# CERTIFICATE

Class - TYBSCIT YEAR - 2024-25

This is to certify that the work entered in this journal is the work of Shri/kumari

Of **TYBSCIT** division- Roll no-

Has satisfactorily completed the required number of practical and worked for term of the year 2024 to 2025 in the college laboratory as laid down by the university.

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| Head of Department | External Examiner | Internal Examiner Subject Teacher |

**Date**

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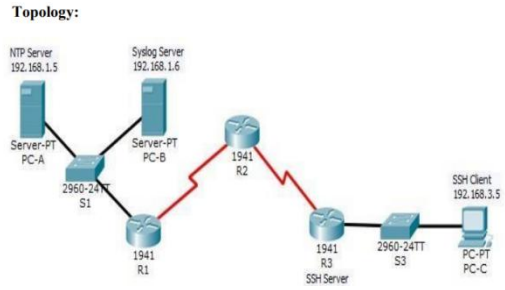
## Practical 1: Configure Routers for Syslog, NTP and SSH operation

Topology:




Addressing Table:

| Device | Interface | IP Address | Subnet Mask | Default Gateway |
|---|---|---|---|---|
| R1 | gig0/0 | 192.168.1.1 | 255.255.255.0 | N/A |
| | Se0/1/0 | 10.1.1.1 | 255.255.255.252 | N/A |
| R2 | Se0/1/0 | 10.1.1.2 | 255.255.255.252 | N/A |
| | Se0/1/1 | 10.2.2.2 | 255.255.255.252 | N/A |
| R3 | gig0/0 | 192.168.3.1 | 255.255.255.0 | N/A |
| | Se0/1/0 | 10.2.2.1 | 255.255.255.252 | N/A |
| PC-A | NIC | 192.168.1.5 | 255.255.255.0 | 192.168.1.1 |
| PC-B | NIC | 192.168.1.6 | 255.255.255.0 | 192.168.1.1 |
| PC-C | NIC | 192.168.3.5 | 255.255.255.0 | 192.168.3.1 |

### Objectives:

- Configure OSPF MD5 authentication.
- Configure NTP.
- Configure routers to log messages to the syslog server.
- Configure R3 to support SSH connections.

### ■ Configure Router with password

**Step 1: Configure password for vty lines**

Execute Command on all routers

R>en

R>conf t

R(config) # line vty 0 4

R(config-line) #password vtypa55

R(config-line) #login

R(config-line) #exit

**Step 2: Configure secret on router**

Execute Command on all routers

R(config) # enable secret enpa55

**Step 3: Configure OSPF on routers**

R1(config) #router ospf 1

R1(config-router) #network 192.168.1.0 0.0.0.255 area 0

R1(config-router) #network 10.1.1.0 0.0.0.3 area 0

R2(config) #router ospf 1

R2(config-router) #network 10.1.1.0 0.0.0.3 area 0

R2(config-router) #network 10.2.2.0 0.0.0.3 area 0

R3(config) #router ospf 1

R3(config-router) #network 192.168.3.0 0.0.0.255 area 0

R3(config-router) #network 10.2.2.0 0.0.0.3 area 0

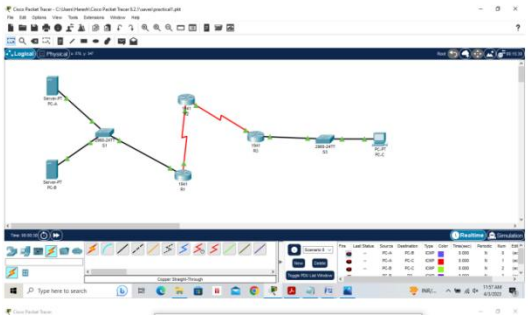
**Step 4: Test Connectivity**

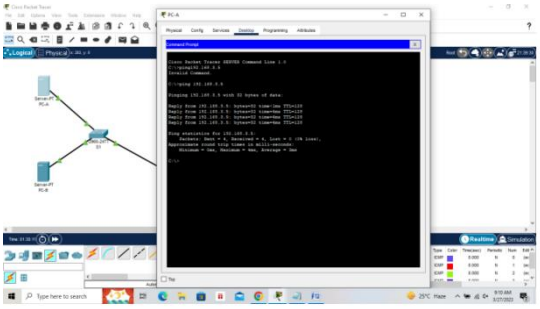
PC-A > ping 192.168.3.5

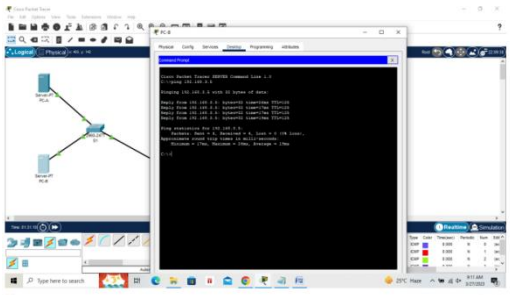
Successful

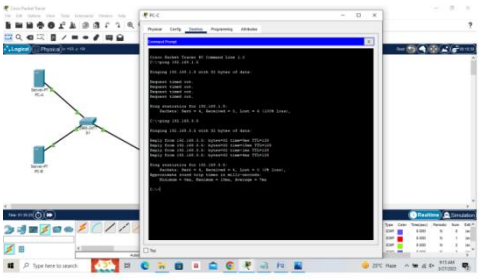
PC-B > ping 192.168.3.5

Successful









**Part 1: Configure OSPF MD5 Authentication**

**Step 1: Test connectivity. All devices should be able to ping all other IP addresses.**

**Step 2: Configure OSPF MD5 authentication for all routers in area 0.**

R1(config)# router ospf 1

R1(config-router)# area 0 authentication message-digest

R1(config-router)#exit

R2(config)# router ospf 1

R2(config-router)# area 0 authentication message-digest

R2(config-router)#exit

R3(config)# router ospf 1

R3(config-router)# area 0 authentication message-digest

R3(config-router)#exit

**Step 3: Configure the MD5 key for all the routers in area 0. Configure an MD5 key on the serial interfaces on R1, R2 and R3. Use the password MD5pa55 for key 1.**

R1(config)# interface s0/1/0

R1(config-if)# ip ospf message-digest-key 1 md5 MD5pa55

R2(config)# interface s0/1/0

R2(config-if)# ip ospf message-digest-key 1 md5 MD5pa55

R2(config-if)# interface s0/1/1

R2(config-if)# ip ospf message-digest-key 1 md5 MD5pa55

R3(config)# interface s0/1/0

R3(config-if)# ip ospf message-digest-key 1 md5 MD5pa55

**Step 4: Verify configurations.**

a. Verify the MD5 authentication configurations using the commands show ip ospf interface.

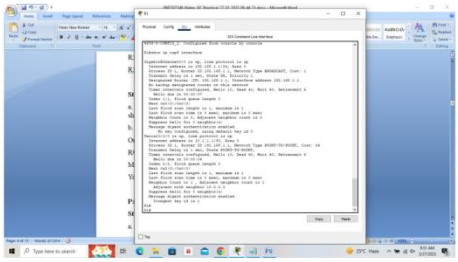
b. Verify end-to-end connectivity.

Output should be shown in all the routers :

R# show ip ospf interface

Message-digest Authentication Enabled

Youngest key ID is 1



**Part 2: Configure NTP**

**Step 1: Enable NTP authentication on PC-A.**

a. On PC-A, click NTP under the Services tab to verify NTP service is enabled.

b. To configure NTP authentication, click Enable under Authentication. Use key 1 and password NTPpa55for authentication.

**Step 2: Configure R1, R2, and R3 as NTP clients.**

R1(config)# ntp server 192.168.1.5

R2(config)# ntp server 192.168.1.5

R3(config)# ntp server 192.168.1.5

**Verify client configuration using the command show ntp status.**

**Step 3: Configure routers to update hardware clock. Configure R1, R2, and R3 to periodically update the hardware clock with the time learned from NTP.**

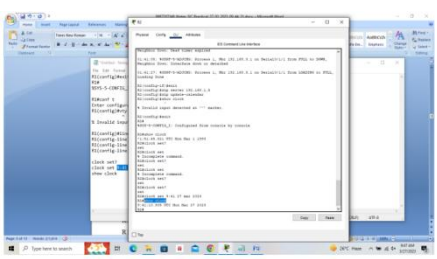
R1(config)# ntp update-calendar

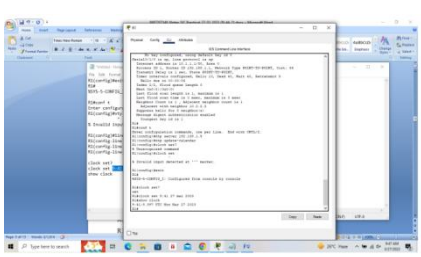
R2(config)# ntp update-calendar

R3(config)# ntp update-calendar

**Verify that the hardware Clock was Updated**

R# show clock





**Step 4: Configure NTP authentication on the routers. Configure NTP authentication on R1, R2, and R3 using key 1 and password NTPpa55**.

R1(config)# ntp authenticate

R1(config)# ntp trusted-key 1

R1(config)# ntp authentication-key 1 md5 NTPpa55

R2(config)# ntp authenticate

R2(config)# ntp trusted-key 1

R2(config)# ntp authentication-key 1 md5 NTPpa55

R3(config)# ntp authenticate

R3(config)# ntp trusted-key 1

R3(config)# ntp authentication-key 1 md5 NTPpa55

**Step 5: Configure routers to timestamp log messages.**

**Execute commands on all routers**

R1(config)# service timestamps log datetime msec

R2(config)# service timestamps log datetime msec

R3(config)# service timestamps log datetime msec

**Part 3: Configure Routers to Log Messages to the Syslog Server**

**Step 1: Configure the routers to identify the remote host (Syslog Server) that will receive logging messages.**

R1(config)# logging host 192.168.1.6

R2(config)# logging host 192.168.1.6

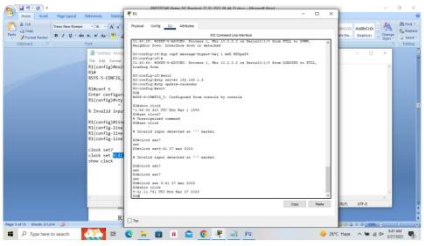
R3(config)# logging host 192.168.1.6

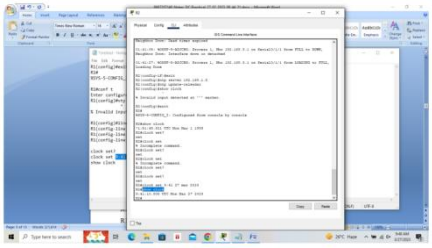
The router console will display a message that logging has started.

**Step 2: Verify logging configuration. Use the command**

R# show logging

to verify logging has been enabled.





**Step 3: Examine logs of the Syslog Server.**

From Services tab of the Syslog Server's dialogue box, select the Syslog services button. Observe the logging messages received from the routers.

Note: Log messages can be generated on the server by executing commands on the router. For example, entering and exiting global configuration mode will generate an informational configuration message. You may need to click a different service and then click Syslog again to refresh the message display.

**Part 4: Configure R3 to Support SSH Connections**

**Step 1: Configure a domain name of ccnasecurity.com on R3.**

R3(config)# ip domain-name ccnasecurity.com

**Step 2: Configure users for login to the SSH server on R3.**

Create a user ID of SSHadmin with the highest possible privilege level and a secret password of sshpa55.

R3(config)# username SSHadmin privilege 15 secret sshpa55

R3(config)#sshpa55

**Step 3: Configure the incoming vty lines on R3. Use the local user accounts for mandatory login and validation. Accept only SSH connections.**

R3(config)# line vty 0 4

R3(config-line)# login local

R3(config-line)# transport input ssh

R3(config-line)#exit

**Step 4: Erase existing key pairs on R3. Any existing RSA key pairs should be erased on the router.**

R3(config)# crypto key zeroize rsa

Note: If no keys exist, you might receive this message: % No Signature RSA Keys found in configuration.

**Step 5: Generate the RSA encryption key pair for R3.**

The router uses the RSA key pair for authentication and encryption of transmitted SSH data. Configure the RSA keys with a modulus of 1024. The default is 512, and the range is from 360 to 2048.

R3(config)# crypto key generate rsa

The name for the keys will be: R3.ccnasecurity.com

Choose the size of the key modulus in the range of 360 to 2048 for your General Purpose Keys. Choosing a key modulus greater than 512 may take a few minutes

How many bits in the modulus [512]: 1024

% Generating 1024 bit RSA keys, keys will be non-exportable...[OK]

Note: The command to generate RSA encryption key pairs for R3 in Packet Tracer differs from those used in the lab.

**Step 6: Verify the SSH configuration.**

Use the show ip ssh command to see the current settings. Verify that the

authentication timeout and retries are at their default values of 120 and 3.

R3# show ip ssh

SSH enabled-version 1.99

Authentication time out: 120 secs; Authentication retries : 3

R#

**Step 7: Configure SSH timeouts and authentication parameters.**

The default SSH timeouts and authentication parameters can be altered to be more restrictive. Set the timeout to 90 seconds, the number of authentication retries to 2, and the version to 2.

R3(config)# ip ssh time-out 90

R3(config)# ip ssh authentication-retries 2

R3(config)# ip ssh version 2

Verify the SSH configuration

R3# show ip ssh

SSH enabled-version 2.0

Authentication time out: 90 secs; Authentication retries : 2

R#

**Step 8: Attempt to connect to R3 via Telnet from PC-C.**

Open the Desktop of PC-C. Select the Command Prompt icon. From PC-C, enter the command to connect to

R3 via Telnet.

PC> telnet 192.168.3.1

This connection should fail because R3 has been configured to accept only SSH connections on the virtual terminal lines.

**Step 9: Connect to R3 using SSH on PC-C.**

Open the Desktop of PC-C. Select the Command Prompt icon. From PC-C, enter the command to connect to R3 via SSH. When prompted for the password, enter the password configured for the administrator shpa55.

PC> ssh –l SSHadmin 192.168.3.1

Password: sshpa55

**Step 10: Connect to R3 using SSH on R2.**

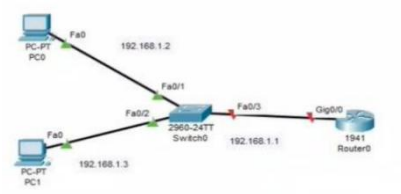
To troubleshoot and maintain R3, the administrator at the ISP must use SSH to access the router CLI. From the CLI of R2, enter the command to connect to R3 via SSH version 2 using the SSHadmin user account. When prompted for the password, enter the password configured for the administrator: ciscosshpa55.

R2# ssh –v 2 –l SSHadmin 10.2.2.1

Password: sshpa55

## Practical 2: Configure AAA Authentication on Cisco routers

Topology:



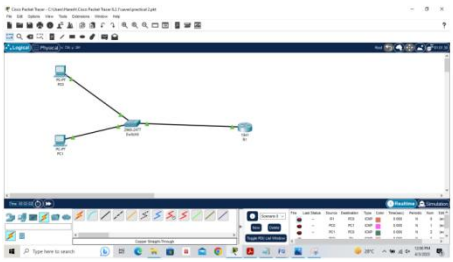

Addressing Table:

| Device | Interface | IP Address | Subnet Mask | Default Gateway |
|---|---|---|---|---|
| R1 | gig0/0 | 192.168.1.1 | 255.255.255.0 | N/A |
| PC0 | NIC | 192.168.1.2 | 255.255.255.0 | 192.168.1.1 |
| PC1 | NIC | 192.168.1.3 | 255.255.255.0 | 192.168.1.1 |

**Objectives:**

▪ Configure a local user account on R1 and configure authenticate on the console and vty lines using local AAA.

▪ Verify local AAA authentication from the R1 console and the PC0 client and PC1 Client.



■ **Configure Router:**

**Step 1: Configure password for vty lines**

R1(config) # line vty 0 4

R1(config-line) #password vtypa55

R1(config-line) #login

**Step 2: Configure secret on router**

R1(config) # enable secret enpa55

**Step 3: Configure OSPF on routers**

R1(config) #router ospf 1

R1(config-router) #network 192.168.1.0 0.0.0.255 area 0

**Step 4: Configure OSPF MD5 authentication for all router in area 0**

R1(config) #router ospf 1

R1(config-router)# area 0 authentication message-digest

**Step 5: Configure MD5 key for all routers in area 0**

R1(config)# int gig0/0

R1(config-if)# ip ospf message-digest-key 1 md5 pa55

**Step 6: Verify configurations**.

a. Verify the MD5 authentication configurations using the commands show ip ospf interface.

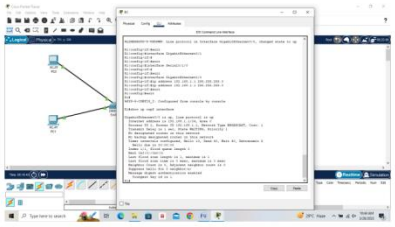
b. Verify end-to-end connectivity.

