

# **Advanced Diploma of Information Technology**

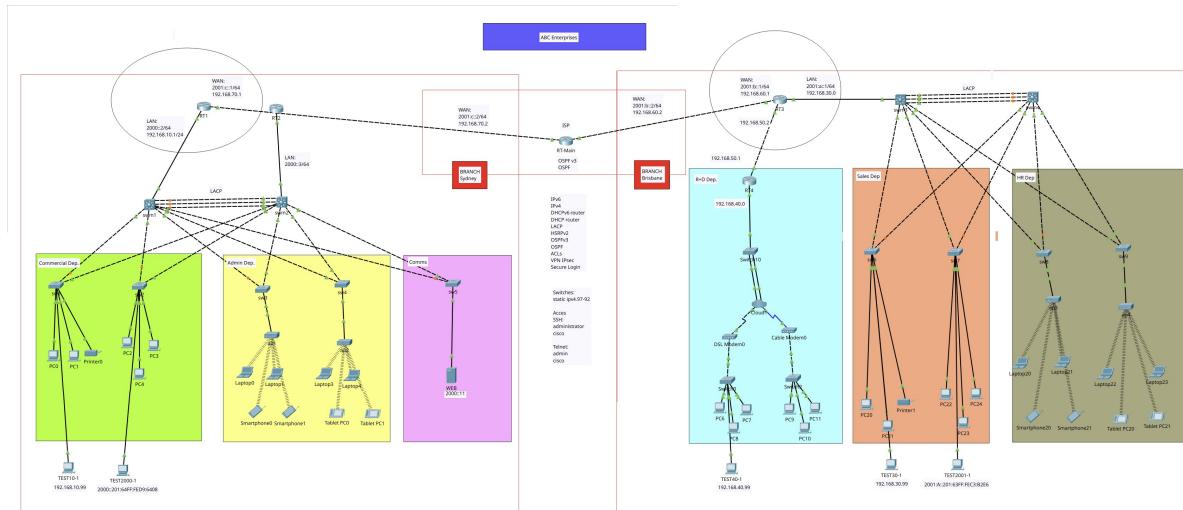
## **ICTNWK541 Assessment**

### **Assessment Task 2: Project Portfolio**

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# ABC Enterprises WAN Expansion



ABC Enterprises is a growing company with headquarters in Melbourne and two branch offices in Sydney and Brisbane. The company currently operates with an outdated network infrastructure that lacks secure, reliable WAN connectivity between sites. The IT department has been tasked with designing, implementing, and securing a new WAN infrastructure that ensures:

- ❖ Secure VPN connectivity between all sites.
- ❖ Optimised bandwidth usage with reliable routing protocols.
- ❖ Proper IPv6 deployment for future scalability.
- ❖ Enhanced security mechanisms including firewall rules and access control lists (ACLs).
- ❖ Troubleshooting and monitoring tools to detect and rectify network issues efficiently.

As part of the project, you will act as a network engineer responsible for implementing the required WAN connectivity for ABC Enterprises.

## Simulation Software & Tools:

Software installed to develop this project.

- ❖ Cisco Packet Tracer 8.2.2
- ❖ Ubuntu 24.04 LTS
- ❖ Wireshark 4.2.2

# Network Design Review & Planning

## Network Details

The ABC-Enterprises Network is a WAN Network with two branches, in Sydney and Brisbane. It was designed with ease of configuration, stability, and security in mind. It is a dual-star, high-availability, three-tier network. Both use Ethernet connections, only in Brisbane Branch uses Coax and phone Lines connections.

It implements a dual-stack with a DHCP-router to avoid having dedicated servers. Redundancy is provided by LACP on the switches and HSRP (only Sydney) on the routers. Additionally, LACP provides three communication lanes to increase bandwidth. Communication between LAN networks over internet is provided by OSPF.

For security, ACLs are implemented to allow only IP traffic from the company's networks. IPsec VPN is also used as a data encapsulation and encryption method. Finally, PPP Authentication and CHAP are implemented as an automatic authentication method between the routers.

My network doesn't support PPP because the WAN connections are Ethernet. PPP requires serial connections. Additionally, PPP isn't compatible with HSRP. So I used the reference network given in class.

Firewall & single-port tests and Dynamic NAT were performed on the files submitted in class due to extra complexity over my network.

## Topology and type

- ❖ Sydney Branch:
  - Type: WAN
  - Topology: Dual-Star high availability
  - Architecture: 3-Tier
- ❖ Brisbane Branch:
  - Type: LAN
  - Topology: Star

## Network Nodes

Device	Name	Network	Device	Name	Network
<b>Router 1</b>	RT1	Sydney	<b>Router 2</b>	RT2	Sydney
<b>Switch 1</b>	sw1	Sydney	<b>Switch 2</b>	sw2	Sydney
<b>Switch 3</b>	sw3	Sydney	<b>Switch 4</b>	sw4	Sydney
<b>Switch 5</b>	sw5	Sydney	<b>Switch ML1</b>	sw11	Sydney
<b>Switch ML2</b>	sw12	Sydney	<b>Router 3</b>	RT3	Brisbane
<b>Router 4</b>	RT4	Brisbane	<b>Switch 6</b>	sw6	Brisbane
<b>Switch 7</b>	sw7	Brisbane	<b>Switch 8</b>	sw8	Brisbane
<b>Switch 9</b>	sw9	Brisbane	<b>Switch 10</b>	sw10	Brisbane
<b>Switch ML3</b>	sw13	Brisbane	<b>Switch ML4</b>	sw14	Brisbane
<b>Router Main</b>	<b>RT-M</b>	<b>ISP</b>	-	-	-

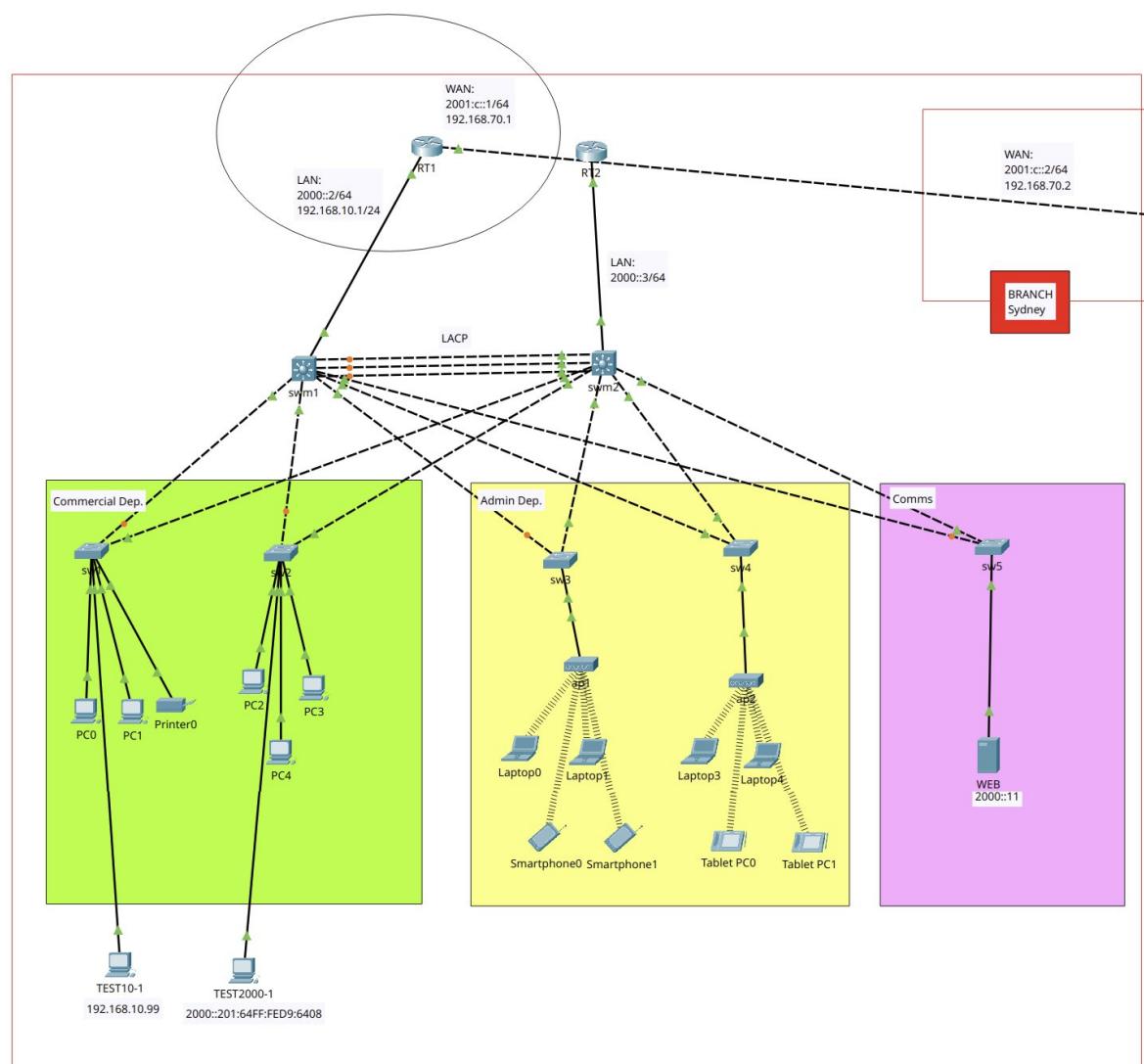
## Network Details – Sydney Branch

Device	Details	Protocols IPv6	Protocols IPv4	Access
RT-M	WAN: 2001:c::2/64 192.168.70.2	OSPFv3	OSPF	
RT1	WAN: 2001:c::1/64 192.168.70.1  LAN: 2000::2/64 192.168.10.1/24  Gateway 2000::210:11FF:FE09:4ED 192.168.10.99  DNS: 2000::10 192.168.10.10	DHCPv6 router HSRPv2 OSPFv3	DHCP router VPN Ipsec ACL	Password Encryption (RSA)  Local: admin  SSH: administrator cisco  Telnet: admin Cisco  FTP cisco cisco
RT2	LAN: 2000::3/64  Gateway: 2000::2  DNS: 2000::10	DHCPv6 router HSRPv2	DHCP router	
swm1	VLAN1: 192.168.10.97	LAC		
swm2	VLAN1: 192.168.10.98	LAC		
sw1	VLAN1: 192.168.10.96			
sw2	VLAN1: 192.168.10.95			
sw3	VLAN1: 192.168.10.94			
sw4	VLAN1: 192.168.10.93			
sw5	VLAN1: 192.168.10.92			

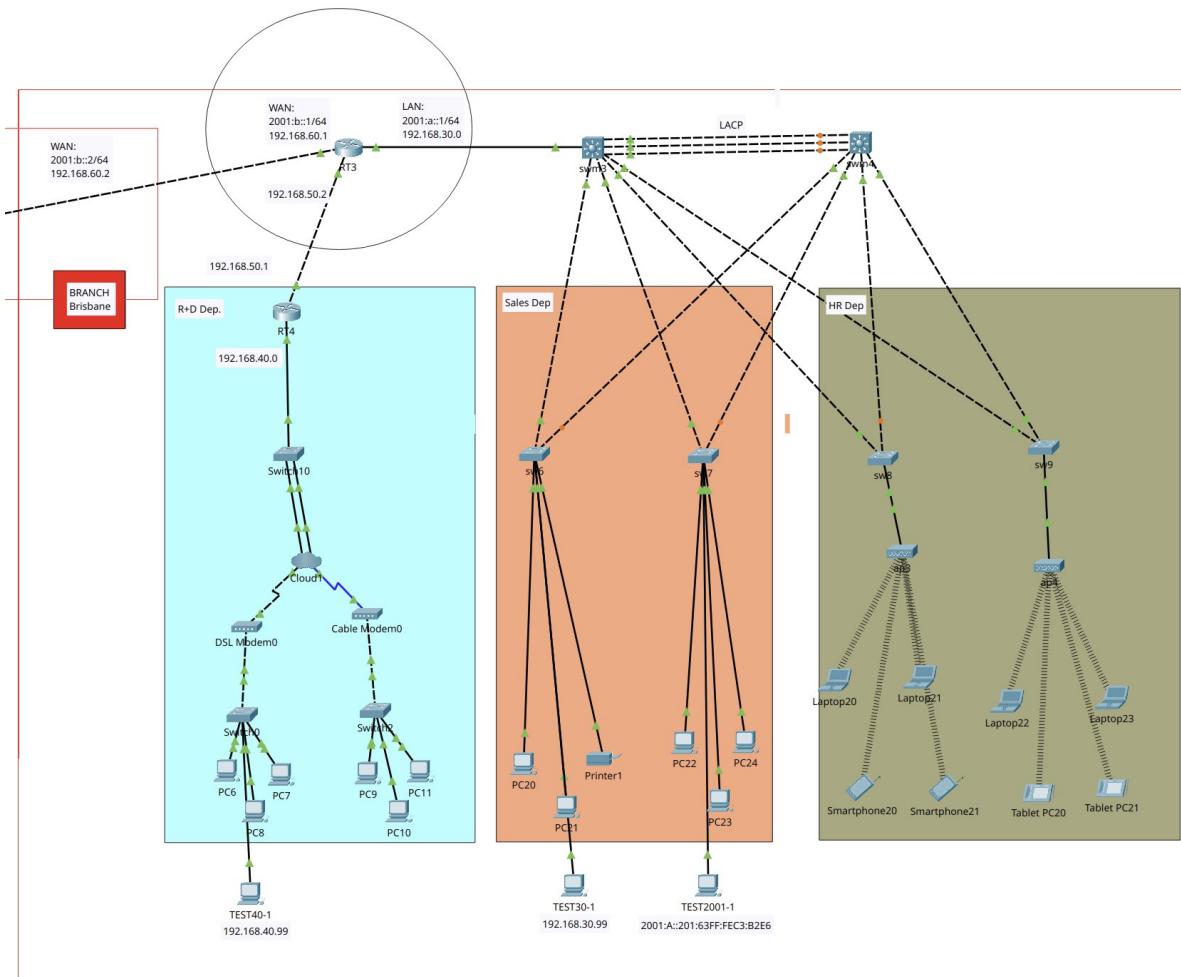
## Network Details – Brisbane Branch

Device	Details	Protocols IPv6	Protocols IPv4	Access
RT-M	WAN: 2001:b::2/64 192.168.60.2	OSPFv3	OSPF	
RT3	WAN: 2001:b::1/64 192.168.60.1  LAN: 2001:a::1/64 192.168.30.0  Gateway 2001:a::1  DNS: 2001:a::10 192.168.30.10	DHCPv6 router HSRPv2 OSPFv3	DHCP router VPN Ipsec ACL	Password Encryption (RSA)
RT4	LAN: 192.168.40.0  Gateway: 192.168.40.1  DNS: 192.168.40.10		DHCP router	Local: admin  SSH: administrator cisco
swm3	VLAN1: 192.168.30.97	LAC		Telnet: admin Cisco
swm4	VLAN1: 192.168.30.98	LAC		
sw6	VLAN1: 192.168.30.96			
sw7	VLAN1: 192.168.30.95			
sw8	VLAN1: 192.168.30.94			
sw9	VLAN1: 192.168.30.93			
sw10	VLAN1: 192.168.40.92			

## Sydney Branch Network



## Brisbane Branch Network



# WAN Configuration

## Installation Plan

1. Implement Network Topology
2. Implement Secure Access by SSH & Telnet
3. Implement Additional Protocols: DHCPv6, IPV6
4. Implement Additional Protocols: LACP
5. Implement Additional Protocols: HSRPv2 IPv6
6. Implement Additional Protocols: WEB Server
7. Implement Additional Protocols: OSPFv3
8. Implement Additional Protocols: DualStack, DHCP
9. Implement Additional Protocols: OSPF
10. Implement WAN protocols: Extended Access Control List (ACL)
11. Implement WAN Protocols: VPN Site-To-Site over IPv4
- 12. Implement WAN Protocols: Encapsulation PPP over IPv4**
- 13. Implement WAN Protocols: Dynamic NAT over IPv4**

## Legal & security: Policies and Procedures

1. Service Password Encryption
2. Mandatory Login Password
3. VPN Site-to-Site
4. Access Control Lists (ACLs)
5. Secure Remote Access to infrastructure

## Troubleshooting & Testing

1. Testing LAN Connectivity (IPv4/IPv6)
2. Testing WAN Connectivity (IPv4/IPv6)
3. Testing Secure Access SSH & Telnet - Local
4. Testing DHCP/DHCPv6 (IPv4/IPv6)
5. Testing LACP (IPv6)
6. Testing HSRPv2 (IPv6)
7. Testing OSPF/OSPFv3 (IPv4/IPv6)
8. Testing ACL (IPv4)
9. Testing VPN Site-To-Site (IPv4)
10. Testing Encapsulation PPP (IPv4)
- 11. Testing Firewall & Single-port**
- 12. Logging Network**
- 13. Dynamic NAT**

## Summary Technologies & Protocols

## Bibliography

# WAN Configuration

## Installation Plan

### 1. Implement Network Topology

Rename all devices:

Device Type	Quantity	Device Type	Quantity
Router	5	Switch	14
PC	20	Laptop	8
Smartphone	4	Tablet	4
Server	1	Printer	2
W Access Point	4	Modem	2

### 3. Additional Protocols: DHCPv6, IPV6

#### Router 1 (RT1)

Firstly, IPv6 will be enable and then DHCPv6 will be set up  
enable

```
configure terminal
hostname RT1
ipv6 unicast-routing
interface gigabitEthernet 0/0
ipv6 address 2000::2/64
no shutdown
ipv6 dhcp pool STATEFUL_POOL
domain-name milestones.com
dns-server 2000::10
prefix-delegation pool STATEFUL_POOL
exit
interface gigabitEthernet 0/0
ipv6 dhcp server STATEFUL_POOL
ipv6 nd managed-config-flag
exit
Do wr
exit
exit
```

#### Router 3 (RT3)

```
enable
configure terminal
hostname RT3
ipv6 unicast-routing
interface gigabitEthernet 0/2
ipv6 address 2001:a::1/64
no shutdown
ipv6 dhcp pool STATEFUL_POOL
domain-name milestones.com
```

```
dns-server 2001:a::10
prefix-delegation pool STATEFUL_POOL
exit
```

```
interface gigabitEthernet 0/2
ipv6 dhcp server STATEFUL_POOL
ipv6 nd managed-config-flag
exit
Do wr
exit
exit
```

## 4. Implement Additional Protocols: LACP

Implementation of Link Aggregation Control Protocol (LACP) on links:

- ❖ swm1 gigabitEthernet 1/0/22 <—> swm2 gigabitEthernet 1/0/22
- ❖ swm1 gigabitEthernet 1/0/23 <—> swm2 gigabitEthernet 1/0/23
- ❖ swm1 gigabitEthernet 1/0/24 <—> swm2 gigabitEthernet 1/0/24
- ❖ swm3 gigabitEthernet 1/0/22 <—> swm4 gigabitEthernet 1/0/22
- ❖ swm3 gigabitEthernet 1/0/23 <—> swm4 gigabitEthernet 1/0/23
- ❖ swm3 gigabitEthernet 1/0/24 <—> swm4 gigabitEthernet 1/0/24

The LACP link will be the **channel-group number 1** on all switches.

