX
Fa0/18 disabled 999 auto auto 10/100BaseTX
Fa0/19 disabled 999 auto auto 10/100BaseTX
Fa0/20 disabled 999 auto auto 10/100BaseTX
Fa0/21 disabled 999 auto auto 10/100BaseTX
Fa0/22 disabled 999 auto auto 10/100BaseTX
Fa0/23 disabled 999 auto auto 10/100BaseTX
Fa0/24 disabled 999 auto auto 10/100BaseTX
Gig0/1 disabled 999 auto auto 10/100BaseTX
Gig0/2 disabled 999 auto auto 10/100BaseTX
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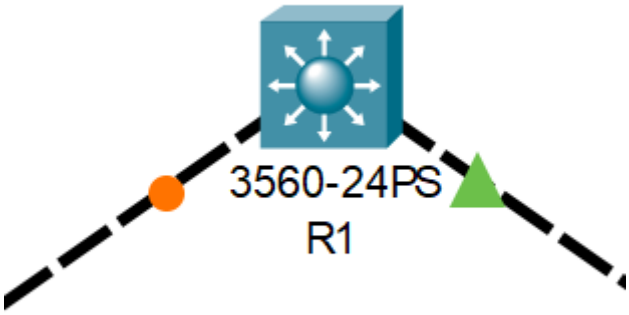
InterVLAN

Para lograr la comunicación entre las diferentes VLANs, hicimos uso de interfaces VLAN en el equipo Switch multicapa identificado como R1 dentro de nuestra topología.



Para crear dichas interfaces, utilizamos los siguientes comandos.

Interface VLAN	Comandos
Interface VLAN 15	enable configure terminal interface vlan 15 ip address 192.168.85.1 255.255.255.248 shutdown no shutdown end
Interface VLAN 25	enable configure terminal interface vlan 25 ip address 192.168.85.9 255.255.255.248 shutdown no shutdown end
Interface VLAN 35	enable configure terminal interface vlan 35 ip address 192.168.85.17 255.255.255.248 shutdown no shutdown end
Interface VLAN 45	enable configure terminal interface vlan 45 ip address 192.168.85.25 255.255.255.248 shutdown

	no shutdown end

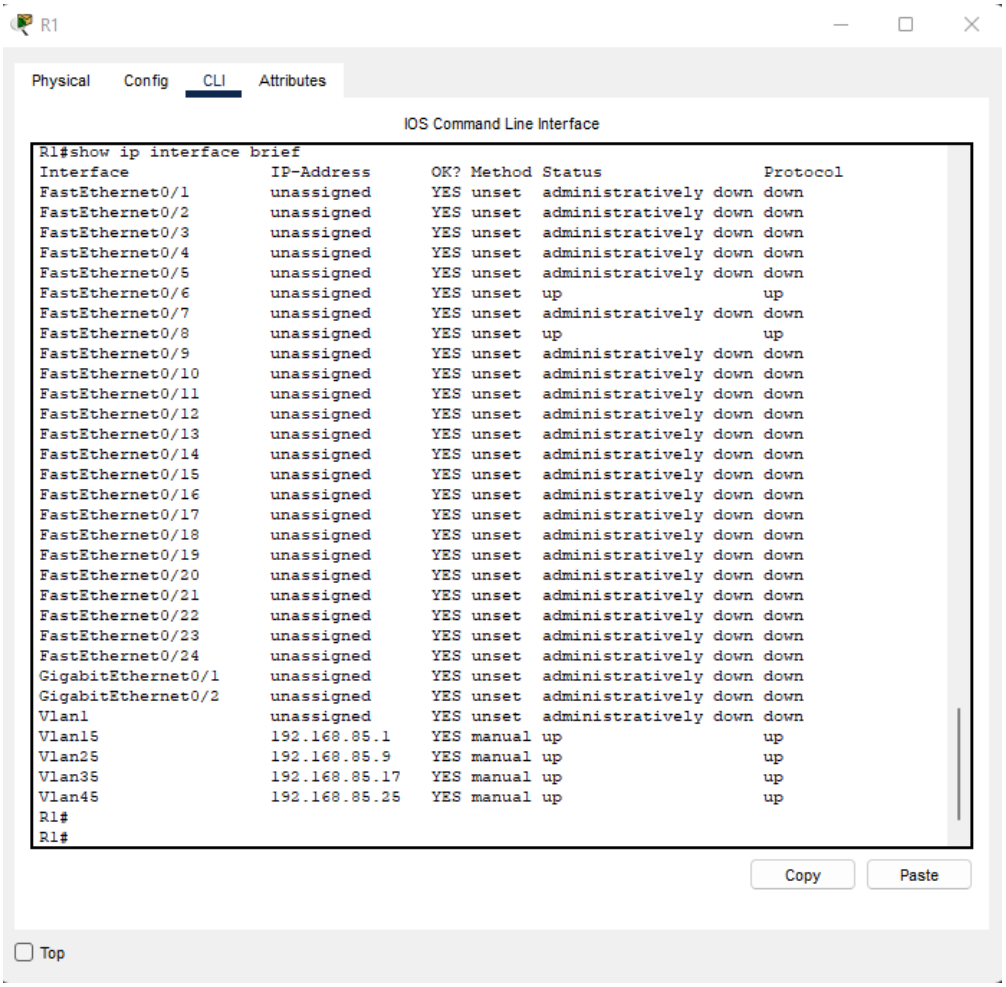
Las direcciones que aparecen en color rojo representan el Gateway de la subred que corresponde a la VLAN.

Además, para poder utilizar el InterVLAN en el equipo fue necesario aplicar el siguiente comando.