Output should be shown in all the routers :

R1# show ip ospf interface

Message-digest Authentication Enabled

Youngest key ID is 1



Part 1: Configure Local AAA Authentication for Console Access on R1

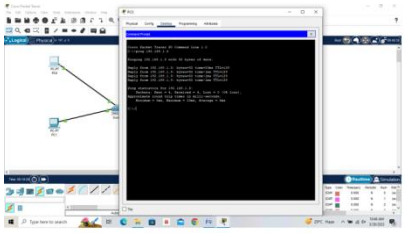
Step 1: Test Connectivity

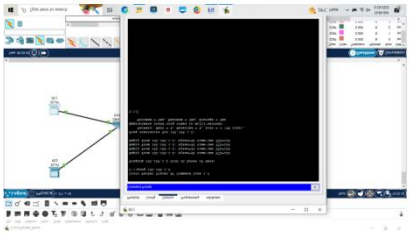
PC0 > ping 192.168.1.3

Successful

PC1 > ping 192.168.1.2

Successful





**Step 2: Configure Local username on R1**

R1(config)# username admin secret adminpa55

**Step 3: Configure local AAA authentication for console access on R1.**

R1(config)# aaa new-model

R1(config)# aaa authentication login default local

**Step 4: Configure the line console to use the defined AAA authentication method.**

R1(config)# line console 0

R1(config-line)# login authentication default

**Step 5: Verify the AAA authentication method.**

R1(config-line)# end

User Access Verification

Username: admin

Password: adminpa55

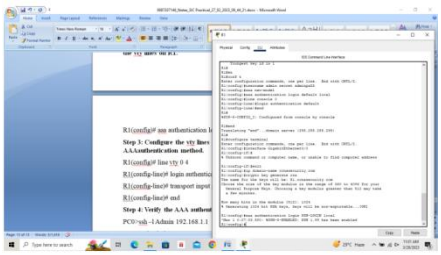
**Part 2: Configure Local AAA Authentication for vty Lines on R1**

**Step 1: Configure domain name and crypto key for use with SSH.**

R1(config)# ip domain-name ccnasecurity.com

R1(config)# crypto key generate rsa

How many bits in the modulus [512]: 1024



**Step 2: Configure a named list AAA authentication method for the vty lines on R1.**

R1(config)# aaa authentication login SSH-LOGIN local

**Step 3: Configure the vty lines to use the defined AAA authentication method.**

R1(config)# line vty 0 4

R1(config-line)# login authentication SSH-LOGIN

R1(config-line)# transport input ssh

R1(config-line)# end

**Step 4: Verify the AAA authentication method.**

PC0> ssh –l Admin 192.168.1.1

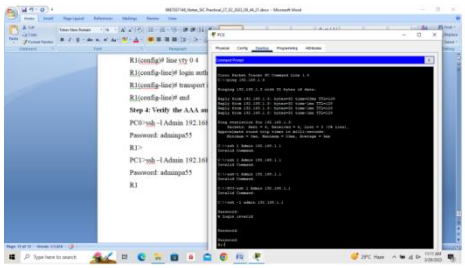
Password: adminpa55

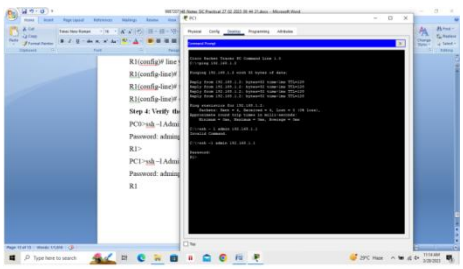
R1>

PC1> ssh –l Admin 192.168.1.1

Password: adminpa55

R1>

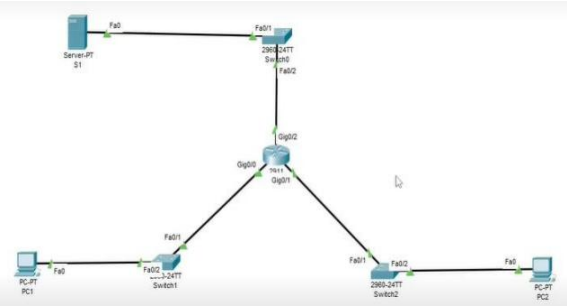




# Practical 3: Configuring Extended ACLs

## A]

## Topology:



**Addressing Table:**

| Device | Interface | IP Address | Subnet Mask | Default Gateway |
|---|---|---|---|---|
| R1 | gig0/0 | 172.22.34.65 | 255.255.255.224 | N/A |
| | gig0/1 | 172.22.34.97 | 255.255.255.240 | N/A |
| | gig0/2 | 172.22.34.1 | 255.255.255.192 | N/A |
| Server | NIC | 172.22.34.62 | 255.255.255.192 | 172.22.34.1 |
| PC1 | NIC | 172.22.34.66 | 255.255.255.224 | 172.22.34.65 |
| PC2 | NIC | 172.22.34.98 | 255.255.255.240 | 172.22.34.97 |

Objectives:

▪ Configure, Apply and Verify an Extended Numbered ACL

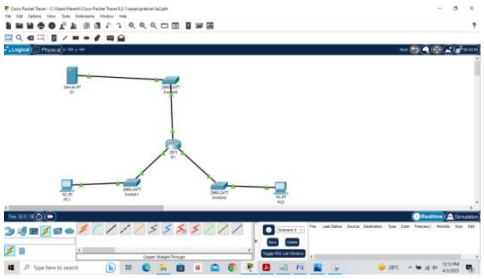
▪ Configure, Apply and Verify an Extended Named ACL

Scenario:

o PC1 Should be allowed only FTP access

o PC2 Should be allowed only web access

o Both PCs must ping server but not each other's



■ Configure Router:

Step 1: Configure password for vty lines

R1(config) # line vty 0 4

R1(config-line) #password vtypa55

R1(config-line) #login

Step 2: Configure secret on router

R1(config) # enable secret enpa55

Part 1: Configure, Apply and Verify an Extended Numbered ACL

Step 1: Configure an ACL to permit FTP and ICMP. (Use Router 2911)

R1(config)# access-list 100 permit tcp 172.22.34.64 0.0.0.31 host 172.22.34.62 eq ftp

R1(config)# access-list 100 permit icmp 172.22.34.64 0.0.0.31 host 172.22.34.62

Step 2: Apply the ACL on the correct interface to filter traffic.

R1(config)# int gig 0/0

R1(config-if)# ip access-group 100 in

Step 3: Verify the ACL implementation.

a. Ping from PC1 to Server.

PC1> ping 172.22.34.62

(Successful)

b. FTP from PC1 to Server. The username and password are both cisco.

PC1> ftp 172.22.34.62

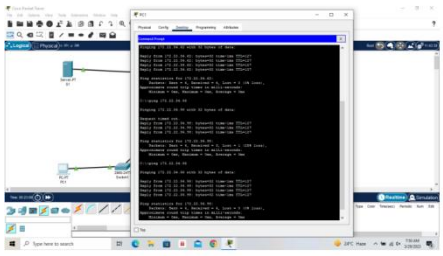
c. Exit the FTP service of the Server.

ftp> quit

d. Ping from PC1 to PC2.

PC1> ping 172.22.34.98

(Unsuccessful) destination host unreachable



Part 2: Configure, Apply and Verify an Extended Named ACL

Step 1: Configure an ACL to permit HTTP access and ICMP.

R1(config)# ip access-list extended HTTP_ONLY

R1(config-ext-nacl)# permit tcp 172.22.34.96 0.0.0.15 host 172.22.34.62 eq www

R1(config-ext-nacl)# permit icmp 172.22.34.96 0.0.0.15 host 172.22.34.62

Step 2: Apply the ACL on the correct interface to filter traffic.

R1(config)# int gig0/1

R1(config-if)# ip access-group HTTP_ONLY in

Step 3: Verify the ACL implementation.

a. Ping from PC2 to Server.

PC2> ping 172.22.34.62

(Successful)

b. FTP from PC2 to Server

PC2> ftp 172.22.34.62

(Unsuccessful)

c. Open the web browser on PC2.

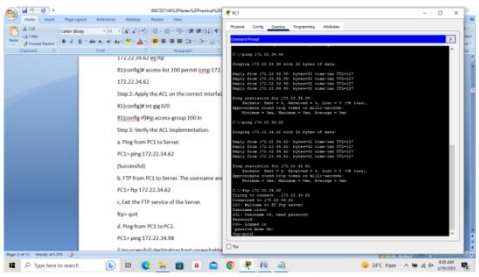
URL -> http://172.22.34.62

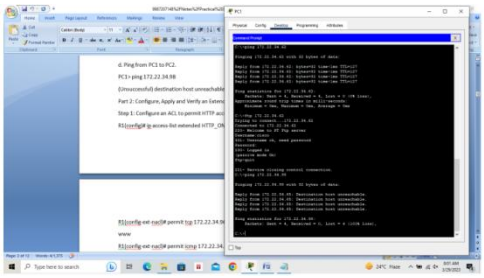
(Successful)

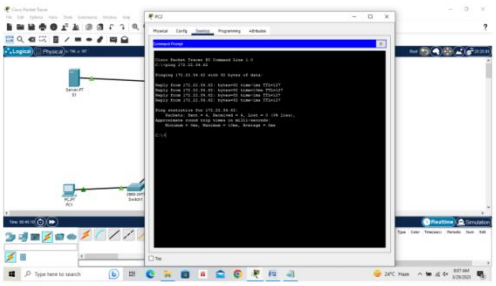
d. Ping from PC2 to PC1.

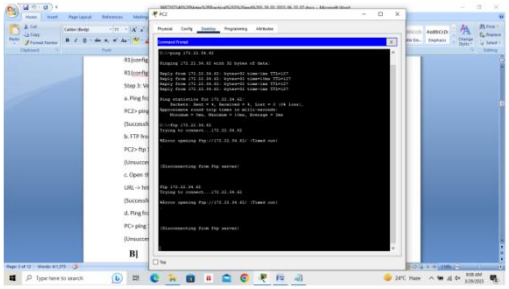
PC> ping 172.22.34.66

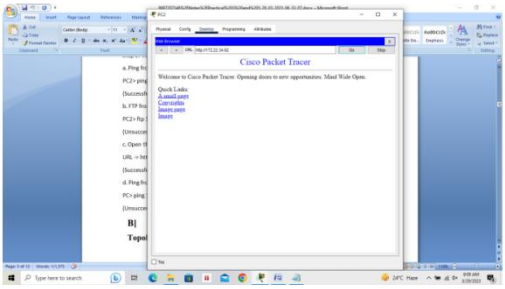
(Unsuccessful)

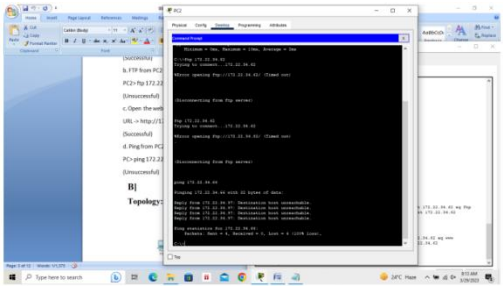






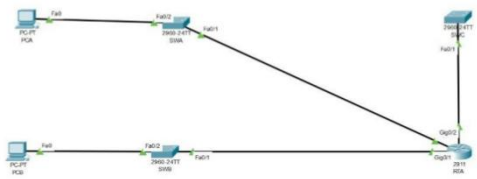




**B|**

**Topology:**



**Addressing Table:**

| Device | Interface | IP Address | Subnet Mask | Default Gateway |
|---|---|---|---|---|
| RTA | gig0/0 | 10.101.117.49 | 255.255.255.248 | N/A |
| | gig0/1 | 10.101.117.33 | 255.255.255.240 | N/A |
| | gig0/2 | 10.101.117.1 | 255.255.255.224 | N/A |
| PCA | NIC | 10.101.117.51 | 255.255.255.248 | 10.101.117.49 |
| PCB | NIC | 10.101.117.35 | 255.255.255.240 | 10.101.117.33 |
| SWA | VLAN 1 | 10.101.117.50 | 255.255.255.248 | 10.101.117.49 |
| SWB | VLAN 1 | 10.101.117.34 | 255.255.255.240 | 10.101.117.33 |
| SWC | VLAN 1 | 10.101.117.2 | 255.255.255.224 | 10.101.117.1 |

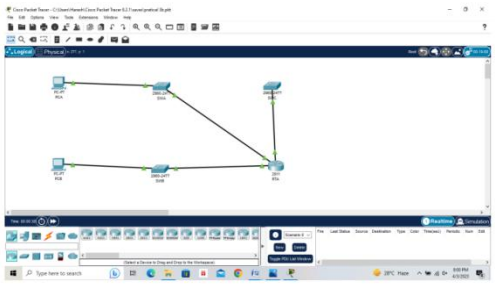
Objectives:

▪ Configure, Apply and Verify an Extended Numbered ACL

Scenario:

o Device on one LAN are allowed to remotely access device in another LAN using SSH protocol

o Besides ICMP all traffic from other network is denied



■ Configure Switch and Router:

Step 1: Configure the IP address on switch

SWA(config)# int vlan 1

SWA(config-if)# ip address 10.101.117.50 255.255.255.248

SWA(config-if)# no shut

SWA(config-if)# ip default-gateway 10.101.117.49

SWB(config)# int vlan 1

SWB(config-if)# ip address 10.101.117.34 255.255.255.240

SWB(config-if)# no shut

SWB(config-if)# ip default-gateway 10.101.117.33

SWC(config)# int vlan 1

SWC(config-if)# ip address 10.101.117.2 255.255.255.224

SWC(config-if)# no shut

SWC(config-if)# ip default-gateway 10.101.117.1

Step 2: Configure the secret on router and switch

RTA/SW(config)# enable secret enpa55

Step 3: Configure the console password on router and switch

RTA/SW(config)# line console 0

RTA/SW(config)# password tyit

RTA/SW(config)# login

Step 4: Test connectivity

Ping from PCA to PC-B.

PCA>ping 10.101.117.35

(Successful)

Ping from PCA to SWC.

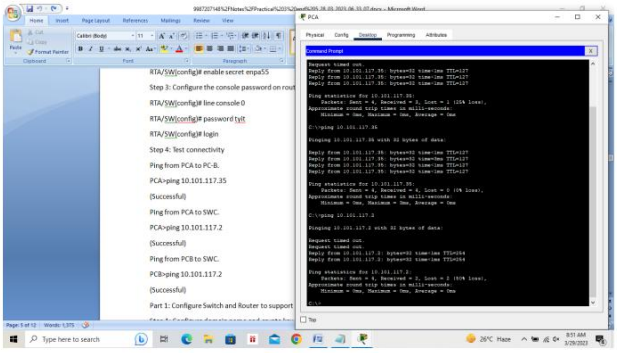
PCA>ping 10.101.117.2

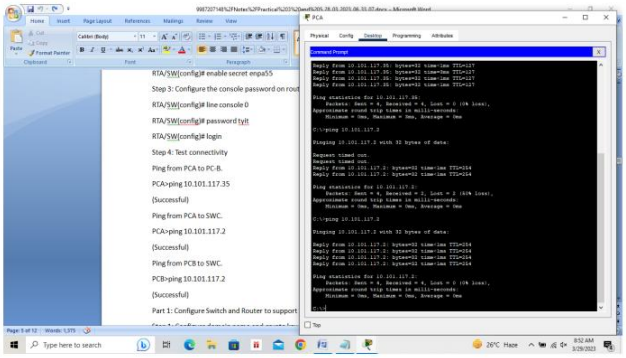
(Successful)

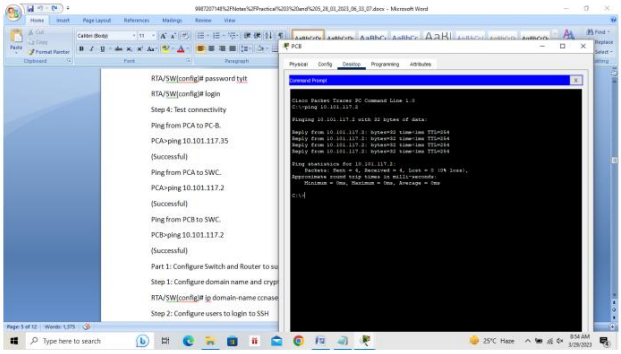
Ping from PCB to SWC.

PCB>ping 10.101.117.2

(Successful)







Part 1: Configure Switch and Router to support SSH Connection

Step 1: Configure domain name and crypto key for use with SSH.

RTA/SW(config)# ip domain-name ccnasecurity.com

Step 2: Configure users to login to SSH

RTA/SW(config)# username admin secret adminpa55

Step 3: Configure incoming vty lines

RTA/SW(config)# line vty 0 4

RTA/SW(config-line)# login local

RTA/SW(config)# crypto key generate rsa

How many bits in the modulus [512]: 1024

Step 4: Verify the SSH Connection

PCA> ssh -l Admin 10.101.117.34

Password: adminpa55

SWB>

PCA> ssh -l Admin 10.101.117.2

Password: adminpa55

SWC>

PCB> ssh -l Admin 10.101.117.50

Password: adminpa55

SWA>

PCB> ssh -l Admin 10.101.117.2

Password: adminpa55

SWC>

SWC> ssh -l Admin 10.101.117.50

Password: adminpa55

SWA>

SWC> ssh -l Admin 10.101.117.34

Password: adminpa55

SWB>

SWB> exit

Part 2: Configure, Apply and Verify an Extended Numbered ACL

Step 1: Configure the extended ACL.

