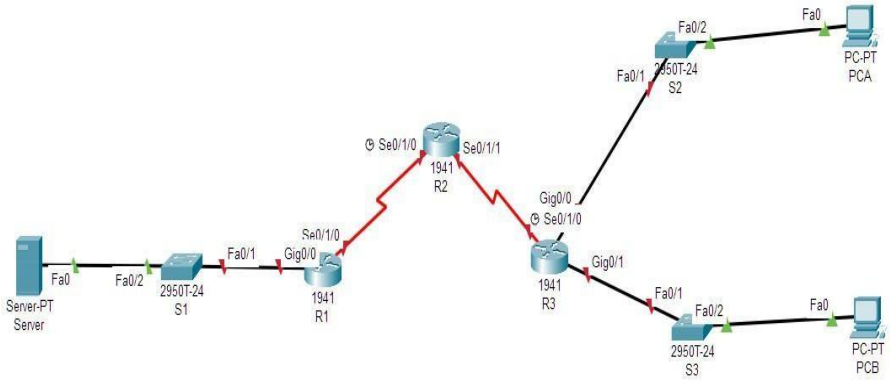
UNIVERSITY OF MUMBAI
TY B.Sc. INFORMATION TECHNOLOGY PRACTICAL EXAMINATION
SEMESTER VI
INFORMATION SECURITY (USIT6P2)

Seat No: _____ Max. Marks: 50

<table>
<tr><td>1.</td><td>Create the following topology using static routing and
▪ Configure, apply and verify an ACL that will block HTTP access on R3 ▪ Configure, apply and verify an ACL that will block HTTPS access on R3.
 

Addressing Table
<table>
<tr><th>Device</th><th>Interface</th><th>IPv6 Address/Prefix</th><th>Default Gateway</th></tr>
<tr><td>Server</td><td>NIC</td><td>2001:DB8:1:10::30/64</td><td>FE80::1</td></tr>
<tr><td rowspan="2">R1</td><td>gig0/0</td><td>2001:DB8:1:10::1/64</td><td>FE80::1</td></tr>
<tr><td>se0/1/0</td><td>2001:DB8:1:1::1/64</td><td>FE80::1</td></tr>
<tr><td rowspan="2">R2</td><td>se0/1/0</td><td>2001:DB8:1:1::2/64</td><td>FE80::2</td></tr>
<tr><td>se0/1/1</td><td>2001:DB8:1:2::2/64</td><td>FE80::2</td></tr>
<tr><td rowspan="3">R3</td><td>gig0/0</td><td>2001:DB8:1:30::1/64</td><td>FE80::3</td></tr>
<tr><td>gig0/1</td><td>2001:DB8:1:31::1/64</td><td>FE80::3</td></tr>
<tr><td>se0/1/0</td><td>2001:DB8:1:2::1/64</td><td>FE80::3</td></tr>
<tr><td>PCA</td><td>NIC</td><td>2001:DB8:1:30::10/64</td><td>FE80::3</td></tr>
<tr><td>PCB</td><td>NIC</td><td>2001:DB8:1:31::11/64</td><td>FE80::3</td></tr>
</table>
</td><td>40</td></tr>
<tr><td>2.</td><td>Viva</td><td>5</td></tr>
<tr><td>3.</td><td>Journal</td><td>5</td></tr>
</table>

Objectives: Configure static routing and apply IPv6 ACLs to block HTTP and HTTPS access on R3.

Topology: R1, R2, R3, Server, PCA, PCB with IPv6 configurations.

Topology

Device	Interface	IPv6 Address/Prefix	Default Gateway
Server	NIC	2001:DB8:1:10::30/64	FE80::1
R1	gig0/0	2001:DB8:1:10::1/64	FE80::1
R1	se0/1/0	2001:DB8:1:1::1/64	FE80::1
R2	se0/1/0	2001:DB8:1:1::2/64	FE80::2
R2	se0/1/1	2001:DB8:1:2::2/64	FE80::2
R3	gig0/0	2001:DB8:1:30::1/64	FE80::3
R3	gig0/1	2001:DB8:1:31::1/64	FE80::3
R3	se0/1/0	2001:DB8:1:2::1/64	FE80::3
PCA	NIC	2001:DB8:1:30::10/64	FE80::3
PCB	NIC	2001:DB8:1:31::11/64	FE80::3

Objectives

- **Configure static routing across R1, R2, and R3.**
- **Configure and verify an IPv6 ACL to block HTTP access on R3.**
- **Configure and verify an IPv6 ACL to block HTTPS access on R3.**

Steps

Step 1: Configure IP Addresses

Server
Desktop > IP Configuration
IPv6 Address: 2001:DB8:1:10::30
Prefix Length: 64
Link Local Address: FE80::1
Default Gateway: 2001:DB8:1:10::1

PCA
Desktop > IP Configuration
IPv6 Address: 2001:DB8:1:30::10
Prefix Length: 64
Link Local Address: FE80::3
Default Gateway: 2001:DB8:1:30::1

PCB
Desktop > IP Configuration
IPv6 Address: 2001:DB8:1:31::11
Prefix Length: 64
Link Local Address: FE80::3
Default Gateway: 2001:DB8:1:31::1

R1
enable
configure terminal
interface gigabitEthernet0/0
ipv6 address 2001:DB8:1:10::1/64
ipv6 address FE80::1 link-local
no shutdown
exit
interface serial0/1/0
ipv6 address 2001:DB8:1:1::1/64
ipv6 address FE80::1 link-local
no shutdown
exit

R2
enable
configure terminal
interface serial0/1/0
ipv6 address 2001:DB8:1:1::2/64
ipv6 address FE80::2 link-local
no shutdown
exit
interface serial0/1/1
ipv6 address 2001:DB8:1:2::2/64
ipv6 address FE80::2 link-local
no shutdown
exit

R3

```
enable
configure terminal
interface gigabitEthernet0/0
ipv6 address 2001:DB8:1:30::1/64
ipv6 address FE80::3 link-local
no shutdown
exit
interface gigabitEthernet0/1
ipv6 address 2001:DB8:1:31::1/64
ipv6 address FE80::3 link-local
no shutdown
exit
interface serial0/1/0
ipv6 address 2001:DB8:1:2::1/64
ipv6 address FE80::3 link-local
no shutdown
exit
```

Step 2: Configure Static Routing

R1

```
ipv6 unicast-routing
ipv6 route 2001:DB8:1:30::/64 2001:DB8:1:1::2
ipv6 route 2001:DB8:1:31::/64 2001:DB8:1:1::2
```

R2

```
ipv6 unicast-routing
ipv6 route 2001:DB8:1:10::/64 2001:DB8:1:1::1
ipv6 route 2001:DB8:1:30::/64 2001:DB8:1:2::1
ipv6 route 2001:DB8:1:31::/64 2001:DB8:1:2::1
```

R3

```
ipv6 unicast-routing
ipv6 route 2001:DB8:1:10::/64 2001:DB8:1:2::2
```

Step 3: Configure ACLs on R3

Block HTTP (port 80)

```
R3(config)# ipv6 access-list BLOCK-HTTP
R3(config-ipv6-acl)# deny tcp any any eq 80
R3(config-ipv6-acl)# permit ipv6 any any
R3(config-ipv6-acl)# exit
R3(config)# interface gigabitEthernet0/0
R3(config-if)# ipv6 traffic-filter BLOCK-HTTP in
```

R3(config-if)# exit
R3(config)# interface gigabitEthernet0/1
R3(config-if)# ipv6 traffic-filter BLOCK-HTTP in
R3(config-if)# exit

Block HTTPS (port 443)
R3(config)# ipv6 access-list BLOCK-HTTPS
R3(config-ipv6-acl)# deny tcp any any eq 443
R3(config-ipv6-acl)# permit ipv6 any any
R3(config-ipv6-acl)# exit
R3(config)# interface gigabitEthernet0/0
R3(config-if)# ipv6 traffic-filter BLOCK-HTTPS in
R3(config-if)# exit
R3(config)# interface gigabitEthernet0/1
R3(config-if)# ipv6 traffic-filter BLOCK-HTTPS in
R3(config-if)# exit

Step 4: Verification

Server Configuration
Config > Services > HTTP/HTTPS: Turn ON both services

Test from PCA/PCB
Desktop > Web Browser
- Try accessing http://[2001:DB8:1:10::30] (Should fail)
- Try accessing https://[2001:DB8:1:10::30] (Should fail)

Verify ACLs on R3
R3# show ipv6 access-list BLOCK-HTTP
(Should show matches on deny statements)
R3# show ipv6 access-list BLOCK-HTTPS
(Should show matches on deny statements)

Test Connectivity
PCA> ping 2001:DB8:1:10::30 (Should work)
PCB> ping 2001:DB8:1:10::30 (Should work)

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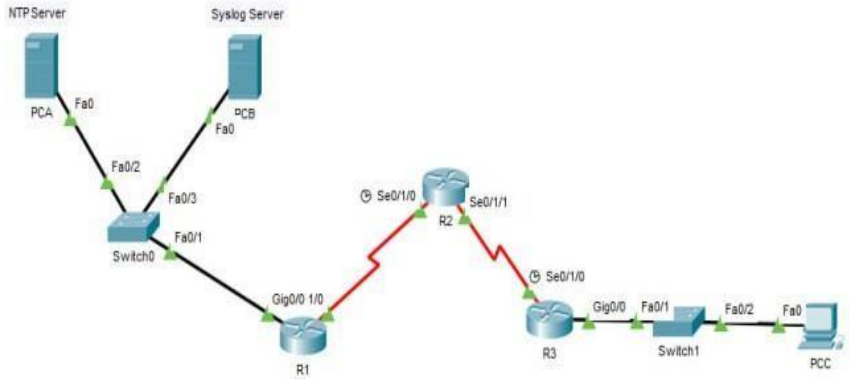
<table>
<tr><td>1.</td><td>Create the following topology and
▪ Configure OSPF MD5 authentication.
▪ Configure NTP and configure routers to log messages to the Syslog Server
 