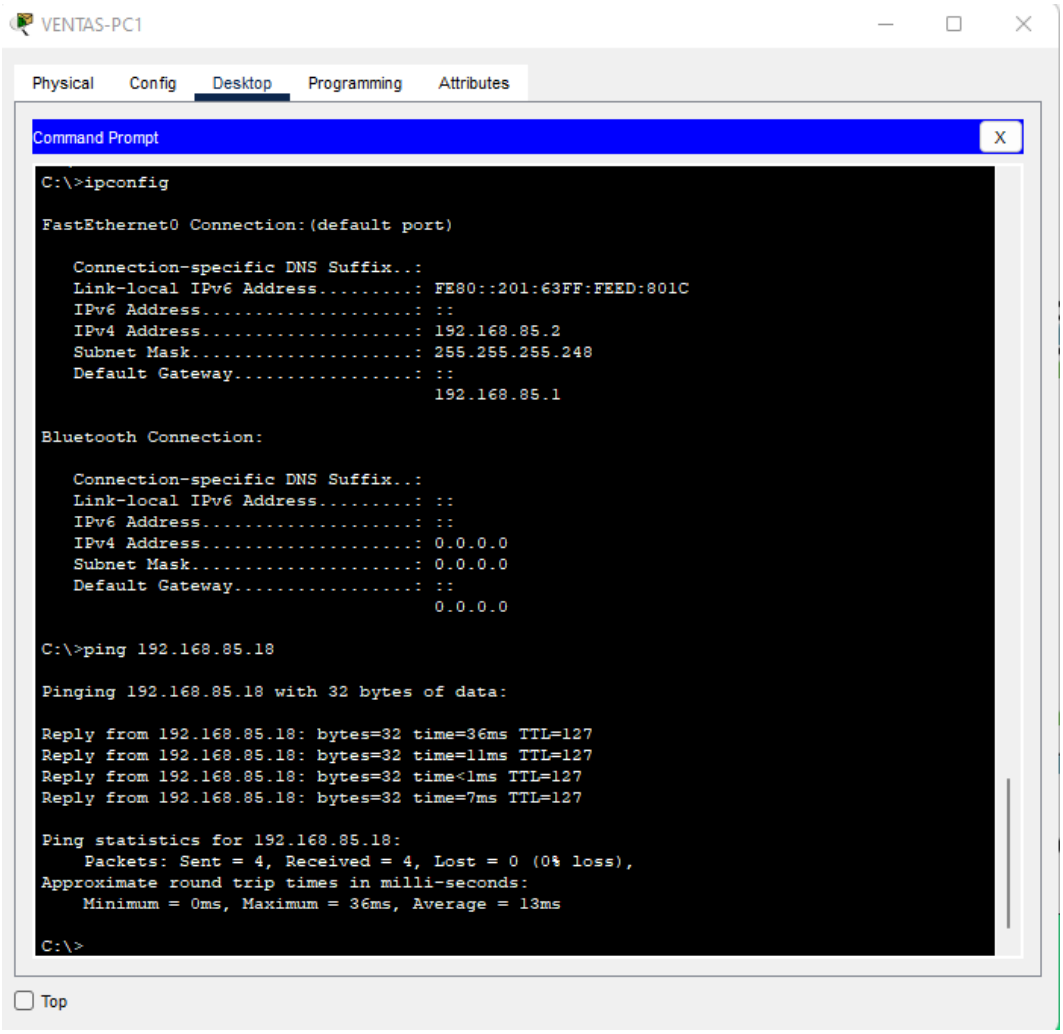
- Enable
- Configure terminal
- Ip routing
- End

De esta manera, fue establecida la comunicación entre equipos pertenecientes a diferentes VLANs. Así mismo, para verificar la creación y estado de las interfaces utilizamos el comando

- Enable
- Show ip interface brief



Como se puede observar, la comunicación entre la VLAN 15, por medio del equipo con dirección 192.168.85.2 hacia la VLAN 35, específicamente al equipo con dirección 192.168.85.18, se realiza sin ningún problema.