RTA(config)# access-list 199 permit tcp 10.101.117.32 0.0.0.15 10.101.117.0

0.0.0.31 eq 22

RTA(config)# access-list 199 permit icmp any any

Step 2: Apply the extended ACL.

RTA(config)# int gig0/2

RTA(config-if)# ip access-group 199 out

Step 3: Verify the extended ACL implementation.

a. Ping from PCB to all of the other IP addresses in the network.

PCB> ping 10.101.117.51

(Successful)

PCB> ping 10.101.117.2

(Successful)

b. SSH from PCB to SWC.

PCB> ssh -l Admin 10.101.117.2

Password:adminpa55

SWC>

c. Exit the SSH session to SWC.

SWC>exit

d. Ping from PCA to all of the other IP addresses in the network.

PCA> ping 10.101.117.35

(Successful)

PCA> ping 10.101.117.2

(Successful)

e. SSH from PCA to SWC

PCA> ssh -l Admin 10.101.117.2

Connection timed out. Remote host not responding

f. SSH from PCA to SWB.

PCA> ssh -l Admin 10.101.117.34

Password: adminpa55

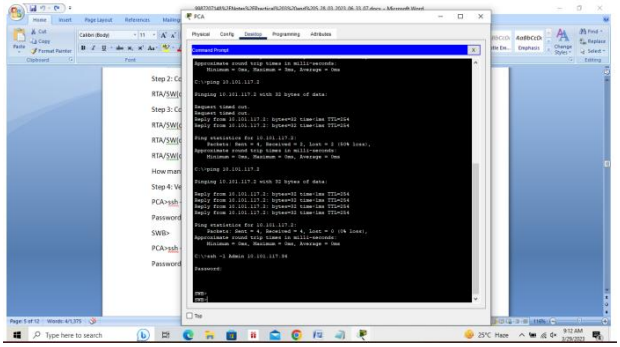
SWB>

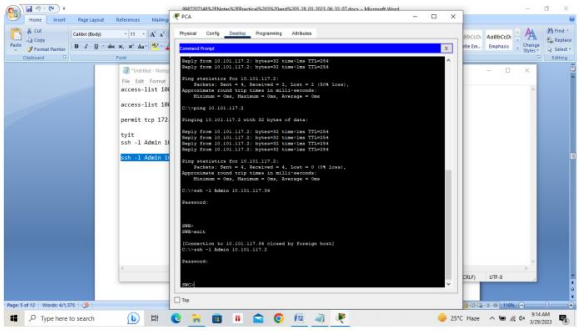
g. After logging into SWB, do not log out. SSH to SWC in privileged EXEC mode.

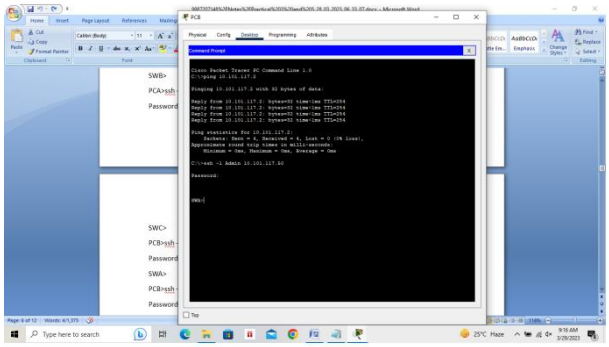
SWB# ssh -l Admin 10.101.117.2

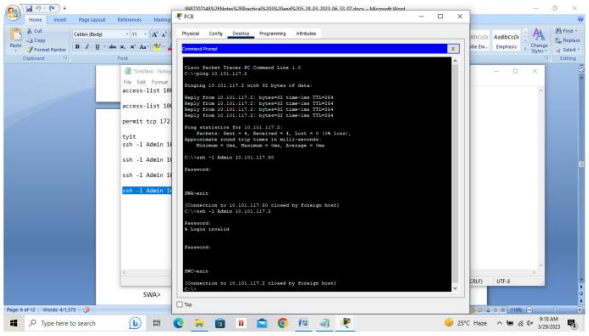
Password: adminpa55

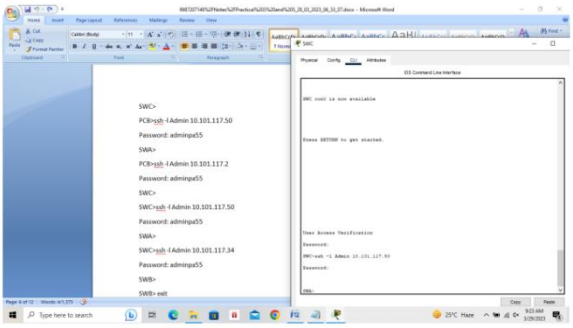
SWC>

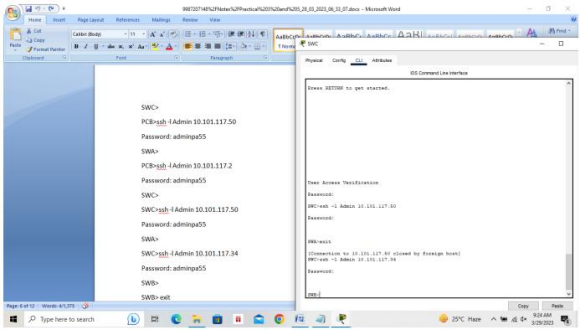


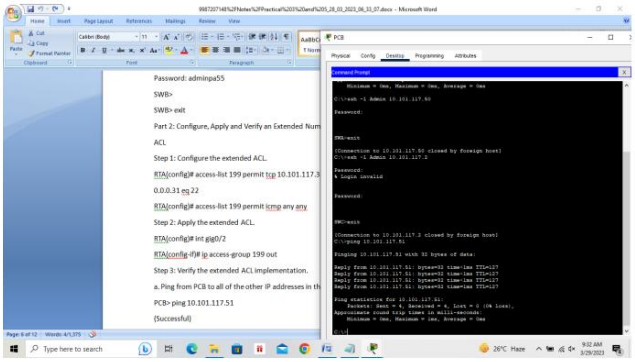


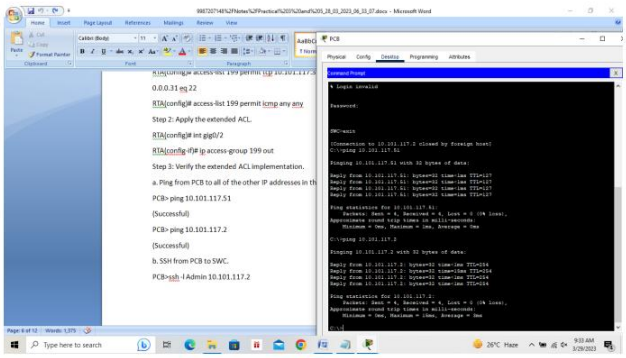


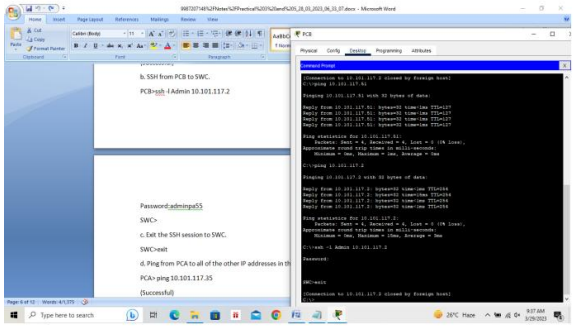


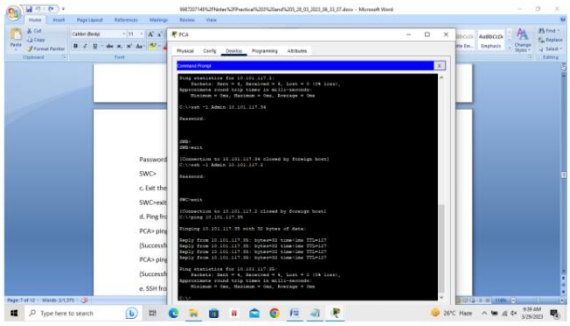


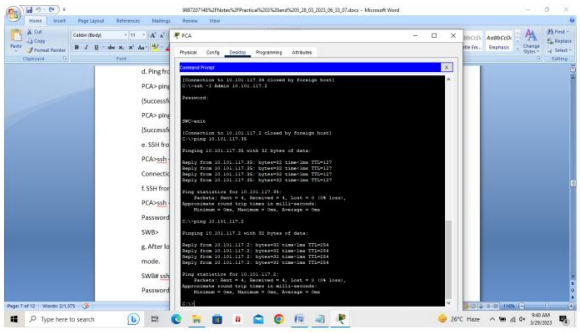


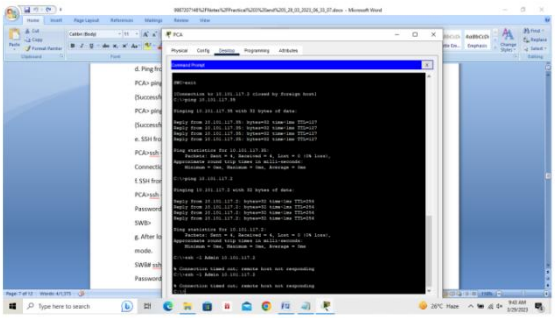


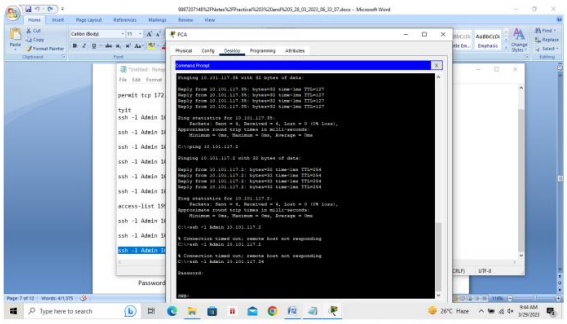


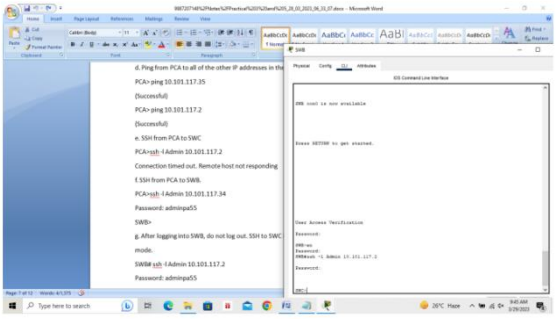

b. SSH from PCB to SWC.
PCB>ssh -l Admin 10.101.117.2
Password:adminpa55
SWC>
c. Exit the SSH session to SWC.
SWC>exit
d. Ping from PCA to all of the other IP addresses in th
PCA> ping 10.101.117.35
(Successful)











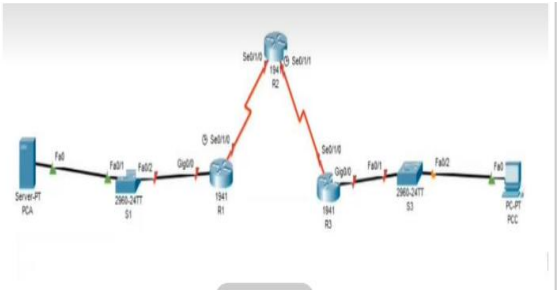
## Practical 4: Configure IP ACLs to Mitigate Attacks

A]

Topology:

Practical 5: Configuring a Zone-Based Policy Firewall (ZPF)

A]Topology:



**Addressing Table:**

| Device | Interface | IP Address | Subnet Mask | Default Gateway |
|---|---|---|---|---|
| R1 | gig0/0 | 192.168.1.1 | 255.255.255.0 | N/A |
| | Se0/1/0 (DCE) | 10.1.1.1 | 255.255.255.252 | N/A |
| R2 | Se0/1/0 | 10.1.1.2 | 255.255.255.252 | N/A |
| | Se0/1/1 (DCE) | 10.2.2.2 | 255.255.255.252 | N/A |
| | Lo0 | 192.168.2.1 | 255.255.255.0 | N/A |
| R3 | gig0/0 | 192.168.3.1 | 255.255.255.0 | N/A |
| | Se0/1/0 | 10.2.2.1 | 255.255.255.252 | N/A |
| PC-A | Fa0 | 192.168.1.3 | 255.255.255.0 | 192.168.1.1 |
| PC-C | Fa0 | 192.168.3.3 | 255.255.255.0 | 192.168.3.1 |

Objectives:

• Verify connectivity among devices before firewall configuration.

• Use ACLs to ensure remote access to the routers is available only from management station PC-C.

• Configure ACLs on R1 and R3 to mitigate attacks.

• Verify ACL functionality.

■ Configure Router:

Step 1: Configure secret on router

R(config) # enable secret enpa55

Step 2: Configure console password on router

R(config) # line console 0

R(config-line) #password conpa55

R(config-line) #login

Step 3: Configure SSH login on router. Execute command on all routers

R(config)# ip domain-name ccnasecurity.com

R(config)# username admin secret adminpa55

R(config)# line vty 0 4

R(config-line)# login local

R(config-line)# crypto key generate rsa

How many bits in the modulus [512]: 1024

Step 4: Configure loop back address on Router 2

R2(config)#int loopback 0

R2(config-if)#ip address 192.168.2.1 255.255.255.0

R2(config-if)# no shut

Step 5: Configure static routing on routers. Execute command on all routers

R1(config)#ip route 192.168.3.0 255.255.255.0 10.1.1.2

R1(config)#ip route 10.2.2.0 255.255.255.252 10.1.1.2

R1(config)#ip route 192.168.2.0 255.255.255.0 10.1.1.2

R2(config)#ip route 192.168.1.0 255.255.255.0 10.1.1.1

R2(config)#ip route 192.168.3.0 255.255.255.0 10.2.2.1

R3(config)#ip route 192.168.1.0 255.255.255.0 10.2.2.2

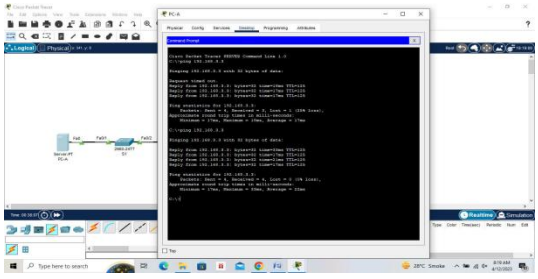
R3(config)#ip route 192.168.2.0 255.255.255.0 10.2.2.2

R3(config)#ip route 10.1.1.0 255.255.255.0 10.2.2.2

Part 2: Verify Basic Network Connectivity

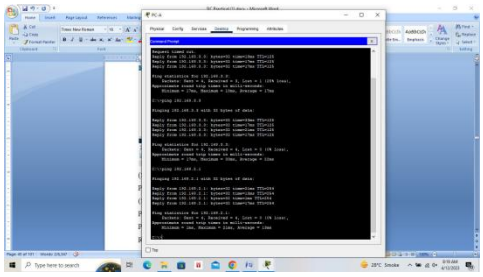
Step 1: From PC-A, verify connectivity to PC-C and R2.

PCA> ping 192.168.3.3



(Successful)

PCA> ping 192.168.2.1

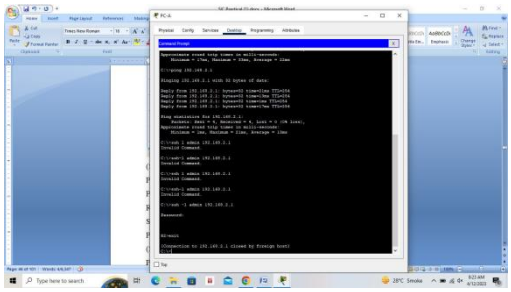


(Successful)

PCA> ssh –l admin 192.168.2.1

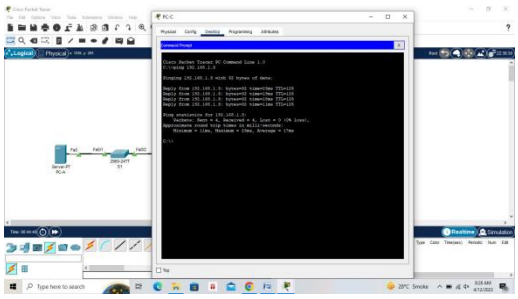
Password: adminpa55

R2>exit



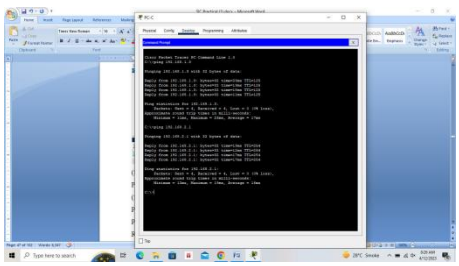
Step 2: From PC-C, verify connectivity to PC-A and R2.