Addressing Table
<table>
<tr><th>Device</th><th>Interface</th><th>IP Address</th><th>Subnet Mask</th><th>Default Gateway</th></tr>
<tr><td rowspan="2">R1</td><td>gig0/0</td><td>192.168.1.1</td><td>255.255.255.0</td><td>N/A</td></tr>
<tr><td>se0/1/0</td><td>10.1.1.1</td><td>255.255.255.252</td><td>N/A</td></tr>
<tr><td rowspan="2">R2</td><td>se0/1/0</td><td>10.1.1.2</td><td>255.255.255.252</td><td>N/A</td></tr>
<tr><td>se0/1/1</td><td>10.2.2.2</td><td>255.255.255.252</td><td>N/A</td></tr>
<tr><td rowspan="2">R3</td><td>gig0/0</td><td>192.168.3.1</td><td>255.255.255.0</td><td>N/A</td></tr>
<tr><td>se0/1/0</td><td>10.2.2.1</td><td>255.255.255.252</td><td>N/A</td></tr>
<tr><td>PC-A</td><td>NIC</td><td>192.168.1.5</td><td>255.255.255.0</td><td>192.168.1.1</td></tr>
<tr><td>PC-B</td><td>NIC</td><td>192.168.1.6</td><td>255.255.255.0</td><td>192.168.1.1</td></tr>
<tr><td>PC-C</td><td>NIC</td><td>192.168.3.5</td><td>255.255.255.0</td><td>192.168.3.1</td></tr>
</table></td><td>40</td></tr>
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</table>

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.**

Steps

Step 1: Configure password for vty lines
R(config)# line vty 0 4
R(config-line)# password vtypa55
R(config-line)# login

Step 2: Configure secret on router
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 the routers in area 0

R1(config)# router ospf 1
R1(config-router)# area 0 authentication message-digest
R2(config)# router ospf 1
R2(config-router)# area 0 authentication message-digest
R3(config)# router ospf 1
R3(config-router)# area 0 authentication message-digest

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.

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 NTPpa55 for 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

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 the 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

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

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
```

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
```

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
```

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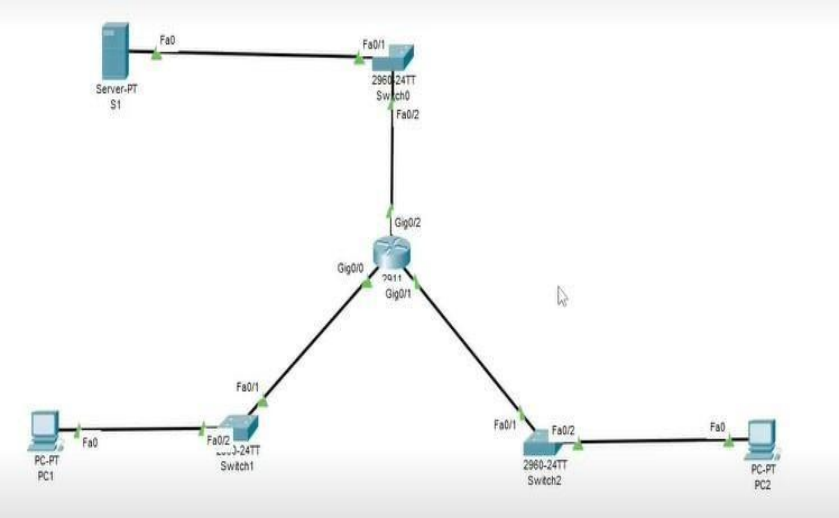
<table>
<tr><td>1.</td><td>Create the following topology and
▪ Configure an ACL that will permit FTP and HTTP access on R1.
▪ Verify the ACL implementation. PC1 (Only FTP). PC2(Only HTTP)
 

Addressing Table
<table>
<tr><th>Device</th><th>Interface</th><th>IP Address</th><th>Subnet Mask</th><th>Default Gateway</th></tr>
<tr><td rowspan="3">R1</td><td>gig0/0</td><td>172.22.34.65</td><td>255.255.255.224</td><td>N/A</td></tr>
<tr><td>gig0/1</td><td>172.22.34.97</td><td>255.255.255.240</td><td>N/A</td></tr>
<tr><td>gig0/2</td><td>172.22.34.1</td><td>255.255.255.192</td><td>N/A</td></tr>
<tr><td>Server</td><td>NIC</td><td>172.22.34.62</td><td>255.255.255.192</td><td>172.22.34.1</td></tr>
<tr><td>PC1</td><td>NIC</td><td>172.22.34.66</td><td>255.255.255.224</td><td>172.22.34.65</td></tr>
<tr><td>PC2</td><td>NIC</td><td>172.22.34.98</td><td>255.255.255.240</td><td>172.22.34.97</td></tr>
</table></td><td>40</td></tr>
<tr><td>2.</td><td>Viva</td><td>5</td></tr>
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</table>

Practical 11: Configure ACLs on R1 for FTP and HTTP
Objectives: Configure an ACL on R1 to permit FTP access from PC1 and HTTP access from PC2.
Topology: R1, Server, PC1, PC2 with IPv4 configurations.
Topology

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	gig0/0	172.22.34.65	255.255.255.224	N/A
R1	gig0/1	172.22.34.97	255.255.255.240	N/A
R1	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 IP addresses on R1, Server, PC1, and PC2.**
- **Configure an ACL on R1 to permit FTP from PC1 and HTTP from PC2 to the Server.**
- **Verify the ACL implementation.**

Steps
Step 1: Configure IP Addresses
Server
Desktop > IP Configuration
IP Address: 172.22.34.62
Subnet Mask: 255.255.255.192
Default Gateway: 172.22.34.1
PC1
Desktop > IP Configuration
IP Address: 172.22.34.66
Subnet Mask: 255.255.255.224
Default Gateway: 172.22.34.65
PC2
Desktop > IP Configuration
IP Address: 172.22.34.98
Subnet Mask: 255.255.255.240
Default Gateway: 172.22.34.97
R1