**Switch Main 1 (swm1)**

```
enable
configure terminal
interface range gigabitEthernet 1/0/22, gigabitEthernet 1/0/23,
gigabitEthernet 1/0/24
channel-group 1 mode active
exit
interface Port-channel 1
switchport mode trunk
exit
do wr
exit
exit
```

```
enable
configure terminal
interface gigabitEthernet 1/0/1
switchport
no shutdown
Exit
Do wr
exit
```

**Switch Main 2 (swm2)**

```
enable
configure terminal
```

```
interface range gigabitEthernet 1/0/22, gigabitEthernet 1/0/23,  
gigabitEthernet 1/0/24
```

```
channel-group 1 mode passive
```

```
exit
```

```
interface Port-channel 1
```

```
switchport mode trunk
```

```
exit
```

```
do wr
```

```
exit
```

```
exit
```

```
enable
```

```
configure terminal
```

```
interface gigabitEthernet 1/0/1
```

```
switchport
```

```
no shutdown
```

```
Exit
```

```
Do wr
```

```
exit
```

### Switch Main 3 (swm3)

```
enable
configure terminal
interface range gigabitEthernet 1/0/22, gigabitEthernet 1/0/23,
gigabitEthernet 1/0/24
channel-group 1 mode active
exit
interface Port-channel 1
switchport mode trunk
exit
do wr
exit
exit
```

```
enable
configure terminal
interface gigabitEthernet 1/0/1
switchport
no shutdown
Exit
Do wr
exit
```

### Switch Main 4 (swm4)

```
enable
configure terminal
interface range gigabitEthernet 1/0/22, gigabitEthernet 1/0/23,
gigabitEthernet 1/0/24
channel-group 1 mode passive
exit
interface Port-channel 1
switchport mode trunk
exit
do wr
exit
```

```
exit
```

```
enable
configure terminal
interface gigabitEthernet 1/0/1
switchport
no shutdown
Exit
Do wr
exit
```

## 5. Implement Additional Protocols: HSRPv2 IPv6

Links:

- ❖ HSRP IPv6 Address: 2000::1/64
- ❖ RT1 gigabitEthernet 0/0 <→ 2000::2 (primary router)
- ❖ RT2 gigabitEthernet 0/0 <→ 2000::3 (secondary router)

Checking

- ❖ show running-config | include standby
- ❖ show standby

### Router 1 (RT1)

```
enable
configure terminal
interface gigabitEthernet 0/0
ipv6 address 2000::2/64
standby version 2
standby 1 ipv6 autoconfig
standby 1 priority 120
no shutdown
Exit
Do wr
exit
exit
```

### Router 2 (RT2)

Firstly, It will be setting up RT2 same as RT1 then RT2 will be marked as a secondary router.

```
enable
configure terminal
hostname RT2
ipv6 unicast-routing

interface gigabitEthernet 0/0
```

```
ipv6 address 2000::3/64
no shutdown
ipv6 dhcp pool STATEFUL_POOL
domain-name milestones.com
dns-server 2000::10
prefix-delegation pool STATEFUL_POOL
exit
interface gigabitEthernet 0/0
ipv6 dhcp server STATEFUL_POOL
ipv6 nd managed-config-flag
exit
Do wr
exit
exit
```

```
enable
configure terminal
interface gigabitEthernet 0/0
ipv6 address 2000::3/64
standby version 2
standby 1 ipv6 autoconfig
no shutdown
Exit
Do wr
exit
exit
```

## 6. Additional Protocols: WEB Server

Firstly, enable HTTP and HTTPS services and disable all other services, then edit index.html

```
<html>

<center><font size='+2' color='blue'>ABC ENTERPRISES
Sydney</font></center>

<hr>Welcome to ABC Enterprises WEB server. This is a project for an
assessment task 2 – May 2025.

<p>Quick Links:

<br><a href='helloworld.html'>A small page</a>

<br><a href='copyrights.html'>Copyrights</a>

<br><a href='image.html'>Image page</a>

<br><a href='cscptlogo177x111.jpg'>Image</a>

</html>
```

## 7. Additional Protocols: OSPFv3

Links:

- ❖ RT1 Network gigabitEthernet 0/0
- ❖ RT1 gigabitEthernet 0/1 <→ RT-M gigabitEthernet 0/0
- ❖ RT3 Network gigabitEthernet 0/2
- ❖ RT-M gigabitEthernet 0/2 <→ RT-3 gigabitEthernet 0/1

Addressing:

- ❖ RT1 → 2000::2/64
- ❖ RT1 <→ RT-M, 2001:c::1/64
- ❖ RT-M <→ RT1, 2001:c::2/64
- ❖ RT3 → 2001:a::1/64
- ❖ RT-M <→ RT3, 2001:b::2/64
- ❖ RT3 <→ RT-M, 2001:b::1/64

Checking, reload:

- ❖ show ipv6 ospf neighbor
- ❖ clear ipv6 ospf process
- ❖ Show ipv6 ospf database

**Router 1 (RT1)**

**!general config, IP link**

enable

configure terminal

interface gigabitEthernet 0/1

ipv6 address 2001:c::1/64

no shutdown

exit

**!enabling unicast and giving id**

ipv6 unicast-routing

ipv6 router OSPF 10

router-id 1.1.1.1

exit

**!enabling OSPF on network link**

interface gigabitEthernet 0/0

```
ipv6 OSPF 10 area 0
```

```
exit
```

```
!enabling OSPF between RT1 and RT-M
```

```
interface gigabitEthernet 0/1
```

```
ipv6 OSPF 10 area 0
```

```
exit
```

```
do wr
```

```
Router Main (RT-Main)
```

```
!general config, IP link
```

```
enable
```

```
configure terminal
```

```
interface gig0/0
```

```
ipv6 address 2001:c::2/64
```

```
no shutdown
```

```
exit
```

```
interface gig0/2
```

```
ipv6 address 2001:b::2/64
```

```
no shutdown
```

```
exit
```

```
!enabling unicast and giving router id
```

```
ipv6 unicast-routing
```

```
ipv6 router OSPF 10
```

```
router-id 2.2.2.2
```

```
exit
```

```
!enabling OSPF between RT-Main and RT1
```

```
interface gig0/0
```

```
ipv6 OSPF 10 area 0
```

```
exit
```

**!enabling OSPF between RT-Main and RT3**

```
interface gig0/2
ipv6 OSPF 10 area 0
exit
do wr
```

**Router 3 (RT3)****!general config, IP link**

```
enable
configure terminal
interface gigabitEthernet 0/1
ipv6 address 2001:b::1/64
no shutdown
exit
```

**!enabling unicast and giving router id**

```
ipv6 unicast-routing
ipv6 router OSPF 10
router-id 3.3.3.3
exit
```

**!enabling OSPF on network link**

```
interface gigabitEthernet 0/2
ipv6 OSPF 10 area 0
exit
```

**!enabling OSPF between RT3 and RT-Main**

```
interface gigabitEthernet 0/1
ipv6 OSPF 10 area 0
exit
do wr
exit
```

## 8. Implement Additional Protocols: DualStack, DHCP

### Router 1 (RT1)

```
!setting up IPv4, dhcp
enable
configure terminal
do wr
interface gigabitEthernet 0/0
ip address 192.168.10.1 255.255.255.0
no shutdown
exit
do wr
ip dhcp pool STATEFUL_POOL
network 192.168.10.0 255.255.255.0
default-router 192.168.10.1
dns-server 192.168.10.10
exit
do wr
```

### Router 3 (RT3)

```
!setting up ipv4, dhcp
enable
configure terminal
do wr
interface gigabitEthernet 0/2
ip address 192.168.30.1 255.255.255.0
no shutdown
exit
do wr
ip dhcp pool STATEFUL_POOL
network 192.168.30.0 255.255.255.0
default-router 192.168.30.1
```

```
dns-server 192.168.30.10
exit
do wr
```

## Router 4 (RT4)

Enabling IPv4 to ensure full compatibility with DSL protocol connection.

```
!setting up IPv4, dhcp
enable
configure terminal
hostname RT4
do wr
interface gigabitEthernet 0/0
ip address 192.168.40.1 255.255.255.0
no shutdown
exit
do wr
ip dhcp pool STATEFUL_POOL
network 192.168.40.0 255.255.255.0
default-router 192.168.40.1
dns-server 192.168.40.10
exit
do wr
```

## 9. Additional Protocols: OSPF

Links:

- ❖ RT1 Network gigabitEthernet 0/0
- ❖ RT1 gigabitEthernet 0/1 <→ RT-M gigabitEthernet 0/0
- ❖ RT3 Network gigabitEthernet 0/2
- ❖ RT-M gigabitEthernet 0/2 <→ RT-3 gigabitEthernet 0/1
- ❖ RT4 Network gigabitEthernet 0/0
- ❖ RT4 gigabitEthernet 0/1 <→ RT-3 gigabitEthernet 0/0

Addressing:

- ❖ RT1 → 192.168.10.1
- ❖ RT1 <→ RT-M, 192.168.70.1
- ❖ RT-M <→ RT1, 192.168.70.2
- ❖ RT3 → 192.168.30.1
- ❖ RT-M <→ RT3, 192.168.60.2
- ❖ RT3 <→ RT-M, 192.168.60.1
- ❖ RT4 → 192.168.40.1
- ❖ RT3 <→ RT4, 192.168.50.1
- ❖ RT4 <→ RT3, 192.168.50.2

Checking, reload:

- ❖ show ip ospf neighbor
- ❖ show ip ospf database
- ❖ clear ip ospf process

## Router 1 (RT1)

```
!general config, IP link
enable
configure terminal
interface gigabitEthernet 0/1
ip address 192.168.70.1 255.255.255.0
no shutdown
exit
!enabling OSPF
router ospf 20
network 192.168.70.0 0.0.0.255 area 0
network 192.168.10.0 0.0.0.255 area 0
exit
do wr
exit
exit
```

## Router Main (RT-M)

```
!general config, IP link
enable
configure terminal
interface gigabitEthernet 0/0
ip address 192.168.70.2 255.255.255.0
no shutdown
exit
interface gigabitEthernet 0/2
ip address 192.168.60.2 255.255.255.0
no shutdown
exit
!enabling OSPF
```

```
router ospf 20
network 192.168.70.0 0.0.0.255 area 0
network 192.168.60.0 0.0.0.255 area 0
exit
do wr
exit
exit
```

### Router 3 (RT3)

```
!general config, IP link
enable
configure terminal
interface gigabitEthernet 0/1
ip address 192.168.60.1 255.255.255.0
no shutdown
exit
interface gigabitEthernet 0/0
ip address 192.168.50.2 255.255.255.0
no shutdown
exit
!enabling OSPF
router ospf 20
network 192.168.60.0 0.0.0.255 area 0
network 192.168.30.0 0.0.0.255 area 0
network 192.168.50.0 0.0.0.255 area 0
network 192.168.40.0 0.0.0.255 area 0

exit
do wr
exit
exit
```

## Router 4 (RT4)

**!general config, IP link**

enable

configure terminal

interface gigabitEthernet 0/1

ip address 192.168.50.1 255.255.255.0

no shutdown

exit

**!enabling OSPF**

router ospf 20

router-id 4.4.4.4

network 192.168.50.0 0.0.0.255 area 0

network 192.168.40.0 0.0.0.255 area 0

exit

do wr

exit

exit

## 11. WAN Protocols: VPN Site-To-Site over IPv4

VPN IPsec (Internet Protocol Security): Creates encrypted connections over the Internet between two networks (site-to-site), protecting the confidentiality and integrity of data.

Compatible hardware:

- ❖ Router model No 2911
- ❖ Switch model No 2690

“checking VPN Ipsec: look for technology: ipbasek9:permanent and securityk9:evaluation”

show version

show crypto IPsec sa

### Router 1 (RT1)

```
!enabling security technology package
```

```
license boot module c2900 technology-package securityk9
```

```
do write
```

```
exit
```

```
copy run start
```

```
reload
```

```
enable
```

```
configure terminal
```

```
crypto isakmp policy 10
```

```
encr aes 256
```

```
authentication pre-share
```

```
group 5
```

```
!
```

```
crypto isakmp key vpnpass address 192.168.60.1
```

```
!
```

```
crypto isakmp key vpnpass address 192.168.50.1
```

```
!
```

```
crypto ipsec transform-set VPN-SET esp-aes esp-sha-hmac
```

```
!
```

```
crypto map VPN-MAP 10 ipsec-isakmp
```

```
description VPN connection to Branch_Router
```

```
set peer 192.168.60.1
```

```
set peer 192.168.50.1
```

```
set transform-set VPN-SET
```

```
match address 110
```

```
!
```

```
interface GigabitEthernet0/1
```

```
crypto map VPN-MAP
```

```
!
```

```
end
```

```
copy run start
```

### Router 3 (RT3)

```
!enabling security technology package
```

```
license boot module c2900 technology-package securityk9
```

```
do write
```

```
exit
```

```
copy run start
```

```
reload
```

```
enable
```

```
configure terminal
```

```
crypto isakmp policy 10
```

```
encr aes 256
```

```
authentication pre-share
```

```
group 5
```

```
!
```

```
crypto isakmp key vpnpass address 192.168.70.1
```

```
!
```

```
crypto isakmp key vpnpass address 192.168.50.1
```

```
!
```

```
crypto ipsec transform-set VPN-SET esp-aes esp-sha-hmac
```

```
!
```

```
crypto map VPN-MAP 10 ipsec-isakmp
```

```
description VPN connection to Branch_Router
```

```
set peer 192.168.70.1
```

```
set peer 192.168.50.1
```

```
set transform-set VPN-SET
```

```
match address 110
```

```
!
```

```
interface GigabitEthernet0/1
```

```
crypto map VPN-MAP
```

```
!
```

```
end
```

```
copy run start
```

Router 4 (RT4)

```
!enabling security technology package
```

```
license boot module c2900 technology-package securityk9
```

```
do write
```

```
exit
```

```
copy run start
```

```
reload
```

```
enable
```

```
configure terminal
```

```
crypto isakmp policy 10
```

```
encr aes 256
```

```
authentication pre-share
```

```
group 5
```

```
!
```

```
crypto isakmp key vpnpass address 192.168.60.1
```

```
!
```

```
crypto isakmp key vpnpass address 192.168.70.1
```

```
!
```

```
crypto ipsec transform-set VPN-SET esp-aes esp-sha-hmac
```

```
!
```

```
crypto map VPN-MAP 10 ipsec-isakmp
```

```
description VPN connection to Branch_Router
```

```
set peer 192.168.70.1
```

```
set peer 192.168.60.1
```

```
set transform-set VPN-SET
```

```
match address 110
```

```
!
```

```
interface GigabitEthernet0/1
```

```
crypto map VPN-MAP
```

```
!
```

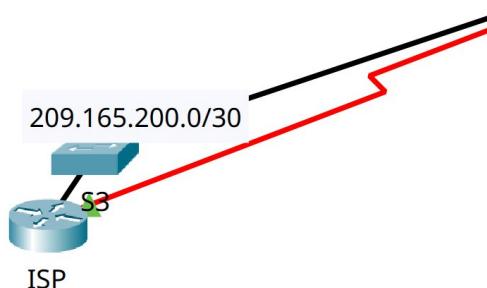
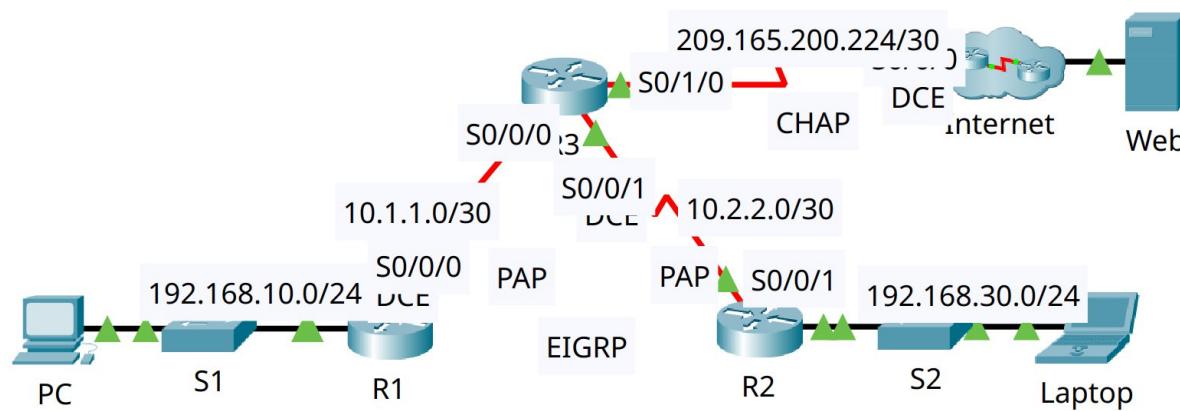
```
end
```

```
copy run start
```

## 12. Implement WAN Protocols: Encapsulation PPP over IPv4

My network doesn't support PPP because the connections are Ethernet. PPP requires serial connections. Additionally, PPP isn't compatible with HSRP. So I'll use the reference network given in class.

Applied on Routers R1, R2, R3 and ISP. Using CHAP as an automatic authentication method instead of PAP.



**Summary configuration:**

```
!setting up Encapsulation Method
interface <WAN_to_target>
encapsulation ppp
!
```

```
!setting up PPP Authentication
username <Router_target> secret cisco
interface SALIDA
ppp authentication chap
```

## Implementation PPP

### R1

```
interface serial 0/0/0
encapsulation ppp
exit
username R3 secret cisco
interface serial 0/0/0
ppp authentication chap
exit
```

### R2

```
interface serial 0/0/1
encapsulation ppp
exit
username R3 secret cisco
interface serial 0/0/1
ppp authentication chap
exit
```

R3

```
interface serial 0/0/0
encapsulation ppp
exit
```

```
interface serial 0/0/1
encapsulation ppp
exit
```

```
interface serial 0/1/0
encapsulation ppp
exit
```

```
!second step on R3
username R1 secret cisco
interface serial 0/0/0
ppp authentication chap
exit
!
username R2 secret cisco
interface serial 0/0/1
ppp authentication chap
exit
!
username ISP secret cisco
interface serial 0/1/0
ppp authentication chap
exit
```

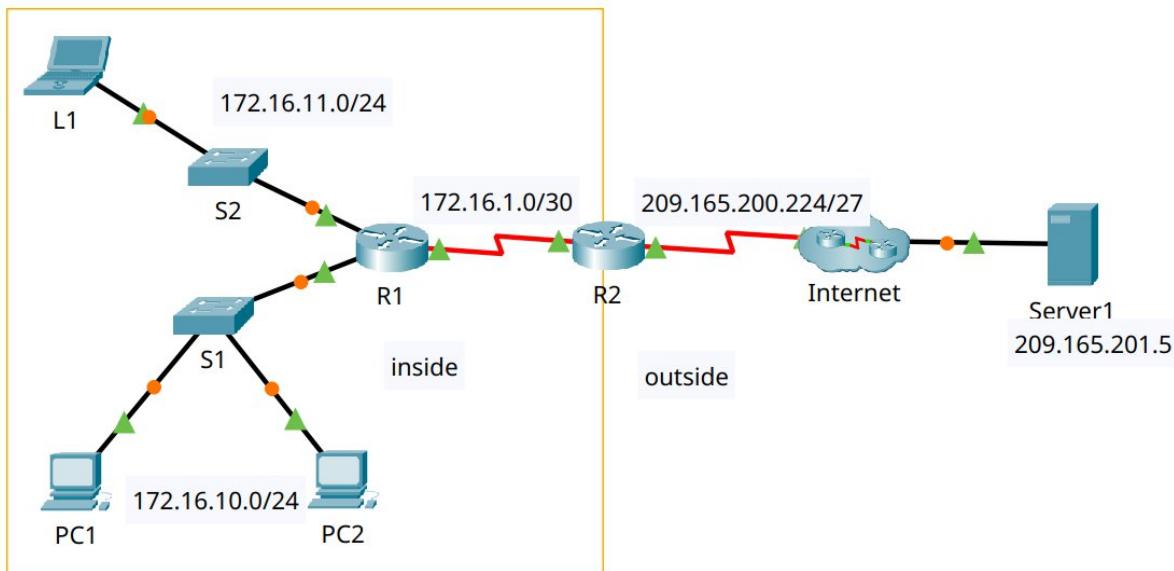
## ISP

```
interface serial 0/0/0
encapsulation ppp
exit
username R3 secret cisco
interface serial 0/0/0
ppp authentication chap
exit
```

## 13. Implement WAN Protocols: Dynamic NAT over IPv4

Dynamic NAT tests were performed on the file submitted in class due to extra complexity over my network.

### Network:



### Implementation

- ❖ Checking:
  - `show ip nat translations`

In ACL list we need to use 172.16.0.0 for allow traffic from 172.16.11.0/24 and 172.16.10.0/24 but their wildcard **IS NOT** 0.0.0.**255**, it is 0.0.**255.255** because this rule will be use for both networks that shared only two first positions **172.16.X.X**

## Network Security Implementation

### 10. Apply Access Control Lists (ACLS)

Implementing ALC over IPv4 networks.

Checking:

- ❖ show access-lists

#### Router 1 (RT1)

```
access-list 110 permit ip 192.168.10.0 0.0.0.255 192.168.30.0 0.0.0.255
```

```
access-list 110 permit ip 192.168.10.0 0.0.0.255 192.168.40.0 0.0.0.255
```

```
access-list 110 permit ip 192.168.30.0 0.0.0.255 192.168.10.0 0.0.0.255
```

```
access-list 110 permit ip 192.168.40.0 0.0.0.255 192.168.10.0 0.0.0.255
```

```
!
```

```
copy run start
```

#### Router 3 (RT3)

```
access-list 110 permit ip 192.168.30.0 0.0.0.255 192.168.10.0 0.0.0.255
```

```
access-list 110 permit ip 192.168.30.0 0.0.0.255 192.168.40.0 0.0.0.255
```

```
access-list 110 permit ip 192.168.10.0 0.0.0.255 192.168.30.0 0.0.0.255
```

```
access-list 110 permit ip 192.168.40.0 0.0.0.255 192.168.30.0 0.0.0.255
```

```
!
```

```
copy run start
```

## Router 4 (RT4)

access-list 110 permit ip 192.168.40.0 0.0.0.255 192.168.10.0 0.0.0.255

access-list 110 permit ip 192.168.40.0 0.0.0.255 192.168.30.0 0.0.0.255

access-list 110 permit ip 192.168.10.0 0.0.0.255 192.168.40.0 0.0.0.255

access-list 110 permit ip 192.168.30.0 0.0.0.255 192.168.40.0 0.0.0.255

!

copy run start

## 2. Secure Access Switches By SSH & Telnet

Checking:

- ❖ show running-config
- ❖ ssh -l administrator <ip\_vlan1>
- ❖ telnet <ip\_vlan1>
- ❖ service password-encryption

### Switch 1 (sw1)

```
enable
configure terminal
!enabling password
enable password admin
!
!enabling vlan
interface VLAN 1
ip address 192.168.10.96 255.255.255.0
no shutdown
exit
do wr

!enabling password on virtual terminals
service password-encryption
username administrator password cisco
ip domain-name milestones.com
hostname sw1
crypto key generate rsa general-keys modulus 1024
!
ip ssh version 2
line vty 5 15
transport input ssh
login local
exit
!
line vty 0 4
```

```
transport input telnet
password cisco
login
!
exit
!
do wr
!
exit
!
```

### Switch 2 (sw2)

```
enable
configure terminal
!enabling password
enable password admin
!
!enabling vlan
interface VLAN 1
ip address 192.168.10.95 255.255.255.0
no shutdown
exit
do wr

!enabling password on virtual terminals
service password-encryption
username administrator password cisco
ip domain-name milestones.com
hostname sw2
crypto key generate rsa general-keys modulus 1024
!
ip ssh version 2
line vty 5 15
```

```
transport input ssh
login local
exit
!
line vty 0 4
transport input telnet
password cisco
login
!
exit
!
do wr
!
exit
!
```

### Switch 3 (sw3)

```
enable
configure terminal
!enabling password
enable password admin
!
!enabling vlan
interface VLAN 1
ip address 192.168.10.94 255.255.255.0
no shutdown
exit
do wr

!enabling password on virtual terminals
service password-encryption
username administrator password cisco
ip domain-name milestones.com
```

```
hostname sw3
crypto key generate rsa general-keys modulus 1024
!
ip ssh version 2
line vty 5 15
transport input ssh
login local
exit
!
line vty 0 4
transport input telnet
password cisco
login
!
exit
!
do wr
!
exit
!
```