PCC> ping 192.168.1.3



(Successful)

PCC> ping 192.168.2.1

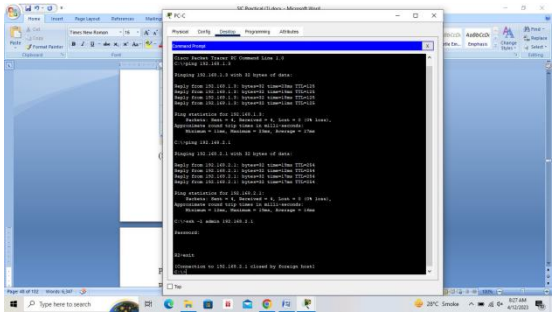


(Successful)

PCC> ssh –l admin 192.168.2.1

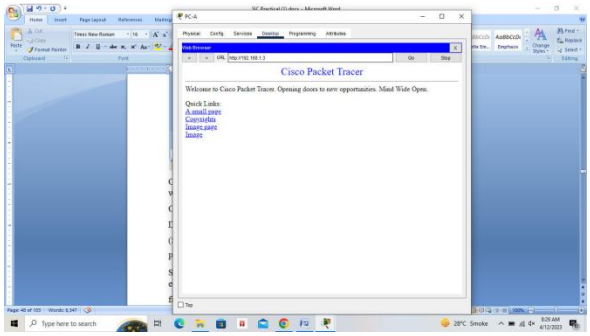
Password: adminpa55

R2>exit



Open a web browser to the PC-A server (192.168.1.3) to display the web page. Close the browser when done.

Desktop->Web Browser->192.168.1.3




(Successful)

Part 3: Secure Access to Routers

Step 1: Configure ACL 10 to block all remote access to the routers except from PC-C

Execute command on all routers

R(config)# access-list 10 permit host 192.168.3.3

Step 2: Apply ACL 10 to ingress traffic on the VTY lines.

Execute command on all routers

R(config)# line vty 0 4

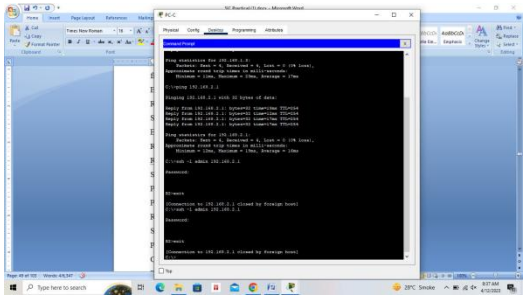
R(config-line)# access-class 10 in

Step 3: Verify exclusive access from management station PC-C.

PCC> ssh –l admin 192.168.2.1

Password: adminpa55

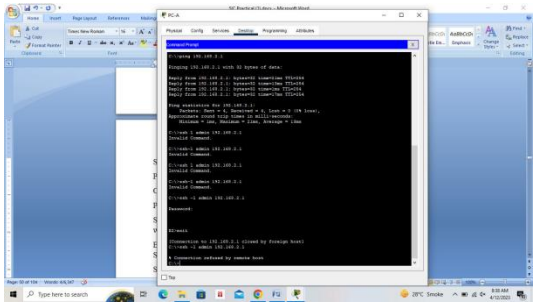
R2>exit



Step 4: Verify denial from PC-A.

PCA> ssh –l admin 192.168.2.1

Connection refused by remote host



Part 4: Create a Numbered IP ACL 120 on R1

Step 1: Verify that PC-C can access the PC-A via HTTPS using the web browser.

Be sure to disable HTTP and enable HTTPS on server PC-A in Services tab.

Step 2: Configure ACL 120 to specifically permit and deny the specified traffic.

R1(config)# access-list 120 permit udp any host 192.168.1.3 eq domain

R1(config)# access-list 120 permit tcp any host 192.168.1.3 eq smtp

R1(config)# access-list 120 permit tcp any host 192.168.1.3 eq ftp

R1(config)# access-list 120 deny tcp any host 192.168.1.3 eq 443

R1(config)# access-list 120 permit tcp host 192.168.3.3 host 10.1.1.1 eq 22

Step 3: Apply the ACL to interface

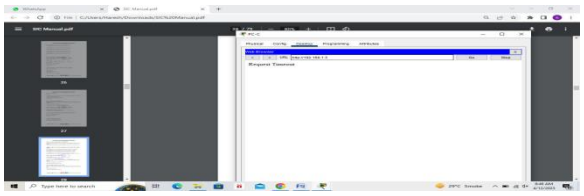
R1(config)# int se0/1/0

R1(config-if)# ip access-group 120 in

Step 4: Verify that PC-C cannot access PC-A via HTTPS using the web browser.

Desktop->Web Browser->192.168.1.3

(Unsuccessful) Request timed out

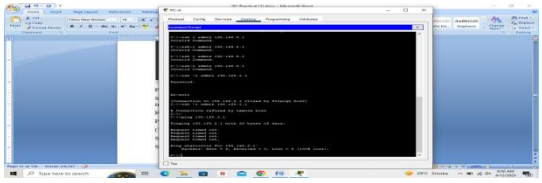


Part 5: Modify an Existing ACL on R1

Step 1: Verify that PC-A cannot successfully ping the loopback interface on

R2.

PCA> ping 192.168.2.1



(Unsuccessful) Request timed out

STUD--Talks: Follow us on for more videos and updates

Step 2: Make any necessary changes to ACL 120 to permit and deny the specified traffic.

R1(config)# access-list 120 permit icmp any any echo-reply

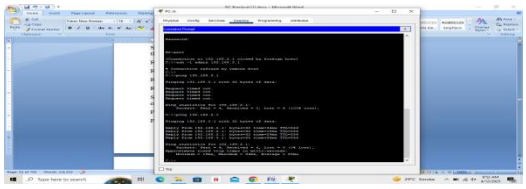
R1(config)# access-list 120 permit icmp any any unreachable

R1(config)# access-list 120 deny icmp any any

R1(config)# access-list 120 permit ip any any

Step 3: Verify that PC-A can successfully ping the loopback interface on R2.

PCA> ping 192.168.2.1 (Successful)



Part 6: Create a Numbered IP ACL 110 on R3

Step 1: Configure ACL 110 to permit only traffic from the inside network.

R3(config)# access-list 110 permit ip 192.168.3.0 0.0.0.255 any

Step 2: Apply the ACL to interface

R3(config)# int gig0/1

R3(config-if)# ip access-group 110 in

Part 7: Create a Numbered IP ACL 100 on R3

Step 1: Configure ACL 100 to block all specified traffic from the outside network.

R3(config)# access-list 100 permit tcp 10.0.0.0 0.255.255.255 host 192.168.3.3 eq 22

R3(config)# access-list 100 deny ip 10.0.0.0 0.255.255.255 any

R3(config)# access-list 100 deny ip 172.16.0.0 0.15.255.255 any

R3(config)# access-list 100 deny ip 192.168.0.0 0.0.255.255 any

R3(config)# access-list 100 deny ip 127.0.0.0 0.255.255.255 any

R3(config)# access-list 100 deny ip 224.0.0.0 15.255.255.255 any

R3(config)# access-list 100 permit ip any any

Step 2: Apply the ACL to interface

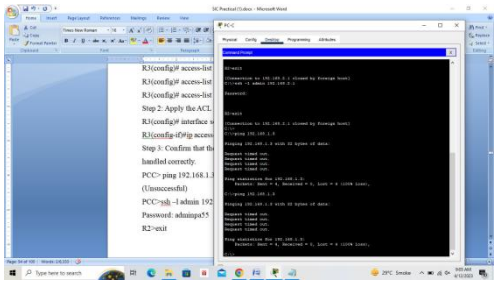
R3(config)# interface se0/1/0

R3(config-if)# ip access-group 100 in

Step 3: Confirm that the specified traffic entering interface Serial is handled correctly.

PCC> ping 192.168.1.3

(Unsuccessful)



PCC> ssh –l admin 192.168.2.1

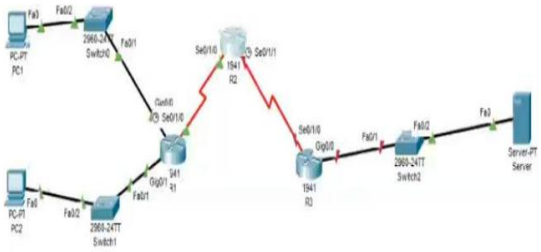
Password: adminpa55

R2>exit

B]

Topology:

Addressing Table:



**Addressing Table:**

| Device | Interface | IPv6 Address/Prefix | Default Gateway |
|---|---|---|---|
| PC1 | NIC | 2001:DB8:1:10::10/64 | FE80::1 |
| PC2 | NIC | 2001:DB8:1:11::11/64 | FE80::1 |
| R1 | gig0/0 | 2001:DB8:1:10::1/64 | FE80::1 |
| | se0/1/0 | 2001:DB8:1:1::1/64 | FE80::1 |
| | gig0/1 | 2001:DB8:1:11::1/64 | FE80::1 |
| R3 | se0/1/0 | 2001:DB8:1:1::2/64 | FE80::2 |
| | se0/1/1 | 2001:DB8:1:2::2/64 | FE80::2 |
| R3 | gig0/0 | 2001:DB8:1:30::1/64 | FE80::3 |
| | se0/1/0 | 2001:DB8:1:2::1/64 | FE80::3 |
| Server | NIC | 2001:DB8:1:30::30/64 | FE80::3 |

Objective:

• Configure, Apply, and Verify an IPv6 ACL

• Configure, Apply, and Verify a Second IPv6 ACL

■ Configure Router:

Step 1: Configure secret on router. Execute command on all routers

R(config)# enable secret enpa55

Step 2: Assign static ipv6 address

R1(config)# int gig0/0

R1(config-if)# ipv6 address 2001:DB8:1:10::1/64

R1(config-if)# ipv6 address FE80::1 link-local

R1(config-if)# no shut

R1(config)# int gig0/1

R1(config-if)# ipv6 address 2001:DB8:1:11::1/64

R1(config-if)# ipv6 address FE80::1 link-local

R1(config-if)# no shut

R1(config)# int se0/1/0

R1(config-if)# ipv6 address 2001:DB8:1:1::1/64

R1(config-if)# ipv6 address FE80::1 link-local

R1(config-if)# no shut

R2(config)# int se0/1/0

R2(config-if)# ipv6 address 2001:DB8:1:1::2/64

R2(config-if)# ipv6 address FE80::2 link-local

R2(config-if)# no shut

R2(config)# int se0/1/1

R2(config-if)# ipv6 address 2001:DB8:1:2::2/64

R2(config-if)# ipv6 address FE80::2 link-local

R2(config-if)# no shut

R3(config)# int gig0/0

R3(config-if)# ipv6 address 2001:DB8:1:30::1/64

R3(config-if)# ipv6 address FE80::3 link-local

R3(config-if)# no shut

R3(config)# int se0/1/0

R3(config-if)# ipv6 address 2001:DB8:1:2::1/64

R3(config-if)# ipv6 address FE80::3 link-local

R3(config-if)# no shut

Step 3: Enable IPv6 routing

R1(config)# ipv6 unicast-routing

R1(config)# ipv6 route 2001:DB8:1:2::0/64 2001:DB8:1:1::2

R1(config)# ipv6 route 2001:DB8:1:30::0/64 2001:DB8:1:1::2

R2(config)# ipv6 unicast-routing

R2(config)# ipv6 route 2001:DB8:1:10::0/64 2001:DB8:1:1::1

R2(config)# ipv6 route 2001:DB8:1:11::0/64 2001:DB8:1:1::1

R2(config)# ipv6 route 2001:DB8:1:30::0/64 2001:DB8:1:2::1

R3(config)# ipv6 unicast-routing

R3(config)# ipv6 route 2001:DB8:1:10::0/64 2001:DB8:1:2::2

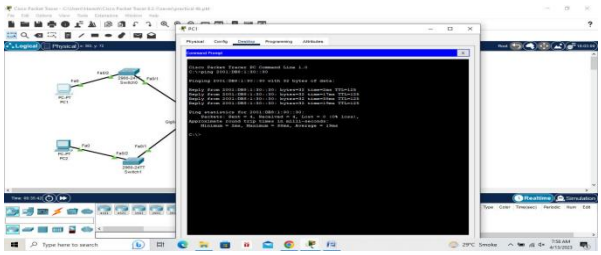
R3(config)# ipv6 route 2001:DB8:1:11::0/64 2001:DB8:1:2::2

R3(config)# ipv6 route 2001:DB8:1:1::0/64 2001:DB8:1:2::2

Step 4: Verify connectivity

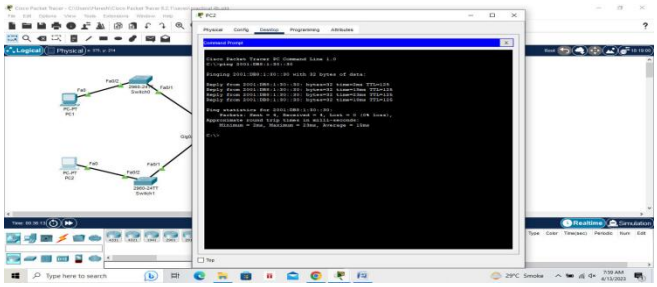
PC1> ping 2001:DB8:1:30::30

(Successful)



PC2> ping 2001:DB8:1:30::30

(Successful)



Part 2: Configure, Apply, and Verify an IPv6 ACL

Step 1: Configure an ACL that will block HTTP and HTTPS access.

R1(config)# ipv6 access-list BLOCK_HTTP

R1(config-ipv6-acl)# deny tcp any host 2001:DB8:1:30::30 eq www

R1(config-ipv6-acl)# deny tcp any host 2001:DB8:1:30::30 eq 443

R1(config-ipv6-acl)# permit ipv6 any any

R1(config-ipv6-acl)# exit

Step 2: Apply the ACL to the correct interface.

R1(config)# int gig0/1

R1(config-if)# ipv6 traffic-filter BLOCK_HTTP in

Step 3: Verify the ACL implementation

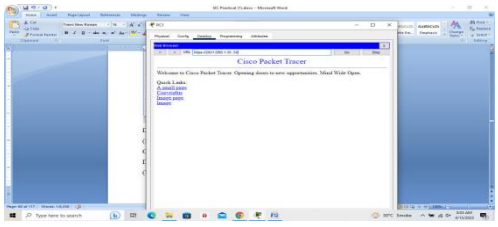
Open a web browser to the PC1 to display the web page.

Desktop->Web Browser->http://2001:DB8:1:30::30

(Successful)

Desktop->Web Browser->https://2001:DB8:1:30::30

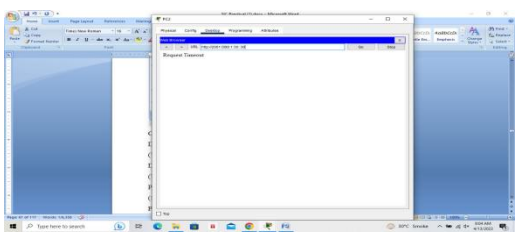
(Successful)



Open a web browser to the PC2 to display the web page.

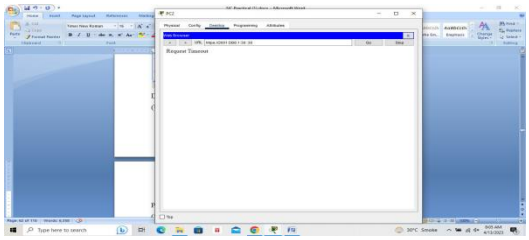
Desktop->Web Browser->http://2001:DB8:1:30::30

(Unsuccessful) – Request Timeout



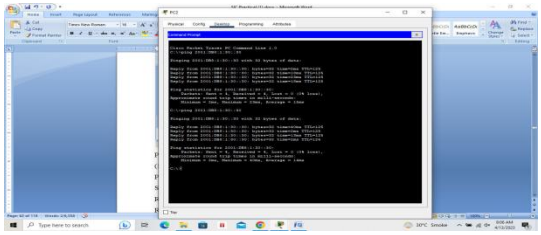
Desktop->Web Browser->https://2001:DB8:1:30::30

(Unsuccessful) – Request Timeout



PC2> ping 2001:DB8:1:30::30

(Successful)



Part 3: Configure, Apply, and Verify a Second IPv6 ACL

Step 1: Create an access list to block ICMP.

R3(config)# ipv6 access-list BLOCK_ICMP

R3(config-ipv6-acl)# deny icmp any any

R3(config-ipv6-acl)# permit ipv6 any any

R3(config-ipv6-acl)# exit

Step 2: Apply the ACL to the correct interface.

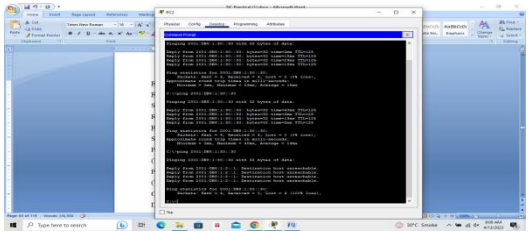
R3(config)# int gig0/0

R3(config-if)# ipv6 traffic-filter BLOCK_ICMP out

Step 3: Verify that the proper access list functions.