```
enable
configure terminal
interface gigabitEthernet0/0
ip address 172.22.34.65 255.255.255.224
no shutdown
exit
interface gigabitEthernet0/1
ip address 172.22.34.97 255.255.255.240
no shutdown
```

exit
interface gigabitEthernet0/2
ip address 172.22.34.1 255.255.255.192
no shutdown
exit

Step 2: Configure Services on Server

Server
Desktop > Services
FTP: ON
- Add a test file (e.g., "test.txt")
HTTP: ON
- Add a simple index.html file

Step 3: Configure ACL on R1

Create and Apply ACL
R1(config)# access-list 100 permit tcp host 172.22.34.66 host 172.22.34.62 eq ftp
R1(config)# access-list 100 permit tcp host 172.22.34.98 host 172.22.34.62 eq www
R1(config)# access-list 100 deny ip any any
R1(config)# exit
R1(config)# interface gigabitEthernet0/0
R1(config-if)# ip access-group 100 in
R1(config-if)# exit
R1(config)# interface gigabitEthernet0/1
R1(config-if)# ip access-group 100 in
R1(config-if)# exit

Server

Step 4: Verification

Test FTP from PC1
Desktop > Command Prompt
PC1> ftp 172.22.34.62
(Should connect successfully)
Try to verify file transfer
Exit FTP with Quit
Test HTTP from PC2
Desktop > Web Browser
Enter http://172.22.34.62
(Should display the webpage)

Test Restrictions

From PC1: Try http://172.22.34.62 in Web Browser (Should fail)
From PC2: Try ftp 172.22.34.62 in Command Prompt (Should fail)

Test Connectivity

From PC1: ping 172.22.34.62 (Should fail due to deny rule)
From PC2: ping 172.22.34.62 (Should fail due to deny rule)

Verify ACL on R1

R1# show access-lists
(Should show matches on permit statements for FTP and HTTP)

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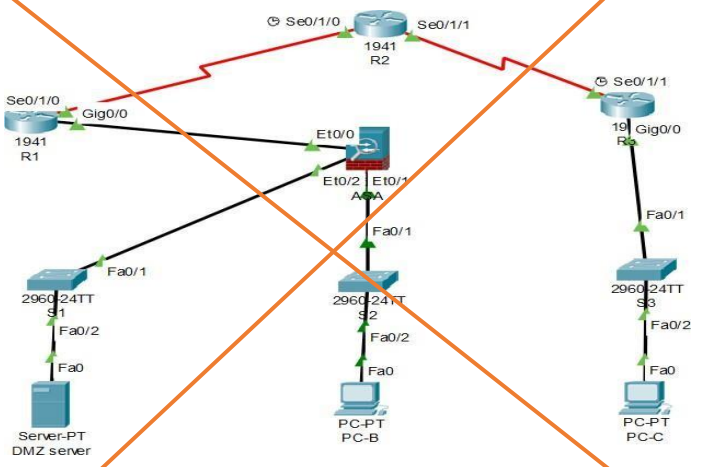
1.	Create the following topology and ▪ Configure basic ASA settings and interface security levels using CLI ▪ Configure routing, address translation, and inspection policy using CLI. ▪ Test connectivity to the ASA.	**40**
2.	Viva	**5**
3.	Journal	**5**



Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	gig0/0	209.165.200.225	255.255.255.248	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	172.16.3.1	255.255.255.0	N/A
	se0/1/0	10.2.2.1	255.255.255.252	N/A
ASA	VLAN 1 (Et0/1)	192.168.1.1	255.255.255.0	N/A
ASA	VLAN 2 (Et0/0)	209.165.200.226	255.255.255.248	N/A
ASA	VLAN 3 (Et0/2)	192.168.2.1	255.255.255.0	N/A
DMZ Server	NIC	192.168.2.3	255.255.255.0	192.168.2.1
PC-B	NIC	192.168.1.3	255.255.255.0	192.168.1.1
PC-C	NIC	172.168.3.3	255.255.255.0	172.168.3.1

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TY B.Sc. INFORMATION TECHNOLOGY PRACTICAL EXAMINATION
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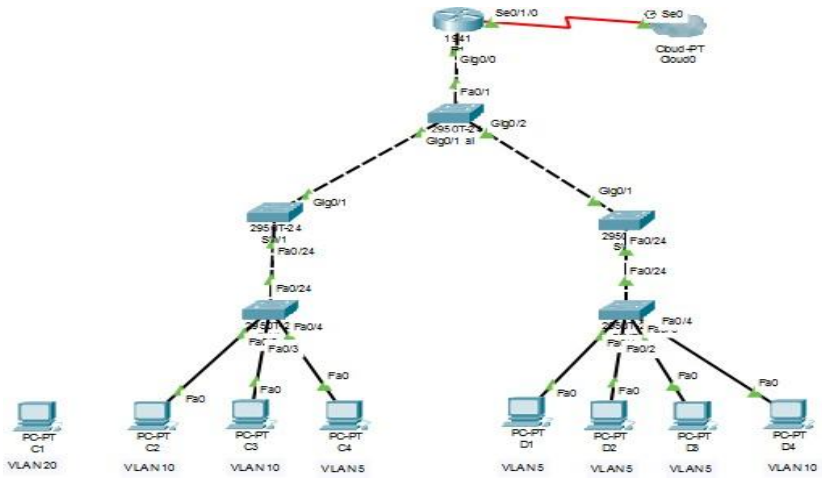
Seat No: _____ **Max. Marks: 50**

<table>
<tr><td>1.</td><td>Create the following topology and
▪ Connect a new redundant link between SW-1 and SW-2.
▪ Enable trunking and configure security on the trunk link.
▪ Create a new management VLAN (VLAN 20) and attach a management PC to that VLAN.
▪ Verify connectivity of the management PC to all switches.
▪ Implement an ACL to prevent outside users from accessing the management VLAN
 

Addressing Table
<table><tr><th>Devices</th><th>Interface</th><th>IP Address</th><th>Subnet Mask</th><th>Default Gateway</th></tr><tr><td rowspan="2">R1</td><td>gig0/1</td><td></td><td></td><td></td></tr><tr><td>se0/0/0</td><td>209.165.200.1</td><td>255.255.255.0</td><td>N/A</td></tr><tr><td>C2</td><td>NIC</td><td>192.168.10.1</td><td>255.255.255.0</td><td>192.168.10.100</td></tr><tr><td>C3</td><td>NIC</td><td>192.168.10.2</td><td>255.255.255.0</td><td>192.168.10.100</td></tr><tr><td>C4</td><td>NIC</td><td>192.168.5.1</td><td>255.255.255.0</td><td>192.168.5.100</td></tr><tr><td>D1</td><td>NIC</td><td>192.168.5.2</td><td>255.255.255.0</td><td>192.168.5.100</td></tr><tr><td>D2</td><td>NIC</td><td>192.168.5.3</td><td>255.255.255.0</td><td>192.168.5.100</td></tr><tr><td>D3</td><td>NIC</td><td>192.168.5.4</td><td>255.255.255.0</td><td>192.168.5.100</td></tr><tr><td>D4</td><td>NIC</td><td>192.168.10.3</td><td>255.255.255.0</td><td>192.168.10.100</td></tr></table></td><td>40</td></tr>
<tr><td>2.</td><td>Viva</td><td>5</td></tr>
<tr><td>3.</td><td>Journal</td><td>5</td></tr>
</table>

Practical 8: Layer 2 VLAN Security

Objectives: Secure trunk links, configure management VLAN, and restrict access with ACLs.

Topology: R1, SW-1, SW-2, SWA, SWB, Central with client devices.

Topology

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	gig0/0	-	-	N/A
R1	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
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
(Output not specified; likely unsuccessful due to ACL)

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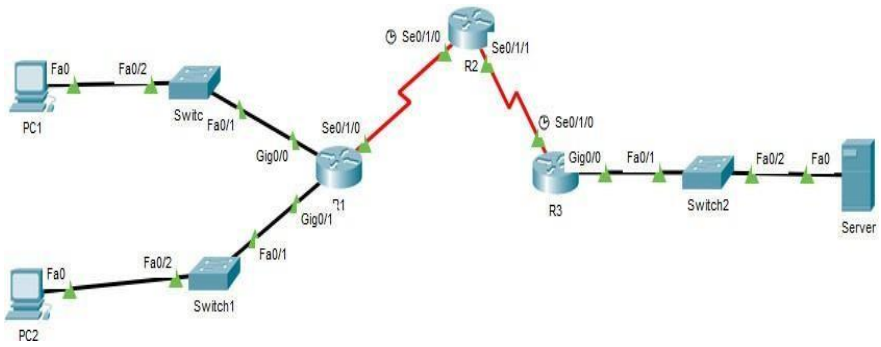
TY B.Sc. INFORMATION TECHNOLOGY PRACTICAL EXAMINATION
SEMESTER VI
INFORMATION SECURITY (USIT6P2)

Seat No: _____ **Max. Marks: 50**

<table>
<tr><td>1.</td><td>Create the following topology using static routing and
▪ Configure, apply and verify an ACL that will block ICMP access on R3
 

Addressing Table
<table>
<tr><th>Device</th><th>Interface</th><th>IPv6 Address/Prefix</th><th>Default Gateway</th></tr>
<tr><td>PC1</td><td>NIC</td><td>2001:DB8:1:10::10/64</td><td>FE80::1</td></tr>
<tr><td>PC2</td><td>NIC</td><td>2001:DB8:1:11::11/64</td><td>FE80::1</td></tr>
<tr><td rowspan="3">R1</td><td>gig0/0</td><td>2001:DB8:1:10::1/64</td><td>FE80::1</td></tr>
<tr><td>gig0/1</td><td>2001:DB8:1:11::1/64</td><td>FE80::1</td></tr>
<tr><td>se0/1/0</td><td>2001:DB8:1:1::1/64</td><td>FE80::1</td></tr>
<tr><td rowspan="2">R2</td><td>se0/1/0</td><td>2001:DB8:1:1::2/64</td><td>FE80::2</td></tr>
<tr><td>se0/1/1</td><td>2001:DB8:1:2::2/64</td><td>FE80::2</td></tr>
<tr><td rowspan="2">R3</td><td>gig0/0</td><td>2001:DB8:1:30::1/64</td><td>FE80::3</td></tr>
<tr><td>se0/1/0</td><td>2001:DB8:1:2::1/64</td><td>FE80::3</td></tr>
<tr><td>Server</td><td>NIC</td><td>2001:DB8:1:30::30/64</td><td>FE80::3</td></tr>
</table></td><td>40</td></tr>
<tr><td>2.</td><td>Viva</td><td>5</td></tr>
<tr><td>3.</td><td>Journal</td><td>5</td></tr>
</table>

Practical 4b: Configure IPv6 ACLs to Mitigate Attacks

Objectives: Configure, apply, and verify IPv6 ACLs.

Topology: R1, R2, R3, PC1, PC2, Server with IPv6 configurations.

Topology

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
R1	se0/1/0	2001:DB8:1:1::1/64	FE80::1
R1	gig0/1	2001:DB8:1:11::1/64	FE80::1
R2	se0/1/0	2001:DB8:1:1::2/64	FE80::2
R2	se0/1/1	2001:DB8:1:2::2/64	FE80::2
R3	gig0/0	2001:DB8:1:30::1/64	FE80::3
R3	se0/1/0	2001:DB8:1:2::1/64	FE80::3
Server	NIC	2001:DB8:1:30::30/64	FE80::3

Objectives

- **Configure, Apply, and Verify an IPv6 ACL**
- **Configure, Apply, and Verify a Second IPv6 ACL**

Steps

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)

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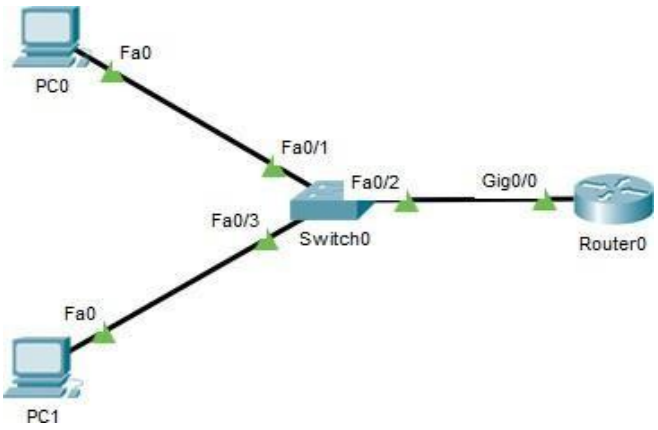
TY B.Sc. INFORMATION TECHNOLOGY PRACTICAL EXAMINATION
SEMESTER VI
INFORMATION SECURITY (USIT6P2)

Seat No: _____ Max. Marks: 50

<table>
<tr><td>1.</td><td>Create the following topology and
▪ Configure OSPF MD5 authentication
▪ 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.
 

Addressing Table
<table><tr><th>Device</th><th>Interface</th><th>IP Address</th><th>Subnet Mask</th><th>Default Gateway</th></tr><tr><td>R1</td><td>gig0/0</td><td>192.168.1.1</td><td>255.255.255.0</td><td>N/A</td></tr><tr><td>PC0</td><td>NIC</td><td>192.168.1.2</td><td>255.255.255.0</td><td>192.168.1.1</td></tr><tr><td>PC1</td><td>NIC</td><td>192.168.1.3</td><td>255.255.255.0</td><td>192.168.1.1</td></tr></table></td><td>40</td></tr>
<tr><td>2.</td><td>Viva</td><td>5</td></tr>
<tr><td>3.</td><td>Journal</td><td>5</td></tr>
</table>

Objectives: Configure local AAA authentication for console and vty lines.

Topology: R1, PC0, PC1 with specific IP configurations.

Topology

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.**

Steps

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.

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

R1>

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>
```