## Switch 4 (sw4)

```
enable
configure terminal
!enabling password
enable password admin
!
!enabling vlan
interface VLAN 1
ip address 192.168.10.93 255.255.255.0
no shutdown
exit
do wr

!enabling password on virtual terminals
service password-encryption
username administrator password cisco
ip domain-name milestones.com
hostname sw4
crypto key generate rsa general-keys modulus 1024
!
ip ssh version 2
line vty 5 15
transport input ssh
login local
exit
!
line vty 0 4
transport input telnet
password cisco
login
!
exit
!
do wr
```

```
!  
exit  
!
```

## Switch 5 (sw5)

```
enable  
configure terminal  
!enabling password  
enable password admin  
!  
!enabling vlan  
interface VLAN 1  
ip address 192.168.10.92 255.255.255.0  
no shutdown  
exit  
do wr  
  
!enabling password on virtual terminals  
service password-encryption  
username administrator password cisco  
ip domain-name milestones.com  
hostname sw5  
crypto key generate rsa general-keys modulus 1024  
!  
ip ssh version 2  
line vty 5 15  
transport input ssh  
login local  
exit  
!  
line vty 0 4  
transport input telnet
```

```
password cisco
login
!
exit
!
do wr
!
exit
!
```

## Multi-layer Switch 1 (swm1)

Before configure, install AC-POWER-SUPPLY module.

```
enable
configure terminal
!enabling password
enable password admin
!
!enabling vlan
interface VLAN 1
ip address 192.168.10.98 255.255.255.0
no shutdown
exit
do wr

!enabling password on virtual terminals
service password-encryption
username administrator password cisco
ip domain-name milestones.com
hostname swm1
crypto key generate rsa general-keys modulus 1024
!
ip ssh version 2
line vty 5 15
```

```
transport input ssh
login local
exit
!
line vty 0 4
transport input telnet
password cisco
login
!
exit
!
do wr
!
exit
!
```

## Multi-layer Switch 2 (swm2)

Before configure, install AC-POWER-SUPPLY module.

```
enable
configure terminal
!enabling password
enable password admin
!
!enabling vlan
interface VLAN 1
ip address 192.168.10.97 255.255.255.0
no shutdown
exit
do wr

!enabling password on virtual terminals
service password-encryption
username administrator password cisco
```

```
ip domain-name milestones.com
hostname swm2
crypto key generate rsa general-keys modulus 1024
!
ip ssh version 2
line vty 5 15
transport input ssh
login local
exit
!
line vty 0 4
transport input telnet
password cisco
login
!
exit
!
do wr
!
exit
!
```

```
Switch 6 (sw6)
enable
configure terminal
!enabling password
enable password admin
!
!enabling vlan
interface VLAN 1
ip address 192.168.30.96 255.255.255.0
no shutdown
exit
do wr
```

```
!enabling password on virtual terminals
service password-encryption
username administrator password cisco
ip domain-name milestones.com
hostname sw6
crypto key generate rsa general-keys modulus 1024
!
ip ssh version 2
line vty 5 15
transport input ssh
login local
exit
!
line vty 0 4
transport input telnet
password cisco
login
!
exit
!
do wr
!
exit
!
```

## Switch 7 (sw7)

```
enable
configure terminal
!enabling password
enable password admin
!
!enabling vlan
interface VLAN 1
ip address 192.168.30.95 255.255.255.0
no shutdown
exit
do wr
```

```
!enabling password on virtual terminals
service password-encryption
username administrator password cisco
ip domain-name milestones.com
hostname sw7
crypto key generate rsa general-keys modulus 1024
!
ip ssh version 2
line vty 5 15
transport input ssh
login local
exit
!
line vty 0 4
transport input telnet
password cisco
login
!
exit
!
do wr
```

```
!  
exit  
!
```

### Switch 8 (sw8)

```
enable  
configure terminal  
!enabling password  
enable password admin  
!  
!enabling vlan  
interface VLAN 1  
ip address 192.168.30.94 255.255.255.0  
no shutdown  
exit  
do wr  
  
!enabling password on virtual terminals  
service password-encryption  
username administrator password cisco  
ip domain-name milestones.com  
hostname sw8  
crypto key generate rsa general-keys modulus 1024  
!  
ip ssh version 2  
line vty 5 15  
transport input ssh  
login local  
exit  
!  
line vty 0 4  
transport input telnet  
password cisco
```

```
login
```

```
!
```

```
exit
```

```
!
```

```
do wr
```

```
!
```

```
exit
```

```
!
```

## Switch 9

```
enable
```

```
configure terminal
```

```
!enabling password
```

```
enable password admin
```

```
!
```

```
!enabling vlan
```

```
interface VLAN 1
```

```
ip address 192.168.30.93 255.255.255.0
```

```
no shutdown
```

```
exit
```

```
do wr
```

```
!enabling password on virtual terminals
```

```
service password-encryption
```

```
username administrator password cisco
```

```
ip domain-name milestones.com
```

```
hostname sw9
```

```
crypto key generate rsa general-keys modulus 1024
```

```
!
```

```
ip ssh version 2
```

```
line vty 5 15
```

```
transport input ssh
```

```
login local
```

```
exit
!
line vty 0 4
transport input telnet
password cisco
login
!
exit
!
do wr
!
exit
!
```

## Multi-layer Switch 3 (swm3)

Before configure, install AC-POWER-SUPPLY module.

```
enable
configure terminal
!enabling password
enable password admin
!
!enabling vlan
interface VLAN 1
ip address 192.168.30.98 255.255.255.0
no shutdown
exit
do wr

!enabling password on virtual terminals
service password-encryption
username administrator password cisco
ip domain-name milestones.com
hostname swm3
crypto key generate rsa general-keys modulus 1024
!
ip ssh version 2
line vty 5 15
transport input ssh
login local
exit
!
line vty 0 4
transport input telnet
password cisco
login
!
exit
!
```

```
do wr
```

```
!
```

```
exit
```

```
!
```

## Multi-layer Switch 4 (swm4)

Before configure, install AC-POWER-SUPPLY module.

```
enable
```

```
configure terminal
```

```
!enabling password
```

```
enable password admin
```

```
!
```

```
!enabling vlan
```

```
interface VLAN 1
```

```
ip address 192.168.30.97 255.255.255.0
```

```
no shutdown
```

```
exit
```

```
do wr
```

```
!enabling password on virtual terminals
```

```
service password-encryption
```

```
username administrator password cisco
```

```
ip domain-name milestones.com
```

```
hostname swm4
```

```
crypto key generate rsa general-keys modulus 1024
```

```
!
```

```
ip ssh version 2
```

```
line vty 5 15
```

```
transport input ssh
```

```
login local
```

```
exit
```

```
!
```

```
line vty 0 4
```

```
transport input telnet
password cisco
login
!
exit
!
do wr
!
exit
!
```

### Switch 10

```
enable
configure terminal
!enabling password
enable password admin
!
!enabling vlan
interface VLAN 1
ip address 192.168.40.97 255.255.255.0
no shutdown
exit
do wr

!enabling password on virtual terminals
service password-encryption
username administrator password cisco
ip domain-name milestones.com
hostname sw10
crypto key generate rsa general-keys modulus 1024
!
ip ssh version 2
line vty 5 15
```

```
transport input ssh
login local
exit
!
line vty 0 4
transport input telnet
password cisco
login
!
exit
!
do wr
!
exit
!
```

## 2. Secure Access Routers By SSH & Telnet

Checking:

- ❖ show running-config
- ❖ ssh -l administrator <ip\_router>
- ❖ telnet <ip\_router>
- ❖ service password-encryption

### Router 1 (RT1)

```
enable
configure terminal
!enabling password
enable password admin
!
!enabling vlan
interface VLAN 1
ip address 192.168.10.96 255.255.255.0
no shutdown
exit
do wr

!enabling password on virtual terminals
service password-encryption
username administrator password cisco
ip domain-name milestones.com
hostname sw1
crypto key generate rsa general-keys modulus 1024
!
ip ssh version 2
line vty 5 15
transport input ssh
login local
exit
!
line vty 0 4
```

```
transport input telnet
password cisco
login
!
exit
!
do wr
!
exit
!
```

## Routers: RT1, RT2, RT3, RT4, RT-M

Use next configuration on all router on this network:

```
enable
configure terminal
!enabling password
enable password admin
!
!enabling password on virtual terminals
service password-encryption
username administrator password cisco
ip domain-name milestones.com
crypto key generate rsa general-keys modulus 1024
!
ip ssh version 2
line vty 5 15
transport input ssh
login local
exit
!
line vty 0 4
transport input telnet
password cisco
login
!
exit
!
do wr
!
exit
!
```

# Legal & security: Policies and Procedures

ABC Enterprises adopts security technologies to ensure data protection. The company's policies are outlined below.

## 1. Service Password Encryption

Policy to prevent access to plain-text passwords in network devices. In compliance with standard ISO/IEC 27001.

ISO/IEC 27001 – to safeguarding of authentication credentials and sensitive information stored in system configurations.

## 2. Mandatory Login Password

Policy on all network devices that requires a login password for any access to routers or switches. In compliance with NIST SP 800-53 (IA-2).

NIST SP 800-53 (IA-2) – apply authentication mechanisms are mandatory to verify user identity prior to access to network infrastructure.

## 3. VPN Site-to-Site

Policy implements IPSec to protect data in transit between different company branches over internet. In compliance with NIST SP 800-77.

NIST SP 800-77 – provides guidance for the secure deployment of IPsec VPNs in enterprise environments.

## 4. Access Control Lists (ACLs)

Policy to filter traffic and control access between subnets, enhance internal network security. In compliance with ISO/IEC 27002 (s13)

ISO/IEC 27002 – control and restricts network access to authorized communications only.

## 5. Secure Remote Access to infrastructure

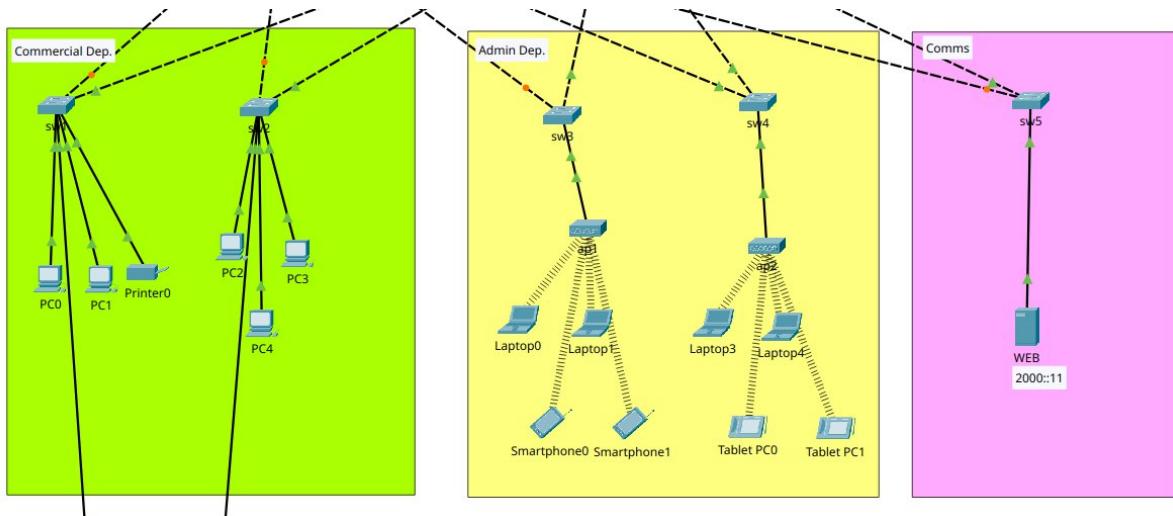
Policy to protect remote access by Telnet and SSH to network devices using password-protected and encrypted. In compliance with This configuration aligns with: NIST SP 800-5.

NIST SP 800-52 – secure protocols for administrative access and discourages the use of unencrypted communication channels.

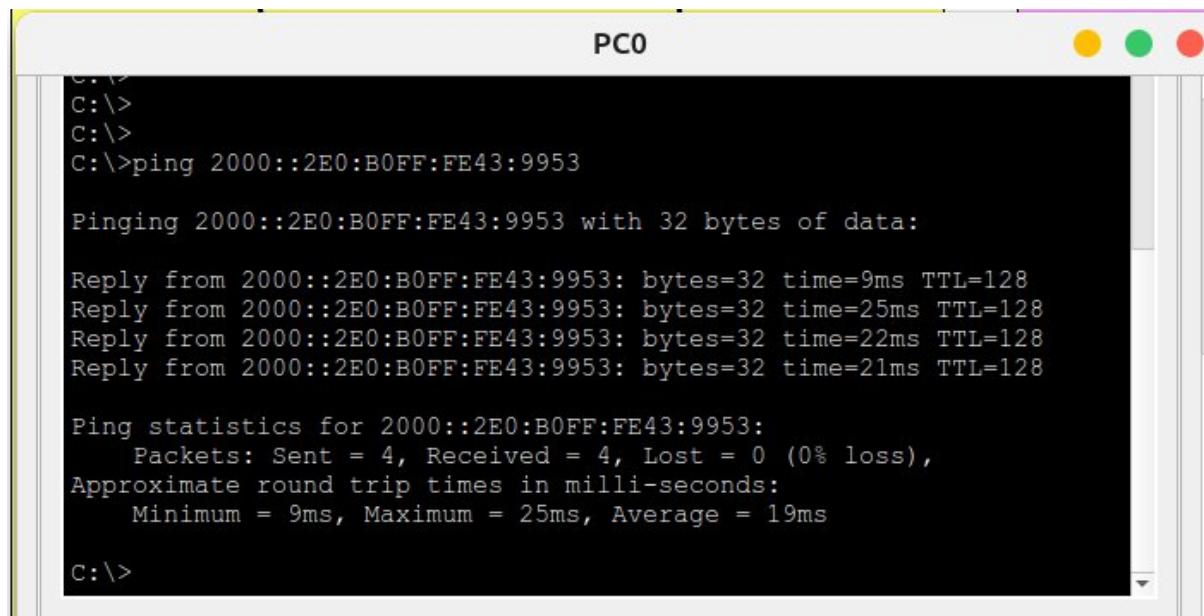
# Troubleshooting & Testing

## 1. Testing LAN Connectivity (IPv4/IPv6)

### Sydney Branch



- ❖ Connectivity between Commercial and Admin over IPv6
- PC0 LAPTOP0



```
C:\>
C:\>
C:\>
C:\>ping 2000::2E0:B0FF:FE43:9953

Pinging 2000::2E0:B0FF:FE43:9953 with 32 bytes of data:

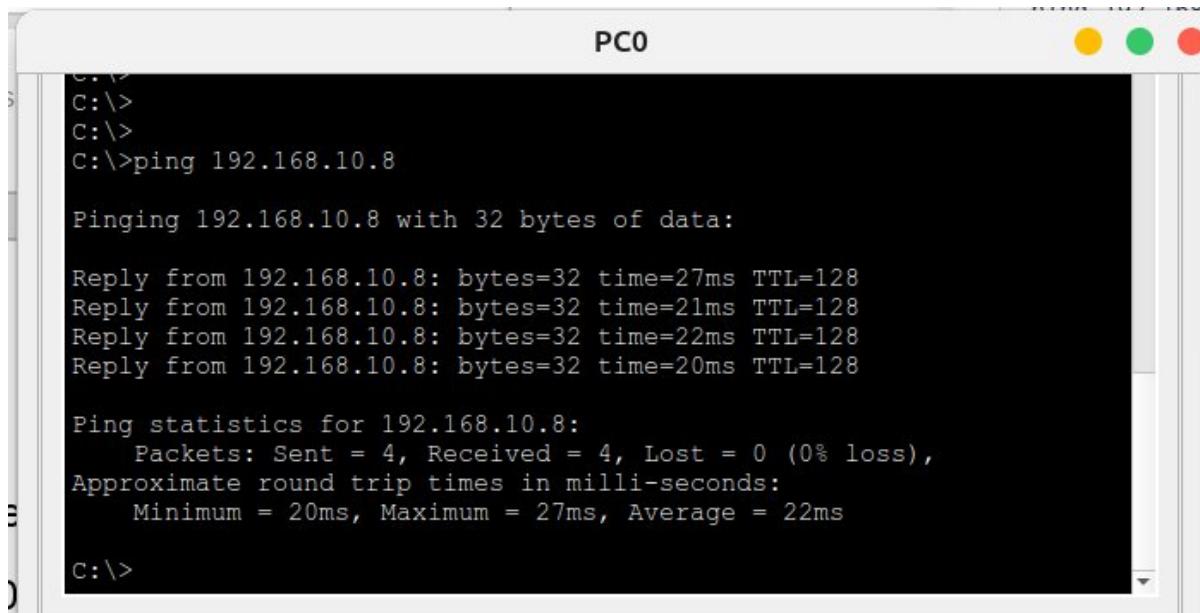
Reply from 2000::2E0:B0FF:FE43:9953: bytes=32 time=9ms TTL=128
Reply from 2000::2E0:B0FF:FE43:9953: bytes=32 time=25ms TTL=128
Reply from 2000::2E0:B0FF:FE43:9953: bytes=32 time=22ms TTL=128
Reply from 2000::2E0:B0FF:FE43:9953: bytes=32 time=21ms TTL=128

Ping statistics for 2000::2E0:B0FF:FE43:9953:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 9ms, Maximum = 25ms, Average = 19ms

C:\>
```

- ❖ Connectivity between Commercial and Admin over IPv4

#### PC0 LAPTOP0



```

C:\>
C:\>
C:\>
C:\>ping 192.168.10.8

Pinging 192.168.10.8 with 32 bytes of data:

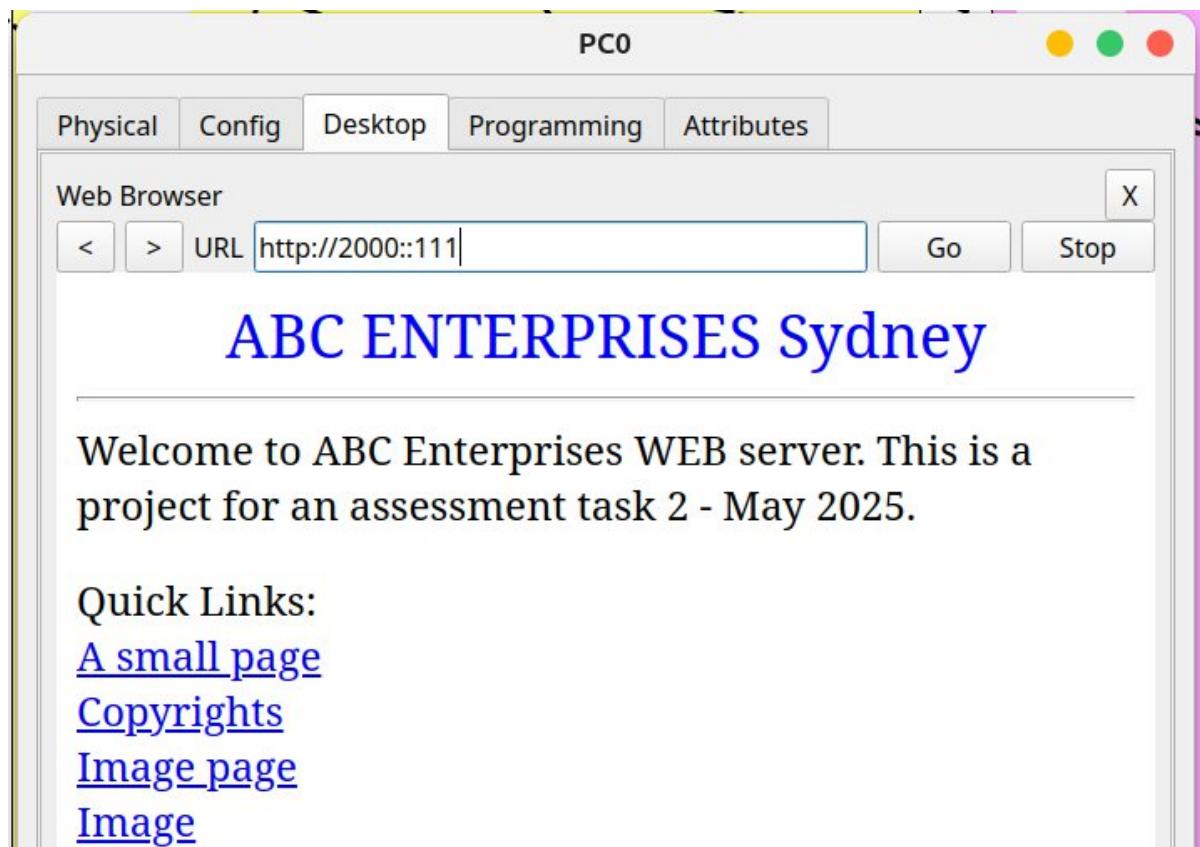
Reply from 192.168.10.8: bytes=32 time=27ms TTL=128
Reply from 192.168.10.8: bytes=32 time=21ms TTL=128
Reply from 192.168.10.8: bytes=32 time=22ms TTL=128
Reply from 192.168.10.8: bytes=32 time=20ms TTL=128

Ping statistics for 192.168.10.8:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 20ms, Maximum = 27ms, Average = 22ms

C:\>
  