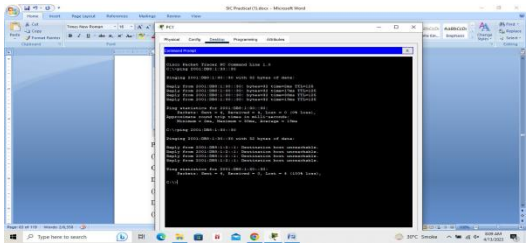
PC2> ping 2001:DB8:1:30::30

(Unsuccessful) - Destination host unreachable



PC1> ping 2001:DB8:1:30::30

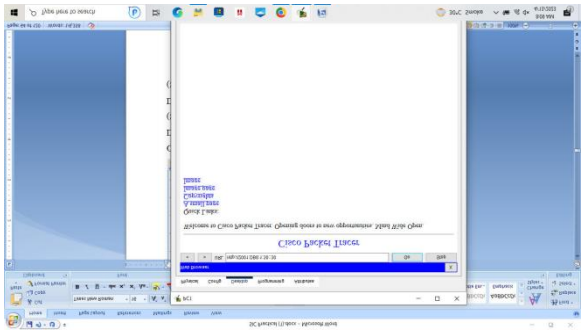
(Unsuccessful) - Destination host unreachable



Open a web browser to the PC1 to display the web page.

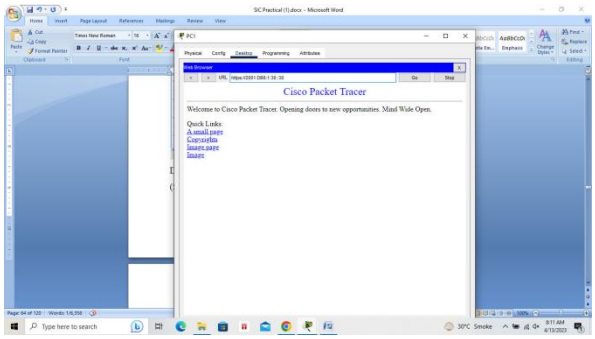
Desktop->Web Browser->http://2001:DB8:1:30::30

(Successful)

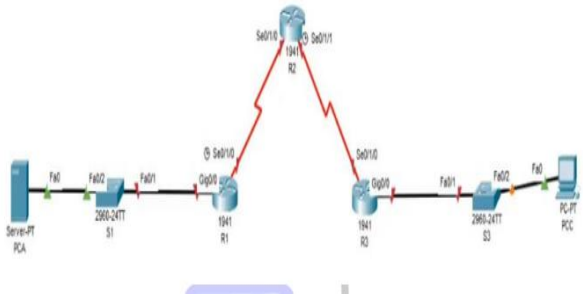


Desktop->Web Browser->https://2001:DB8:1:30::30

(Successful)



# Practical 5: Configuring a Zone-Based Policy Firewall (ZPF)



**Addressing Table:**

| Device | Interface | IP Address | Subnet Mask | Default Gateway |
|---|---|---|---|---|
| R1 | gig0/0 | 192.168.1.1 | 255.255.255.0 | N/A |
| | Se0/1/0 (DCE) | 10.1.1.1 | 255.255.255.252 | N/A |
| R2 | Se0/1/0 | 10.1.1.2 | 255.255.255.252 | N/A |
| | Se0/1/1 (DCE) | 10.2.2.2 | 255.255.255.252 | N/A |
| R3 | gig0/0 | 192.168.3.1 | 255.255.255.0 | N/A |
| | Se0/1/0 | 10.2.2.1 | 255.255.255.252 | N/A |
| PC-A | NIC | 192.168.1.3 | 255.255.255.0 | 192.168.1.1 |
| PC-C | NIC | 192.168.3.3 | 255.255.255.0 | 192.168.3.1 |

Objectives:

- Verify connectivity among devices before firewall configuration.
- Configure a zone-based policy (ZPF) firewall on R3.
- Verify ZPF firewall functionality using ping, SSH, and a web browser

Configure Router:

Step 1: Configure console password on router

Execute command on all routers

R(config) # line console 0

R(config-line) #password conpa55

R(config-line) #login

Step 2: Configure password for vty lines

Execute command on all routers

R(config)# line vty 0 4

R(config-line)# password vtypa55

R(config-line)# login

Step 3: Configure secret on router

R(config) # enable secret enpa55

Step 4: Configure SSH login on router

Execute command on all routers

R(config)# ip domain-name ccnasecurity.com

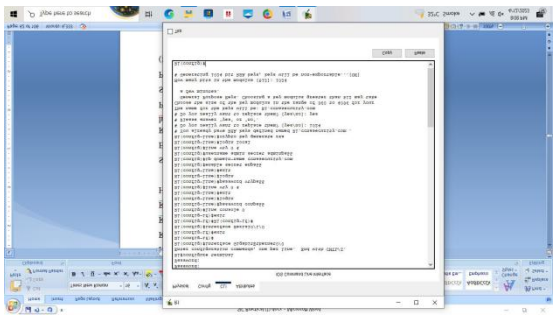
R(config)# username admin secret adminpa55

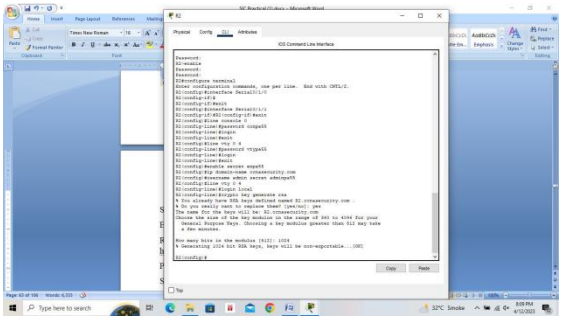
R(config)# line vty 0 4

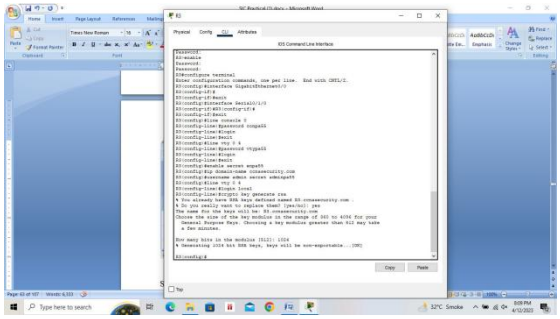
R(config-line)# login local

R(config-line)# crypto key generate rsa

How many bits in the modulus [512]: 1024







Step 5: Configure static routing on routers. Execute command on all routers

R1(config)#ip route 10.2.2.0 255.255.255.252 10.1.1.2

R1(config)#ip route 192.168.3.0 255.255.255.0 10.1.1.2

R2(config)#ip route 192.168.1.0 255.255.255.0 10.1.1.1

R2(config)#ip route 192.168.3.0 255.255.255.0 10.2.2.1

R3(config)#ip route 192.168.1.0 255.255.255.0 10.2.2.2

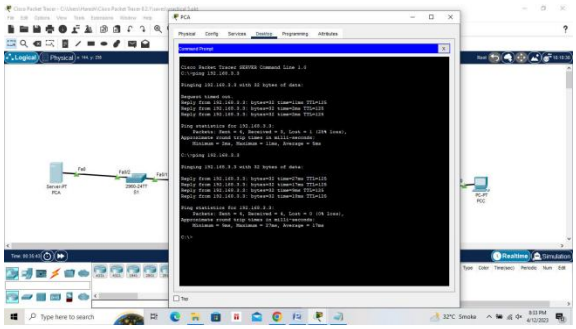
R3(config)#ip route 10.1.1.0 255.255.255.252 10.2.2.2

Part 2: Verify Basic Network Connectivity

Step 1: Check connectivity from PCA to PCC

PCA>ping 192.168.3.3

(Successful)

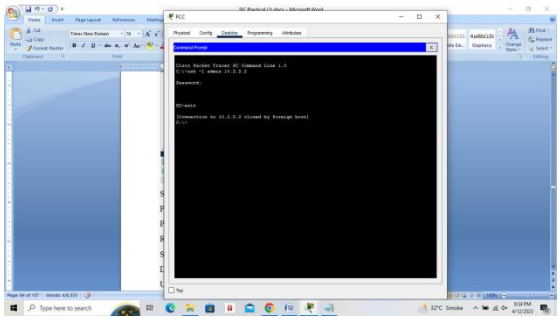


Step 2: Access R2 using SSH.

PCC>ssh –l admin 10.2.2.2

Password:adminpa55

R2>exit

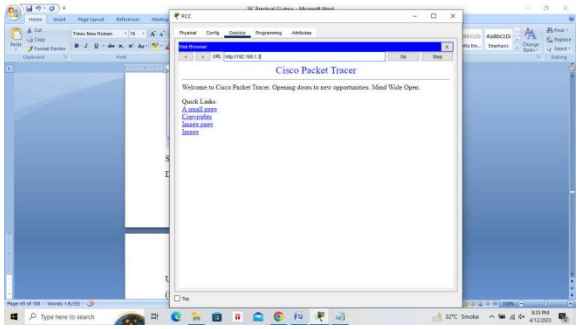


Step 3: From PC-C, open a web browser to the PC-A server.

Desktop -> Web Browser

URL: http://192.168.1.3

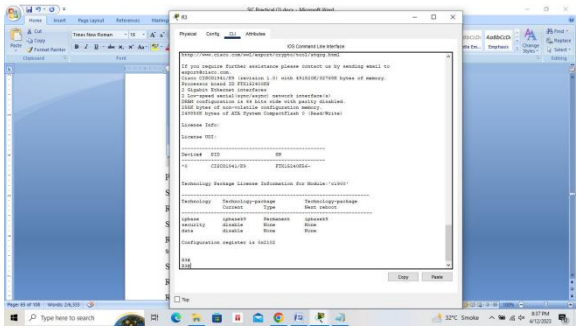
(Successful)




Part 3: Create the Firewall Zones on R3

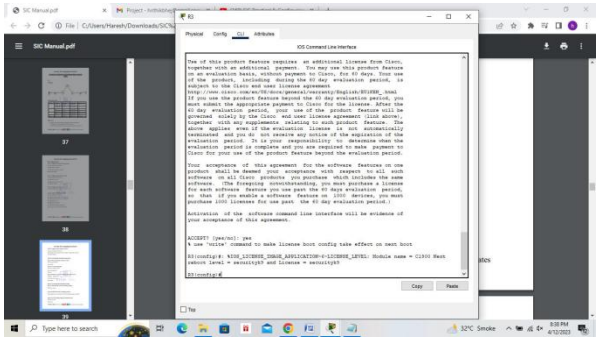
Step 1: Verify that the Security Technology package

R3# show version



Step 2: Enable the Security Technology package

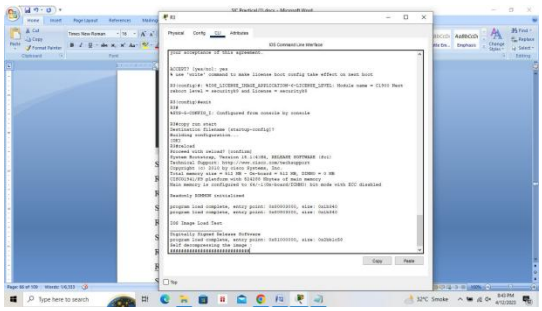
R3(config)# license boot module c1900 technology-package securityk9

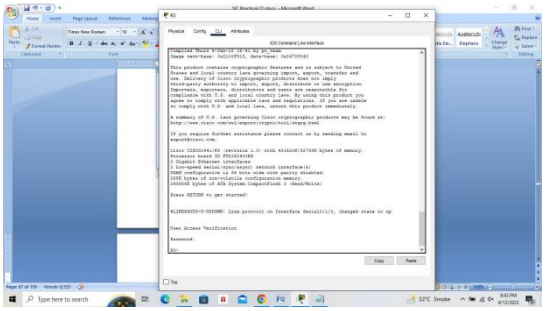


Step 3: Save the running-config and reload the router

R3#copy run start

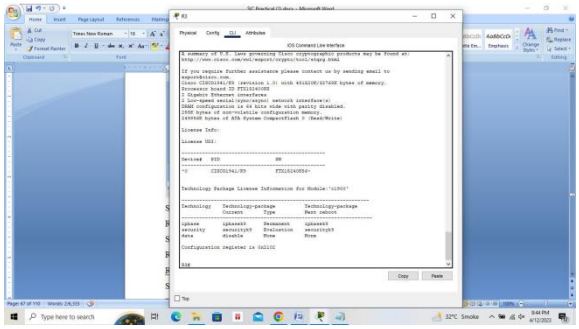
R3# reload





Step 4: Verify that the Security Technology package

R3# show version



Step 5: Create an internal zone.

R3(config)# zone security IN-ZONE

R3(config-sec-zone)# exit

Step 6: Create an external zone.

R3(config)# zone security OUT-ZONE

R3(config-sec-zone)# exit

Part 4: Identify Traffic Using a Class-Map

Step 1: Create an ACL that defines internal traffic.

R3(config)# access-list 101 permit ip 192.168.3.0 0.0.0.255 any

Step 2: Create a class map referencing the internal traffic ACL

R3(config)# class-map type inspect match-all IN-NET-CLASS-MAP

R3(config-cmap)# match access-group 101

R3(config-cmap)# exit

Part 5: Specify Firewall Policies

Step 1: Create a policy map to determine what to do with matched traffic.

R3(config)# policy-map type inspect IN-2-OUT-PMAP

Step 2: Specify a class type of inspect and reference class map IN-NETCLASS-MAP.

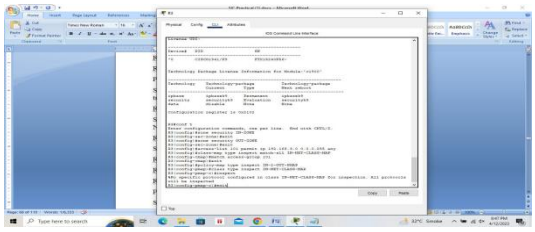
R3(config-pmap)# class type inspect IN-NET-CLASS-MAP

Step 3: Specify the action of inspect for this policy map.

R3(config-pmap-c)# inspect

R3(config-pmap-c)# exit

R3(config-pmap)# exit



Part 6: Apply Firewall Policies

Step 1: Create a pair of zones.

R3(config)# zone-pair security IN-2-OUT-ZPAIR source IN-ZONE destination OUTZONE

Step 2: Specify the policy map for handling the traffic between the two zones.

R3(config-sec-zone-pair)# service-policy type inspect IN-2-OUT-PMAP

R3(config-sec-zone-pair)# exit

R3(config)#

Step 3: Assign interfaces to the appropriate security zones.

R3(config)# int g0/0

R3(config-if)# zone-member security IN-ZONE

R3(config-if)# exit

R3(config)# int s0/1/0

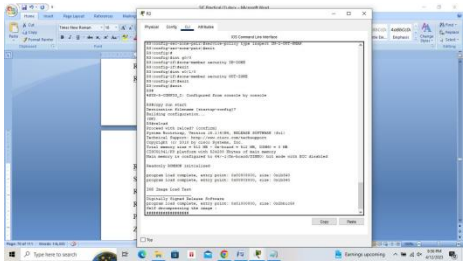
R3(config-if)# zone-member security OUT-ZONE

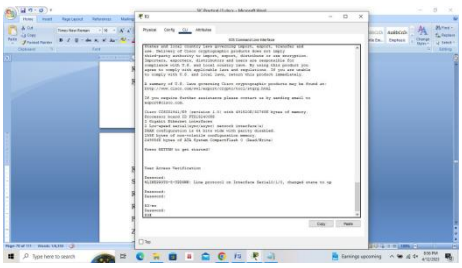
R3(config-if)# exit

Step 4: Copy the running configuration to the startup configuration.

R3# copy run start

R3# reload



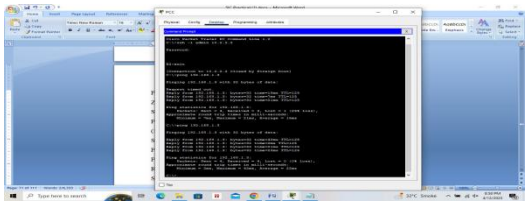


Part 7: Test Firewall Functionality from IN-ZONE to OUT ZONE

Step 1: From internal PC-C, ping the external PC-A server.

PCC>ping 192.168.1.3

(Successful)

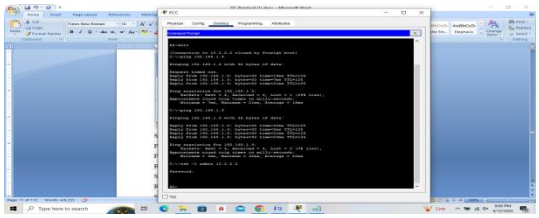


Step 2: Access R2 using SSH.

PCC>ssh –l admin 10.2.2.2

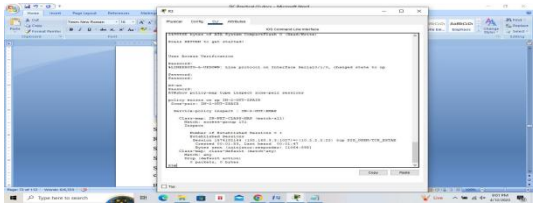
Password:

R2>



Step 3: View established sessions

R3# show policy-map type inspect zone-pair sessions



Session 175216232 (192.168.3.3:1028)=>(10.2.2.2:22) tcp

SIS_OPEN/TCP_ESTAB

Step 4: From PC-C, exit the SSH session on R2 and close the command prompt window.