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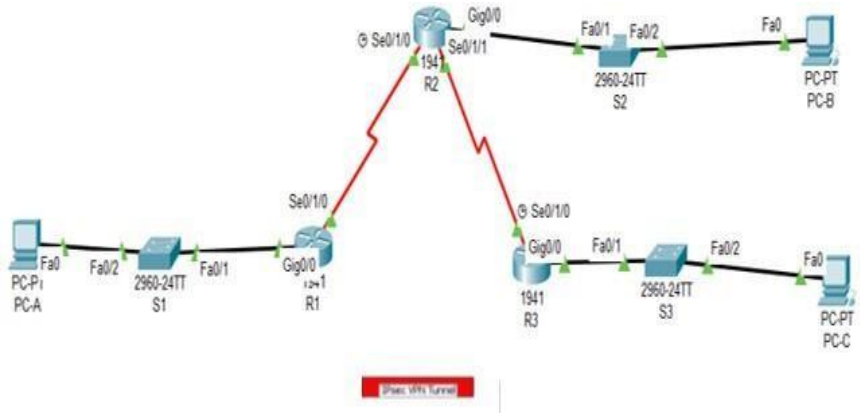
TY B.Sc. INFORMATION TECHNOLOGY PRACTICAL EXAMINATION
SEMESTER VI
INFORMATION SECURITY (USIT6P2)

Seat No: _____ Max. Marks: 50

<table>
<tr><td>1.</td><td>Create the following topology and
▪ Configure and verify R1 to support a site-to-site IPsec VPN with R3.
 

Addressing Table
<table>
<tr><th>Device</th><th>Interface</th><th>IP Address</th><th>Subnet Mask</th><th>Default Gateway</th></tr>
<tr><td rowspan="2">R1</td><td>gig0/0</td><td>192.168.1.1</td><td>255.255.255.0</td><td>N/A</td></tr>
<tr><td>se0/1/0</td><td>10.1.1.2</td><td>255.255.255.252</td><td>N/A</td></tr>
<tr><td rowspan="3">R2</td><td>gig0/0</td><td>192.168.2.1</td><td>255.255.255.0</td><td>N/A</td></tr>
<tr><td>se0/1/0</td><td>10.1.1.1</td><td>255.255.255.252</td><td>N/A</td></tr>
<tr><td>se0/1/1</td><td>10.2.2.1</td><td>255.255.255.252</td><td>N/A</td></tr>
<tr><td rowspan="2">R3</td><td>gig0/0</td><td>192.168.2.1</td><td>255.255.255.0</td><td>N/A</td></tr>
<tr><td>se0/1/0</td><td>10.2.2.2</td><td>255.255.255.252</td><td>N/A</td></tr>
<tr><td>PC-A</td><td>NIC</td><td>192.168.1.3</td><td>255.255.255.0</td><td>192.168.1.1</td></tr>
<tr><td>PC-B</td><td>NIC</td><td>192.168.2.3</td><td>255.255.255.0</td><td>192.168.2.1</td></tr>
<tr><td>PC-C</td><td>NIC</td><td>192.168.3.3</td><td>255.255.255.0</td><td>192.168.3.1</td></tr>
</table></td><td>40</td></tr>
<tr><td>2.</td><td>Viva</td><td>5</td></tr>
<tr><td>3.</td><td>Journal</td><td>5</td></tr>
</table>

Practical 9: Configure Site-to-Site IPsec VPN

Objectives: Configure and verify a site-to-site IPsec VPN between R1 and R3.

Topology: R1, R2, R3, PC-A, PC-B, PC-C with specific IP configurations.

Topology

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	gig0/0	192.168.1.1	255.255.255.0	N/A
R1	Se0/1/0	10.1.1.2	255.255.255.252	N/A
R2	gig0/0	192.168.2.1	255.255.255.0	N/A
R2	Se0/1/0	10.1.1.1	255.255.255.252	N/A
R2	Se0/1/1	10.2.2.1	255.255.255.252	N/A
R3	gig0/0	192.168.3.1	255.255.255.0	N/A
R3	Se0/1/0	10.2.2.2	255.255.255.252	N/A
PC-A	NIC	192.168.1.3	255.255.255.0	192.168.1.1
PC-B	NIC	192.168.2.3	255.255.255.0	192.168.2.1
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-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 192.168.2.0 0.0.0.255 area 0
R2(config-router)# network 10.2.2.0 0.0.0.3 area 0
R2(config-router)# network 10.1.1.0 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

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

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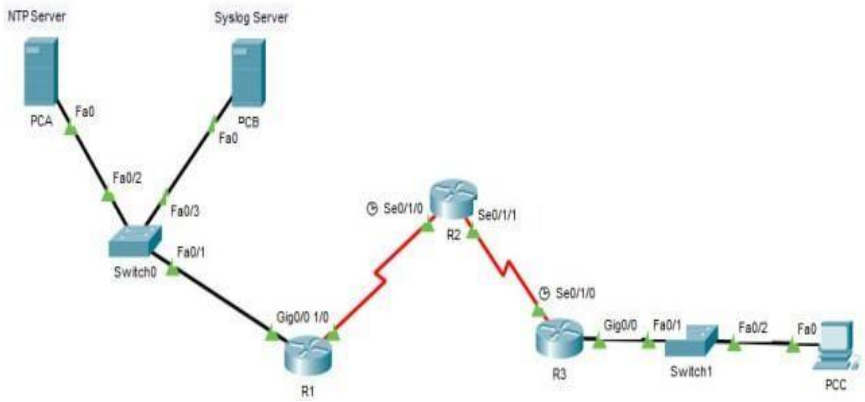
SEMESTER VI
INFORMATION SECURITY (USIT6P2)

Seat No: _____ Max. Marks: 50

<table>
<tr><td>1.</td><td>Create the following topology with OSPF routing and ▪ Configure NTP.
▪ Configure Routers to log messages to the syslog server.
▪ Configure R3 to support SSH connections
 

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<tr><td rowspan="2">R2</td><td>se0/1/0</td><td>10.1.1.2</td><td>255.255.255.252</td><td>N/A</td></tr>
<tr><td>se0/1/1</td><td>10.2.2.2</td><td>255.255.255.252</td><td>N/A</td></tr>
<tr><td rowspan="2">R3</td><td>gig0/0</td><td>192.168.3.1</td><td>255.255.255.0</td><td>N/A</td></tr>
<tr><td>se0/1/0</td><td>10.2.2.1</td><td>255.255.255.252</td><td>N/A</td></tr>
<tr><td>PC-A</td><td>NIC</td><td>192.168.1.5</td><td>255.255.255.0</td><td>192.168.1.1</td></tr>
<tr><td>PC-B</td><td>NIC</td><td>192.168.1.6</td><td>255.255.255.0</td><td>192.168.1.1</td></tr>
<tr><td>PC-C</td><td>NIC</td><td>192.168.3.5</td><td>255.255.255.0</td><td>192.168.3.1</td></tr>
</table></td><td>40</td></tr>
<tr><td>2.</td><td>Viva</td><td>5</td></tr>
<tr><td>3.</td><td>Journal</td><td>5</td></tr>
</table>

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.**

Steps

Step 1: Configure password for vty lines
R(config)# line vty 0 4
R(config-line)# password vtypa55
R(config-line)# login

Step 2: Configure secret on router
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 the routers in area 0

R1(config)# router ospf 1
R1(config-router)# area 0 authentication message-digest
R2(config)# router ospf 1
R2(config-router)# area 0 authentication message-digest
R3(config)# router ospf 1
R3(config-router)# area 0 authentication message-digest

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.

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 NTPpa55 for 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

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 the 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

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

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

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

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

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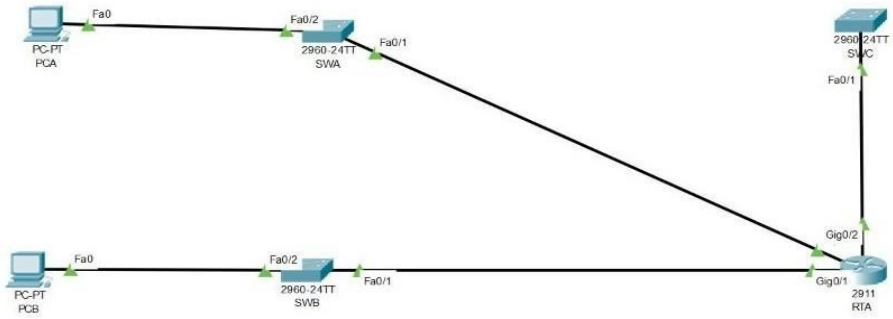
TY B.Sc. INFORMATION TECHNOLOGY PRACTICAL EXAMINATION
SEMESTER VI
INFORMATION SECURITY (USIT6P2)

Seat No: _____ Max. Marks: 50

<table>
<tr><td>1.</td><td>Create the following topology and
▪ Configure an ACL that will permit one LAN to remotely access device in another LAN using SSH Protocol
▪ Besides ICMP all traffic from other network is denied.
▪ Verify the ACL implementation.
 