```

- ❖ Connectivity between Commercial and Comms over IPv6

#### WEB PC0



PC0

Physical Config Desktop Programming Attributes

Web Browser

< > URL <http://2000::111> Go Stop X

**ABC ENTERPRISES Sydney**

---

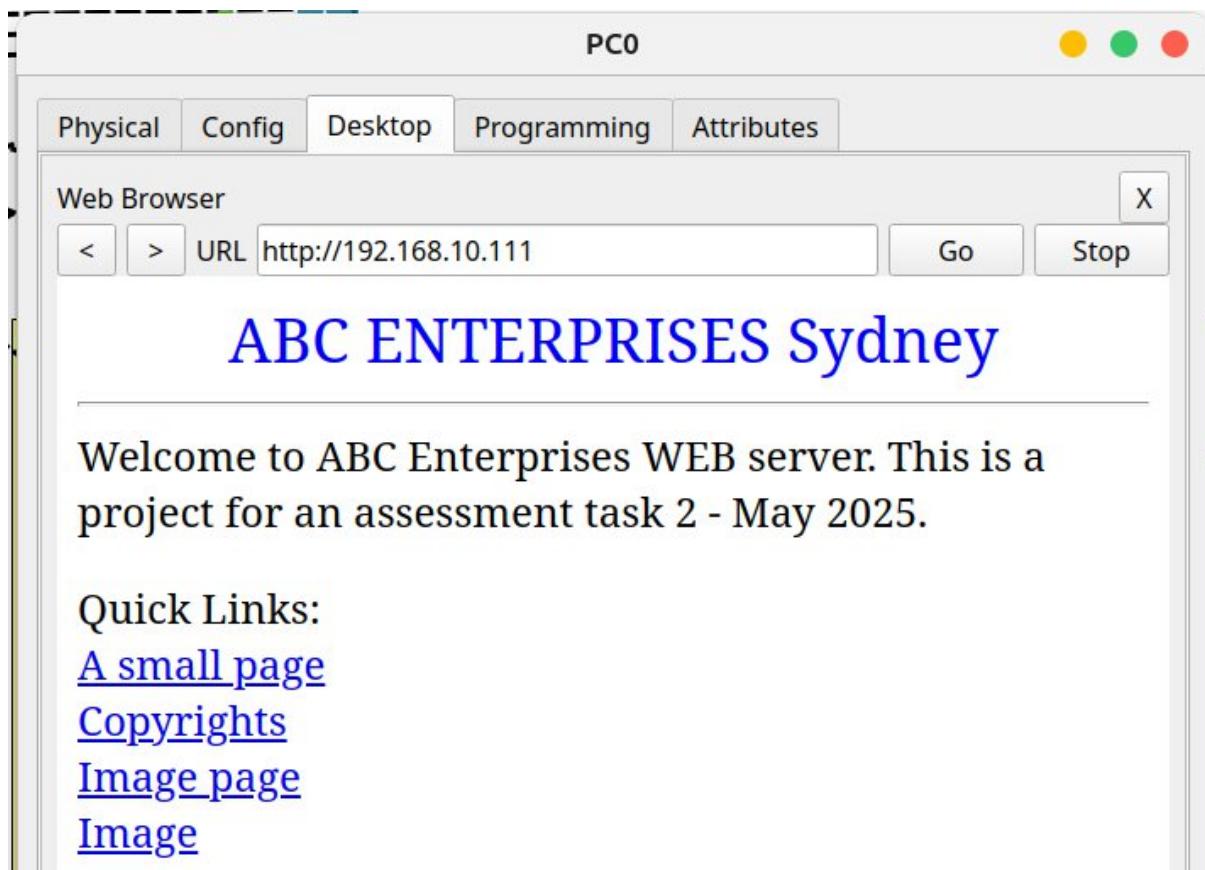
Welcome to ABC Enterprises WEB server. This is a project for an assessment task 2 - May 2025.

Quick Links:

[A small page](#)  
[Copyrights](#)  
[Image page](#)  
[Image](#)

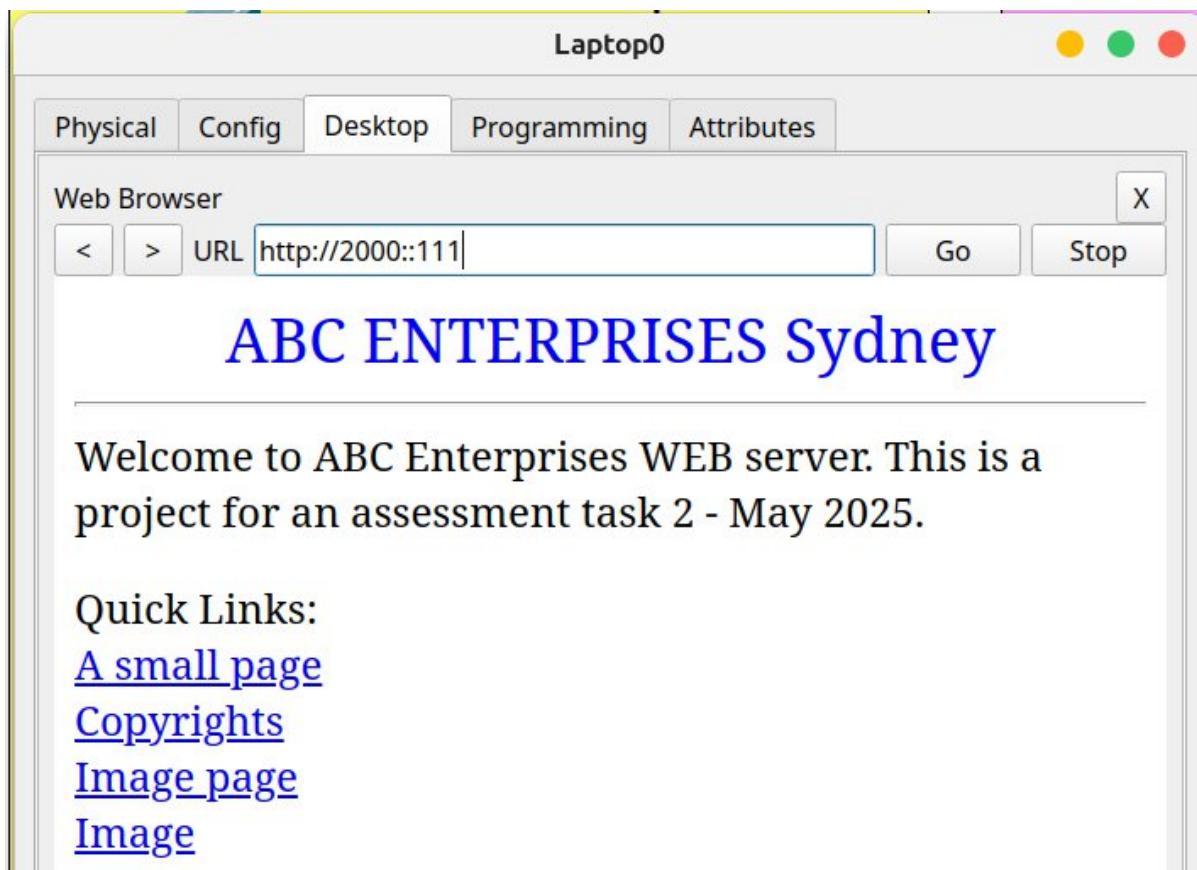
- ❖ Connectivity between Commercial and Comms over IPv4

## WEB PC0



- ❖ Connectivity between Admin and Comms over IPv6

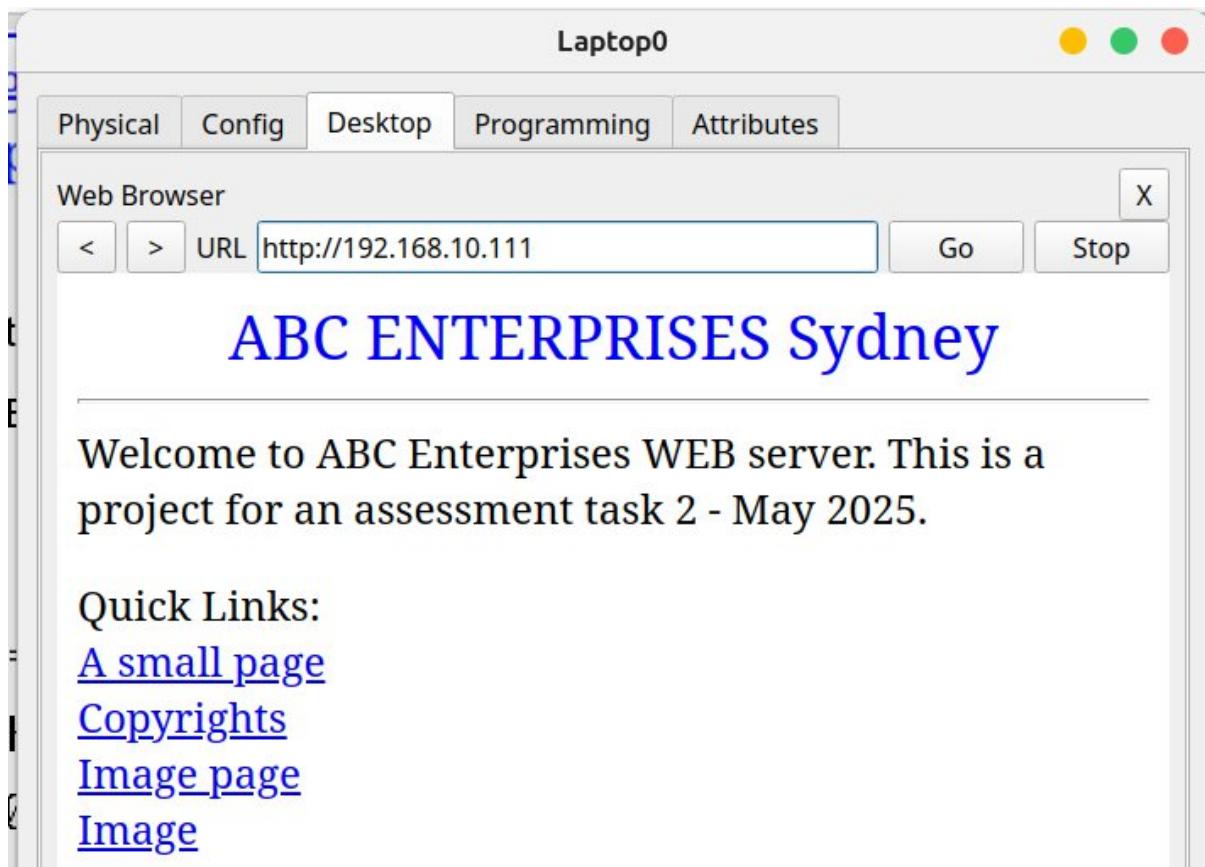
## LAPTOP0 WEB



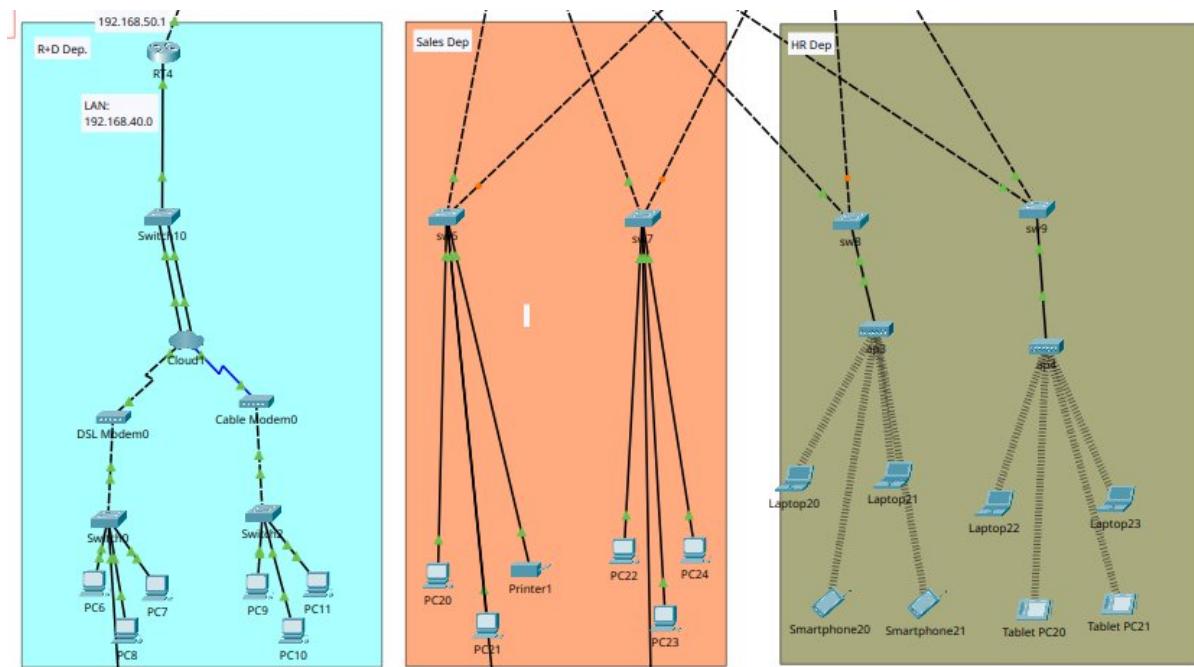
The screenshot shows a laptop interface titled "Laptop0". The top menu bar includes tabs for "Physical", "Config", "Desktop", "Programming", and "Attributes". The "Desktop" tab is selected. Below the menu is a "Web Browser" window. The URL bar contains "http://2000::111". There are "Go" and "Stop" buttons next to the URL bar. The main content area displays the text "ABC ENTERPRISES Sydney" in blue. Below this, a message reads: "Welcome to ABC Enterprises WEB server. This is a project for an assessment task 2 - May 2025." A "Quick Links:" section follows, listing several hyperlinks: [A small page](#), [Copyrights](#), [Image page](#), and [Image](#).

- ❖ Connectivity between Admin and Comms over IPv4

## LAPTOP0 WEB

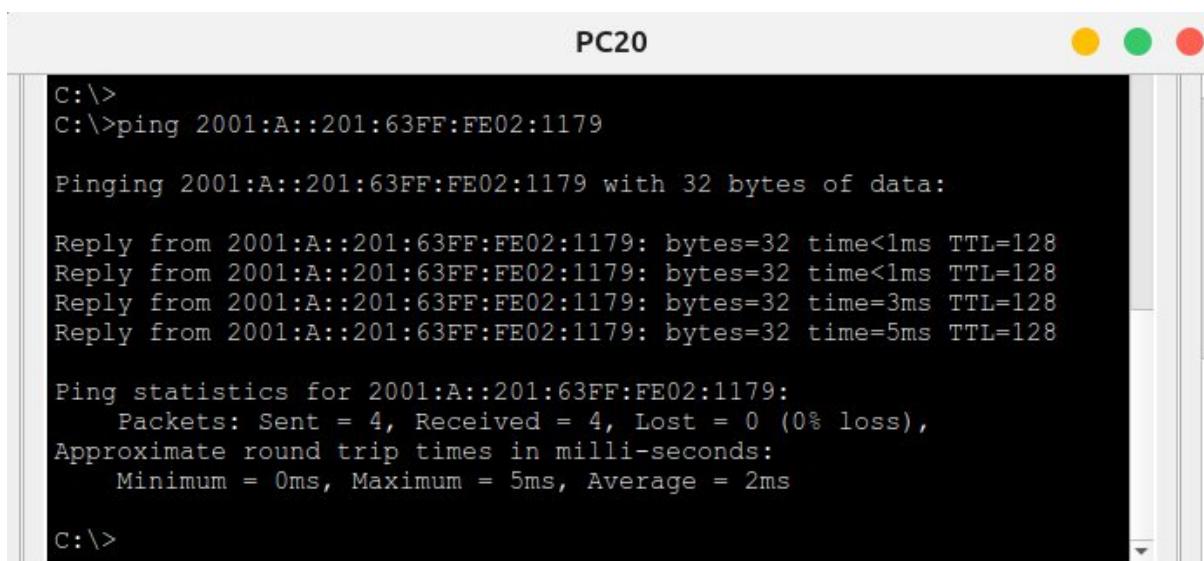


## Brisbane Branch



- ❖ Connectivity between Sales and HR over IPv6

PC20 LAPTOP20



```

PC20
C:\>
C:\>ping 2001:A::201:63FF:FE02:1179

Pinging 2001:A::201:63FF:FE02:1179 with 32 bytes of data:

Reply from 2001:A::201:63FF:FE02:1179: bytes=32 time<1ms TTL=128
Reply from 2001:A::201:63FF:FE02:1179: bytes=32 time<1ms TTL=128
Reply from 2001:A::201:63FF:FE02:1179: bytes=32 time=3ms TTL=128
Reply from 2001:A::201:63FF:FE02:1179: bytes=32 time=5ms TTL=128

Ping statistics for 2001:A::201:63FF:FE02:1179:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 5ms, Average = 2ms

C:\>
  
```

- ❖ Connectivity between Sales and HR over IPv4

## PC20 LAPTOP20

PC20

```
C:\>
C:\>ping 192.168.30.2

Pinging 192.168.30.2 with 32 bytes of data:

Reply from 192.168.30.2: bytes=32 time=16ms TTL=128
Reply from 192.168.30.2: bytes=32 time=5ms TTL=128
Reply from 192.168.30.2: bytes=32 time=4ms TTL=128
Reply from 192.168.30.2: bytes=32 time=3ms TTL=128

Ping statistics for 192.168.30.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 3ms, Maximum = 16ms, Average = 7ms

C:\>
```

- ❖ Connectivity between Sales and R+D over IPv4

## PC20 PC6

PC20

```
Pinging 192.168.40.6 with 32 bytes of data:

Request timed out.
Reply from 192.168.40.6: bytes=32 time=56ms TTL=126
Reply from 192.168.40.6: bytes=32 time=65ms TTL=126
Reply from 192.168.40.6: bytes=32 time=42ms TTL=126

Ping statistics for 192.168.40.6:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 42ms, Maximum = 65ms, Average = 54ms
```

- ❖ Connectivity between HR and R+D over IPv4

## LAPTOP20 PC6

```
Laptop20

Pinging 192.168.40.6 with 32 bytes of data:

Reply from 192.168.40.6: bytes=32 time=132ms TTL=126
Reply from 192.168.40.6: bytes=32 time=54ms TTL=126
Reply from 192.168.40.6: bytes=32 time=64ms TTL=126
Reply from 192.168.40.6: bytes=32 time=48ms TTL=126

Ping statistics for 192.168.40.6:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 48ms, Maximum = 132ms, Average = 74ms
```

## 2. Testing WAN Connectivity (IPv4/IPv6)

- ❖ Connectivity between Sydney Branch and Brisbane Branch

**TEST10-1**

```
C:\>
C:\>
C:\>ping 192.168.30.99

Pinging 192.168.30.99 with 32 bytes of data:

Reply from 192.168.30.99: bytes=32 time<1ms TTL=126
Reply from 192.168.30.99: bytes=32 time=1ms TTL=126
Reply from 192.168.30.99: bytes=32 time<1ms TTL=126
Reply from 192.168.30.99: bytes=32 time<1ms TTL=126

Ping statistics for 192.168.30.99:
  Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
  Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>
```

**TEST2000-1**

Physical	Config	Desktop	Programming	Attributes
----------	--------	---------	-------------	------------

**Command Prompt**

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 2001:A::201:63FF:FEC3:B2E6

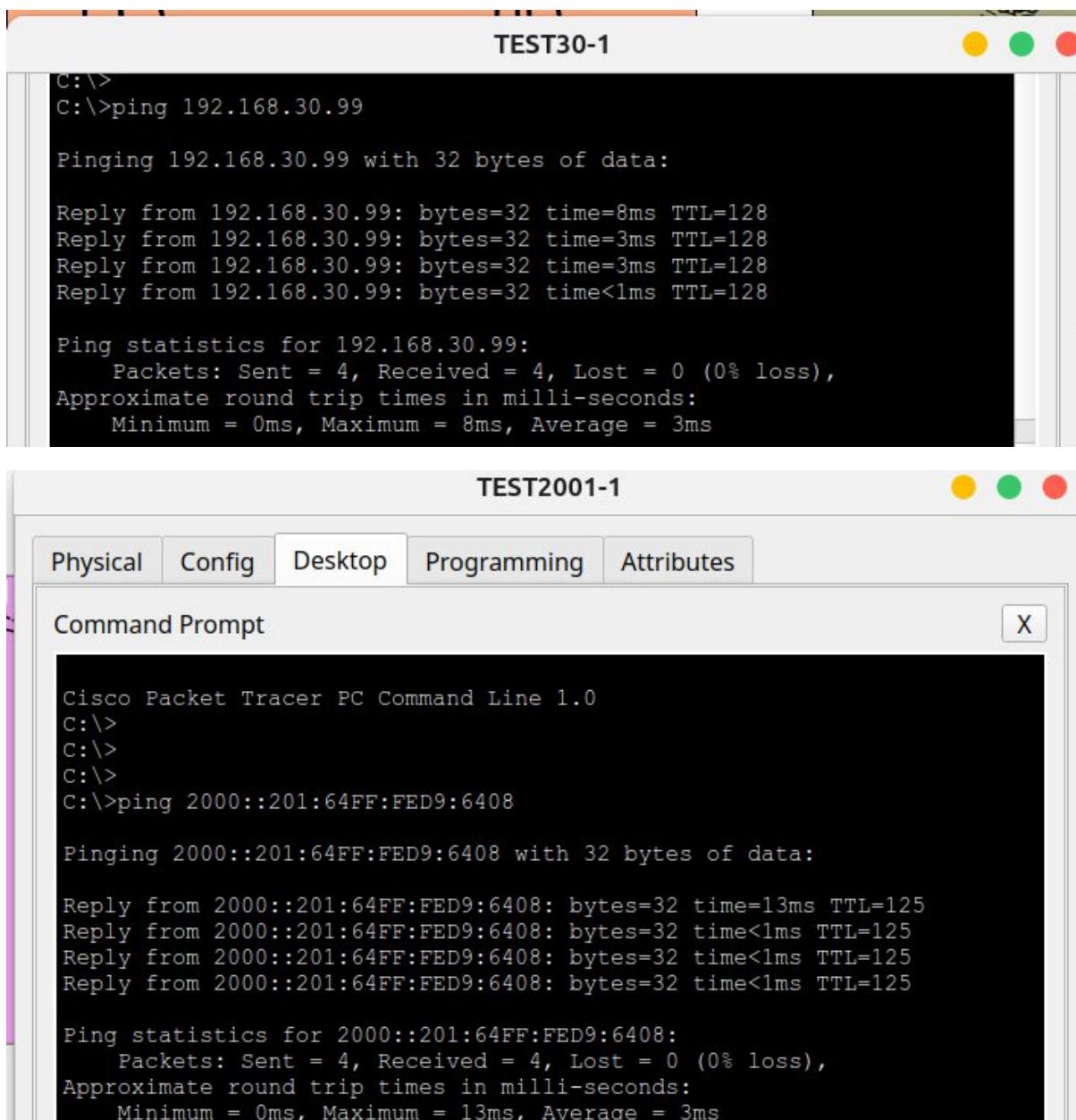
Pinging 2001:A::201:63FF:FEC3:B2E6 with 32 bytes of data:

Reply from 2001:A::201:63FF:FEC3:B2E6: bytes=32 time<1ms TTL=125
Reply from 2001:A::201:63FF:FEC3:B2E6: bytes=32 time<1ms TTL=125
Reply from 2001:A::201:63FF:FEC3:B2E6: bytes=32 time=12ms TTL=125
Reply from 2001:A::201:63FF:FEC3:B2E6: bytes=32 time<1ms TTL=125

Ping statistics for 2001:A::201:63FF:FEC3:B2E6:
  Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
  Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 12ms, Average = 3ms

C:\>|
```

❖ Connectivity between Brisbane Branch and Sydney Branch



**TEST30-1**

```
C:\>
C:\>ping 192.168.30.99

Pinging 192.168.30.99 with 32 bytes of data:

Reply from 192.168.30.99: bytes=32 time=8ms TTL=128
Reply from 192.168.30.99: bytes=32 time=3ms TTL=128
Reply from 192.168.30.99: bytes=32 time=3ms TTL=128
Reply from 192.168.30.99: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.30.99:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 8ms, Average = 3ms
```

**TEST2001-1**

Physical Config Desktop Programming Attributes

Command Prompt X

```
Cisco Packet Tracer PC Command Line 1.0
C:\>
C:\>
C:\>
C:\>ping 2000::201:64FF:FED9:6408

Pinging 2000::201:64FF:FED9:6408 with 32 bytes of data:

Reply from 2000::201:64FF:FED9:6408: bytes=32 time=13ms TTL=125
Reply from 2000::201:64FF:FED9:6408: bytes=32 time<1ms TTL=125
Reply from 2000::201:64FF:FED9:6408: bytes=32 time<1ms TTL=125
Reply from 2000::201:64FF:FED9:6408: bytes=32 time<1ms TTL=125

Ping statistics for 2000::201:64FF:FED9:6408:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 13ms, Average = 3ms
```

**Notes:**

---

Sydney Branch =====

PC0 = 2000::201:97FF:FE02:1170

PC0 = 192.168.10.2

LAPTOP0 = 2000::2E0:B0FF:FE43:9953

LAPTOP0 = 192.168.10.8

WEB = 2000::111

WEB = 192.168.10.111

---

Brisbane Branch =====

PC20 = 2001:A::201:63FF:FE02:1179

PC20 = 192.168.30.2

LAPTOP20 = 2001:A::260:70FF:FE99:235C

LAPTOP20 = 192.168.30.9

PC6 -----

PC6 = 192.168.40.7

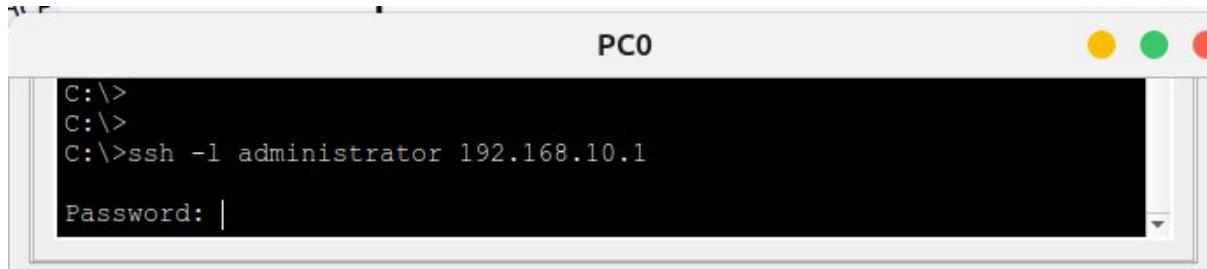
---

### 3. Testing Secure Access SSH & Telnet - Local

Commands:

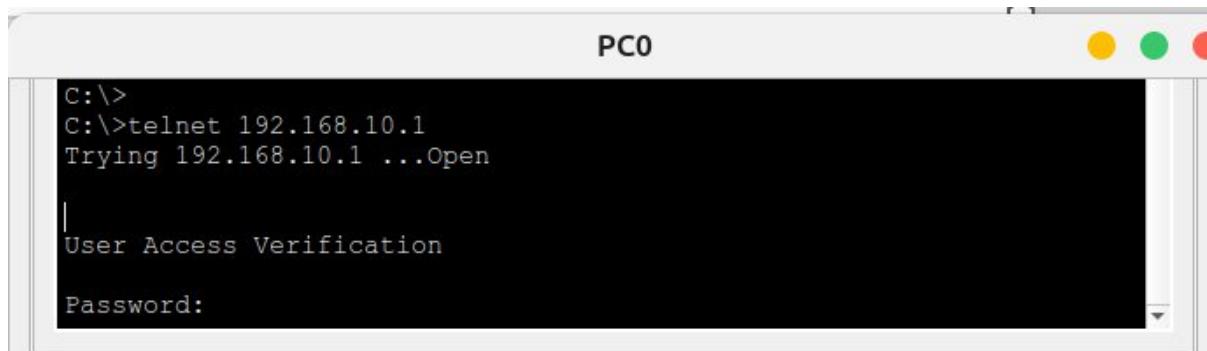
```
SSH = ssh -l administrator <ip>
Telnet = telnet <ip>
```

❖ RT1 192.168.10.1



PC0

```
C:\>
C:\>
C:\>ssh -l administrator 192.168.10.1
Password: |
```

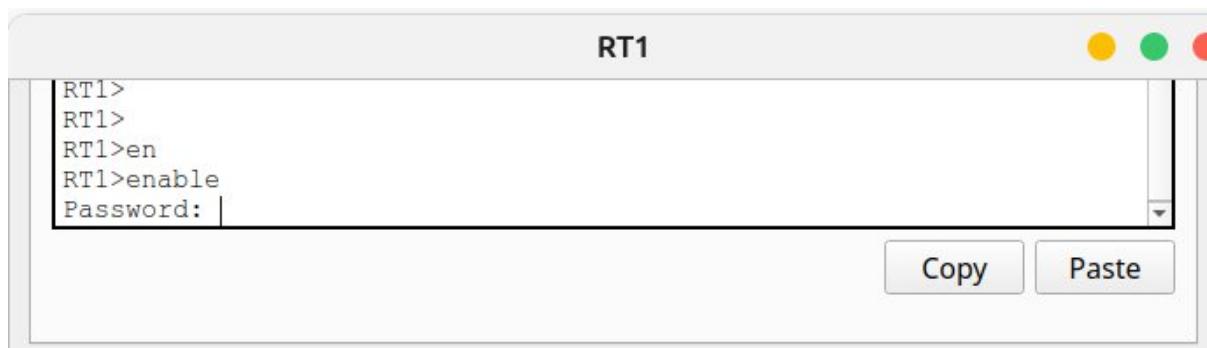


PC0

```
C:\>
C:\>telnet 192.168.10.1
Trying 192.168.10.1 ...Open

User Access Verification

Password: |
```



RT1

```
RT1>
RT1>
RT1>en
RT1>enable
Password: |
```

Copy Paste

❖ RT2 2000::3

PC0

```
C:\>
C:\>
C:\>
C:\>ssh -l administrator 2000::3

Password:
```

Top

PC0

```
C:\>
C:\>
C:\>telnet 2000::3
Trying 2000::3 ...Open

User Access Verification

Password:
```

RT2

```
RT2>
RT2>en
RT2>enable
Password: |
```

**Copy**   **Paste**

❖ swm1 VLAN1:192.168.10.97

PC0

```
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>ssh -l administrator 192.168.10.97
Password: |
```

PC0

```
C:\>
C:\>
C:\>telnet 192.168.10.97
Trying 192.168.10.97 ...Open

User Access Verification

Password: |
```

swm1

```
swm1>
swm1>
swm1>en
swm1>enable
Password: |
```

❖ swm2 VLAN1:192.168.10.98

PC0

```
C:\>
C:\>
C:\>
C:\>ssh -l administrator 192.168.10.98
Password: |
```

Top

PC0

```
C:\>
C:\>telnet 192.168.10.98
Trying 192.168.10.98 ...Open

User Access Verification

Password: |
```

swm2

```
swm2>
swm2>
swm2>en
swm2>enable
Password:
```

❖ sw1 VLAN1:192.168.10.96

sw1

```
sw1>
sw1>ena
sw1>enable
Password: |
```



❖ sw2 VLAN1:192.168.10.95

PC0

```
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>ssh -l administrator 192.168.10.95
Password: |
```

PC0

```
C:\>
C:\>telnet 192.168.10.95
Trying 192.168.10.95 ...Open

User Access Verification

Password: |
```

sw2

```
sw2>
sw2>
sw2>en
sw2>enable
Password: |
```

❖ sw3 VLAN1:192.168.10.94

PC0

```
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>ssh -l administrator 192.168.10.94
Password: |
```

PC0

```
C:\>
C:\>telnet 192.168.10.94
Trying 192.168.10.94 ...Open

User Access Verification

Password: |
```

sw3

```
sw3>
sw3>
sw3>en
sw3>enable
Password:
```

❖ sw4 VLAN1:192.168.10.93

PC0

```
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>ssh -l administrator 192.168.10.93
Password: |
```

PC0

```
C:\>
C:\>telnet 192.168.10.93
Trying 192.168.10.93 ...Open

User Access Verification

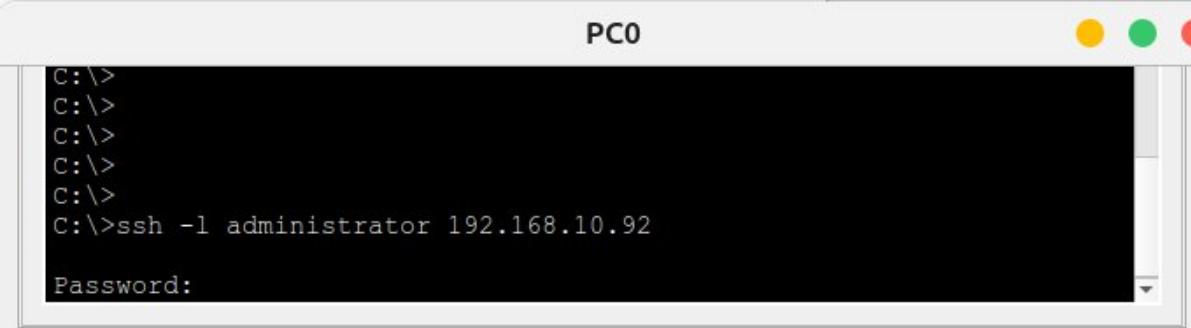
Password: |
```

sw4

```
sw4>
sw4>
sw4>en
sw4>enable
Password:
```

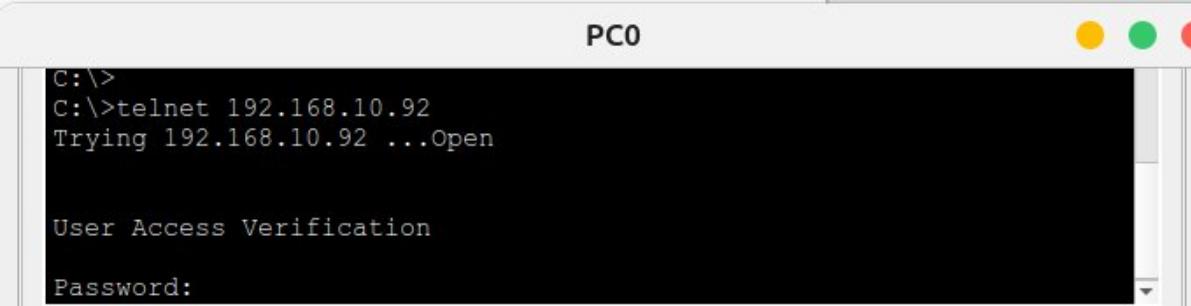
**Copy** **Paste**

❖ sw5 VLAN1:192.168.10.92



PC0

```
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>ssh -l administrator 192.168.10.92
Password:
```

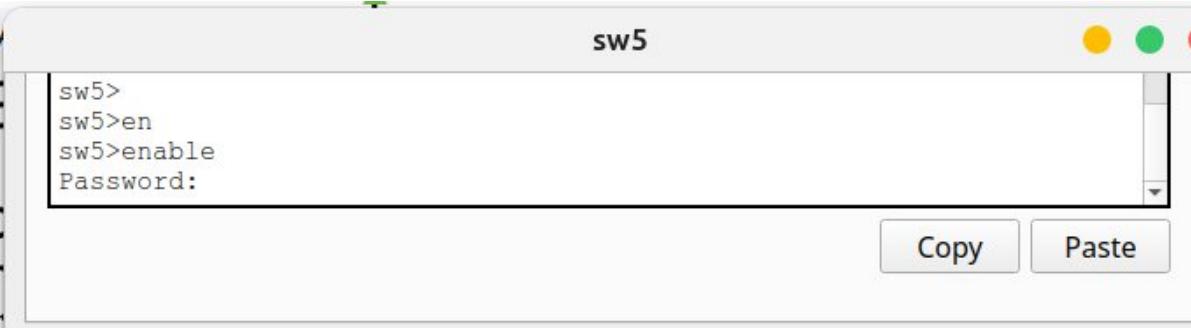


PC0

```
C:\>
C:\>telnet 192.168.10.92
Trying 192.168.10.92 ...Open

User Access Verification

Password:
```



sw5

```
sw5>
sw5>en
sw5>enable
Password:
```

Copy Paste

❖ RT-M 2001:b::2

PC0

```
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>ssh -l administrator 2001:b::2
Password:
```

PC0

```
C:\>
C:\>telnet 2001:b::2
Trying 2001:B::2 ...Open

User Access Verification

Password:
```

RT-Main

```
RT-M>en
RT-M>enable
Password:
```

Top

Copy      Paste

❖ RT3 2001:a::1

PC20

```
C:\>
C:\>
C:\>
C:\>ssh -l administrator 2001:a::1
Password:
```

Top

PC20

```
c:\>telnet 2001:a::1
Trying 2001:A::1 ...Open

User Access Verification

Password:
```

RT3

```
RT3>
RT3>
RT3>
RT3>
RT3>
RT3>en
RT3>enable
Password:
```

Top

Copy Paste

❖ swm3 VLAN1:192.168.30.97

PC20

```
C:\>
C:\>
C:\>
C:\>
C:\>ssh -l administrator 192.168.30.97
Password:
```

PC20

```
C:\>telnet 192.168.30.97
Trying 192.168.30.97 ...Open

User Access Verification

Password: |
```

swm3

```
swm3>
swm3>
swm3>
swm3>en
swm3>enable
Password:
```

❖ swm4 VLAN1:192.168.30.98

PC20

```
C:\>
C:\>
C:\>
C:\>
C:\>ssh -l administrator 192.168.30.98
Password: |
```

PC20

```
C:\>telnet 192.168.30.98
Trying 192.168.30.98 ...Open

User Access Verification

Password: |
```

swm4

```
swm4>
swm4>
swm4>
swm4>
swm4>en
swm4>enable
Password: |
```

❖ sw6 VLAN1:192.168.30.96

PC20

```
C:\>
C:\>
C:\>
C:\>
C:\>ssh -l administrator 192.168.30.96
Password: |
```

PC20

```
c:\>telnet 192.168.30.96
Trying 192.168.30.96 ...Open

User Access Verification

Password: |
```

sw6

```
sw6>
sw6>en
sw6>enable
Password: |
```

sw7 VLAN1:192.168.30.95

PC20

```
C:\>
C:\>
C:\>
C:\>
C:\>ssh -l administrator 192.168.30.95
Password: |
```

PC20

```
C:\>
C:\>telnet 192.168.30.95
Trying 192.168.30.95 ...Open

User Access Verification

Password: |
```

sw7

```
sw7>
sw7>en
sw7>enable
Password: |
```

Top

❖ sw8 VLAN1:192.168.30.94

PC20

```
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>ssh -l administrator 192.168.30.94
Password:
```

PC20

```
C:\>
C:\>telnet 192.168.30.94
Trying 192.168.30.94 ...Open

User Access Verification

Password: |
```

sw8

```
sw8>
sw8>en
sw8>enable
Password:
```

❖ sw9 VLAN1:192.168.30.93

PC20

```
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>ssh -l administrator 192.168.30.93
Password: |
```

PC20

```
C:\>
C:\>telnet 192.168.30.93
Trying 192.168.30.93 ...Open

User Access Verification

Password: |
```

sw9

```
sw9>
sw9>en
sw9>enable
Password: |
```

❖ RT4 192.168.40.1

PC6

```
C:\>
C:\>
C:\>
C:\>
C:\>ssh -l administrator 192.168.40.1

Password:
```

Top

PC6

```
C:\>telnet 192.168.40.1
Trying 192.168.40.1 ...Open

User Access Verification

Password:
```

Top

RT4

```
RT4>
RT4>en
RT4>enable
Password:
```

❖ sw10 VLAN1:192.168.40.98

PC6

```
C:\>
C:\>
C:\>
C:\>
C:\>ssh -l administrator 192.168.40.98
Password: |
```

Top

PC6