R2>exit

Step 5: From internal PC-C, open a web browser to the PC-A server web page.

Desktop -> Web Browser

URL: http://192.168.1.3

(Successful)

Step 6: View established sessions

R3# show policy-map type inspect zone-pair sessions

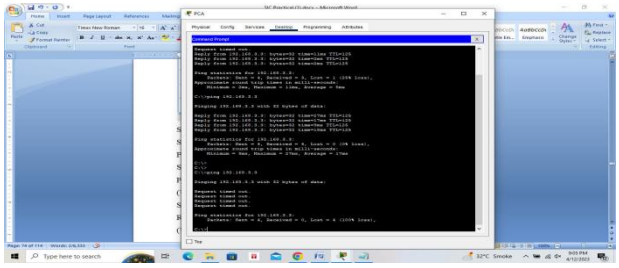
Session 565266624 (192.168.3.3:1031)=>(192.168.1.3:80) tcp

SIS_OPEN/TCP_ESTAB

Part 8: Test Firewall Functionality from OUT-ZONE to INZONE

Step 1: From internal PC-A, ping the external PC-C server.

PCA>ping 192.168.3.3

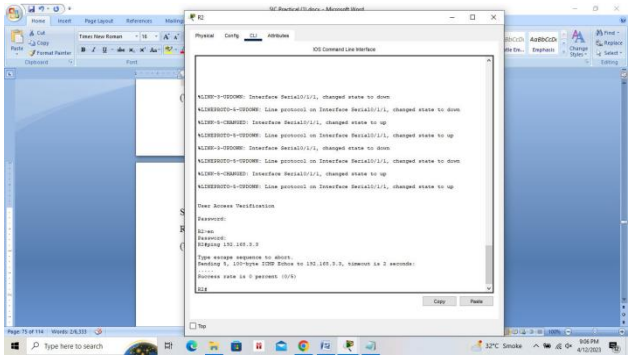


(Unsuccessful – Request timed out)

Step 2: From R2, ping PC-C.

R2# ping 192.168.3.3

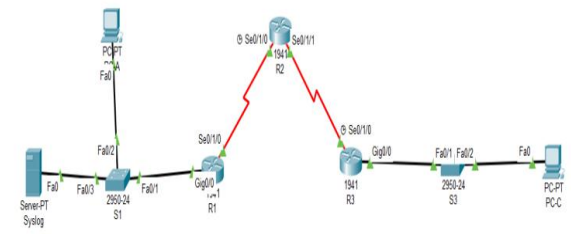
(Unsuccessful – Request timed out)

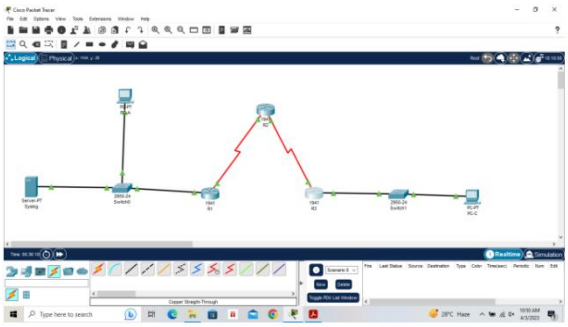


# Practical 6: Configure IOS Intrusion Prevention System (IPS) Using the CL

Addressing Table:

**Topology:**



| Device | Interface | IP Address | Subnet Mask | Default Gateway |
|---|---|---|---|---|
| R1 | gig0/0 | 192.168.1.1 | 255.255.255.0 | N/A |
| | Se0/1/0 | 10.1.1.1 | 255.255.255.252 | N/A |
| R2 | Se0/1/0 | 10.1.1.2 | 255.255.255.252 | N/A |
| | Se0/1/1 | 10.2.2.2 | 255.255.255.252 | N/A |
| R3 | gig0/0 | 192.168.3.1 | 255.255.255.0 | N/A |
| | Se0/1/0 | 10.2.2.1 | 255.255.255.252 | N/A |
| Syslog | NIC | 192.168.1.50 | 255.255.255.0 | 192.168.1.1 |
| PC-A | NIC | 192.168.1.2 | 255.255.255.0 | 192.168.1.1 |
| PC-C | NIC | 192.168.3.2 | 255.255.255.0 | 192.168.3.1 |

Objectives

- Enable IOS IPS.
- Configure logging.
- Modify an IPS signature.
- Verify IPS

Part 1: Configure router

Step 1: Configure secret on router

Execute command on all routers

R(config)# enable secret enpa55

Step 2: Configure console password on router

Execute command on all routers

R(config)# line console 0

R(config-line)# password conpa55

R(config-line)# login

Step 3: Configure SSH login on router. Execute command on all routers

R(config)# ip domain-name ccnasecurity.com

R(config)# username admin secret adminpa55

R(config)# line vty 0 4

R(config-line)# login local

R(config)# crypto key generate rsa

How many bits in the modulus [512]: 1024

Step 4: Configure OSPF on routers. Execute command on router 1

R1(config)#router ospf 1

R1(config-router)# network 192.168.1.0 0.0.0.255 area 0

R1(config-router)# network 10.1.1.0 0.0.0.3 area 0

Execute command on router 2

R2(config)#router ospf 1

R2(config-router)# network 10.1.1.0 0.0.0.3 area 0

R2(config-router)# network 10.2.2.0 0.0.0.3 area 0

Execute command on router 3

R3(config)#router ospf 1

R3(config-router)# network 10.2.2.0 0.0.0.3 area 0

R3(config-router)# network 192.168.3.0 0.0.0.255 area 0

Part 2: Enable IOS IPS

Step 1: Enable the Security Technology package

R1# show version

```
Technology Package License Information for Module:'c1900'

-----------------------------------------------------------------
Technology    Technology-package          Technology-package
              Current       Type          Next reboot
-----------------------------------------------------------------
ipbase        ipbasek9      Permanent     ipbasek9
security      None          None          None
data          None          None          None
```

(When command “show version” is given the above result comes, remember for further practicals)

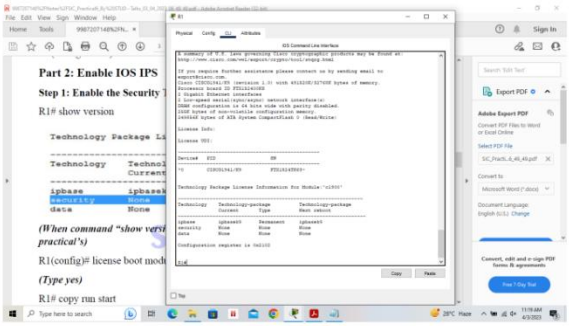
R1(config)# license boot module c1900 technology-package securityk9

(Type yes)

R1# copy run start

R1# reload

R1# show version



```
Technology Package License Information for Module:'c1900'

-----------------------------------------------------------------
Technology    Technology-package          Technology-package
              Current       Type          Next reboot
-----------------------------------------------------------------
ipbase        ipbasek9      Permanent     ipbasek9
security      securityk9    Evaluation    securityk9
data          disable       None          None
```

(When command “show version” is given again the above result comes to check If security is enabled or not, remember for further practical’s)

Step 2: Verify network connectivity

PCA> ping 192.168.3.2

(Successful)

PCC> ping 192.168.1.2

(Successful)

Step 3: Create an IOS IPS configuration directory in flash.

R1# mkdir ipsdir

Create directory filename [ipsdir]? <Enter>

Step 4: Configure the IPS signature storage location.

R1(config)# ip ips config location flash:ipsdir

Step 5: Create an IPS rule

R1(config)# ip ips name iosips

Step 6: Enable logging.

R1(config)# ip ips notify log

R1# clock set hr:min:sec date month year

R1(config)# service timestamps log datetime msec

R1(config)# logging host 192.168.1.50

Step 7: Configure IOS IPS to use the signature categories.

R1(config)# ip ips signature-category

R1(config-ips-category)# category all

R1(config-ips-category-action)# retired true

R1(config-ips-category-action)# exit

R1(config-ips-category)# category ios_ips basic

R1(config-ips-category-action)# retired false

R1(config-ips-category-action)# exit

R1(config-ips-cateogry)# exit

Do you want to accept these changes? [confirm] <Enter>

Step 8: Apply the IPS rule to an interface.

R1(config)# int gig0/0

R1(config-if)# ip ips iosips out

Step 9: Use show commands to verify IPS.

R1# show ip ips all

(Output)

Step 10: View the syslog messages.

Click the Syslog server->Services tab-> SYSLOG

(Output)

Part 3: Modify the Signature

Step 1: Change the event-action of a signature.

R1(config)# ip ips signature-definition

R1(config-sigdef)# signature 2004 0

R1(config-sigdef-sig)# status

R1(config-sigdef-sig-status)# retired false

R1(config-sigdef-sig-status)# enabled true

R1(config-sigdef-sig-status)# exit

R1(config-sigdef-sig)# engine

R1(config-sigdef-sig-engine)# event-action produce-alert

R1(config-sigdef-sig-engine)# event-action deny-packet-inline

R1(config-sigdef-sig-engine)# exit

R1(config-sigdef-sig)# exit

R1(config-sigdef)# exit

Do you want to accept these changes? [confirm] <Enter>

Step 2: Use show commands to verify IPS.

R1# show ip ips all

(Output)

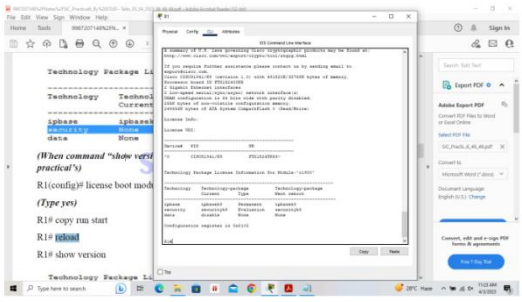
Step 3: Verify that IPS is working properly.

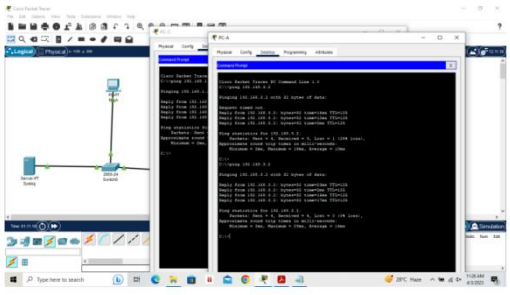
PCC> ping 192.168.1.2(Unsuccessful – Request timed out)

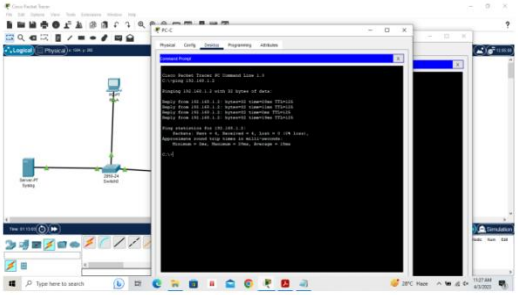
PCA> ping 192.168.3.2(Successful)

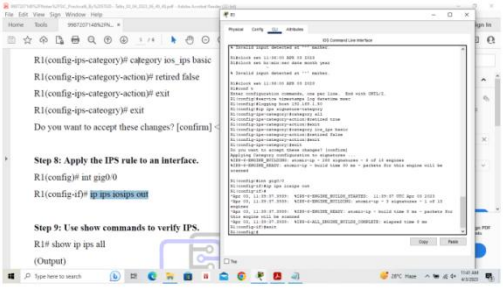
Step 4: View the syslog messages.

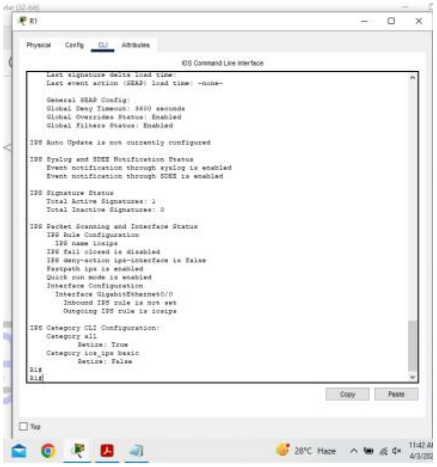
Click the Syslog server->Services tab-> SYSLOG

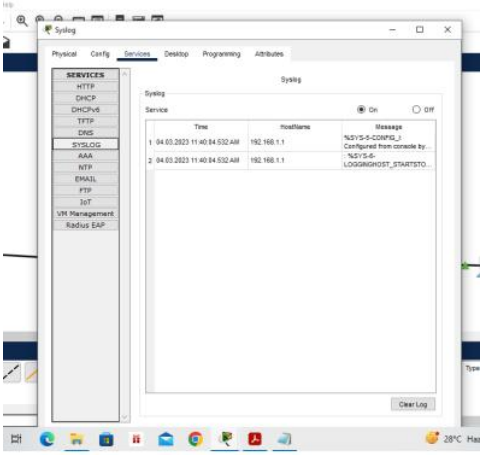


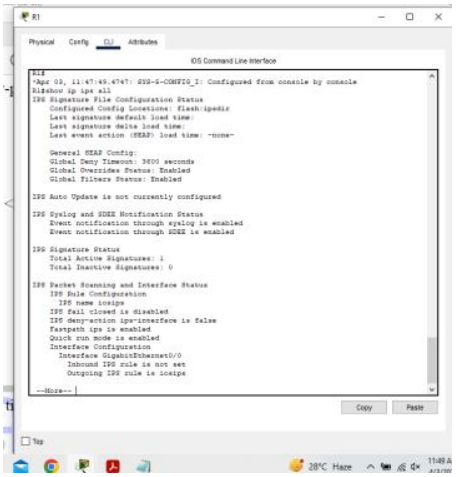


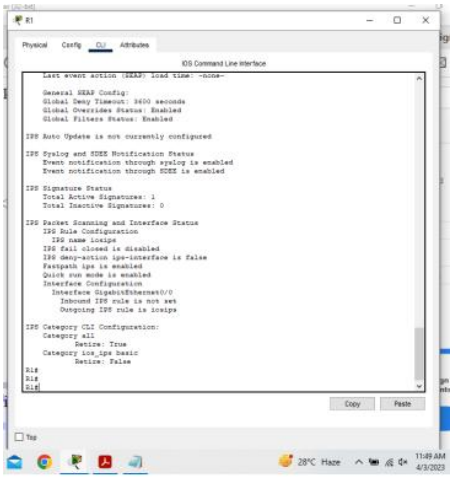


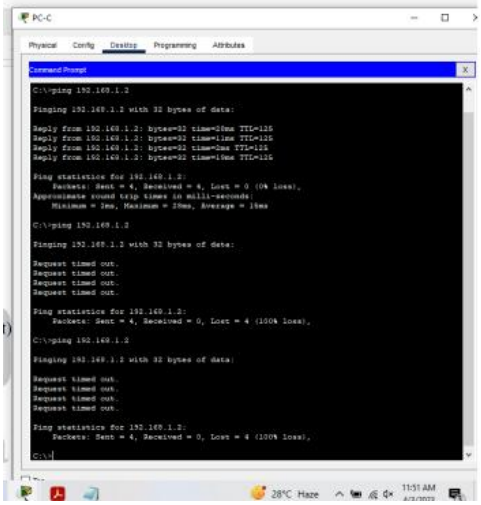

R1(config-ips-category)# category ios_ips basic
R1(config-ips-category-action)# retired false
R1(config-ips-category-action)# exit
R1(config-ips-category)# exit
Do you want to accept these changes? [confirm]
Step 8: Apply the IPS rule to an interface.
R1(config)# int gig0/0
R1(config-if)# ip ips iosips out
Step 9: Use show commands to verify IPS.
R1# show ip ips all
(Output)

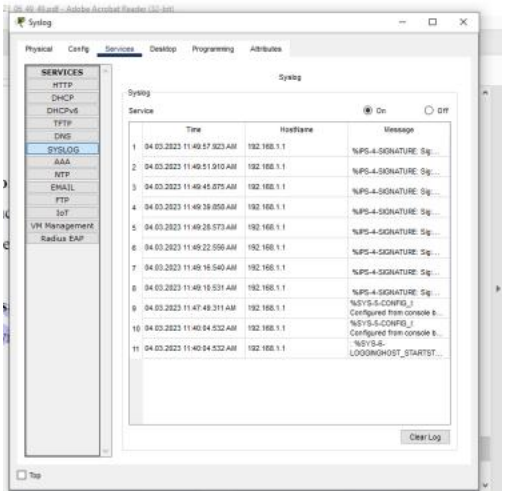






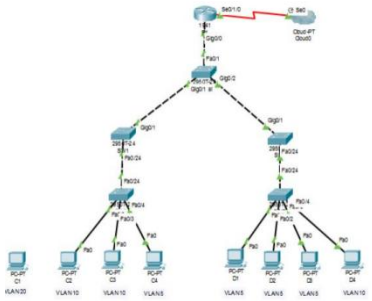






## Practical 7: Layer 2 VLAN Security

Topology:



**Addressing Table:**

| Device | Interface | IP Address | Subnet Mask | Default Gateway |
|---|---|---|---|---|
| R1 | gig0/0 | | | |
| | se0/1/0 | 209.165.200.1 | 255.255.255.0 | N/A |
| C2 | NIC | 192.168.10.1 | 255.255.255.0 | 192.168.10.100 |
| C3 | NIC | 192.168.10.2 | 255.255.255.0 | 192.168.10.100 |
| C4 | NIC | 192.168.5.1 | 255.255.255.0 | 192.168.5.100 |
| D1 | NIC | 192.168.5.2 | 255.255.255.0 | 192.168.5.100 |
| D2 | NIC | 192.168.5.3 | 255.255.255.0 | 192.168.5.100 |
| D3 | NIC | 192.168.5.4 | 255.255.255.0 | 192.168.5.100 |
| D4 | NIC | 192.168.10.3 | 255.255.255.0 | 192.168.10.100 |

Objectives

• Connect a new redundant link between SW-1 and SW-2.