Addressing Table
<table>
<tr><th>Device</th><th>Interface</th><th>IP Address</th><th>Subnet Mask</th><th>Default Gateway</th></tr>
<tr><td rowspan="3">RTA</td><td>gig0/0</td><td>10.101.117.49</td><td>255.255.255.248</td><td>N/A</td></tr>
<tr><td>gig0/1</td><td>10.101.117.33</td><td>255.255.255.240</td><td>N/A</td></tr>
<tr><td>gig0/2</td><td>10.101.117.1</td><td>255.255.255.224</td><td>N/A</td></tr>
<tr><td>PCA</td><td>NIC</td><td>10.101.117.51</td><td>255.255.255.248</td><td>10.101.117.49</td></tr>
<tr><td>PCB</td><td>NIC</td><td>10.101.117.35</td><td>255.255.255.240</td><td>10.101.117.33</td></tr>
<tr><td>SWA</td><td>VLAN 1</td><td>10.101.117.50</td><td>255.255.255.248</td><td>10.101.117.49</td></tr>
<tr><td>SWB</td><td>VLAN 1</td><td>10.101.117.34</td><td>255.255.255.240</td><td>10.101.117.33</td></tr>
<tr><td>SWC</td><td>VLAN 1</td><td>10.101.117.2</td><td>255.255.255.224</td><td>10.101.117.1</td></tr>
</table></td><td>40</td></tr>
<tr><td>2.</td><td>Viva</td><td>5</td></tr>
<tr><td>3.</td><td>Journal</td><td>5</td></tr>
</table>

Practical 3b: Configuring Extended ACLs (SSH Scenario)

Objectives: Configure, apply, and verify an extended numbered ACL.

Topology: RTA, SWA, SWB, SWC, PCA, PCB with specific IP configurations.

Topology

Device	Interface	IP Address	Subnet Mask	Default Gateway
RTA	gig0/0	10.101.117.49	255.255.255.248	N/A
RTA	gig0/1	10.101.117.33	255.255.255.240	N/A
RTA	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

- **Devices on one LAN are allowed to remotely access devices in another LAN using SSH protocol**
- **Besides ICMP, all traffic from other networks is denied**

Steps

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

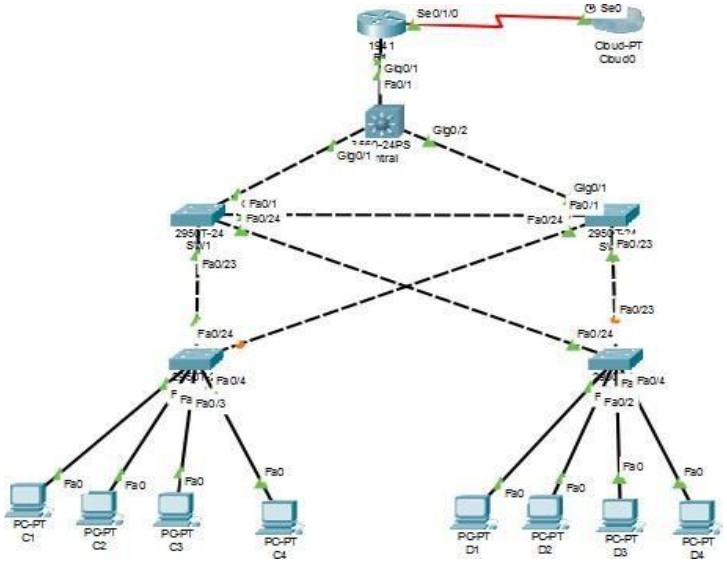
Step 1: Configure the extended ACL
RTA(config)# access-list 199 permit tcp 10.101.117.32 0.0.0.15 10.101.117.0 0.0.0.31 eq 22
RTA(config)# access-list 199 permit icmp any any

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

1.	Create the following topology and ▪ Assign the Central switch as the root bridge. ▪ Secure spanning-tree parameters to prevent STP manipulation attacks. ▪ Enable port security to prevent CAM table overflow attacks.	**40**
2.	Viva	**5**
3.	Journal	**5**



Addressing Table

Devices	Interface	IP Address	Subnet Mask	Default Gateway
R1	gig0/1	192.168.1.1	255.255.255.0	N/A
	se0/0/0	209.165.200.1	255.255.255.0	N/A
C1	NIC	10.1.1.10	255.255.255.0	10.1.1.1
C2	NIC	10.1.1.11	255.255.255.0	10.1.1.1
C3	NIC	10.1.1.12	255.255.255.0	10.1.1.1
C4	NIC	10.1.1.13	255.255.255.0	10.1.1.1
D1	NIC	10.1.1.14	255.255.255.0	10.1.1.1
D2	NIC	10.1.1.15	255.255.255.0	10.1.1.1
D3	NIC	10.1.1.16	255.255.255.0	10.1.1.1
D4	NIC	10.1.1.17	255.255.255.0	10.1.1.1

Practical 7: Secure Layer 2 Switches

Objectives: Configure root bridge, secure STP, and enable port security.

Topology: R1, Central, SW1, SW2, SWA, SWB with client devices.

Topology

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	gig0/0	192.168.1.1	255.255.255.0	N/A
R1	Se0/1/0	209.165.200.1	255.255.255.0	N/A
C1	NIC	10.1.1.10	255.255.255.0	10.1.1.1
C2	NIC	10.1.1.11	255.255.255.0	10.1.1.1
C3	NIC	10.1.1.12	255.255.255.0	10.1.1.1
C4	NIC	10.1.1.13	255.255.255.0	10.1.1.1
D1	NIC	10.1.1.114	255.255.255.0	10.1.1.1
D2	NIC	10.1.1.15	255.255.255.0	10.1.1.1
D3	NIC	10.1.1.16	255.255.255.0	10.1.1.1
D4	NIC	10.1.1.17	255.255.255.0	10.1.1.1

Objectives

- **Assign the Central switch as the root bridge.**
- **Secure spanning-tree parameters to prevent STP manipulation attacks.**
- **Enable port security to prevent CAM table overflow attacks.**

Part 1: Configure Switch / Router

Step 1: Configure secret
Execute command on all switches and router
R1/SW(config)# enable secret enpa55

Step 2: Configure console password
Execute command on all switches and router
R1/SW(config)# line console 0
R1/SW(config-line)# password conpa55
R1/SW(config-line)# login

Step 3: Configure SSH login
Execute command on all switches and router
R1/SW(config)# ip domain-name ccnasecurity.com
R1/SW(config)# username admin secret adminpa55
R1/SW(config)# line vty 0 4
R1/SW(config-line)# login local
R1/SW(config-line)# crypto key generate rsa
How many bits in the modulus [512]: 1024

Part 2: Configure Root Bridge

Step 1: Determine the current root bridge
Central# show spanning-tree
SW1# show spanning-tree

Step 2: Assign Central as the primary root bridge
Central(config)# spanning-tree vlan 1 root primary
Central# show spanning-tree

Step 3: Assign SW-1 as a secondary root bridge
SW1(config)# spanning-tree vlan 1 root secondary
SW1# show spanning-tree

Part 3: Protect Against STP Attacks

Step 1: Enable PortFast on all access ports
SWA/B(config)# int range fa0/1 - 4
SWA/B(config-if-range)# spanning-tree portfast

Step 2: Enable BPDU guard on all access ports
SWA/B(config)# int range fa0/1 - 4
SWA/B(config-if-range)# spanning-tree bpduguard enable

Step 3: Enable root guard
SW-1/2(config)# int range fa0/23 - 24
SW-1/2(config-if-range)# spanning-tree guard root

Part 4: Configure Port Security and Disable Unused Ports

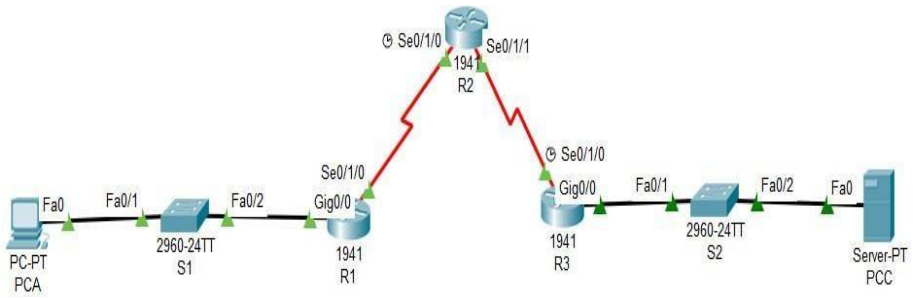
Step 1: Configure basic port security on all ports connected to host devices
SW-A/B(config)# int range fa0/1 - 22
SW-A/B(config-if-range)# switchport mode access
SW-A/B(config-if-range)# switchport port-security
SW-A/B(config-if-range)# switchport port-security maximum 2
SW-A/B(config-if-range)# switchport port-security violation shutdown
SW-A/B(config-if-range)# switchport port-security mac-address sticky

Step 2: Verify port security
SW-A/B# show port-security int fa0/1

Step 3: Disable unused ports
SW-A/B(config)# int range fa0/5 - 22
SW-A/B(config-if-range)# shutdown

Step 4: Verify Connectivity
Ping C1->C2 (Successful)
Ping C1->D1 (Successful)

Step 5: Verify port security
No specific command provided; assume repeat of Step 2 verification.
SW-A/B# show port-security int fa0/1

1.	Create the following topology using static routing and configure ▪ A zone-based policy (ZPF) firewall on R1 ▪ Verify ZPF firewall functionality using ping, SSH and a web browser.  **Addressing table** **Device** / **Interface** / **IP Address** / **Subnet Mask** / **Default Gateway** R1 / gig0/0 / 192.168.1.1 / 255.255.255.0 / N/A R1 / 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 R2 / 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 R3 / 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	**40**
2.	Viva	**5**
3.	Journal	**5**

Practical 5: Configure Zone-Based Policy Firewall on Cisco Routers

Objectives: Configure and verify a zone-based policy firewall on R3.