```
C:\>telnet 192.168.40.98
Trying 192.168.40.98 ...Open

User Access Verification

Password: |
```

Top

Switch10

```
sw10>
sw10>
sw10>
sw10>
sw10>
sw10>en
sw10>enable
Password:
```

**Notes:**

=====

RT1 192.168.10.1

RT2 2000::3

swm1 VLAN1:192.168.10.97

swm2 VLAN1:192.168.10.98

sw1 VLAN1:192.168.10.96

sw2 VLAN1:192.168.10.95

sw3 VLAN1:192.168.10.94

sw4 VLAN1:192.168.10.93

sw5 VLAN1:192.168.10.92

RT-M

2001:b::2

RT3 2001:a::1

RT4 192.168.40.1

swm3 VLAN1:192.168.30.97

swm4 VLAN1:192.168.30.98

sw6 VLAN1:192.168.30.96

sw7 VLAN1:192.168.30.95

sw8 VLAN1:192.168.30.94

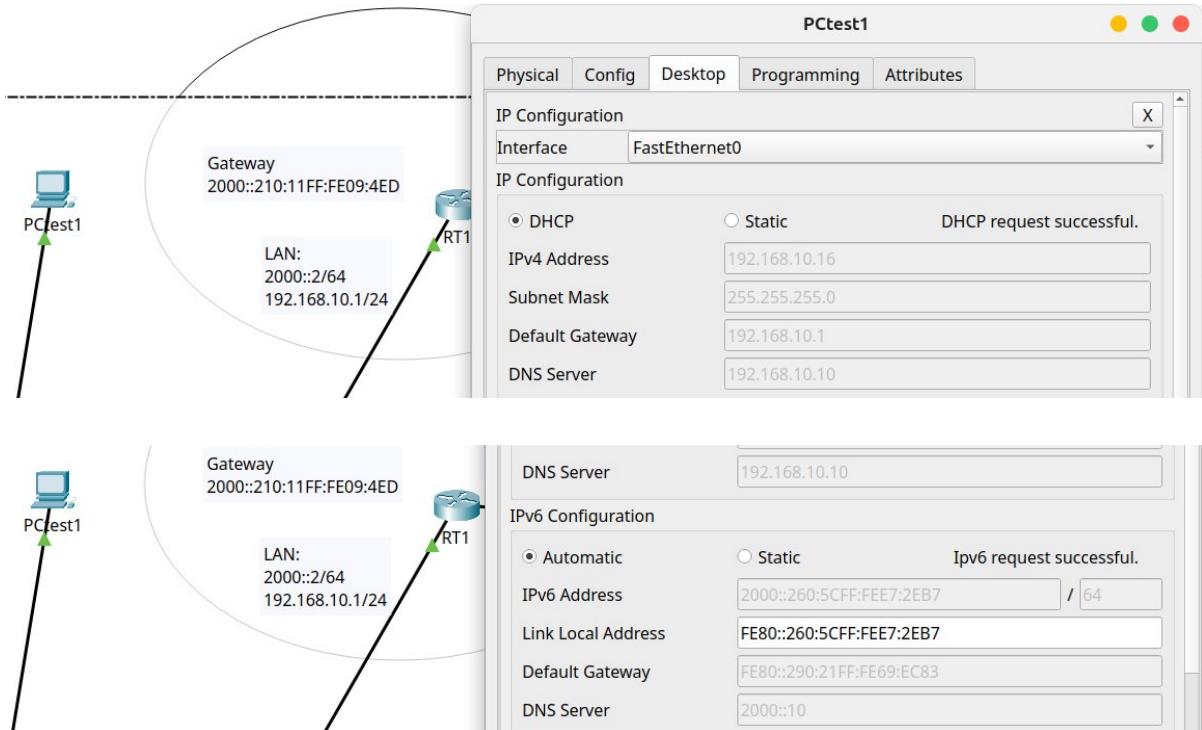
sw9 VLAN1:192.168.30.93

sw10 VLAN1:192.168.40.92

## 4. Testing DHCP/DHCPv6 (IPv4/IPv6)

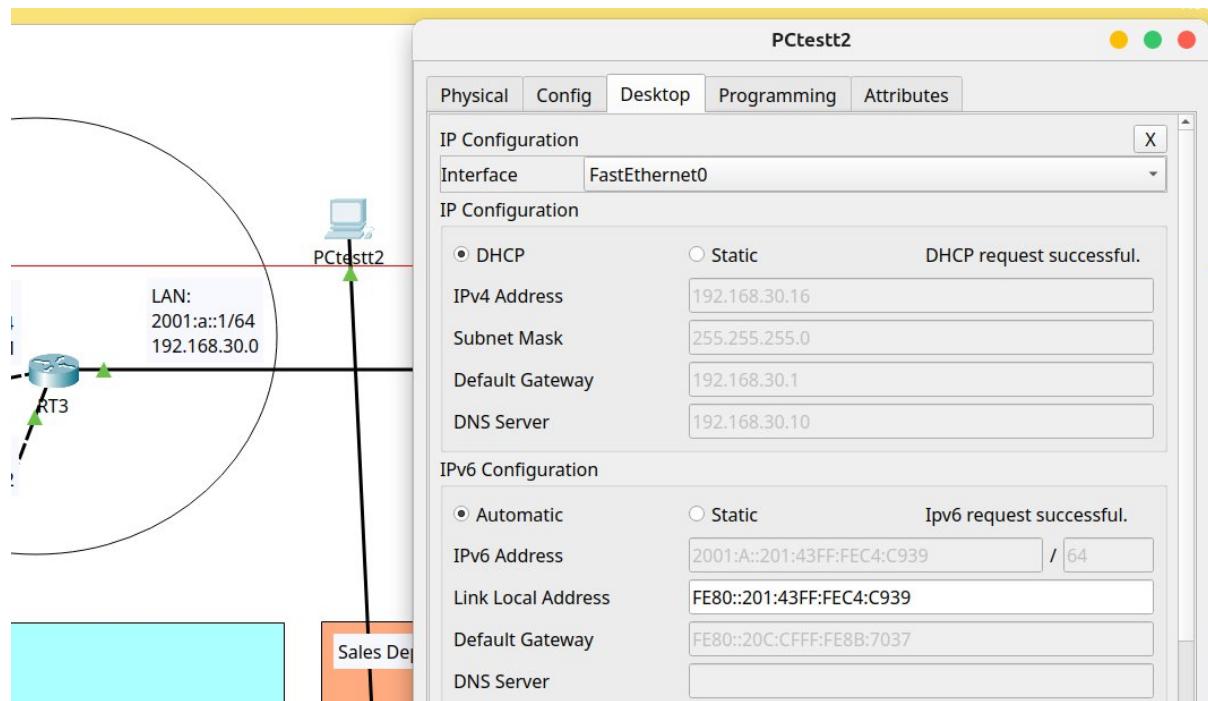
❖ RT1

New PC configured to DHCP and IPv6 Auto



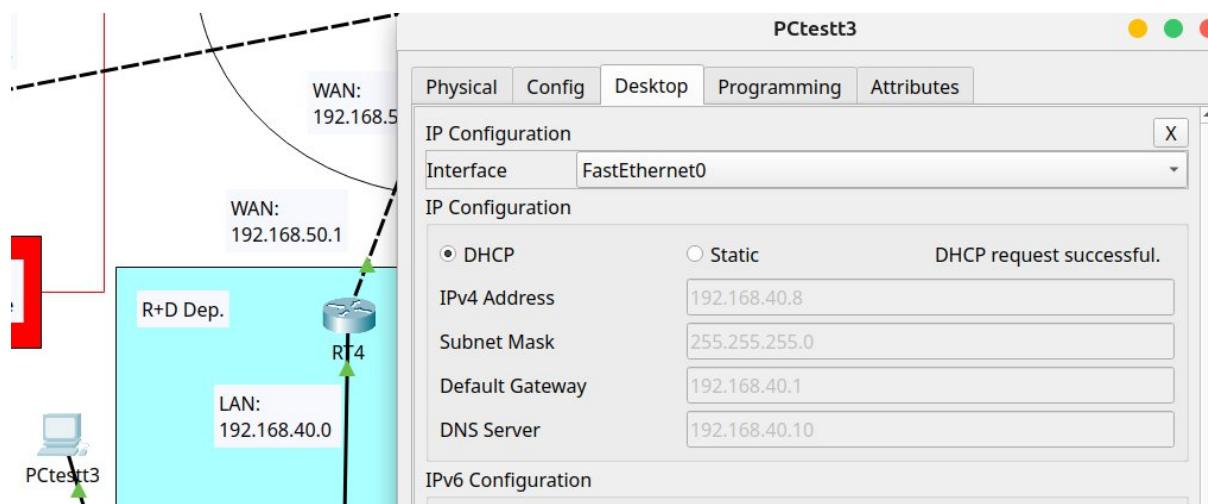
❖ RT3

New PC configured to DHCP and IPv6 Auto



❖ RT4

New PC configured to DHCP



## 5. Testing LACP (IPv6)

#### ❖ Summary port-channel Sydney Branch

swm1#show et  
swm1#show etherchannel su  
swm1#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: 1  
Number of aggregators: 1

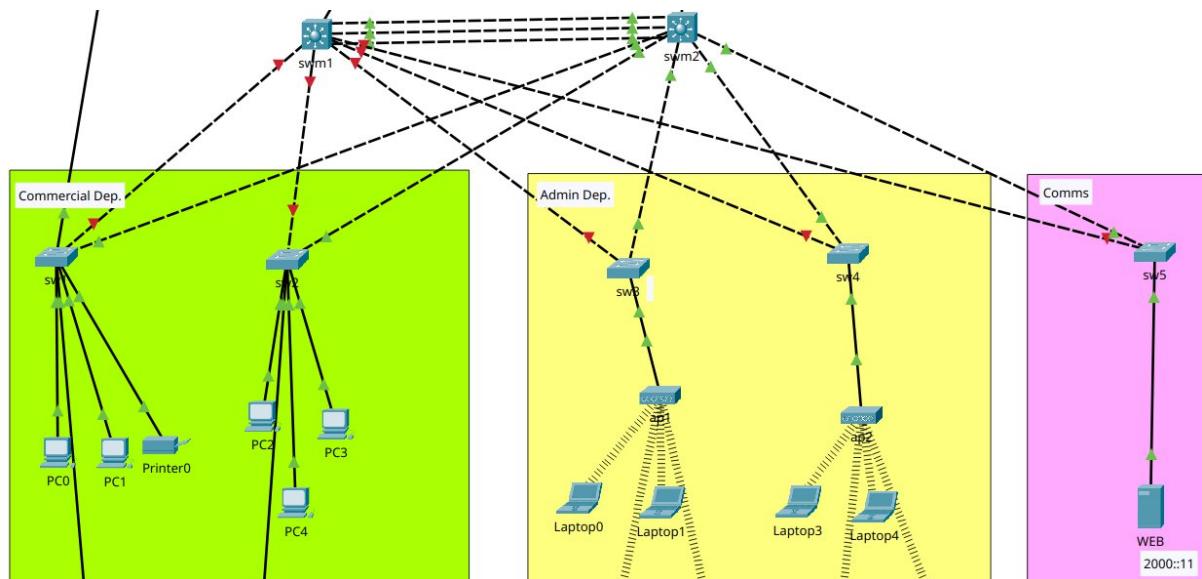
Group	Port-channel	Protocol	Ports
1	Pol(SU)	LACP	Gig1/0/22(P) Gig1/0/23(P) Gig1/0/24(P)

#### ❖ Summary port-channel Bisbane Branche

Number of aggregators.				
Group	Port-channel	Protocol	Ports	
1	Pol(SU)	LACP	Gig1/0/22(P)	Gig1/0/23(P)
swm3#				Gig1/0/24(P)
swm3#				
swm3#				
swm3#				

❖ Testing LACP on Sydney Branch

All connections from swm1 to all local devices was turned off to test redundancy from swm2.



PC0

```
C:\>ping 2000::11

Pinging 2000::11 with 32 bytes of data:

Reply from 2000::11: bytes=32 time=1ms TTL=128
Reply from 2000::11: bytes=32 time<1ms TTL=128
Reply from 2000::11: bytes=32 time<1ms TTL=128
Reply from 2000::11: bytes=32 time=12ms TTL=128

Ping statistics for 2000::11:
  Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
  Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 12ms, Average = 3ms
```

PC0

```
C:\>ping 2001:a::1

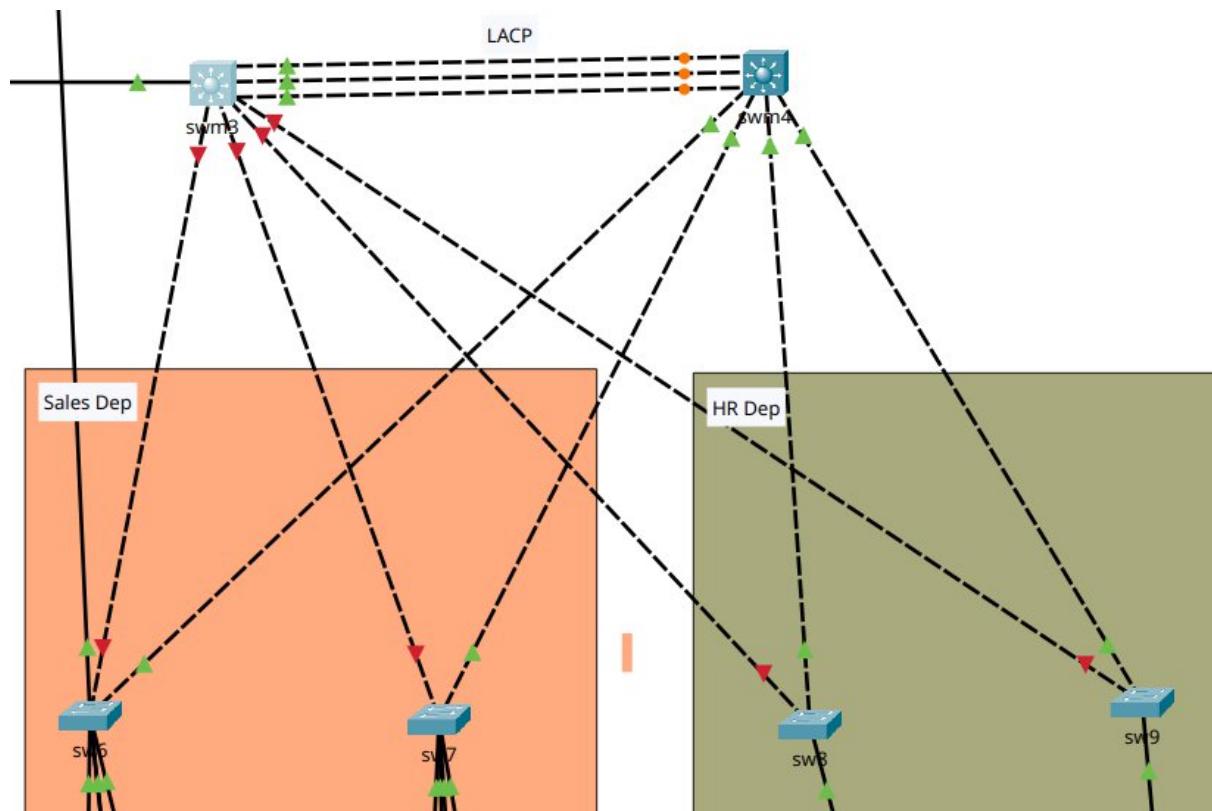
Pinging 2001:a::1 with 32 bytes of data:

Reply from 2001:a::1: bytes=32 time<1ms TTL=253

Ping statistics for 2001:a::1:
  Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
  Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

❖ Testing LACP on Brisbane Branch

All connections from swm3 to all local devices was turned off to test redundancy from swm4.



**Laptop20**

```
Pinging 2001:a::99 with 32 bytes of data:
Reply from 2001:A::99: bytes=32 time=34ms TTL=128
Reply from 2001:A::99: bytes=32 time=20ms TTL=128
Reply from 2001:A::99: bytes=32 time=11ms TTL=128
Reply from 2001:A::99: bytes=32 time=16ms TTL=128

Ping statistics for 2001:A::99:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
```

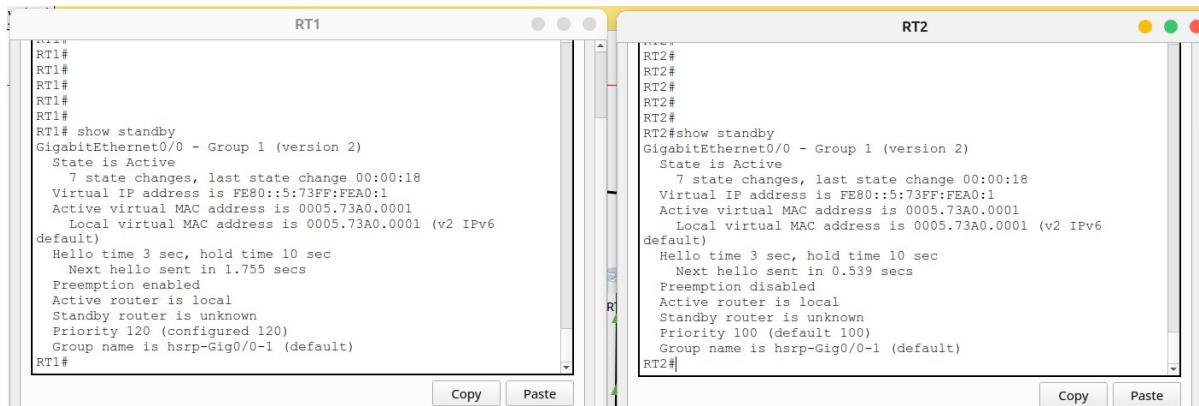
**Smartphone20**

```
Pinging 192.168.10.99 with 32 bytes of data:
Request timed out.
Reply from 192.168.10.99: bytes=32 time=20ms TTL=126
Reply from 192.168.10.99: bytes=32 time=34ms TTL=126
Reply from 192.168.10.99: bytes=32 time=22ms TTL=126

Ping statistics for 192.168.10.99:
Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
```

## 6. Testing HSRPv2 (IPv6)

RT1 is running as a primary (priority 120) and RT2 as a secondary (priority 100).



```

RT1# show standby
GigabitEthernet0/0 - Group 1 (version 2)
  State is Active
    7 state changes, last state change 00:00:18
  Virtual IP address is FE80::5:73FF:FEA0:1
  Active virtual MAC address is 0005.73A0.0001
  Local virtual MAC address is 0005.73A0.0001 (v2 IPv6
default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 1.755 secs
  Preemption enabled
  Active router is local
  Standby router is unknown
  Priority 120 (configured 120)
  Group name is hsrp-Gig0/0-1 (default)
RT1#

```

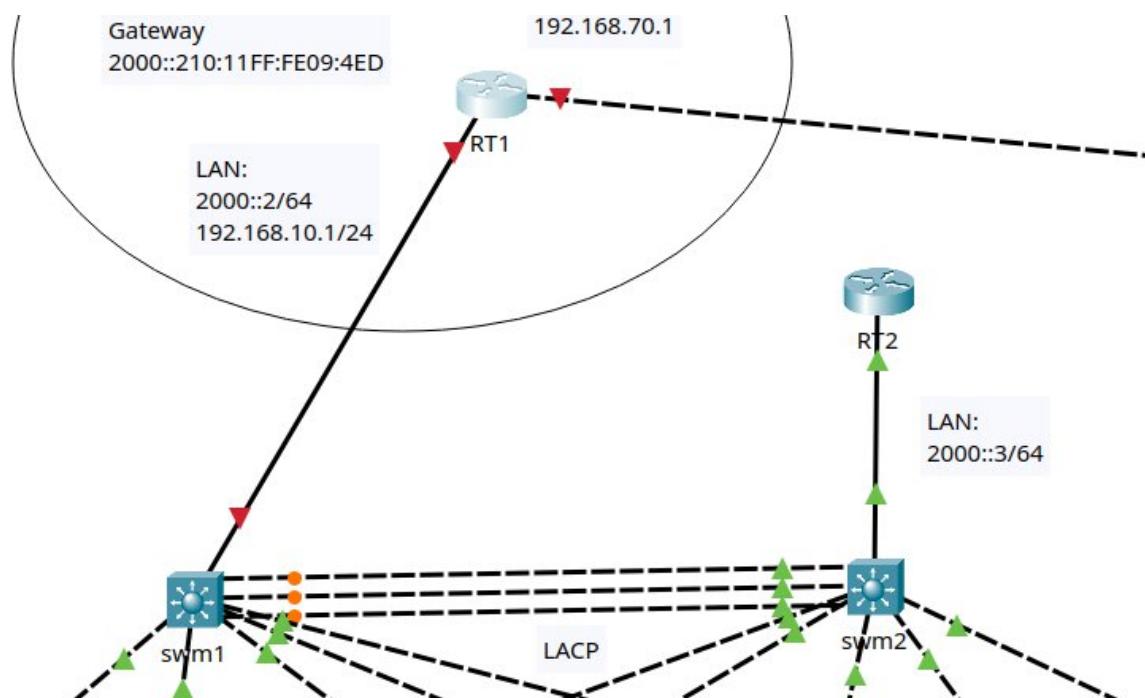
  

```

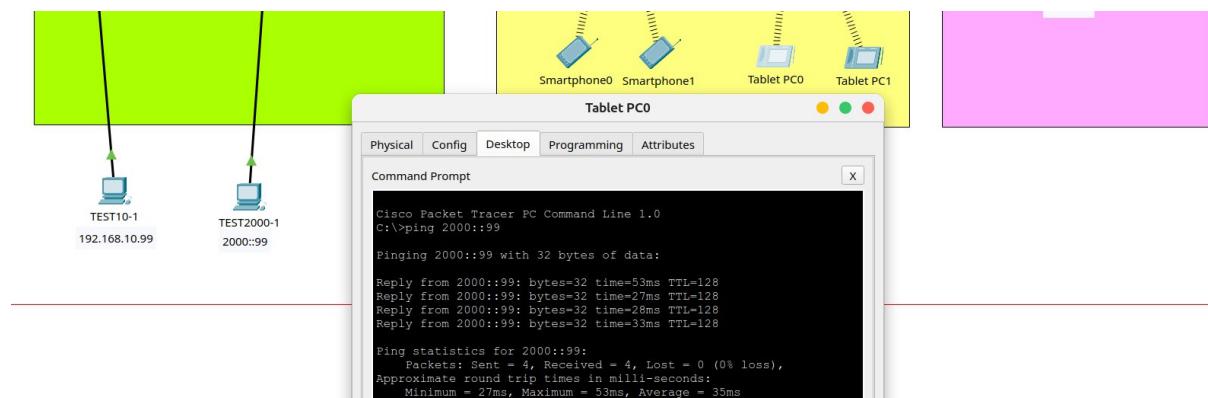
RT2# show standby
GigabitEthernet0/0 - Group 1 (version 2)
  State is Active
    7 state changes, last state change 00:00:18
  Virtual IP address is FE80::5:73FF:FEA0:1
  Active virtual MAC address is 0005.73A0.0001
  Local virtual MAC address is 0005.73A0.0001 (v2 IPv6
default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 0.539 secs
  Preemption disabled
  Active router is local
  Standby router is unknown
  Priority 100 (default 100)
  Group name is hsrp-Gig0/0-1 (default)
RT2#

```

The primary router will be turned off to verify network behaviour.



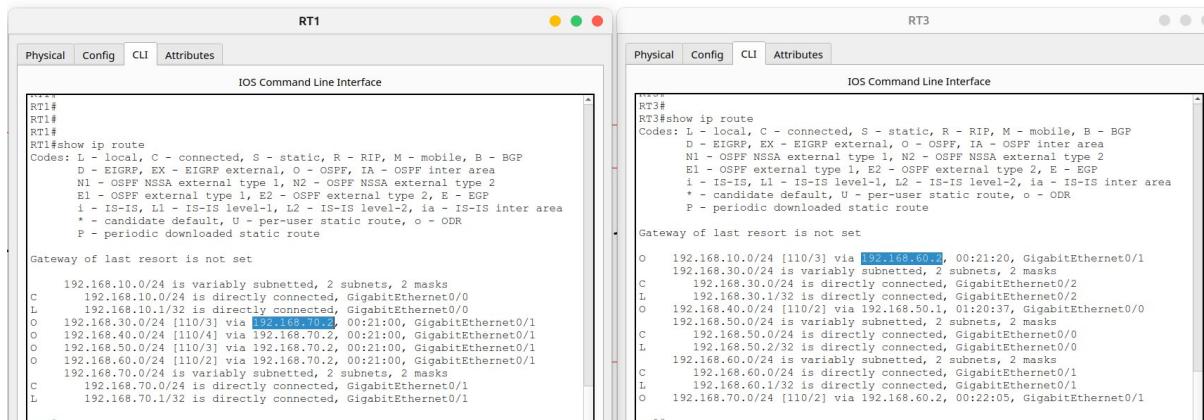
## Testing local connection:



## 7. Testing OSPF/OSPFv3 (IPv4/IPv6)

Routes between devices are proved by OSPF and OSPFv3.