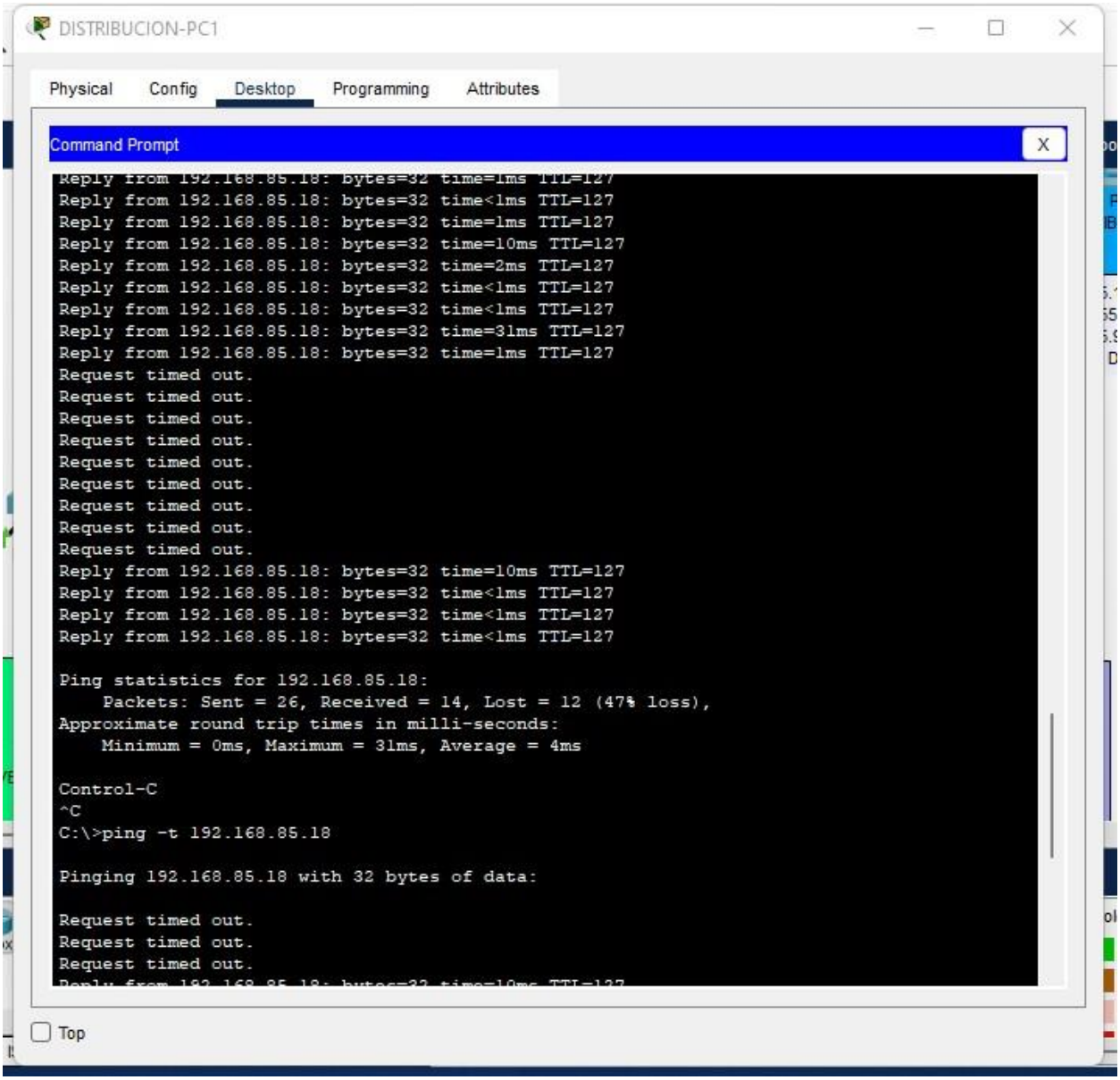


Elección de escenario con mejor convergencia

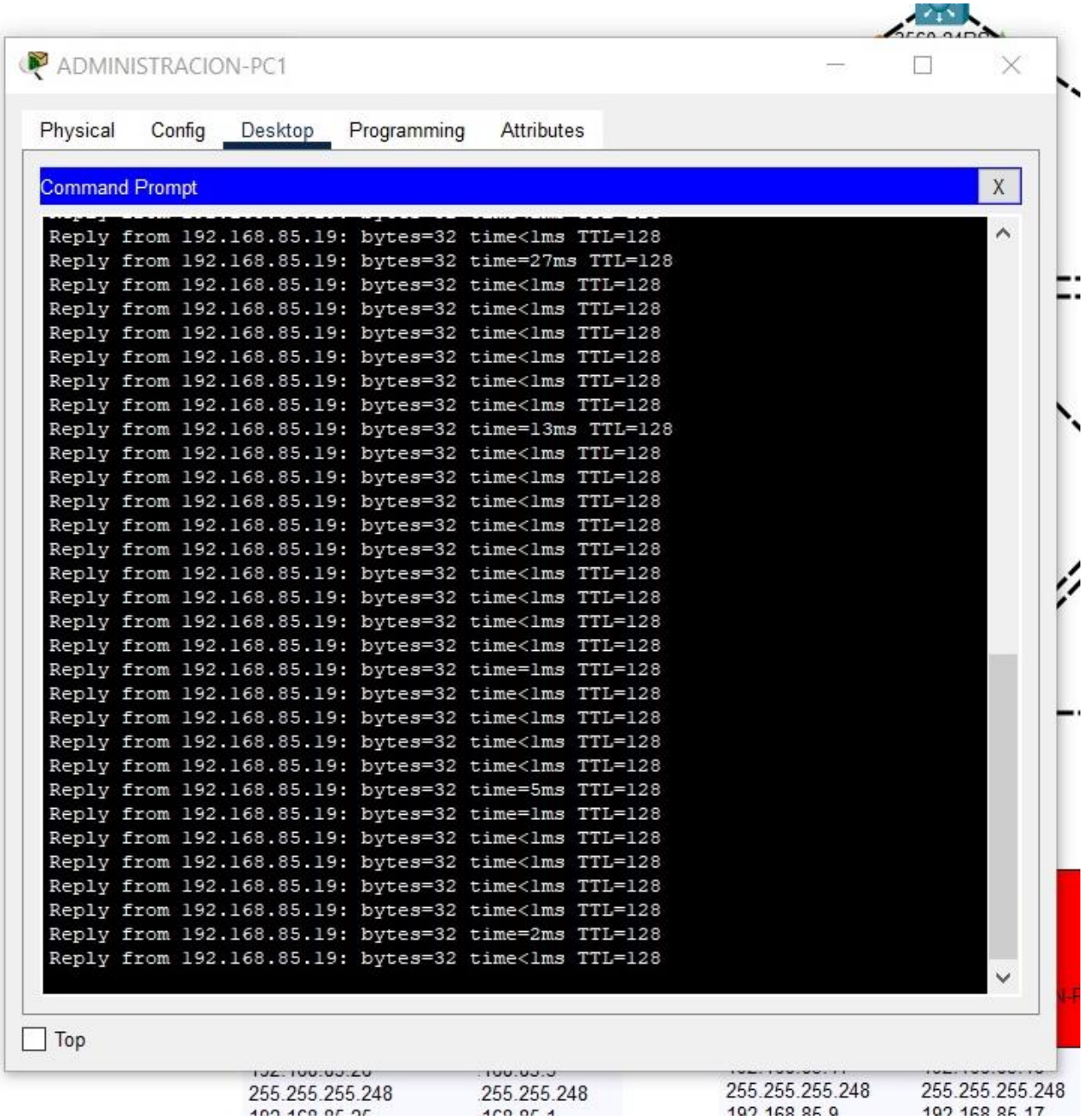
Una vez configurados los protocolos requeridos en el enunciado, obtuvimos 4 topologías diferentes, en base a las siguientes combinaciones.

- PAgP - PVST
- PAgP – RPVST
- LACP - PVST
- LACP - RPVST

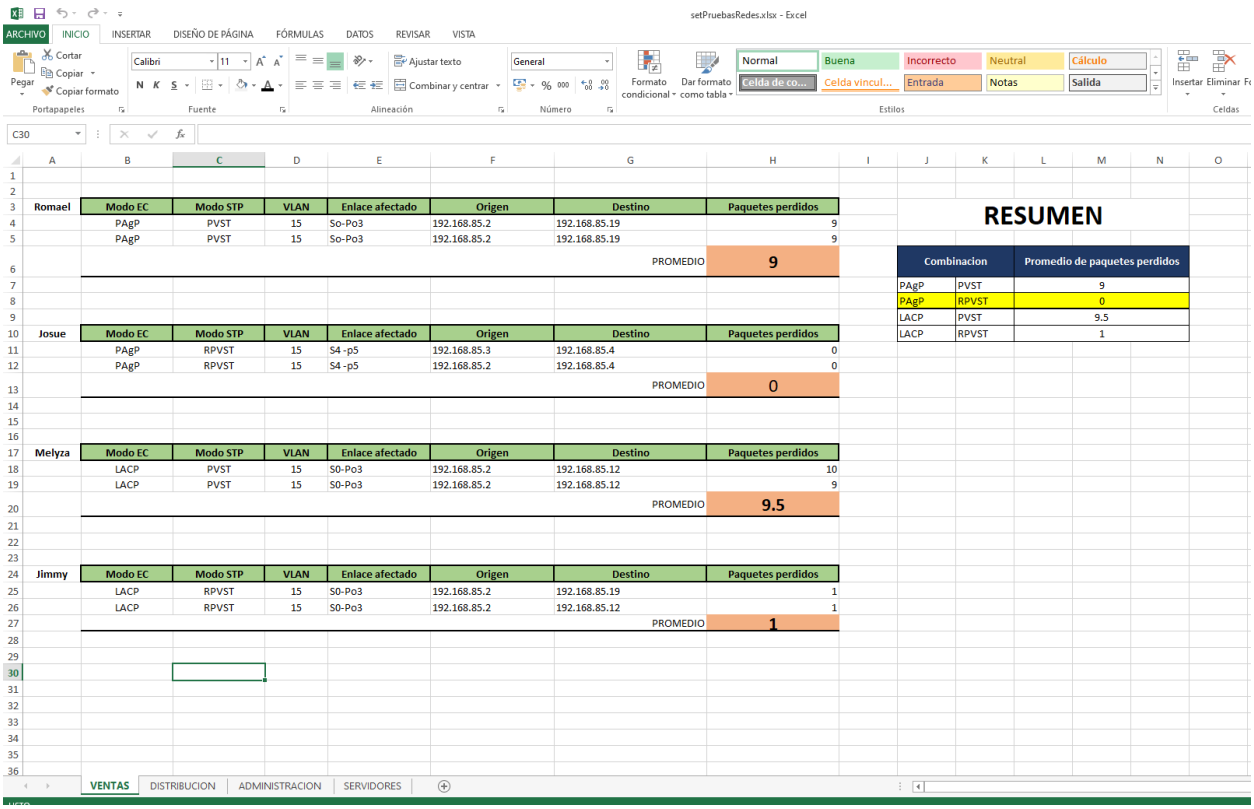
Para determinar la combinación con la mejor convergencia realizamos un set de pruebas, tomando en cuenta a cada una de las VLANs, durante las pruebas ejecutadas iniciamos la comunicación entre dos equipos con un ping extendido, posteriormente, deshabilitamos un enlace, en este momento notamos que la comunicación se veía interrumpida (en algunos casos).