Topology: R1, R2, R3, PC-A, PC-C with specific IP configurations.

Topology

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	gig0/0	192.168.1.1	255.255.255.0	N/A
R1	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
R2	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
R3	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.**

Steps

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)# crypto key generate rsa
How many bits in the modulus [512]: 1024

Step 5: Configure static routing on routers
Execute command on all routers
R(config)# ip route destination-network-address subnetmask next-hopdestination-address
Note: Replace with specific routes as needed based on topology.

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-NET-CLASS-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 OUT-ZONE

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

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: adminpa55
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

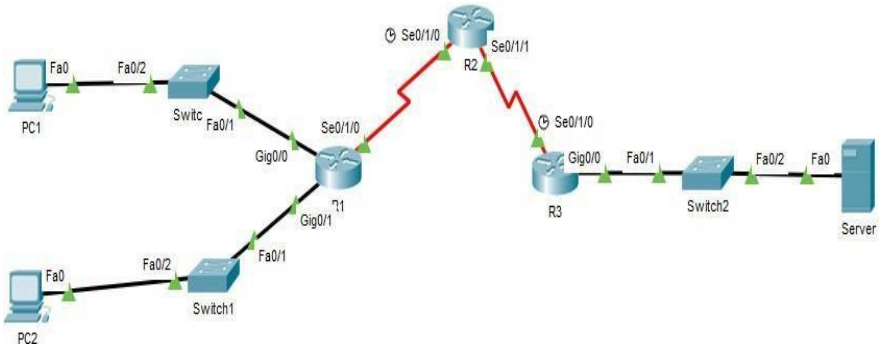
Step 5: From internal PC-C, open a web browser to the PC-A server web page
Desktop -> Web Browser
URL: http://192.168.1.3
(Successful)

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 IN-ZONE

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)

4.	Create the following topology using static routing and ▪ Configure, apply and verify an ACL that will block HTTP access on R1  ▪ Configure, apply and verify an ACL that will block HTTPS access on R1 **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 R1 / gig0/1 / 2001:DB8:1:11::1/64 / FE80::1 R1 / se0/1/0 / 2001:DB8:1:1::1/64 / FE80::1 R2 / se0/1/0 / 2001:DB8:1:1::2/64 / FE80::2 R2 / se0/1/1 / 2001:DB8:1:2::2/64 / FE80::2 R3 / gig0/0 / 2001:DB8:1:30::1/64 / FE80::3 R3 / se0/1/0 / 2001:DB8:1:2::1/64 / FE80::3 Server / NIC / 2001:DB8:1:30::30/64 / FE80::3	**40**
5.	Viva	**5**
6.	Journal	**5**

Practical 11: Configure ACLs on R1 for FTP and HTTP

Objectives: Configure an ACL on R1 to permit FTP access from PC1 and HTTP access from PC2.

Topology: R1, Server, PC1, PC2 with IPv4 configurations.

Topology

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	gig0/0	172.22.34.65	255.255.255.224	N/A
R1	gig0/1	172.22.34.97	255.255.255.240	N/A
R1	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 IP addresses on R1, Server, PC1, and PC2.

Configure an ACL on R1 to permit FTP from PC1 and HTTP from PC2 to the Server.

Verify the ACL implementation.

Steps

Step 1: Configure IP Addresses

Server

Desktop > IP Configuration

IP Address: 172.22.34.62

Subnet Mask: 255.255.255.192

Default Gateway: 172.22.34.1

PC1

Desktop > IP Configuration

IP Address: 172.22.34.66

Subnet Mask: 255.255.255.224

Default Gateway: 172.22.34.65

PC2

Desktop > IP Configuration

IP Address: 172.22.34.98

Subnet Mask: 255.255.255.240

Default Gateway: 172.22.34.97

R1

enable

configure terminal

interface gigabitEthernet0/0

ip address 172.22.34.65 255.255.255.224

no shutdown

exit

interface gigabitEthernet0/1

ip address 172.22.34.97 255.255.255.240

no shutdown

exit

interface gigabitEthernet0/2

ip address 172.22.34.1 255.255.255.192

no shutdown

exit

Step 2: Configure Services on Server

Server

Desktop > Services

FTP: ON

- Add a test file (e.g., "test.txt")

HTTP: ON

- Add a simple index.html file

Step 3: Configure ACL on R1

Create and Apply ACL

R1(config)# access-list 100 permit tcp host 172.22.34.66 host 172.22.34.62 eq ftp

R1(config)# access-list 100 permit tcp host 172.22.34.98 host 172.22.34.62 eq www

R1(config)# access-list 100 deny ip any any

R1(config)# exit

R1(config)# interface gigabitEthernet0/0

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

R1(config-if)# exit

R1(config)# interface gigabitEthernet0/1

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

R1(config-if)# exit

Notes:

- eq ftp permits FTP (port 21)

- eq www permits HTTP (port 80)

- The implicit deny is made explicit with deny ip any any

- ACL is applied inbound on G0/0 (PC1) and G0/1 (PC2) to control traffic from PCs to Server

Step 4: Verification

Test FTP from PC1

Desktop > Command Prompt

PC1> ftp 172.22.34.62

(Should connect successfully)

Try to verify file transfer

Exit FTP with Quit

Test HTTP from PC2

Desktop > Web Browser

Enter http://172.22.34.62

(Should display the webpage)

Test Restrictions

From PC1: Try http://172.22.34.62 in Web Browser (Should fail)

From PC2: Try ftp 172.22.34.62 in Command Prompt (Should fail)

Test Connectivity

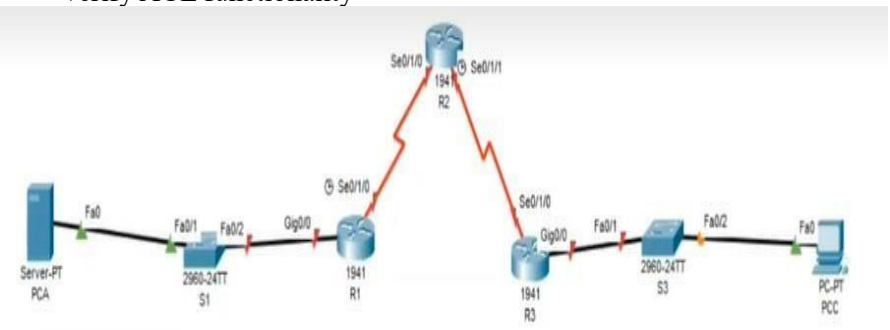
From PC1: ping 172.22.34.62 (Should fail due to deny rule)

From PC2: ping 172.22.34.62 (Should fail due to deny rule)

Verify ACL on R1

R1# show access-lists

(Should show matches on permit statements for FTP and HTTP)

1.	Create the following topology using static routing ▪ Configure ACL to allow access to routers R1, R2, and R3 to only be permitted from PC-C, the management station. PC-C is also used for connectivity testing to PC-A, which is a server providing DNS, SMTP, FTP, and HTTPS services. ▪ Verify ACL functionality  Addressing Table	**40**
2.	Viva	**5**
3.	Journal	**5**

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
	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	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

Practical 4: Configure IP ACLs to Mitigate Attacks
Objectives: Use ACLs to secure remote access and mitigate attacks.
Topology: R1, R2, R3, PC-A, PC-C with specific IP configurations.
Topology

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	gig0/0	192.168.1.1	255.255.255.0	N/A
R1	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
R2	Se0/1/1 (DCE)	10.2.2.2	255.255.255.252	N/A
R2	Lo0	192.168.2.1	255.255.255.0	N/A
R3	gig0/0	192.168.3.1	255.255.255.0	N/A
R3	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.**

Steps
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)# 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

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 gig0/0
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

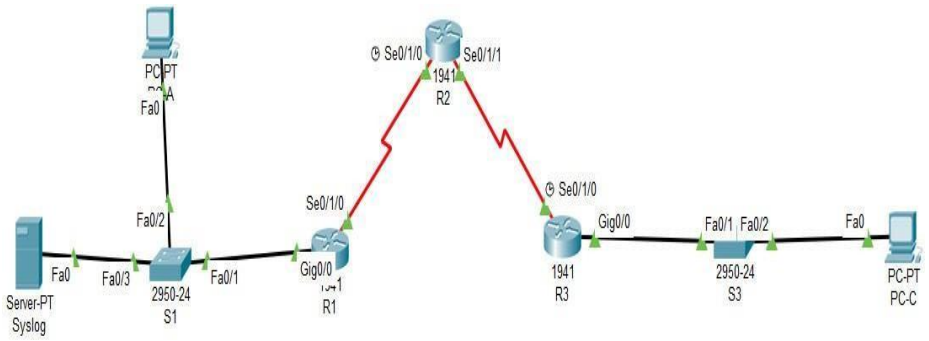
R3(config)# interface se0/1/0
R3(config-if)# ip access-group 100 in

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

UNIVERSITY OF MUMBAI
TY B.Sc. INFORMATION TECHNOLOGY PRACTICAL EXAMINATION
SEMESTER VI
INFORMATION SECURITY(USIT6P2)

Seat No: _____ Max. Marks: 50

<table>
<tr><td>1.</td><td>Create the following topology and
▪ Enable IOS IPS
▪ Configure logging and verify IPS
▪ Modify signature and verify again
 

Addressing Table
<table>
<tr><th>Device</th><th>Interface</th><th>IP Address</th><th>Subnet Mask</th><th>Default Gateway</th></tr>
<tr><td rowspan="2">R1</td><td>gig0/0</td><td>192.168.1.1</td><td>255.255.255.0</td><td>N/A</td></tr>
<tr><td>se0/1/0</td><td>10.1.1.1</td><td>255.255.255.252</td><td>N/A</td></tr>
<tr><td rowspan="2">R2</td><td>se0/1/0</td><td>10.1.1.2</td><td>255.255.255.252</td><td>N/A</td></tr>
<tr><td>se0/1/1</td><td>10.2.2.2</td><td>255.255.255.252</td><td>N/A</td></tr>
<tr><td rowspan="2">R3</td><td>gig0/0</td><td>192.168.3.1</td><td>255.255.255.0</td><td>N/A</td></tr>
<tr><td>se0/1/0</td><td>10.2.2.1</td><td>255.255.255.252</td><td>N/A</td></tr>
<tr><td>Syslog</td><td>NIC</td><td>192.168.1.50</td><td>255.255.255.0</td><td>192.168.1.1</td></tr>
<tr><td>PC-A</td><td>NIC</td><td>192.168.1.2</td><td>255.255.255.0</td><td>192.168.1.1</td></tr>
<tr><td>PC-C</td><td>NIC</td><td>192.168.3.2</td><td>255.255.255.0</td><td>192.168.3.1</td></tr>
</table></td><td>40</td></tr>
<tr><td>2.</td><td>Viva</td><td>5</td></tr>
<tr><td>3.</td><td>Journal</td><td>5</td></tr>
</table>

Objectives: Enable and configure IOS IPS with logging and signature modification.