• Enable trunking and configure security on the new trunk link between SW-1 and SW-2.

• Create a new management VLAN (VLAN 20) and attach a management PC to that VLAN.

• Implement an ACL to prevent outside users from accessing the management VLAN

Scenario

A company's network is currently set up using two separate VLANs: VLAN 5

and VLAN 10. In addition, all trunk ports are configured with native VLAN 15.

Part 1: Configure Switch/Router

Step 1: Configure secret. Execute command on all switches/router

SW/R1(config)# enable secret enpa55

Step 2: Configure console password. Execute command on all switches/router

SW/R1(config)# line console 0

SW/R1(config-line)# password conpa55

SW/R1(config-line)# login

Step 3: Configure SSH login. Execute command on all switches/router

SW/R1(config)# ip domain-name ccnasecurity.com

SW/R1(config)# username admin secret adminpa55

SW/R1(config)# line vty 0 4

SW/R1(config-line)# login local

SW/R1(config-line)# crypto key generate rsa

How many bits in the modulus [512]: 1024

Part 2: Create VLAN and assign access mode and trunk mode to interfaces

Step 1: Check existing VLAN. Execute command on all switches

SW# show vlan brief

Step 2: Create new VLAN. Execute command on all switches

SW(config)# vlan 5

SW(config-vlan) # exit

SW(config)# vlan 10

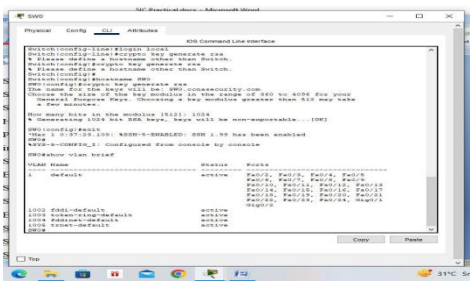
SW(config-vlan) # exit

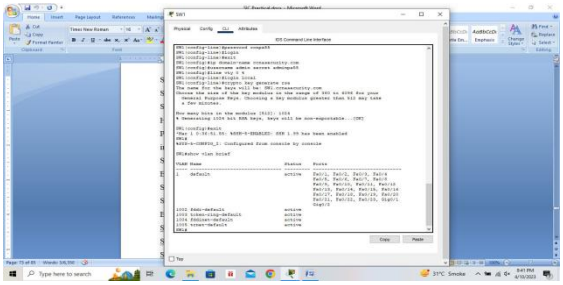
SW(config)# vlan 15

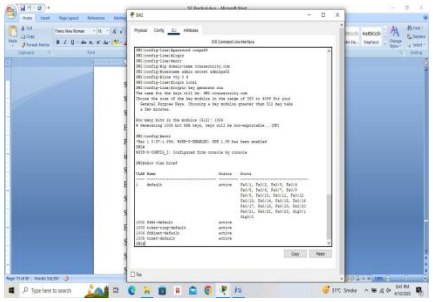
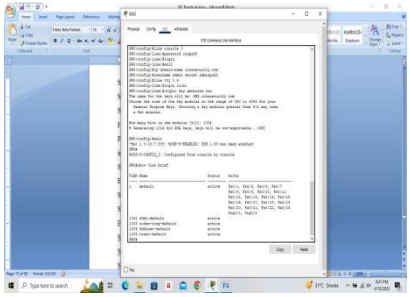
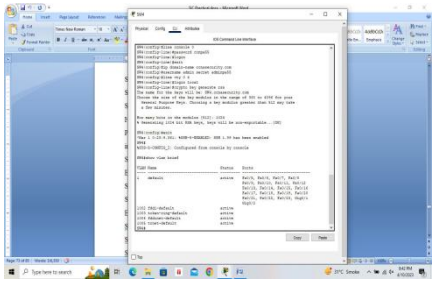
SW(config-vlan) # exit

Step 3: Check the new VLAN. Execute command on all switches

SW# show vlan brief





Step 4: Assign access mode to VLAN switch interfaces

Execute command on switches SWA/SWB

SWA(config)# int fa0/2

SWA(config -if)# switchport mode access

SWA(config -if)# switchport access vlan 10

SWA(config)# int fa0/3

SWA(config -if)# switchport mode access

SWA(config -if)# switchport access vlan 10

SWA(config)# int fa0/4

SWA(config -if)# switchport mode access

SWA(config -if)# switchport access vlan 5

SWB(config)# int fa0/1

SWB(config -if)# switchport mode access

SWB(config -if)# switchport access vlan 5

SWB(config)# int fa0/2

SWB(config -if)# switchport mode access

SWB(config -if)# switchport access vlan 5

SWB(config)# int fa0/3

SWB(config -if)# switchport mode access

SWB(config -if)# switchport access vlan 5

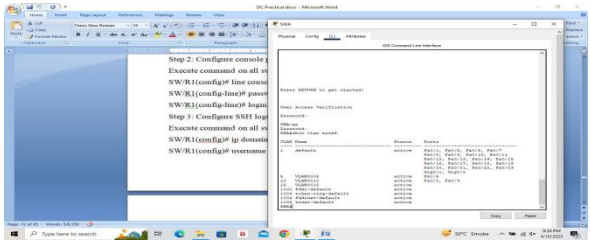
SWB(config)# int fa0/4

SWB(config -if)# switchport mode access

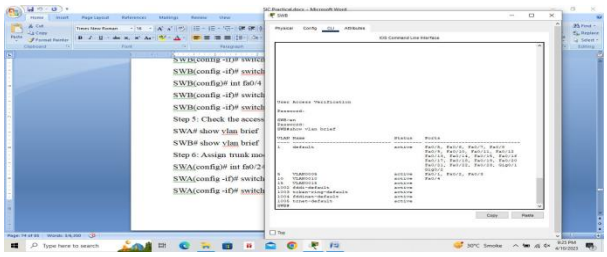
SWB(config -if)# switchport access vlan 10

Step 5: Check the access mode allocations

SWA# show vlan brief



SWB# show vlan brief



Step 6: Assign trunk mode to other switch interfaces

SWA(config)# int fa0/24

SWA(config -if)# switchport mode trunk

SWA(config -if)# switchport trunk native vlan 15

SWB(config)# int fa0/24

SWB(config -if)# switchport mode trunk

SWB(config -if)# switchport trunk native vlan 15

SW1(config)# int fa0/24

SW1(config -if)# switchport mode trunk

SW1(config -if)# switchport trunk native vlan 15

SW1(config)# int gig0/1

SW1(config -if)# switchport mode trunk

SW1(config -if)# switchport trunk native vlan 15

SW2(config)# int fa0/24

SW2(config -if)# switchport mode trunk

SW2(config -if)# switchport trunk native vlan 15

SW2(config)# int gig0/1

SW2(config -if)# switchport mode trunk

SW2(config -if)# switchport trunk native vlan 15

Central(config)# int range gig0/1-2

Central(config –if-range)# switchport mode trunk

Central(config –if-range)# switchport trunk native vlan 15

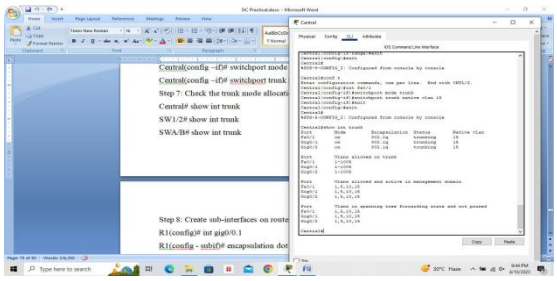
Central(config)# int fa0/1

Central(config –if)# switchport mode trunk

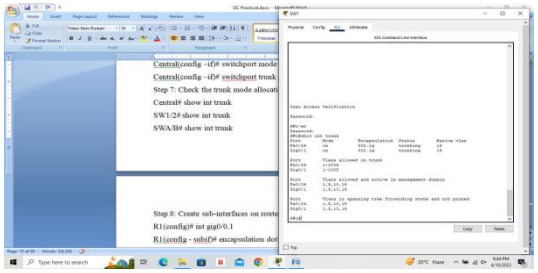
Central(config –if)# switchport trunk native vlan 15

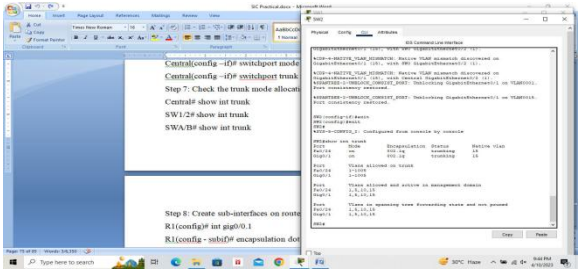
Step 7: Check the trunk mode allocations

Central# show int trunk

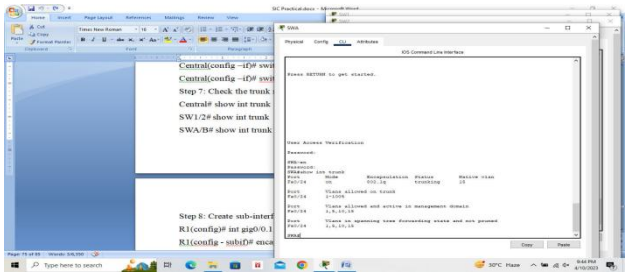


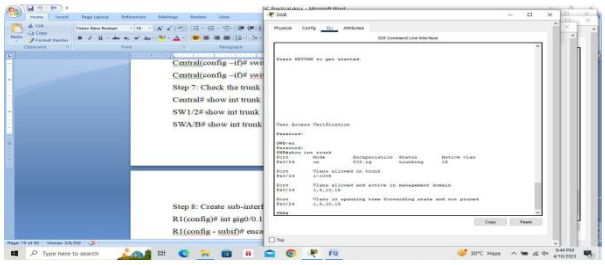
SW1/2# show int trunk





SWA/B# show int trunk





Step 8: Create sub-interfaces on router to support VLAN

R1(config)# int gig0/0.1

R1(config - subif)# encapsulation dot1q 5

R1(config - subif)# ip address 192.168.5.100 255.255.255.0

R1(config)# int gig0/0.2

R1(config - subif)# encapsulation dot1q 10

R1(config - subif)# ip address 192.168.10.100 255.255.255.0

R1(config)# int gig0/0.15

R1(config - subif)# encapsulation dot1q 15

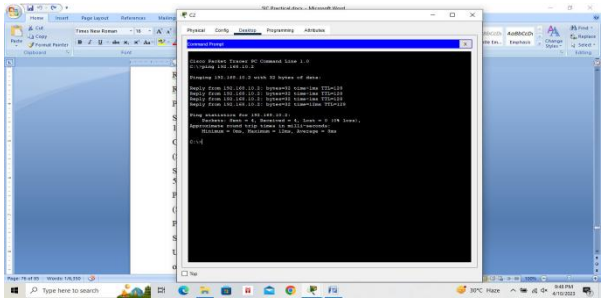
R1(config - subif)# ip address 192.168.15.100 255.255.255.0

Part 3: Verify Connectivity

Step 1: Verify connectivity between C2 (VLAN 10) and C3 (VLAN 10).

C2> ping 192.168.10.2

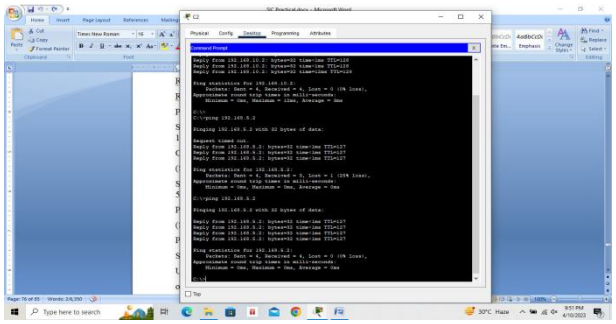
(Successful)



Step 2: Verify connectivity between C2 (VLAN 10) and D1 (VLAN 5).

PC2> ping 192.168.5.2

(Successful)



Part 4: Create a Redundant Link between SW-1 and SW-2

Step 1: Connect SW-1 and SW-2.

Using a crossover cable, connect port Fa0/23 on SW-1 to port Fa0/23 on SW-2.

Step 2: Enable trunking, including all trunk security mechanisms on the link between SW-1 and SW-2.

(Execute command on SW- 1 and SW-2)

SW1/2(config)# int fa0/23

SW1/2(config-if)# switchport mode trunk

SW1/2(config-if)# switchport trunk native vlan 15

SW1/2(config-if)# switchport nonegotiate

Part 5: Enable VLAN 20 as a Management VLAN

Step 1: Enable a management VLAN (VLAN 20) on SW-A.

SW-A(config)# vlan 20

SW-A(config-vlan)# exit

SW-A(config)# int vlan 20

SW-A(config-if)# ip address 192.168.20.1 255.255.255.0

Step 2: Enable the same management VLAN on all other switches

(Execute command on SW-B, SW-1, SW-2, and Central)

SW(config)# vlan 20

SW(config-vlan)# exit

Create an interface VLAN 20 on all switches and assign an IP address within

the 192.168.20.0/24 network.

SW-B(config)# int vlan 20

SW-B(config-if)# ip address 192.168.20.2 255.255.255.0

SW-1(config)#int vlan 20

SW-1(config-if)#ip address 192.168.20.3 255.255.255.0

SW-2(config)#int vlan 20

SW-2(config-if)#ip address 192.168.20.4 255.255.255.0

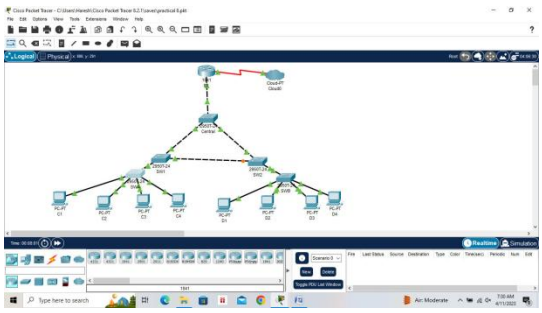
Central(config)# int vlan 20

Central(config-if)# ip address 192.168.20.5 255.255.255.0

Step 3: Connect and configure the management PC.

Connect the management PC using copper straight-through to SW-A port

Fa0/1 and ensure that it is assigned an available IP address 192.168.20.50



Step 4: On SW-A, ensure the management PC is part of VLAN 20.

SW-A(config)# int fa0/1

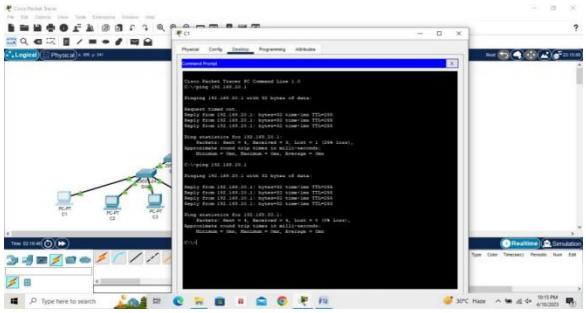
SW-A(config)# switchport mode access

SW-A(config-if)# switchport access vlan 20

Step 5: Verify connectivity of the management PC to all switches.

C1> ping 192.168.20.1 (SW-A)

(Successful)



C1> ping 192.168.20.2 (SW-B)

(Successful)

C1> ping 192.168.20.3 (SW-1)

(Successful)

C1> ping 192.168.20.4 (SW-2)

(Successful)

C1> ping 192.168.20.5 (Central)

(Successful)

Part 6: Enable the Management PC to Access Router R1

Step 1: Enable a new subinterface on router R1.

R1(config)# int gig0/0.3

R1(config-subif)# encapsulation dot1q 20

R1(config-subif)# ip address 192.168.20.100 255.255.255.0

Step 2: Set default gateway in management PC.

C1 – 192.168.20.100

Step 3: Verify connectivity between the management PC and R1.

C1> ping 192.168.20.100

(Successful)

Step 4: Enable security.