En algunos otros casos, la comunicación se mantenía constante.



Como criterio de decisión, utilizamos la cantidad de paquetes perdidos durante el tiempo que el protocolo recalculaba el árbol de expansión. Con esta base, registramos cada uno de los resultados obtenidos en un archivo colaborativo.

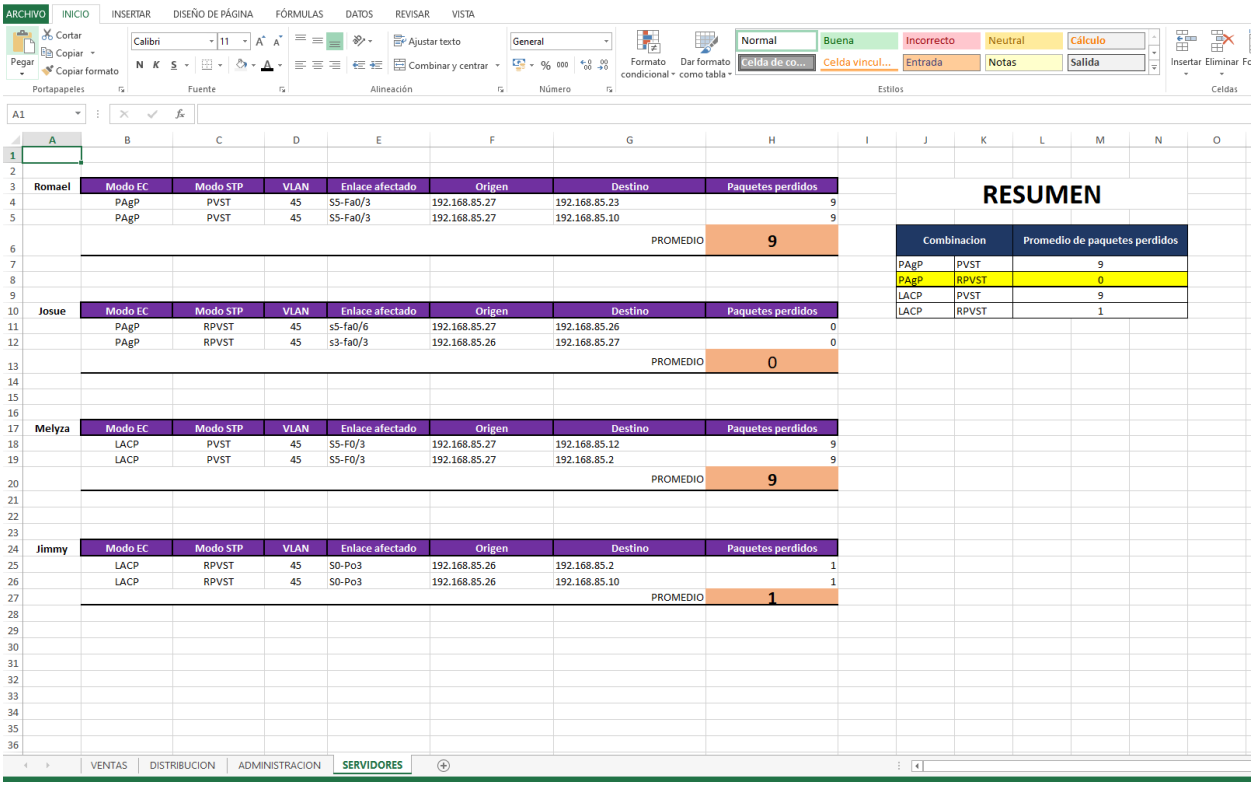


setPruebasRedes.xlsx - Excel

Romael	Modo EC	Modo STP	VLAN	Enlace afectado	Origen	Destino	Paquetes perdidos
	PAgP	PVST	15	So-Po3	192.168.85.2	192.168.85.19	9
	PAgP	PVST	15	So-Po3	192.168.85.2	192.168.85.19	9
						PROMEDIO	9
Josue	Modo EC	Modo STP	VLAN	Enlace afectado	Origen	Destino	Paquetes perdidos
	PAgP	RPVST	15	S4 -p5	192.168.85.3	192.168.85.4	0
	PAgP	RPVST	15	S4 -p5	192.168.85.2	192.168.85.4	0
						PROMEDIO	0
Melyza	Modo EC	Modo STP	VLAN	Enlace afectado	Origen	Destino	Paquetes perdidos
	LACP	PVST	15	S0-Po3	192.168.85.2	192.168.85.12	10
	LACP	PVST	15	S0-Po3	192.168.85.2	192.168.85.12	9
						PROMEDIO	9.5
Jimmy	Modo EC	Modo STP	VLAN	Enlace afectado	Origen	Destino	Paquetes perdidos
	LACP	RPVST	15	S0-Po3	192.168.85.2	192.168.85.19	1
	LACP	RPVST	15	S0-Po3	192.168.85.2	192.168.85.12	1
						PROMEDIO	1

RESUMEN

Combinacion		Promedio de paquetes perdidos
PAgP	PVST	9
PAgP	RPVST	0
LACP	PVST	9.5
LACP	RPVST	1