### Communication via WAN interfaces by OSPF



```

RT1# show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

Gateway of last resort is not set

 192.168.10.0/24 is variably subnetted, 2 subnets, 2 masks
   C   192.168.10.1/32 is directly connected, GigabitEthernet0/0
   L   192.168.10.1/32 is directly connected, GigabitEthernet0/0
 O  192.168.30.0/24 [110/3] via 192.168.70.0, 00:21:00, GigabitEthernet0/1
 O  192.168.40.0/24 [110/4] via 192.168.70.2, 00:21:00, GigabitEthernet0/1
 O  192.168.50.0/24 [110/3] via 192.168.70.2, 00:21:00, GigabitEthernet0/1
 O  192.168.60.0/24 [110/2] via 192.168.70.2, 00:21:00, GigabitEthernet0/1
   C   192.168.70.0/24 is variably subnetted, 2 subnets, 2 masks
   C   192.168.70.0/24 is directly connected, GigabitEthernet0/1
   L   192.168.70.0/24 is directly connected, GigabitEthernet0/1

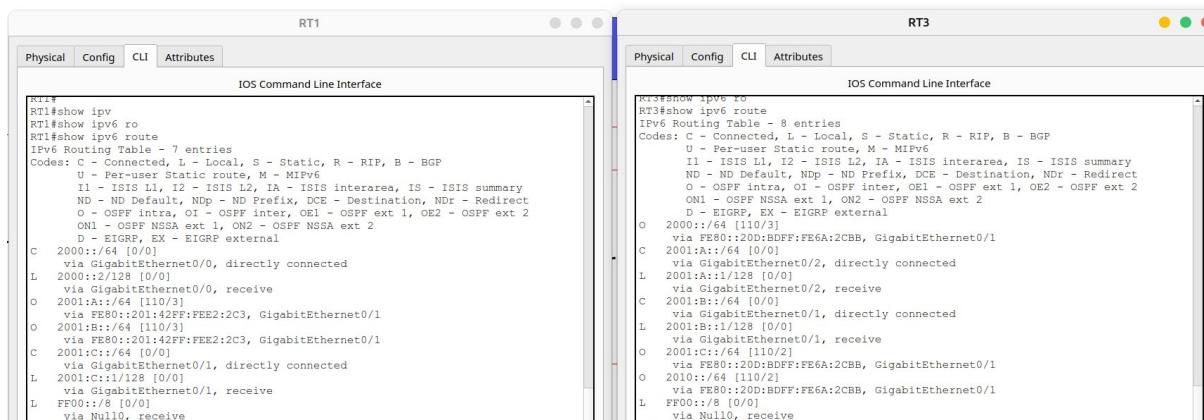
RT3# show ip routes
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

Gateway of last resort is not set

O  192.168.10.0/24 [110/2] via 192.168.60.2, 00:21:20, GigabitEthernet0/1
   C   192.168.30.0/24 is variably subnetted, 2 subnets, 2 masks
   C   192.168.30.1/32 is directly connected, GigabitEthernet0/2
   L   192.168.30.1/32 is directly connected, GigabitEthernet0/2
 O  192.168.40.0/24 [110/2] via 192.168.50.1, 01:20:37, GigabitEthernet0/0
   C   192.168.50.0/24 is variably subnetted, 2 subnets, 2 masks
   C   192.168.50.1/32 is directly connected, GigabitEthernet0/0
   L   192.168.50.2/32 is directly connected, GigabitEthernet0/0
   C   192.168.60.0/24 is variably subnetted, 2 subnets, 2 masks
   C   192.168.60.1/32 is directly connected, GigabitEthernet0/1
   L   192.168.60.1/32 is directly connected, GigabitEthernet0/1
 O  192.168.70.0/24 [110/2] via 192.168.60.2, 00:22:05, GigabitEthernet0/1

```

### Communication via WAN interfaces by OSPFv3



```

RT1# show ipv6 route
RT1# show ipv6 ro
RT1# show ipv6 route
IPv6 Routing Table - 7 entries
Codes: C - Connected, L - Local, S - Static, R - RIP, B - BGP
      U - Per-user Static route, M - MIPv6
      I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary
      ND - ND Default, NDP - ND Prefix, DCE - Destination, NDR - Redirect
      O - OSPF intra, OI - OSPF inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
      ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
      D - EIGRP, EX - EIGRP external
C  2000::/64 [0/0]
  via Null0, GigabitEthernet0/0, directly connected
L  2000::1/128 [0/0]
  via GigabitEthernet0/0, receive
O  2001::/64 [110/3]
  via FE80::201:42FF:FEE2:2C3, GigabitEthernet0/1
O  2001::/64 [110/3]
  via FE80::201:42FF:FEE2:2C3, GigabitEthernet0/1
C  2001::/64 [0/0]
  via GigabitEthernet0/1, directly connected
L  2001::1/128 [0/0]
  via GigabitEthernet0/2, receive
C  2001::/64 [0/0]
  via GigabitEthernet0/2, directly connected
L  2001::1/128 [0/0]
  via GigabitEthernet0/1, receive
O  2001::/64 [110/2]
  via FE80::200:2DDFF:FE6A:2CBB, GigabitEthernet0/1
O  2001::/64 [110/2]
  via FE80::20D:BDFF:FE6A:2CBB, GigabitEthernet0/1
L  FF00::/8 [0/0]
  via Null0, receive

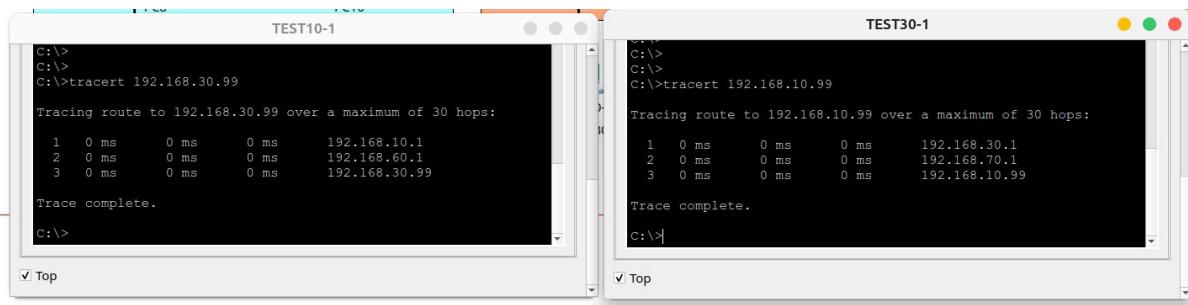
RT3# show ipv6 routes
RT3# show ipv6 routes
Codes: C - Connected, L - Local, S - Static, R - RIP, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

Gateway of last resort is not set

O  2000::/64 [110/3]
  via FE80::20D:BDFF:FE6A:2CBB, GigabitEthernet0/1
  via GigabitEthernet0/2, directly connected
L  2001::/64 [0/0]
  via GigabitEthernet0/2, receive
C  2001::/64 [0/0]
  via GigabitEthernet0/1, directly connected
L  2001::1/128 [0/0]
  via GigabitEthernet0/1, receive
O  2001::/64 [110/2]
  via FE80::200:2DDFF:FE6A:2CBB, GigabitEthernet0/1
O  2001::/64 [110/2]
  via FE80::20D:BDFF:FE6A:2CBB, GigabitEthernet0/1
L  FF00::/8 [0/0]
  via Null0, receive

```

- ❖ Bidirectional connectivity testing between Sydney Branch and Brisbane Branch over IPv4



TEST10-1

```
C:\>
C:\>
C:\>tracert 192.168.30.99
Tracing route to 192.168.30.99 over a maximum of 30 hops:
  1  0 ms      0 ms      0 ms      192.168.10.1
  2  0 ms      0 ms      0 ms      192.168.60.1
  3  0 ms      0 ms      0 ms      192.168.30.99

Trace complete.

C:\>
```

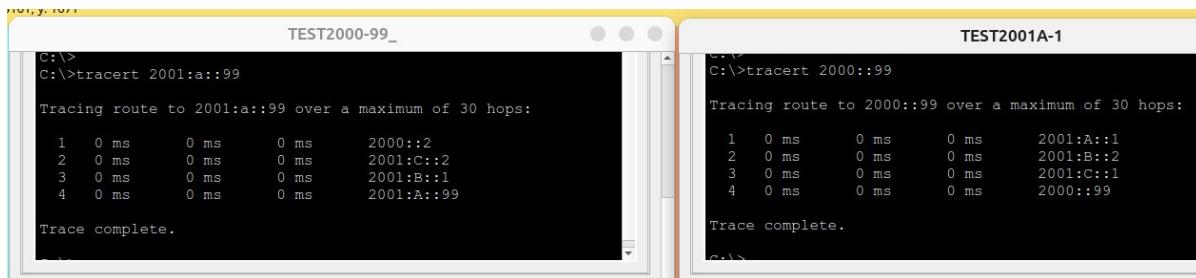
TEST30-1

```
C:\>
C:\>
C:\>tracert 192.168.10.99
Tracing route to 192.168.10.99 over a maximum of 30 hops:
  1  0 ms      0 ms      0 ms      192.168.30.1
  2  0 ms      0 ms      0 ms      192.168.70.1
  3  0 ms      0 ms      0 ms      192.168.10.99

Trace complete.

C:\>|
```

- ❖ Bidirectional connectivity testing between Sydney Branch and Brisbane Branch over IPv6



TEST2000-99\_

```
C:\>
C:\>tracert 2001:a::99
Tracing route to 2001:a::99 over a maximum of 30 hops:
  1  0 ms      0 ms      0 ms      2000::2
  2  0 ms      0 ms      0 ms      2001:C::2
  3  0 ms      0 ms      0 ms      2001:B::1
  4  0 ms      0 ms      0 ms      2001:A::99

Trace complete.
```

TEST2001A-1

```
C:\>
C:\>tracert 2000::99
Tracing route to 2000::99 over a maximum of 30 hops:
  1  0 ms      0 ms      0 ms      2001:A::1
  2  0 ms      0 ms      0 ms      2001:B::2
  3  0 ms      0 ms      0 ms      2001:C::1
  4  0 ms      0 ms      0 ms      2000::99

Trace complete.

C:\>|
```

## 8. Testing ACL (IPv4)

### Current Configuration:

```
RT1
RT1#
RT1#show access-lists
Extended IP access list 110
    10 permit ip 192.168.10.0 0.0.0.255 192.168.30.0 0.0.0.255
    20 permit ip 192.168.10.0 0.0.0.255 192.168.40.0 0.0.0.255
(1 match(es))
    30 permit ip 192.168.30.0 0.0.0.255 192.168.10.0 0.0.0.255
    40 permit ip 192.168.40.0 0.0.0.255 192.168.10.0 0.0.0.255

RT3
RT3#
RT3#show access-lists
Extended IP access list 110
    10 permit ip 192.168.30.0 0.0.0.255 192.168.10.0 0.0.0.255
(1 match(es))
    20 permit ip 192.168.30.0 0.0.0.255 192.168.40.0 0.0.0.255
    30 permit ip 192.168.10.0 0.0.0.255 192.168.30.0 0.0.0.255
    40 permit ip 192.168.40.0 0.0.0.255 192.168.30.0 0.0.0.255

RT4
RT4#
RT4#show ac
RT4#show access-lists
Extended IP access list 110
    10 permit ip 192.168.40.0 0.0.0.255 192.168.10.0 0.0.0.255
(1 match(es))
    20 permit ip 192.168.40.0 0.0.0.255 192.168.30.0 0.0.0.255
(1 match(es))
    30 permit ip 192.168.10.0 0.0.0.255 192.168.40.0 0.0.0.255
    40 permit ip 192.168.30.0 0.0.0.255 192.168.40.0 0.0.0.255
```

- ❖ Test current connectivity from PC-Test (Brisbane IPv4) to PC-Test (Sydney IPv4)

**TEST30-1**

```
CISCO PACKET TRACER FC COMMAND LINE 1.0
C:>ping 192.168.10.99

Pinging 192.168.10.99 with 32 bytes of data:

Request timed out.
Reply from 192.168.10.99: bytes=32 time=11ms TTL=126
Reply from 192.168.10.99: bytes=32 time<1ms TTL=126
Reply from 192.168.10.99: bytes=32 time=7ms TTL=126

Ping statistics for 192.168.10.99:
  Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
  Minimum = 0ms, Maximum = 11ms, Average = 6ms
```

- ❖ Test deny connectivity from PC-Test (Brisbane IPv4) to PC-Test (Sydney IPv4)

Rule changed on R1 to deny traffic from 192.168.10.99:

**RT1**

```
RT1#
RT1#
RT1#
RT1#
RT1#show access-lists
Extended IP access list 110
  10 deny ip 192.168.10.0 0.0.0.255 192.168.30.0 0.0.0.255
  20 deny ip 192.168.30.0 0.0.0.255 192.168.10.0 0.0.0.255
RT1#
```

Copy      Paste

**TEST30-1**

```
C:>ping 192.168.10.99

Pinging 192.168.10.99 with 32 bytes of data:

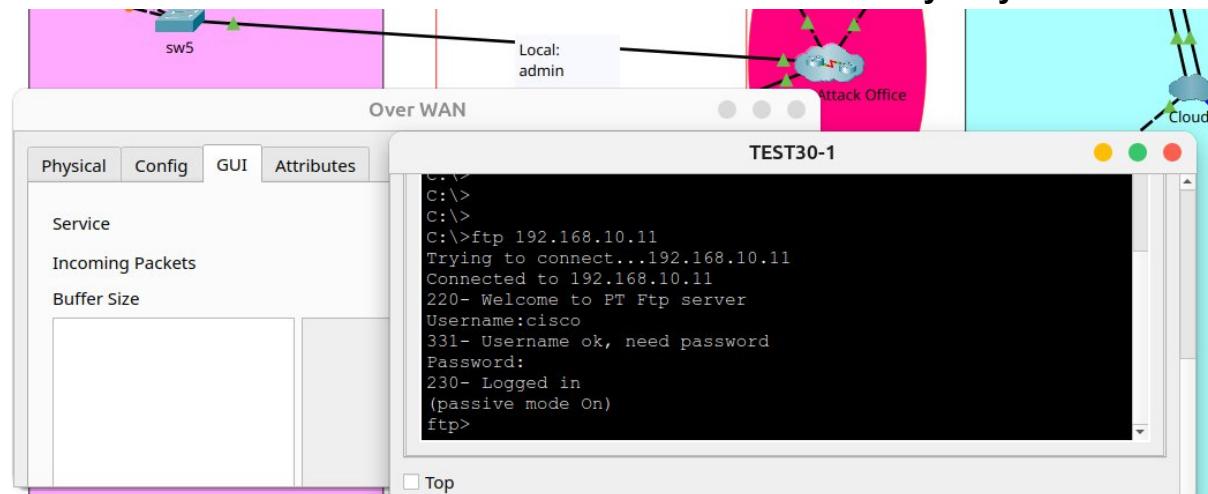
Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 192.168.10.99:
  Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
C:>
```

## 9. Testing VPN Site-To-Site (IPv4)

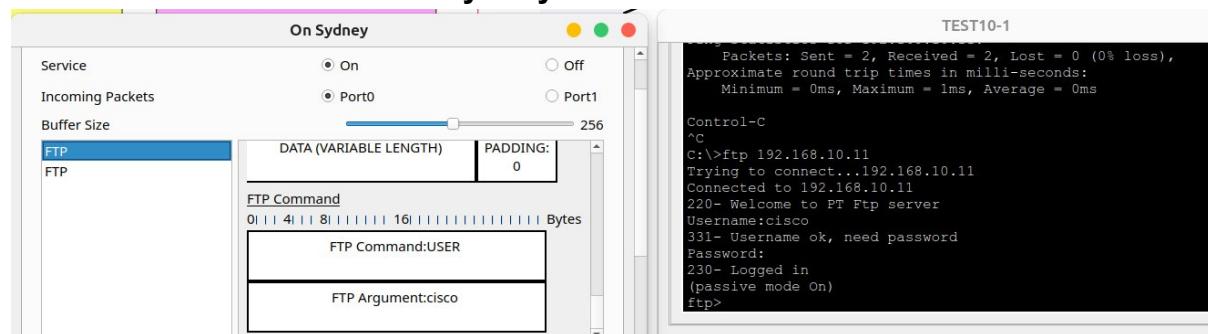
- ❖ Internet connection intercepted by a criminal sniffer (secure by VPN tunnel)

### FTP connection from PC on Brisbane Branch to Server on Sydney



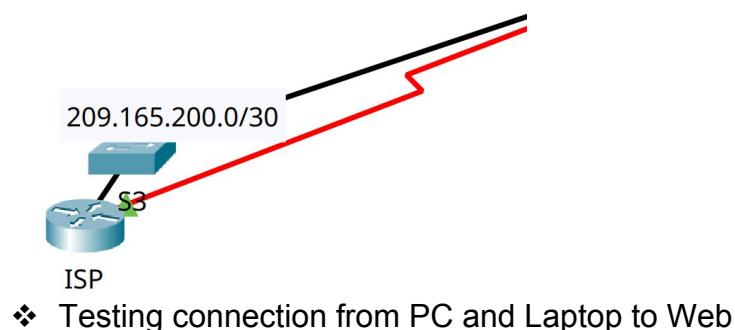
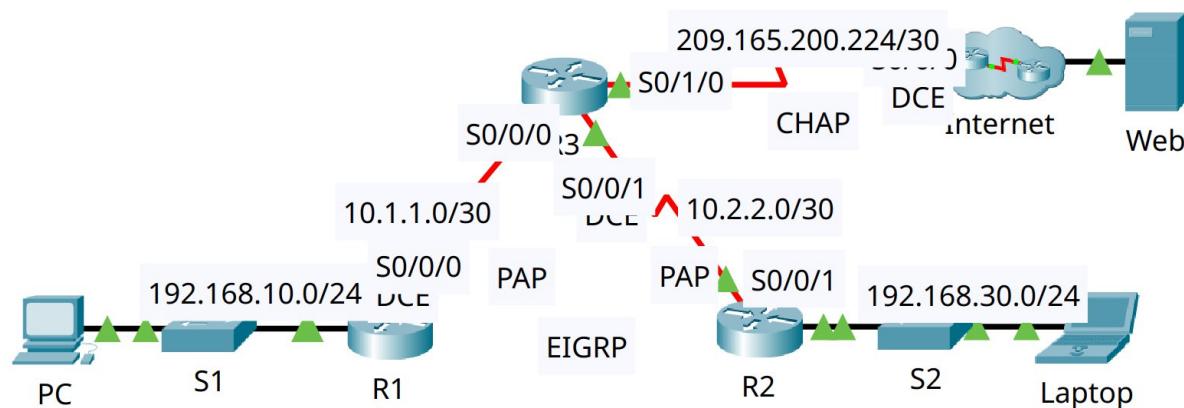
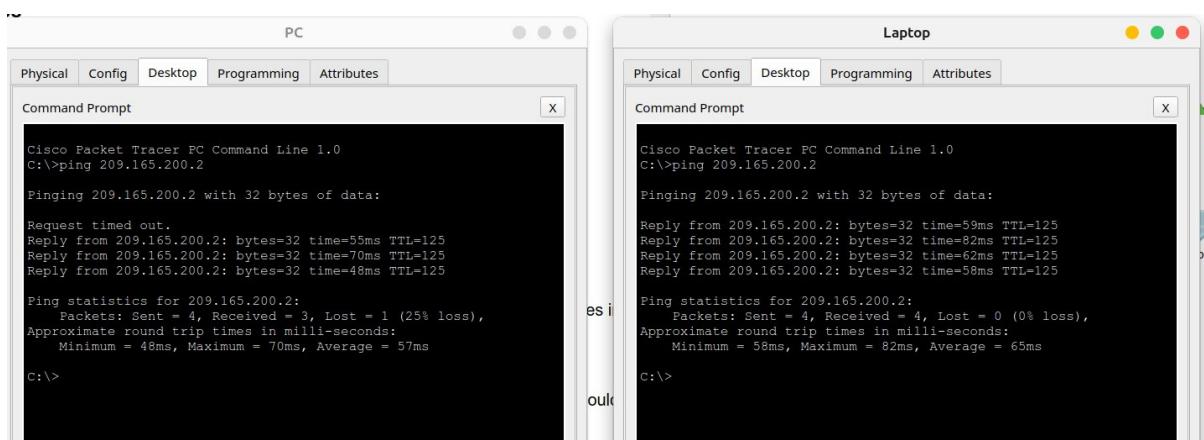
- ❖ Local connection intercepted by a criminal sniffer (no secure Lan connection)

### FTP connection from PC on Sydney Local Network



## 10. Testing Encapsulation PPP (IPv4)

Applied on Routers R1, R2, R3 and ISP. Using CHAP as an automatic authentication method instead of PAP.