Topology: R1, R2, R3, Syslog, PC-A, PC-C with specific IP configurations.

Topology

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	gig0/0	192.168.1.1	255.255.255.0	N/A
R1	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
R2	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
R3	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
R1(config)# license boot module c1900 technology-package securityk9
(Type yes)
R1# copy run start
R1# reload
R1# show version

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-category)# 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

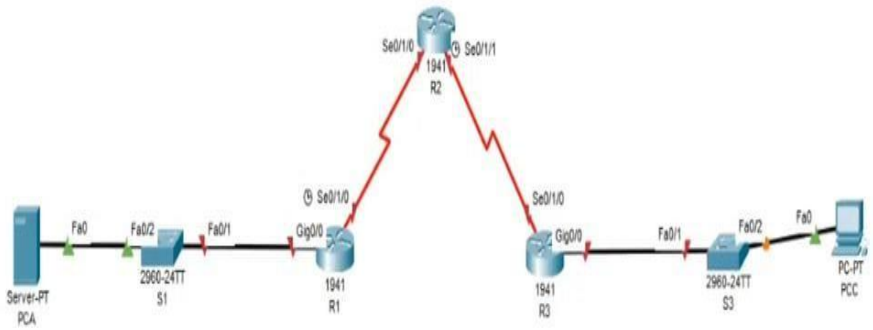
Step 1: Change the event-action of a signature
R1(config)# ip ips signature-definition
R1(config-sigdef)# signature 2004 0
R1(config-sigdef-sig)# status
R1(config-sigdef-sig-status)# retired false
R1(config-sigdef-sig-status)# enabled true
R1(config-sigdef-sig-status)# exit
R1(config-sigdef-sig)# engine
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

1.	Create the following topology using static routing and configure ▪ A zone-based policy (ZPF) firewall on R3 ▪ Verify ZPF firewall functionality using ping, SSH and a web browser.	**40**
2.	Viva	**5**
3.	Journal	**5**



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	192.168.1.3	255.255.255.0	192.168.1.1
PC-C	NIC	192.168.3.3	255.255.255.0	192.168.3.1

Practical 5: Configure Zone-Based Policy Firewall on Cisco Routers

Objectives: Configure and verify a zone-based policy firewall on R3.

Topology: R1, R2, R3, PC-A, PC-C with specific IP configurations.

Topology

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	gig0/0	192.168.1.1	255.255.255.0	N/A
R1	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
R2	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
R3	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.**

Steps

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)# crypto key generate rsa
How many bits in the modulus [512]: 1024

Step 5: Configure static routing on routers
Execute command on all routers
R(config)# ip route destination-network-address subnetmask next-hopdestination-address
Note: Replace with specific routes as needed based on topology.

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-NET-CLASS-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 OUT-ZONE

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

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: adminpa55
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

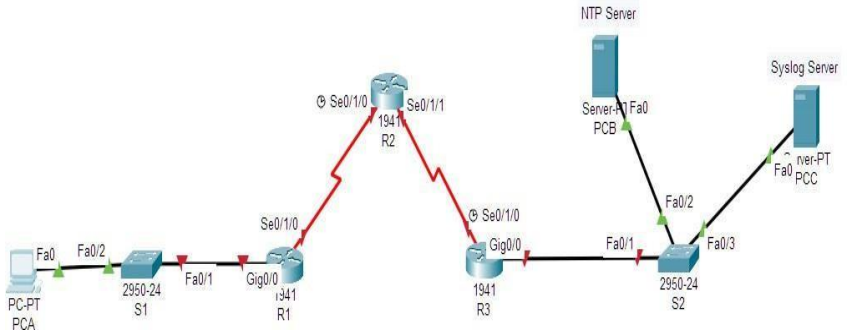
Step 5: From internal PC-C, open a web browser to the PC-A server web page
Desktop -> Web Browser
URL: http://192.168.1.3
(Successful)

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 IN-ZONE

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)

1.	Create the following topology and ▪ Configure OSPF MD5 authentication. ▪ Configure NTP and configure routers to log messages to the Syslog Server  **Addressing Table** **Device** / **Interface** / **IP Address** / **Subnet Mask** / **Default Gateway** R1 / gig0/0 / 192.168.1.1 / 255.255.255.0 / N/A R1 / 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 R2 / 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 R3 / 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 / 192.168.3.5 / 255.255.255.0 / 192.168.3.1 PC-C / NIC / 192.168.3.6 / 255.255.255.0 / 192.168.3.1	**40**
2.	Viva	**5**
3.	Journal	**5**

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.**

Steps

Step 1: Configure password for vty lines
R(config)# line vty 0 4
R(config-line)# password vtypa55
R(config-line)# login

Step 2: Configure secret on router
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 the routers in area 0
R1(config)# router ospf 1
R1(config-router)# area 0 authentication message-digest

R2(config)# router ospf 1
R2(config-router)# area 0 authentication message-digest
R3(config)# router ospf 1
R3(config-router)# area 0 authentication message-digest

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.

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 NTPpa55 for 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

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 the 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

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

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

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

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.

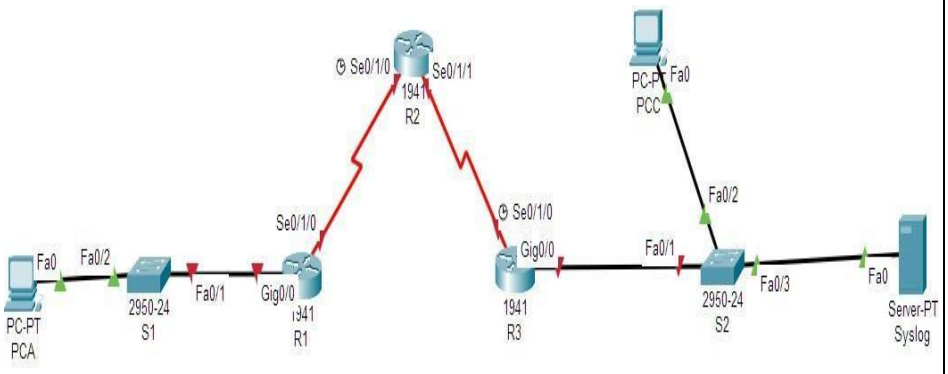
PC> ssh -l SSHadmin 192.168.3.1
Password: sshpa55

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

1.	Create the following topology and ▪ Enable IOS IPS ▪ Configure logging and verify IPS ▪ Modify signature and verify again	**40**
2.	Viva	**5**
3.	Journal	**5**



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
Syslog	NIC	192.168.3.50	255.255.255.0	192.168.3.1
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 and configure IOS IPS with logging and signature modification.

Topology: R1, R2, R3, Syslog, PC-A, PC-C with specific IP configurations.

Topology

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	gig0/0	192.168.1.1	255.255.255.0	N/A
R1	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
R2	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
R3	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
R1(config)# license boot module c1900 technology-package securityk9
(Type yes)
R1# copy run start
R1# reload
R1# show version

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-category)# 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

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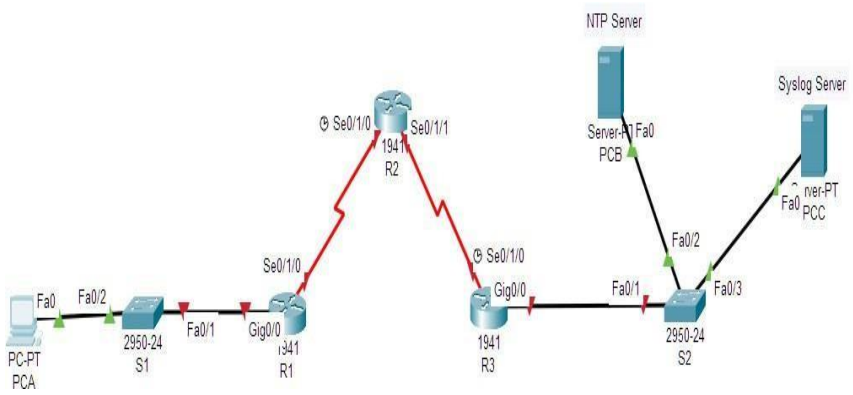
TY B.Sc. INFORMATION TECHNOLOGY PRACTICAL EXAMINATION
SEMESTER VI
INFORMATION SECURITY(USIT6P2)

Seat No: _____ Max. Marks: 50

<table>
<tr><td>1.</td><td>Create the following topology with OSPF routing and ▪ Configure NTP.
▪ Configure Routers to log messages to the syslog server.
▪ Configure R1 to support SSH connections.
 