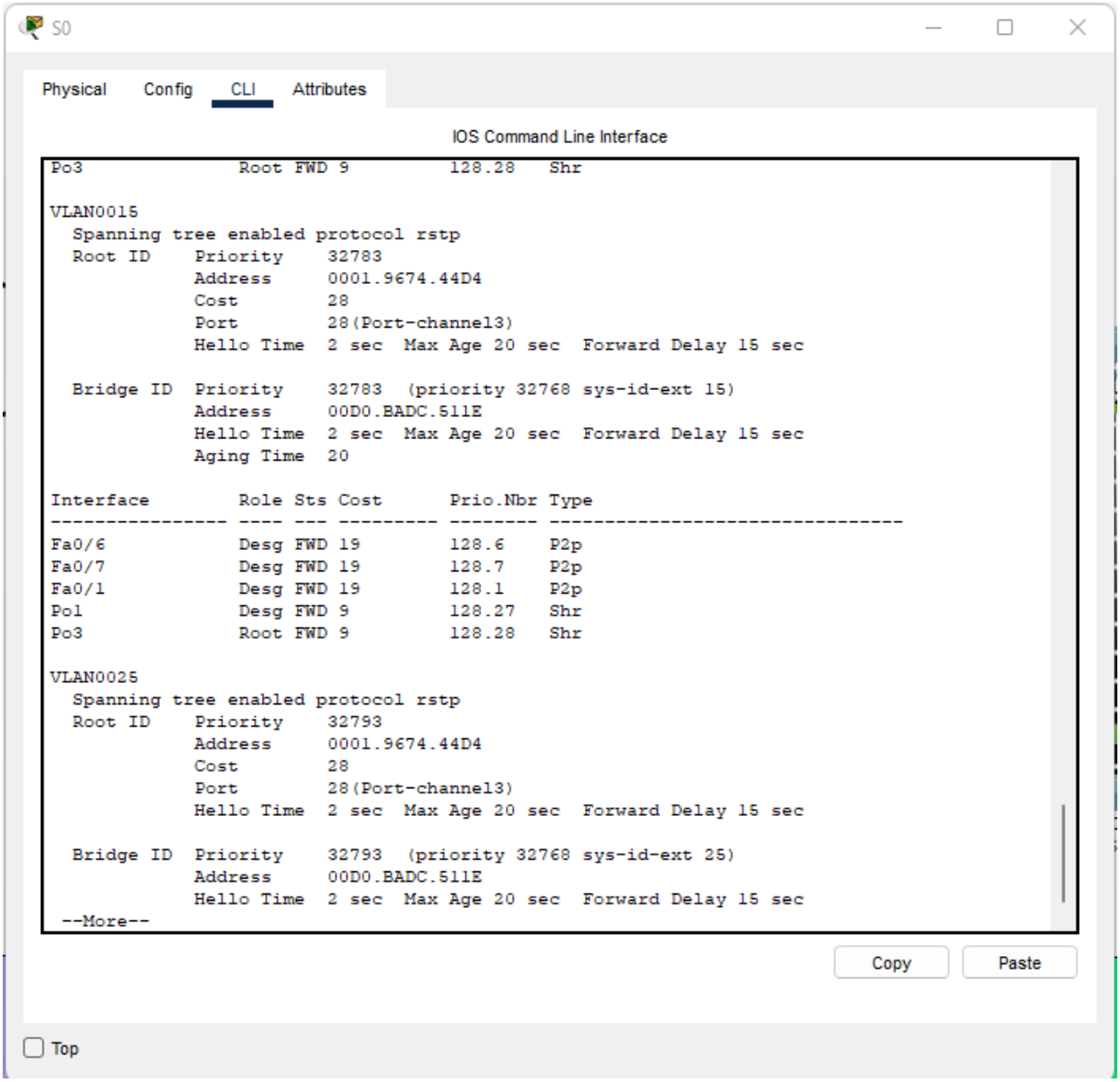
Romael	Modo EC	Modo STP	VLAN	Enlace afectado	Origen	Destino	Paquetes perdidos
	PAgP	PVST	45	S5-Fa0/3	192.168.85.27	192.168.85.23	9
	PAgP	PVST	45	S5-Fa0/3	192.168.85.27	192.168.85.10	9
						PROMEDIO	9
Josue	Modo EC	Modo STP	VLAN	Enlace afectado	Origen	Destino	Paquetes perdidos
	PAgP	RPVST	45	s5-fa0/6	192.168.85.27	192.168.85.26	0
	PAgP	RPVST	45	s3-fa0/3	192.168.85.26	192.168.85.27	0
						PROMEDIO	0
Melyza	Modo EC	Modo STP	VLAN	Enlace afectado	Origen	Destino	Paquetes perdidos
	LACP	PVST	45	S5-F0/3	192.168.85.27	192.168.85.12	9
	LACP	PVST	45	S5-F0/3	192.168.85.27	192.168.85.2	9
						PROMEDIO	9
Jimmy	Modo EC	Modo STP	VLAN	Enlace afectado	Origen	Destino	Paquetes perdidos
	LACP	RPVST	45	S0-Po3	192.168.85.26	192.168.85.2	1
	LACP	RPVST	45	S0-Po3	192.168.85.26	192.168.85.10	1
						PROMEDIO	1

RESUMEN

Combinacion		Promedio de paquetes perdidos
PAgP	PVST	9
PAgP	RPVST	0
LACP	PVST	9
LACP	RPVST	1

Para determinar el enlace a deshabilitar, utilizamos el comando show spanning-tree active, este nos indica la información correspondiente al protocolo STP en el switch correspondiente.

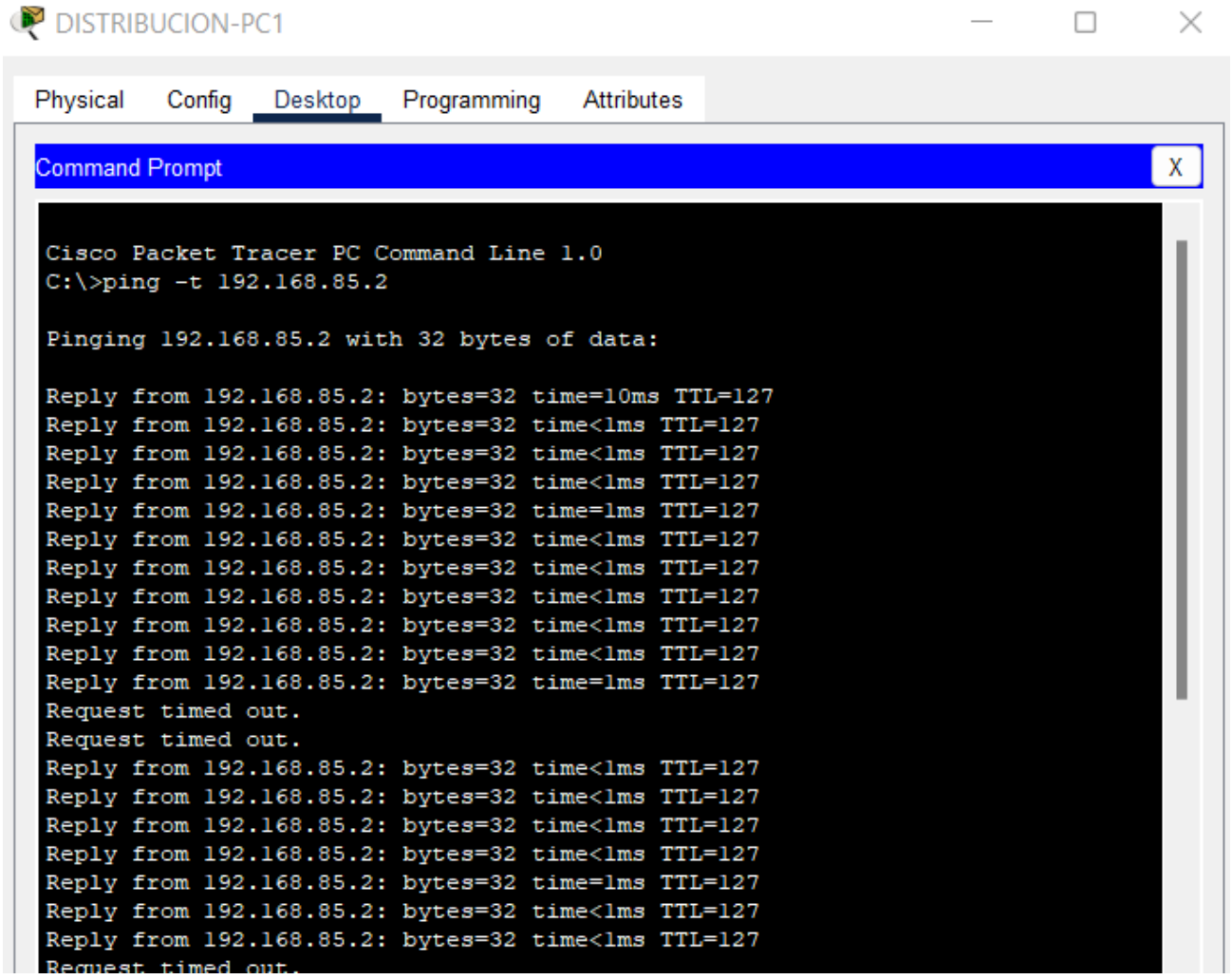
Como se puede observar, el enlace ROOT para la VLAN 15 (Ventas) en el Switch identificado como S0 es Po3, por lo tanto, este es el enlace que se colocó en modo inactivo.