R1(config)# access-list 101 deny ip any 192.168.20.0 0.0.0.255

R1(config)# access-list 101 permit ip any any

R1(config)# access-list 102 permit ip host 192.168.20.50 any

Step 5: Apply ACL on correct interfaces

R1(config)# int gig0/0.1

R1(config-subif)# ip access-group 101 in

R1(config-subif)# int gig0/0.2

R1(config-subif)# ip access-group 101 in

R1(config-subif)# line vty 0 4

R1(config-line)# access-class 102 in

Step 6: Verify connectivity between the management PC and SW-A, SW-B and R1

C1> ping 192.168.20.1 (SW-A)

(Successful)

C1> ping 192.168.20.2 (SW-B)

(Successful)

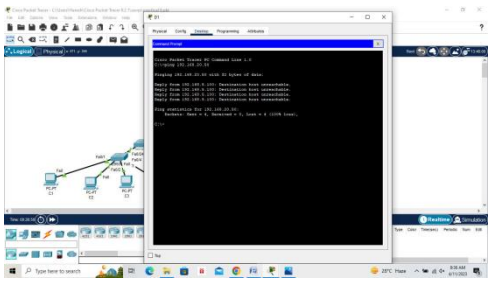
C1> ping 192.168.20.100 (R1)

(Successful)

Step 7: Verify connectivity between the D1 and management PC.

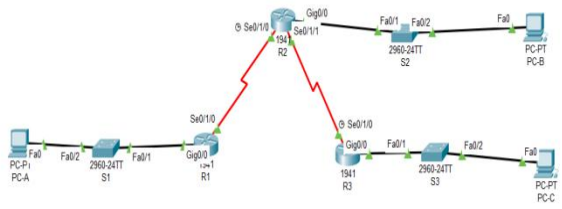
D1>ping 192.168.20.50

(Unsuccessful – Destination host unreachable)



# Practical 8: Configure and Verify a Site-to-Site IPsec VPN Using CLI

**Topology:**




**Addressing Table:**

| Device | Interface | IP Address | Subnet Mask | Default Gateway |
|---|---|---|---|---|
| R1 | gig0/0 | 192.168.1.1 | 255.255.255.0 | N/A |
| | Se0/1/0 (DCE) | 10.1.1.1 | 255.255.255.252 | N/A |
| R2 | Se0/1/0 | 10.1.1.2 | 255.255.255.252 | N/A |
| | Se0/1/1 (DCE) | 10.2.2.2 | 255.255.255.252 | N/A |
| R3 | gig0/0 | 192.168.3.1 | 255.255.255.0 | N/A |
| | Se0/1/0 | 10.2.2.1 | 255.255.255.252 | N/A |
| PC-A | NIC | 192.168.1.3 | 255.255.255.0 | 192.168.1.1 |
| PC-C | NIC | 192.168.3.3 | 255.255.255.0 | 192.168.3.1 |

Objectives:

• Verify connectivity throughout the network.

• Configure R1 to support a site-to-site IPsec VPN with R3

Part 1: Configure router

Step 1: Configure secret on router

Execute command on all routers

R(config)# enable secret enpa55

Step 2: Configure console password on router. Execute command on all routers

R(config)# line console 0

R(config-line)# password conpa55

R(config-line)# login

Step 3: Configure SSH login on router. Execute command on all routers

R(config)# ip domain-name ccnasecurity.com

R(config)# username admin secret adminpa55

R(config)# line vty 0 4

R(config-line)# login local

R(config)# crypto key generate rsa

How many bits in the modulus [512]: 1024

Step 4: Configure OSPF on routers

R1(config)# router ospf 1

R1(config)# network 192.168.1.0 0.0.0.255 area 0

R1(config)# network 10.1.1.0 0.0.0.3 area 0

R2(config)# router ospf 1

R2(config)# network 192.168.2.0 0.0.0.255 area 0

R2(config)# network 10.2.2.0 0.0.0.3 area 0

R2(config)# network 10.1.1.0 0.0.0.3 area 0

R3(config)# router ospf 1

R3(config)# network 192.168.3.0 0.0.0.255 area 0

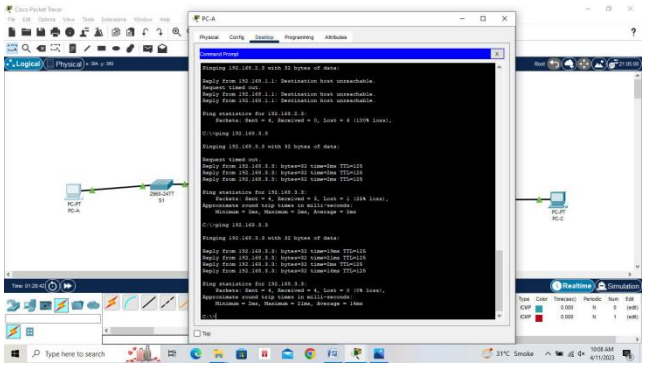
R3(config)# network 10.2.2.0 0.0.0.3 area 0

Part 2: Configure IPsec Parameters on R1

Step 1: From PC-A, verify connectivity to PC-C and PC-B.

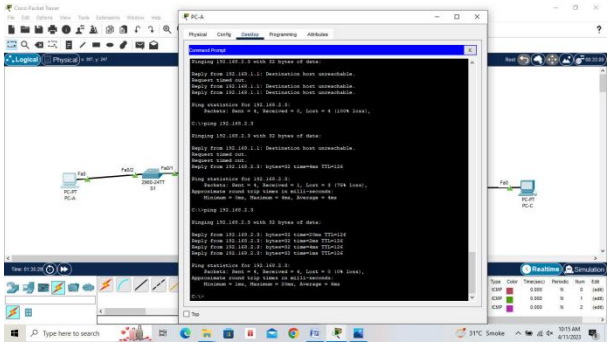
PCA> ping 192.168.3.3

(Successful)



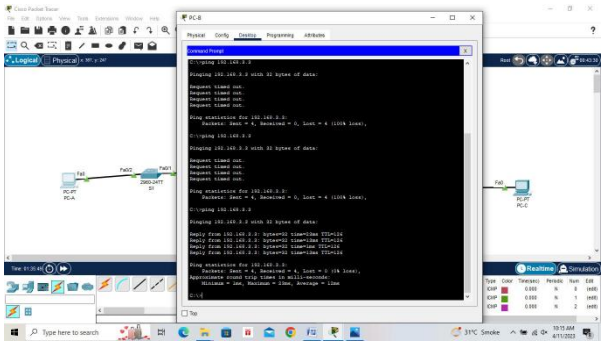
PCA> ping 192.168.2.3

(Successful)



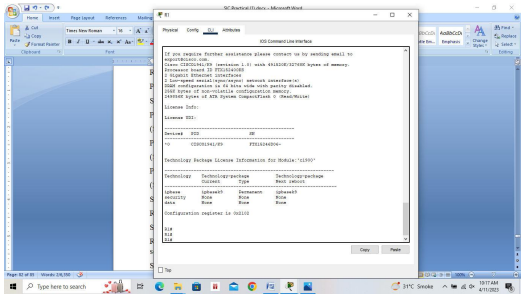
PCB> ping 192.168.3.3

(Successful)



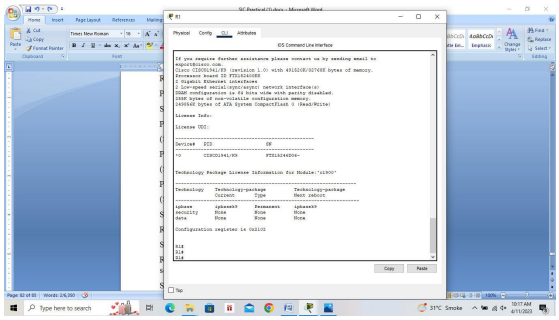
Step 2: Check if the Security Technology package is enabled

R1# show version

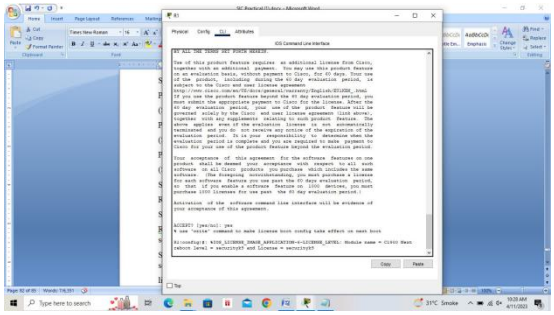


Step 3: Enable the Security Technology package.

R1(config)# license boot module c1900 technology-package securityk9

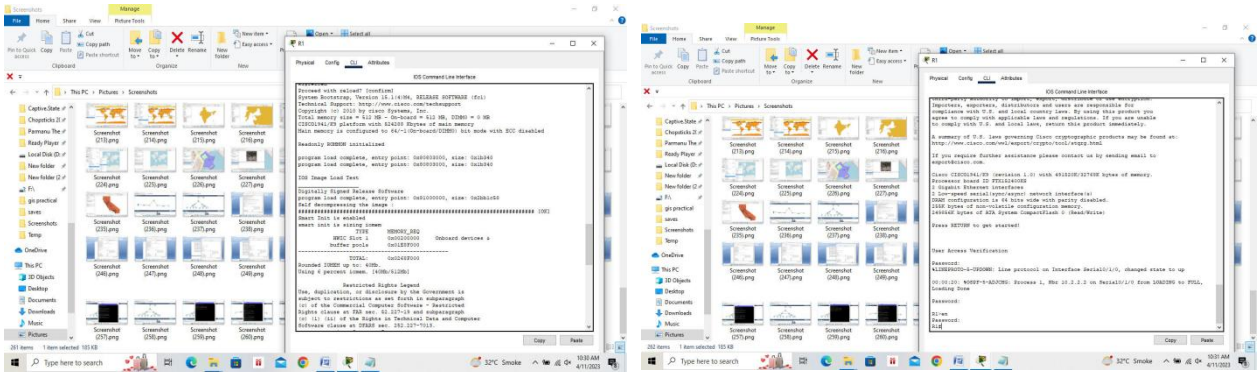


Step 4: Save the running config and reload the router to enable the security License



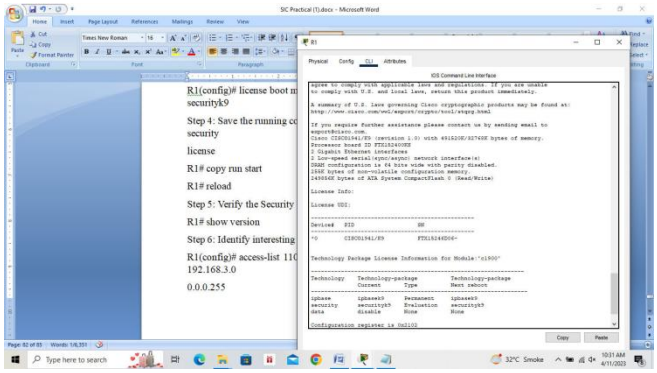
R1# copy run start

R1# reload



Step 5: Verify the Security Technology package is enabled

R1# show version



Step 6: Identify interesting traffic on R1.

R1(config)# access-list 110 permit ip 192.168.1.0 0.0.0.255 192.168.3.0 0.0.0.255

Step 7: Configure the IKE Phase 1 ISAKMP policy on R1.

R1(config)# crypto isakmp policy 10

R1(config-isakmp)# encryption aes 256

R1(config-isakmp)# authentication pre-share

R1(config-isakmp)# group 5

R1(config-isakmp)# exit

R1(config)# crypto isakmp key vpnpa55 address 10.2.2.2

Step 8: Configure the IKE Phase 2 IPsec policy on R1.

R1(config)# crypto ipsec transform-set VPN-SET esp-aes esp-sha-hmac

R1(config)# crypto map VPN-MAP 10 ipsec-isakmp

R1(config-crypto-map)# description VPN connection to R3

R1(config-crypto-map)# set peer 10.2.2.2

R1(config-crypto-map)# set transform-set VPN-SET

R1(config-crypto-map)# match address 110

R1(config-crypto-map)# exit

Step 9: Configure the crypto map on the outgoing interface.

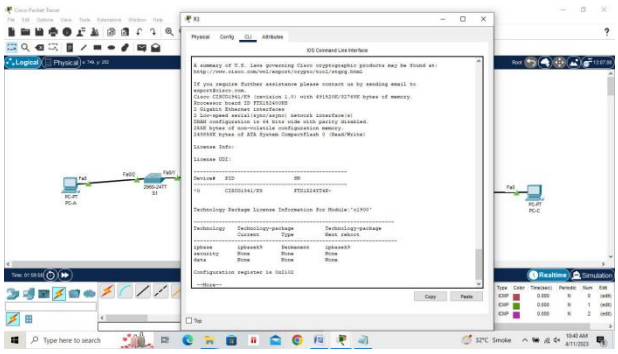
R1(config)# int se0/1/0

R1(config-if)# crypto map VPN-MAP

Part 3: Configure IPsec Parameters on R3

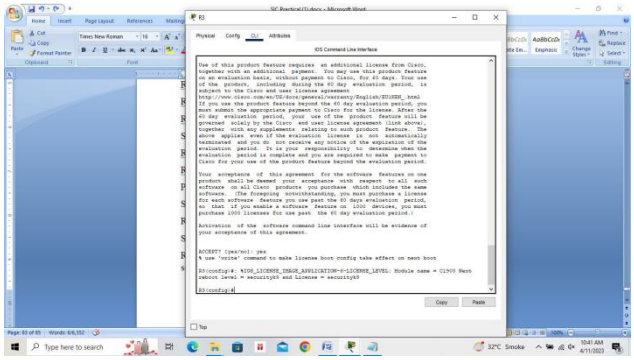
Step 1: Check if the Security Technology package is enabled

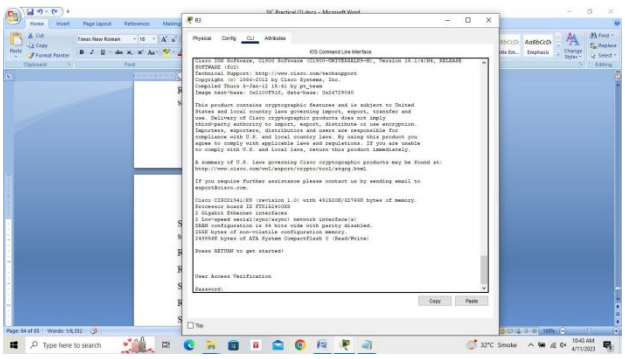
R3# show version



Step 2: Enable the Security Technology package.

R3(config)# license boot module c1900 technology-package securityk9





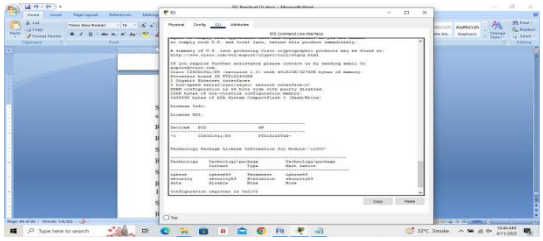
Step 3: Save the running config and reload the router to enable the security license

R3# copy run start

R3# reload

Step 4: Verify the Security Technology package is enabled

R3# show version



Step 5: Configure router R3 to support a site-to-site VPN with R1.

R3(config)# access-list 110 permit ip 192.168.3.0 0.0.0.255 192.168.1.0 0.0.0.255

Step 6: Configure the IKE Phase 1 ISAKMP properties on R3.

R3(config)# crypto isakmp policy 10

R3(config-isakmp)# encryption aes 256

R3(config-isakmp)# authentication pre-share

R3(config-isakmp)# group 5

R3(config-isakmp)# exit

R3(config)# crypto isakmp key vpnpa55 address 10.1.1.2

Step 7: Configure the IKE Phase 2 IPsec policy on R3.

R3(config)# crypto ipsec transform-set VPN-SET esp-aes esp-sha-hmac

R3(config)# crypto map VPN-MAP 10 ipsec-isakmp

R3(config-crypto-map)# description VPN connection to R1

R3(config-crypto-map)# set peer 10.1.1.2

R3(config-crypto-map)# set transform-set VPN-SET

R3(config-crypto-map)# match address 110

R3(config-crypto-map)# exit

Step 8: Configure the crypto map on the outgoing interface.

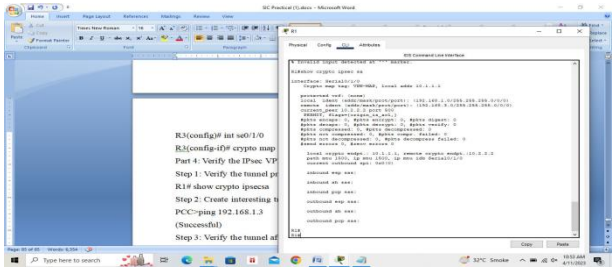
R3(config)# int se0/1/0

R3(config-if)# crypto map VPN-MAP

Part 4: Verify the IPsec VPN

Step 1: Verify the tunnel prior to interesting traffic.

R1# show crypto ipsec sa



Step 2: Create interesting traffic.

PCC>ping 192.168.1.3

(Successful)

Step 3: Verify the tunnel after interesting traffic.

R1# show crypto ipsec sa

Step 4: Create uninteresting traffic

PCB>ping 192.168.1.3

(Successful)

R1#ping 192.168.3.3

(Successful)

R3#ping 192.168.1.3

(Successful)

Step 5: Verify the tunnel.

R1# show crypto ipsec sa