The screenshot shows two windows from Cisco Packet Tracer:

- PC** window: Shows a ping command to **209.165.200.2**. The output indicates a 25% loss of packets.
- Laptop** window: Shows a ping command to **209.165.200.2**. The output indicates 0% loss of packets.

```

Cisco Packet Tracer PC Command Line 1.0
C:\>ping 209.165.200.2

Pinging 209.165.200.2 with 32 bytes of data:
Request timed out.
Reply from 209.165.200.2: bytes=32 time=55ms TTL=125
Reply from 209.165.200.2: bytes=32 time=70ms TTL=125
Reply from 209.165.200.2: bytes=32 time=48ms TTL=125

Ping statistics for 209.165.200.2:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 46ms, Maximum = 70ms, Average = 57ms

C:\>

Cisco Packet Tracer FC Command Line 1.0
C:\>ping 209.165.200.2

Pinging 209.165.200.2 with 32 bytes of data:
Reply from 209.165.200.2: bytes=32 time=59ms TTL=125
Reply from 209.165.200.2: bytes=32 time=82ms TTL=125
Reply from 209.165.200.2: bytes=32 time=62ms TTL=125
Reply from 209.165.200.2: bytes=32 time=58ms TTL=125

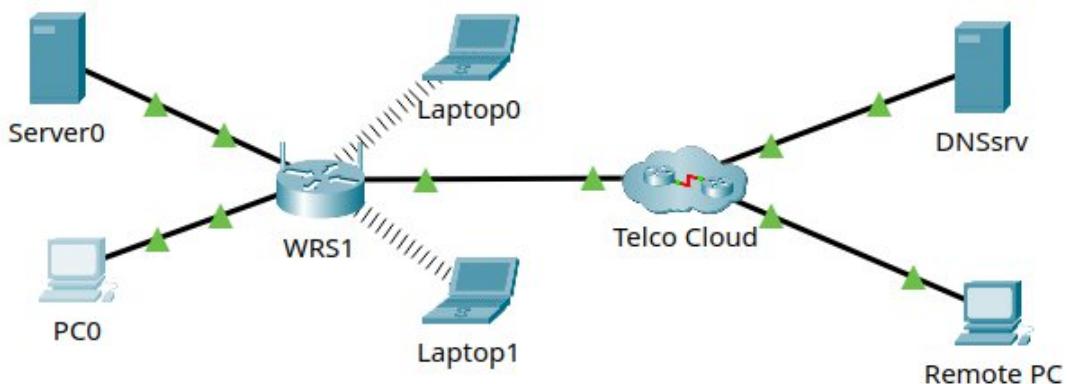
Ping statistics for 209.165.200.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 56ms, Maximum = 82ms, Average = 65ms

C:\>
  
```

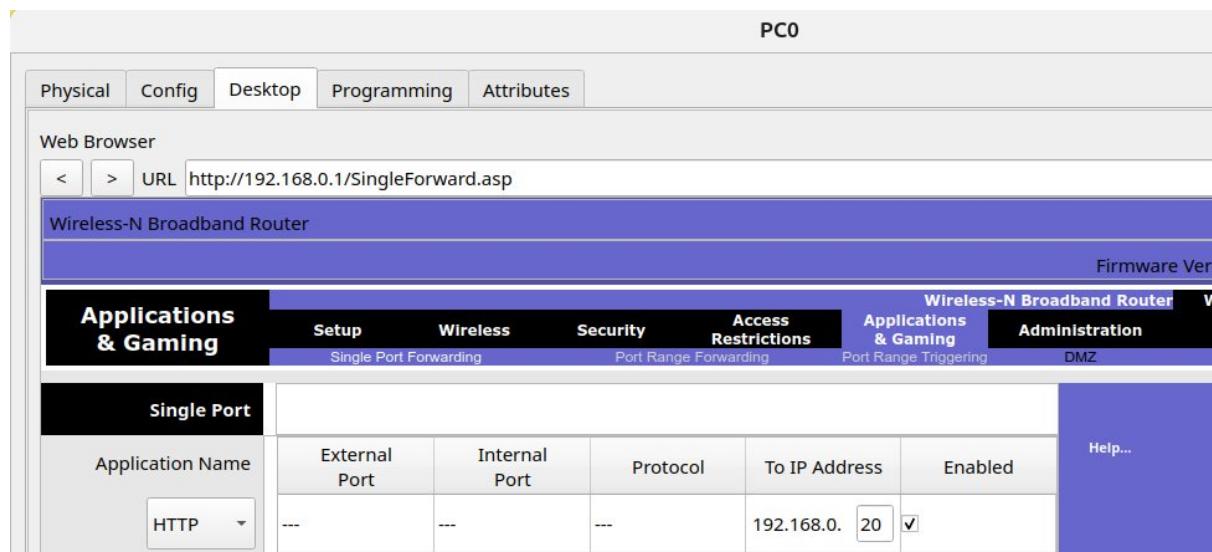
## 11. Testing Firewall and Single-port

Firewall and single-port tests were performed on the file submitted in class due to extra complexity over my network.

Network:



Configuration – Single-Port enabled:



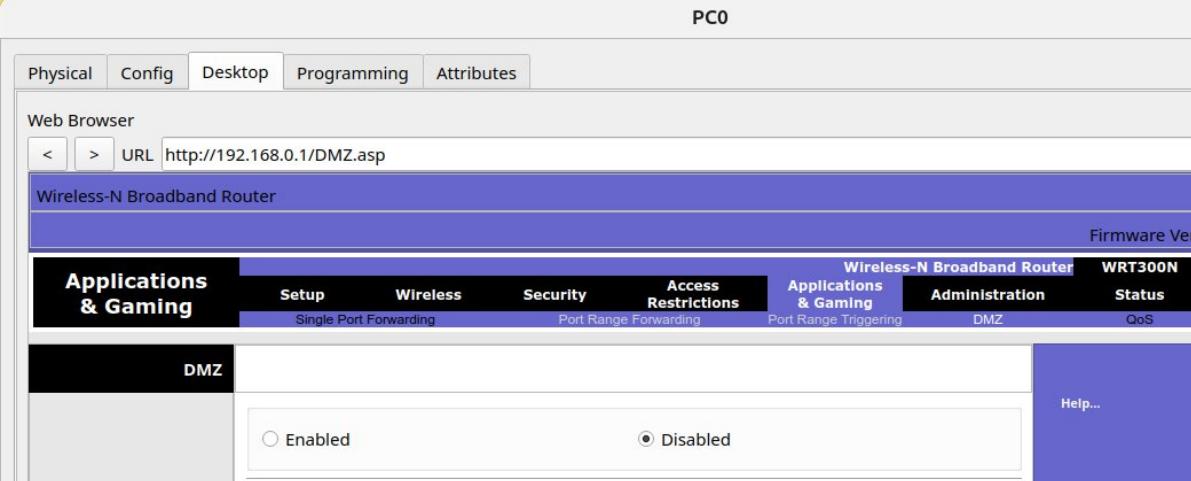
The screenshot shows a web-based configuration interface for a 'Wireless-N Broadband Router'. The top navigation bar includes tabs for Physical, Config, Desktop, Programming, and Attributes. Below this, there are sections for Web Browser (URL: http://192.168.0.1/SingleForward.asp) and Firmware Version.

The main content area features a navigation menu with Applications & Gaming, Setup, Wireless, Security, Access Restrictions, Applications & Gaming, and Administration tabs. The Applications & Gaming tab is active, and its sub-section is Single Port Forwarding. The interface displays a table for configuring single port forwarding rules.

Application Name	External Port	Internal Port	Protocol	To IP Address	Enabled
HTTP	---	---	---	192.168.0.20	<input checked="" type="checkbox"/>

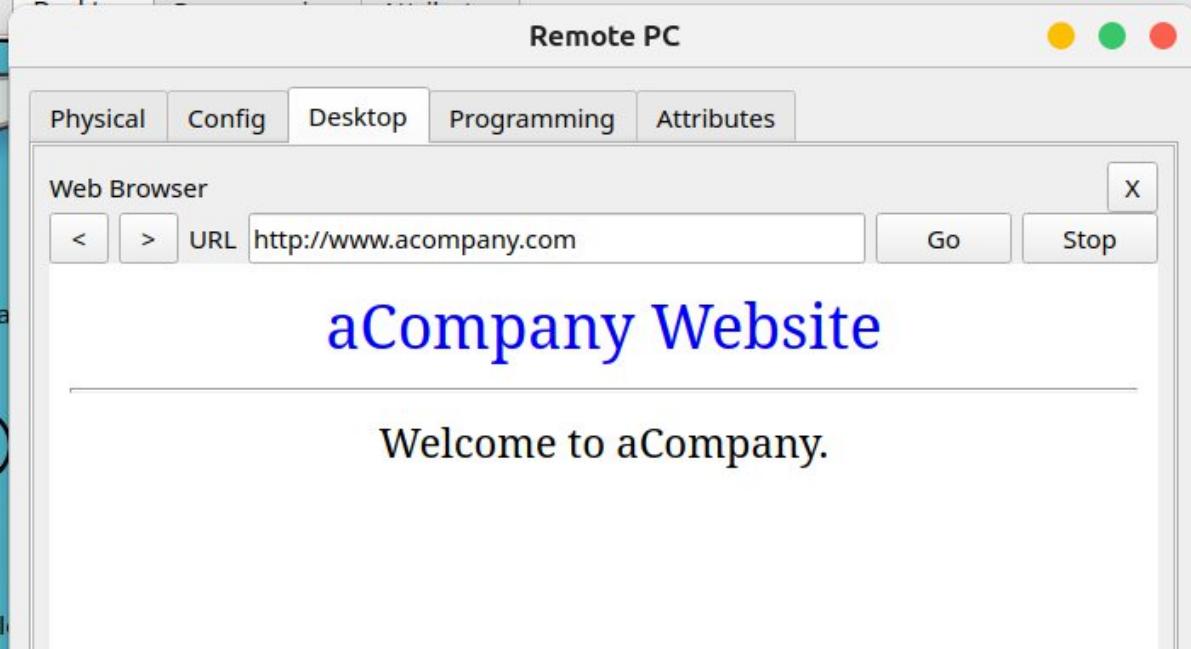
A help button is located on the right side of the table.

Configuration – DMZ disabled:



The screenshot shows the configuration interface for a Wireless-N Broadband Router. The top navigation bar includes tabs for Physical, Config, Desktop, Programming, and Attributes. Below this is a Web Browser section with a URL field containing <http://192.168.0.1/DMZ.asp>. The main content area has a blue header bar labeled "Wireless-N Broadband Router" and "Firmware Vers". Below this is a navigation menu with tabs for Applications & Gaming, Setup, Wireless, Security, Access Restrictions, Wireless-N Broadband Router, WRT300N, Administration, DMZ, and QoS. The Applications & Gaming tab is currently selected. Under the Applications & Gaming tab, there are three sub-sections: Single Port Forwarding, Port Range Forwarding, and Port Range Triggering. The Port Range Forwarding section is active. In the DMZ section, there are two radio buttons: "Enabled" (unchecked) and "Disabled" (checked). A "Help..." link is located on the right side of the interface.

- ❖ Testing connection from Remote PC to WEB Server

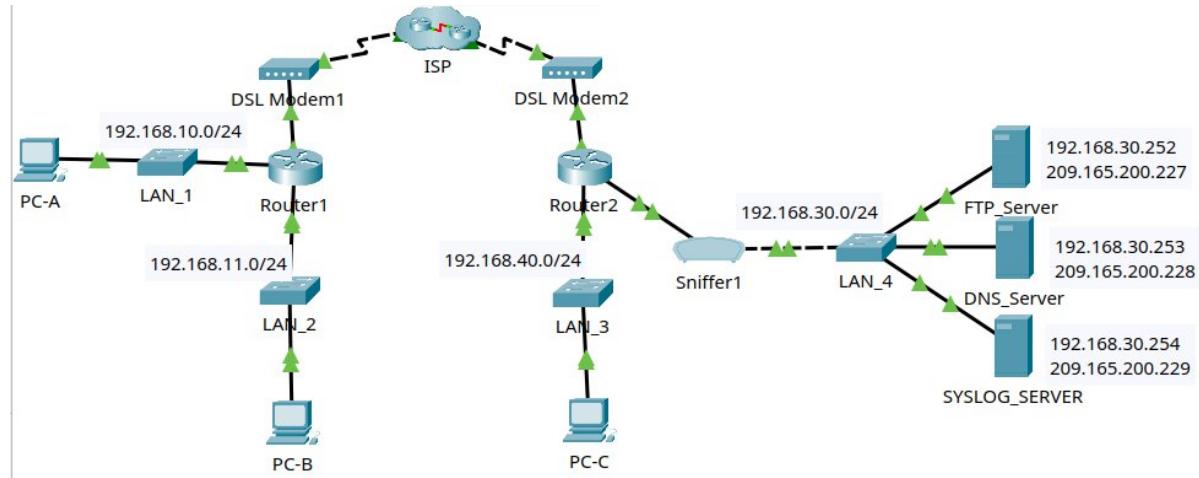


The screenshot shows a web browser window titled "Remote PC". The browser interface includes a toolbar with Physical, Config, Desktop, Programming, and Attributes tabs. Below the toolbar is a Web Browser section with a URL field containing <http://www.acompany.com>, a Go button, and a Stop button. The main content area displays the "aCompany Website" with the heading "Welcome to aCompany.".

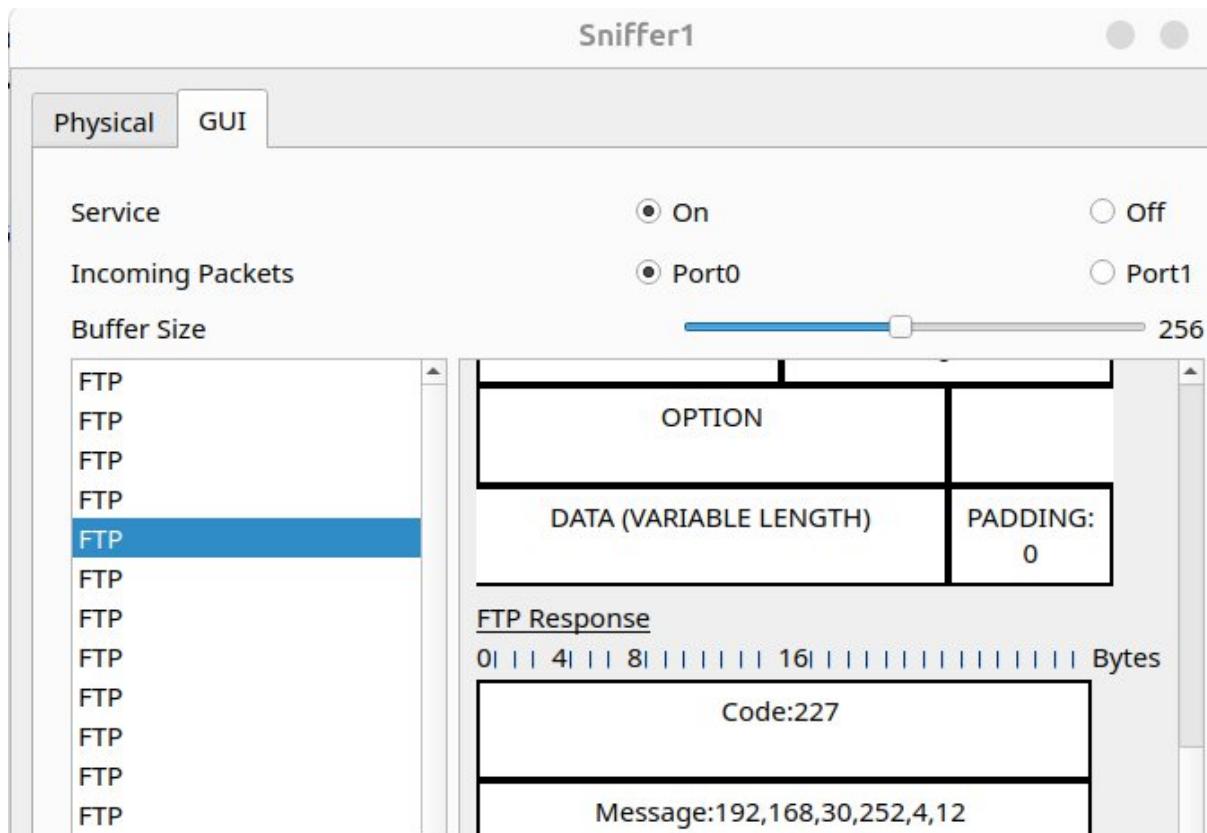
## 12. Logging Network

Logging network test were performed on the file submitted in class due to extra complexity over my network.

Network:



- ❖ Vulnerability: FTP messages are being transmitted in clear-text



The screenshot shows the **Sniffer1** tool interface with the following settings:

- Physical** tab is selected.
- Service**:  On,  Off
- Incoming Packets**:  Port0,  Port1
- Buffer Size**: 256

The left pane lists captured packets, with the **FTP** packet highlighted in blue. The right pane displays the packet structure:

OPTION	
DATA (VARIABLE LENGTH)	PADDING: 0

**FTP Response** details:

- Code: 227
- Message: 192,168,30,252,4,12

- ❖ Echo replies from PC-A/B to R2 its destination is WAN interface of R2

Syslog

Service

On  Off

Time	HostName	Message
1 02.13.2020 06:53:22.804 AM	192.168.30.1	...
2 02.13.2020 06:53:23.895 AM	192.168.30.1	[ICMP: echo reply sent, src 209.165.200.226, dst 209.165.200.225]
3 02.13.2020 06:53:25.050 AM	192.168.30.1	...
4 02.13.2020 06:53:26.160 AM	192.168.30.1	...
5 02.13.2020 06:53:49.033 AM	192.168.30.1	...
6 02.13.2020 06:53:50.151 AM	192.168.30.1	...
7 02.13.2020 06:53:51.267 AM	192.168.30.1	...
8 02.13.2020 06:53:52.382 AM	192.168.30.1	...

- ❖ Echo replies from R2 to PC-C its destination is LAN interface of R2 (because is its local network)

Syslog

Service

On  Off

Time	HostName	Message
1 02.13.2020 ...	192.168.30.1	[0.1, dst 192.168.40.2]
2 02.13.2020 ...	192.168.30.1	...
3 02.13.2020 ...	192.168.30.1	...
4 02.13.2020 ...	192.168.30.1	...

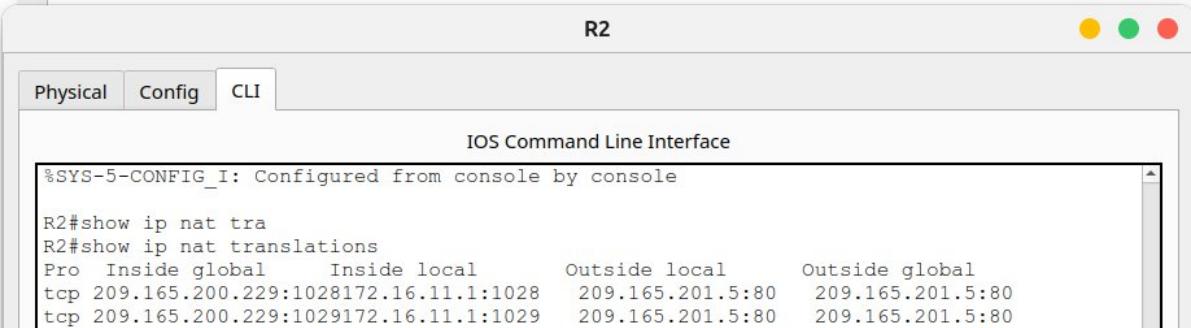
## 13. Dynamic NAT

Dynamic NAT were performed on the file submitted in class due to extra complexity over my network.

### Router 2 (R2)

```
enable
configure terminal
!
!Standard ACL Configuration
access-list 1 permit 172.16.0.0 0.0.255.255
!
!exit
!Pool for NAT 209.165.200.228 209.165.200.229
ip nat pool micpool 209.165.200.228 209.165.200.229 netmask
255.255.255.252
!
!Mapping ACL with pool
ip nat inside source list 1 pool micpool
!
!Define NAT interfaces for inside and outside
ip nat inside source list 1 pool micpool
interface serial 0/0/1
ip nat inside
exit
!
interface serial 0/0/0
ip nat outside
exit
!
```

## ❖ NAT Translations



R2

Physical Config CLI

IOS Command Line Interface

```
%SYS-5-CONFIG_I: Configured from console by console
R2#show ip nat tra
R2#show ip nat translations
Pro Inside global     Inside local      Outside local      Outside global
tcp 209.165.200.229:1028172.16.11.1:1028  209.165.201.5:80  209.165.201.5:80
tcp 209.165.200.229:1029172.16.11.1:1029  209.165.201.5:80  209.165.201.5:80
```

## ❖ Testing WEB connection



# Summary Technologies & Protocols

## **DHCP (Dynamic Host Configuration Protocol):**

Automatically assigns IP, gateway, and DNS addresses to devices on the network

## **LACP (Link Aggregation Control Protocol):**

Combines several physical links to form a single logical link for the purpose of increasing bandwidth also providing redundancy when one of the switches fails.

## **HSRP (Hot Standby Router Protocol):**

Provides redundancy. If the primary router fails, another router automatically takes over, ensuring service continuity.

## **OSPF (Open Shortest Path First):**

Dynamic routing that allows the calculation of the most efficient route to send packets in a network.

## **ACLs (Access Control Lists):**

Rules applied to allow or deny traffic. They are used to filter traffic and improve security.

## **VPN IPsec (Internet Protocol Security):**

Creates secure (encrypted) connections over the Internet between two networks (site-to-site), protecting data confidentiality and integrity.

## **PPP Authentication (Point-to-Point Protocol Authentication):**

Responsible for establishing point-to-point connections and provides encapsulation to facilitate the connection. Also supports authentication mechanisms (CHAP) between two network devices to add an additional layer of security.

## **Dynamic NAT (Dynamic Network Address Translation):**

Map a public network to multiple private networks on a WAN to communicate with external IPs.

# Bibliography

- ❖ Network System: [Gurutech Networking Training - Secure Network Training](#)
- ❖ DHCPv6 Router: [Gurutech Networking Training - DHCPv6](#)
- ❖ DHCPv6 stateless-stateful: [ShefferKimanzi - DCHP v6 configuration](#)
- ❖ LACP: [ITExamAnswers.net - Configure EtherChannel I](#)
- ❖ HRSP v2 IPv6: [Packet Tracer Network - HSRP Configuration](#)
- ❖ IPCisco.com: [ADSL IPv6](#)
- ❖ ACLs: [Packet Tracer Network - ACLs](#)
- ❖ OSPFv3: [Networking Academy - IPv6 OSPFv3](#)
- ❖ OSPf: [Computer Networking - OSPF](#)
- ❖ VPN IPsec tunnel (site-to-site): [Abdullah Irfan, Medium, VPN tunnel](#)
- ❖ VPN site-to-site, IPsec: [Gurutech Networking Training - VPN IPsec](#)
- ❖ SSH: [Sheffer Kimanzi, Configuring ssh](#)
- ❖ Telnet: [Sheffer Kimanzi, Configuring telnet](#)
- ❖ Dynamic NAT: [ComputerNetworkingNotes - Dynamic NAT](#)

## ISSUES:

- I was using wrong gateway in IPv6, gateway must be ID IPv6 network. Now, connection from/to 192.168.40.1 is working.