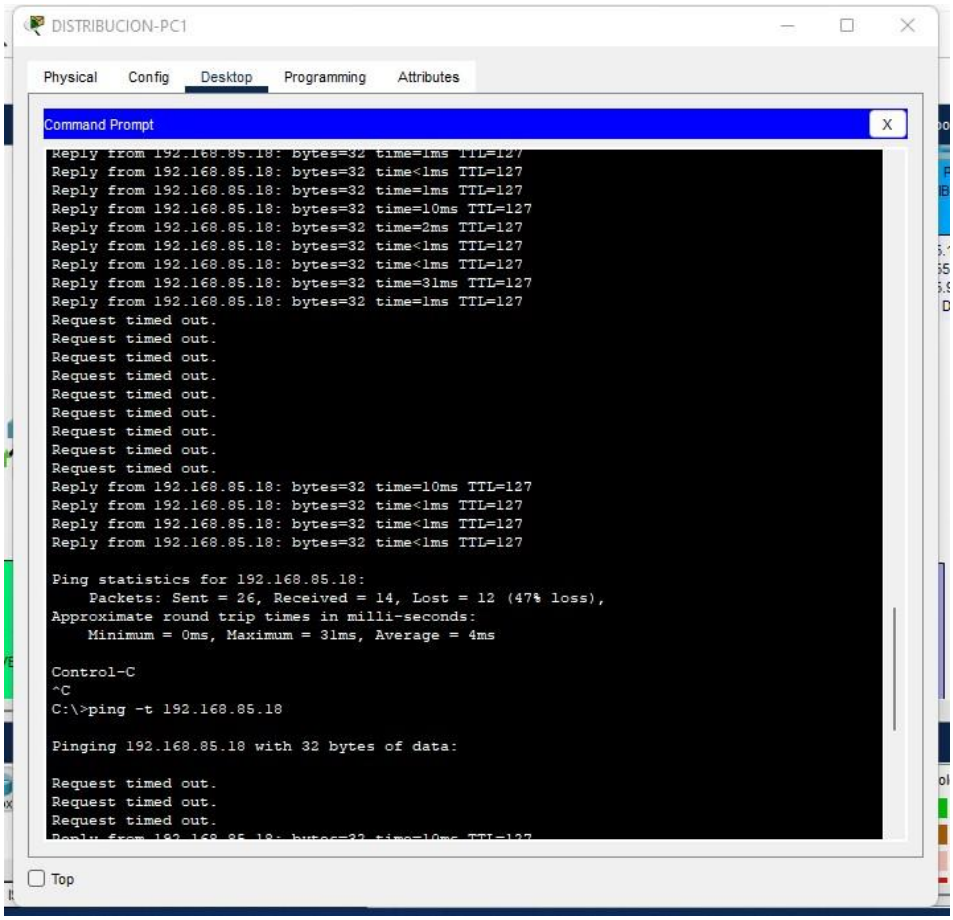


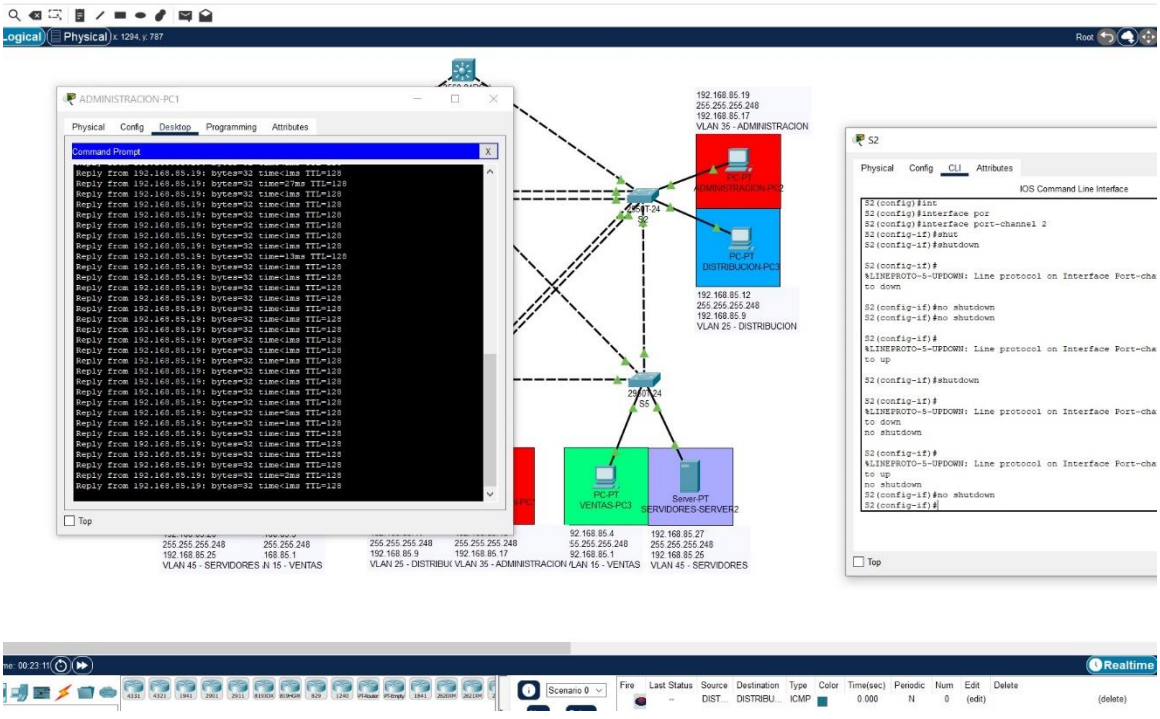
Modo EC	Modo STP	VLAN	Enlace afectado	Origen	Destino	Paquetes perdidos
PAgP	PVST	15	So-Po3	192.168.85.2	192.168.85.19	9
PAgP	PVST	15	So-Po3	192.168.85.2	192.168.85.19	9
					PROMEDIO	9

El archivo completo se puede obtener en el siguiente enlace.

Set de pruebas:
https://docs.google.com/spreadsheets/d/1w6prufoAX6DLOJNev87nYc_2OosvZXGq/edit?usp=sharing&ouid=101479678041370353006&rtpof=true&sd=true




DISTRIBUCION-PC1
Physical
Config
Desktop
Programming
Attributes
Command Prompt
Reply from 192.168.85.18: bytes=32 time=1ms TTL=127
Reply from 192.168.85.18: bytes=32 time<1ms TTL=127
Reply from 192.168.85.18: bytes=32 time=1ms TTL=127
Reply from 192.168.85.18: bytes=32 time=10ms TTL=127
Reply from 192.168.85.18: bytes=32 time=2ms TTL=127
Reply from 192.168.85.18: bytes=32 time<1ms TTL=127
Reply from 192.168.85.18: bytes=32 time<1ms TTL=127
Reply from 192.168.85.18: bytes=32 time=31ms TTL=127
Reply from 192.168.85.18: bytes=32 time=1ms TTL=127
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Reply from 192.168.85.18: bytes=32 time=10ms TTL=127
Reply from 192.168.85.18: bytes=32 time<1ms TTL=127
Reply from 192.168.85.18: bytes=32 time<1ms TTL=127
Reply from 192.168.85.18: bytes=32 time<1ms TTL=127
Ping statistics for 192.168.85.18:
Packets: Sent = 26, Received = 14, Lost = 12 (47% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 31ms, Average = 4ms
Control-C
^C
C:\>ping -t 192.168.85.18
Pinging 192.168.85.18 with 32 bytes of data:
Request timed out.
Request timed out.
Request timed out.
Top


Logical
Physical
Root
ADMINISTRACION-PC1
Physical
Config
Desktop
Programming
Attributes
Command Prompt
Top
192.168.85.19
255.255.255.248
192.168.85.17
VLAN 35 - ADMINISTRACION
PC-PT
ADMINISTRACION-PC2
PC-PT
DISTRIBUCION-PC3
192.168.85.12
255.255.255.248
192.168.85.9
VLAN 25 - DISTRIBUCION
PC-PT
VENTAS-PC3
Server-PT
SERVIDORES-SERVER2
192.168.85.4
255.255.255.248
192.168.86.1
VLAN 15 - VENTAS
192.168.85.27
255.255.255.248
192.168.85.25
VLAN 45 - SERVIDORES
S2
Physical
Config
CLI
Attributes
IOS Command Line Interface
S2(config)#int
S2(config)#interface por
S2(config)#interface port-channel 2
S2(config-if)#shut
S2(config-if)#shutdown
S2(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Port-cha
to down
S2(config-if)#no shutdown
S2(config-if)#no shutdown
S2(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Port-cha
to up
S2(config-if)#shutdown
S2(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Port-cha
to down
no shutdown
S2(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Port-cha
to up
no shutdown
S2(config-if)#no shutdown
S2(config-if)#
Top
Realtime
Scenario 0
Fire
Last Status
Source
Destination
Type
Color
Time(sec)
Periodic
Num
Edit
Delete
(edit)
(delete)

Resumen de los resultados:

Combinación		Promedio de paquetes perdidos
PAgP	PVST	9
PAgP	RPVST	0
LACP	PVST	9.5
LACP	RPVST	1

Combinación		Promedio de paquetes perdidos
PAgP	PVST	8
PAgP	RPVST	0
LACP	PVST	9
LACP	RPVST	1.5

Combinación		Promedio de paquetes perdidos
PAgP	PVST	5
PAgP	RPVST	0
LACP	PVST	7
LACP	RPVST	1

Combinación		Promedio de paquetes perdidos
PAgP	PVST	9
PAgP	RPVST	0
LACP	PVST	9
LACP	RPVST	1

Por lo tanto, determinamos que el mejor escenario de convergencia es la combinación de protocolo:

PAgP con Rapid Per-VLAN Spanning Tree

Siendo esta nuestra solución elegida como implementación.

Anexos

Cisco Packet Tracer

Cisco Packet Tracer. Es un poderoso programa de simulación de red que permite a los estudiantes experimentar con el comportamiento de la red y hacer preguntas de "qué pasaría si". Como parte integral de la experiencia de aprendizaje integral de Networking Academy, Packet Tracer proporciona capacidades de simulación, visualización, autoría, evaluación y colaboración, y facilita la enseñanza y el aprendizaje de conceptos tecnológicos complejos.

Packet Tracer complementa el equipo físico en el aula al permitir a los estudiantes crear una red con una cantidad casi ilimitada de dispositivos, fomentando la práctica, el descubrimiento y la resolución de problemas. El entorno de aprendizaje basado en la simulación ayuda a los estudiantes a desarrollar habilidades del siglo XXI, como la toma de decisiones, el pensamiento creativo y crítico y la resolución de problemas. Packet Tracer complementa los currículos de Networking Academy, permitiendo a los instructores enseñar y demostrar fácilmente conceptos técnicos complejos y diseño de sistemas de redes.

En este programa se crea la topología física de la red simplemente arrastrando los dispositivos a la pantalla. Luego clickando en ellos se puede ingresar a sus consolas de configuración. Allí están soportados todos los comandos del Cisco OS e incluso funciona el “tab completion”. Una vez completada la configuración física y lógica de la red, también se puede hacer simulaciones de conectividad (pings, traceroutes, etc) todo ello desde las misma consolas incluidas.

¿Quién utiliza Packet Tracer?

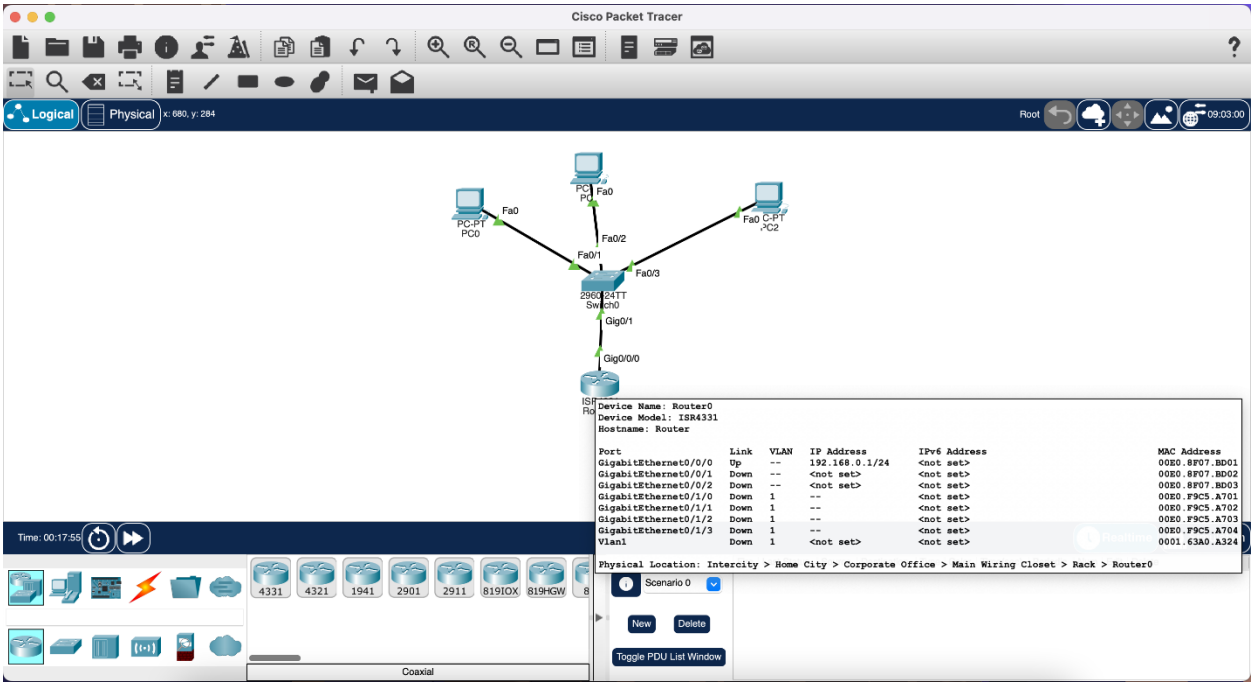
- Estudiantes que exploran redes y carreras tecnológicas
- Estudiantes de redes, IoT y ciberseguridad
- Ingenieros, educadores e instructores
- Enseñanza y aprendizaje a distancia

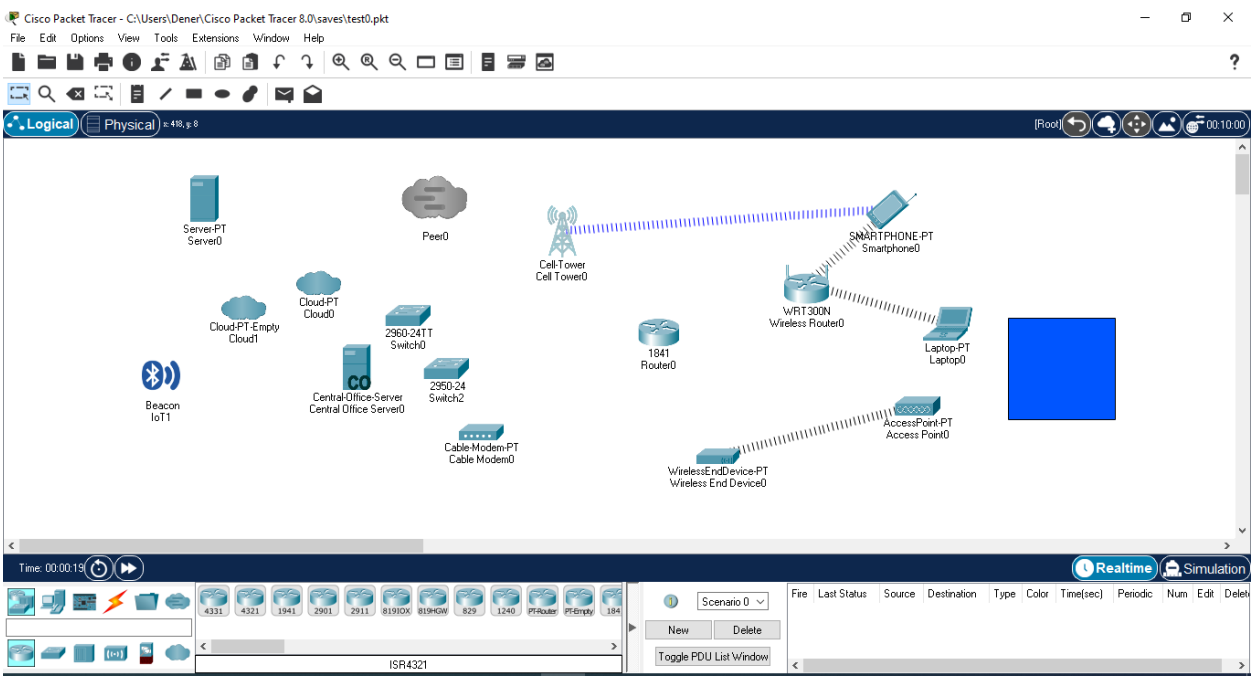
Principales usos dentro del ambiente académico

- Practicar la creación de redes simples y complejas
- Visualizar cómo funciona una red
- Practicar habilidades de rack, apilamiento y cableado en el laboratorio virtual
- Integrar dispositivos de IoT, código de Python o automatización de la red

Funciones colaborativas

- Colabore y compita dentro de Packet Tracer
- Comparta diseños de red para recibir comentarios
- Conéctese con nuestra comunidad global de Facebook para compartir ideas e inspirarse


Cisco Packet Tracer
Logical
Physical
Root
09:03:00
PC-PT PC0
PC-PT PC1
PC-PT PC2
Fa0
Fa0/1
Fa0/2
Fa0/3
2960-24TT Switch0
Gig0/1
Gig0/0/0
Device Name: Router0
Device Model: ISR4331
Hostname: Router
Port Link VLAN IP Address IPv6 Address MAC Address
GigabitEthernet0/0/0 Up -- 192.168.0.1/24 <not set> 00E0.8F07.BD01
GigabitEthernet0/0/1 Down -- <not set> <not set> 00E0.8F07.BD02
GigabitEthernet0/0/2 Down -- <not set> <not set> 00E0.8F07.BD03
GigabitEthernet0/1/0 Down 1 -- <not set> 00E0.F9C5.A701
GigabitEthernet0/1/1 Down 1 -- <not set> 00E0.F9C5.A702
GigabitEthernet0/1/2 Down 1 -- <not set> 00E0.F9C5.A703
GigabitEthernet0/1/3 Down 1 -- <not set> 00E0.F9C5.A704
Vlan1 Down 1 <not set> <not set> 0001.63A0.A324
Physical Location: Intercity > Home City > Corporate Office > Main Wiring Closet > Rack > Router0
Time: 00:17:55
4331
4321
1941
2901
2911
819IOX
819HGW
Coaxial
Scenario 0
New
Delete
Toggle PDU List Window


Cisco Packet Tracer - C:\Users\Dener\Cisco Packet Tracer 8.0\saves\test0.pkt
File Edit Options View Tools Extensions Window Help
Logical
Physical
[Root]
00:10:00
Server-PT Server0
Peer0
Cell-Tower Cell Tower0
SMARTPHONE-PT Smartphone0
WRT300N Wireless Router0
Laptop-PT Laptop0
Cloud-PT Cloud0
Cloud-PT-Empty Cloud1
2960-24TT Switch0
1841 Router0
Central-Office-Server Central Office Server0
2950-24 Switch2
Beacon IoT1
Cable-Modem-PT Cable Modem0
AccessPoint-PT Access Point0
WirelessEndDevice-PT Wireless End Device0
Time: 00:00:19
Realtime
Simulation
ISR4321
Scenario 0
New
Delete
Toggle PDU List Window
Fire
Last Status
Source
Destination
Type
Color
Time(sec)
Periodic
Num
Edit