Addressing Table
<table>
<tr><th>Device</th><th>Interface</th><th>IP Address</th><th>Subnet Mask</th><th>Default Gateway</th></tr>
<tr><td rowspan="2">R1</td><td>gig0/0</td><td>192.168.1.1</td><td>255.255.255.0</td><td>N/A</td></tr>
<tr><td>se0/1/0</td><td>10.1.1.1</td><td>255.255.255.252</td><td>N/A</td></tr>
<tr><td rowspan="2">R2</td><td>se0/1/0</td><td>10.1.1.2</td><td>255.255.255.252</td><td>N/A</td></tr>
<tr><td>se0/1/1</td><td>10.2.2.2</td><td>255.255.255.252</td><td>N/A</td></tr>
<tr><td rowspan="2">R3</td><td>gig0/0</td><td>192.168.3.1</td><td>255.255.255.0</td><td>N/A</td></tr>
<tr><td>se0/1/0</td><td>10.2.2.1</td><td>255.255.255.252</td><td>N/A</td></tr>
<tr><td>PC-A</td><td>NIC</td><td>192.168.1.5</td><td>255.255.255.0</td><td>192.168.1.1</td></tr>
<tr><td>PC-B</td><td>NIC</td><td>192.168.3.5</td><td>255.255.255.0</td><td>192.168.3.1</td></tr>
<tr><td>PC-C</td><td>NIC</td><td>192.168.3.6</td><td>255.255.255.0</td><td>192.168.3.1</td></tr>
</table></td><td>40</td></tr>
<tr><td>2.</td><td>Viva</td><td>5</td></tr>
<tr><td>3.</td><td>Journal</td><td>5</td></tr>
</table>

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.**

Steps

Step 1: Configure password for vty lines
R(config)# line vty 0 4
R(config-line)# password vtypa55
R(config-line)# login

Step 2: Configure secret on router
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 the routers in area 0
R1(config)# router ospf 1
R1(config-router)# area 0 authentication message-digest
R2(config)# router ospf 1
R2(config-router)# area 0 authentication message-digest
R3(config)# router ospf 1
R3(config-router)# area 0 authentication message-digest

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.

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 NTPpa55 for 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

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 the 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

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

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

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

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
```

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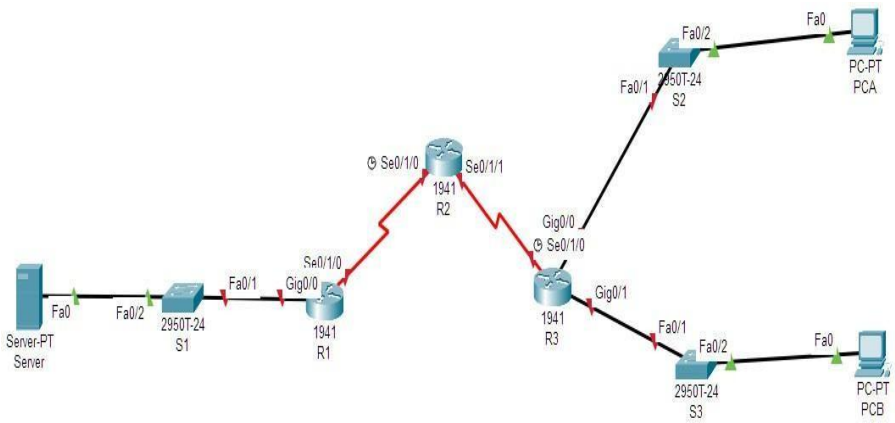
TY B.Sc. INFORMATION TECHNOLOGY PRACTICAL EXAMINATION
SEMESTER VI
INFORMATION SECURITY (USIT6P2)

Seat No: _____ Max. Marks: 50

<table>
<tr><td>1.</td><td>Create the following topology using static routing and
▪ Configure, apply and verify an ACL that will block ICMP access on R1
 

<table>
<tr><th>Device</th><th>Interface</th><th>IPv6 Address/Prefix</th><th>Default Gateway</th></tr>
<tr><td>AddressiServer</td><td>ıgNIC Table</td><td>2001:DB8:1:10::30/64</td><td>FE80::1</td></tr>
<tr><td rowspan="2">R1</td><td>gig0/0</td><td>2001:DB8:1:10::1/64</td><td>FE80::1</td></tr>
<tr><td>se0/1/0</td><td>2001:DB8:1:1::1/64</td><td>FE80::1</td></tr>
<tr><td rowspan="2">R2</td><td>se0/1/0</td><td>2001:DB8:1:1::2/64</td><td>FE80::2</td></tr>
<tr><td>se0/1/1</td><td>2001:DB8:1:2::2/64</td><td>FE80::2</td></tr>
<tr><td rowspan="3">R3</td><td>gig0/0</td><td>2001:DB8:1:30::1/64</td><td>FE80::3</td></tr>
<tr><td>gig0/1</td><td>2001:DB8:1:31::1/64</td><td>FE80::3</td></tr>
<tr><td>se0/1/0</td><td>2001:DB8:1:2::1/64</td><td>FE80::3</td></tr>
<tr><td>PCA</td><td>NIC</td><td>2001:DB8:1:30::10/64</td><td>FE80::3</td></tr>
<tr><td>PCB</td><td>NIC</td><td>2001:DB8:1:31::11/64</td><td>FE80::3</td></tr>
</table></td><td>40</td></tr>
<tr><td>2.</td><td>Viva</td><td>5</td></tr>
<tr><td>3.</td><td>Journal</td><td>5</td></tr>
</table>

Practical 4b: Configure IPv6 ACLs to Mitigate Attacks

Objectives: Configure, apply, and verify IPv6 ACLs.

Topology: R1, R2, R3, PC1, PC2, Server with IPv6 configurations.

Topology

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
R1	se0/1/0	2001:DB8:1:1::1/64	FE80::1
R1	gig0/1	2001:DB8:1:11::1/64	FE80::1
R2	se0/1/0	2001:DB8:1:1::2/64	FE80::2
R2	se0/1/1	2001:DB8:1:2::2/64	FE80::2
R3	gig0/0	2001:DB8:1:30::1/64	FE80::3
R3	se0/1/0	2001:DB8:1:2::1/64	FE80::3
Server	NIC	2001:DB8:1:30::30/64	FE80::3

Objectives

- **Configure, Apply, and Verify an IPv6 ACL**
- **Configure, Apply, and Verify a Second IPv6 ACL**

Steps

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)

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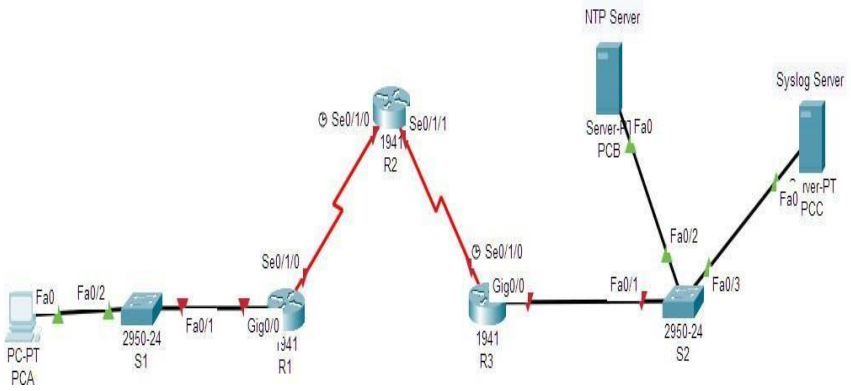
SEMESTER VI
INFORMATION SECURITY (USIT6P2)

Seat No: _____ Max. Marks: 50

<table>
<tr><td>1.</td><td>Create the following topology with OSPF routing and ▪ Configure NTP.
▪ Configure Routers to log messages to the syslog server.
▪ Configure R1 to support SSH connections.
 

<table>
<tr><th>Device</th><th>Interface</th><th>IP Address</th><th>Subnet Mask</th><th>Default Gateway</th></tr>
<tr><td>Addres R1</td><td>inggig0/0 Table</td><td>192.168.1.1</td><td>255.255.255.0</td><td>N/A</td></tr>
<tr><td></td><td>se0/1/0</td><td>10.1.1.1</td><td>255.255.255.252</td><td>N/A</td></tr>
<tr><td rowspan="2">R2</td><td>se0/1/0</td><td>10.1.1.2</td><td>255.255.255.252</td><td>N/A</td></tr>
<tr><td>se0/1/1</td><td>10.2.2.2</td><td>255.255.255.252</td><td>N/A</td></tr>
<tr><td rowspan="2">R3</td><td>gig0/0</td><td>192.168.3.1</td><td>255.255.255.0</td><td>N/A</td></tr>
<tr><td>se0/1/0</td><td>10.2.2.1</td><td>255.255.255.252</td><td>N/A</td></tr>
<tr><td>PC-A</td><td>NIC</td><td>192.168.1.5</td><td>255.255.255.0</td><td>192.168.1.1</td></tr>
<tr><td>PC-B</td><td>NIC</td><td>192.168.3.5</td><td>255.255.255.0</td><td>192.168.3.1</td></tr>
<tr><td>PC-C</td><td>NIC</td><td>192.168.3.6</td><td>255.255.255.0</td><td>192.168.3.1</td></tr>
</table></td><td>40</td></tr>
<tr><td>2.</td><td>Viva</td><td>5</td></tr>
<tr><td>3.</td><td>Journal</td><td>5</td></tr>
</table>

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.**

Steps

Step 1: Configure password for vty lines
R(config)# line vty 0 4
R(config-line)# password vtypa55
R(config-line)# login

Step 2: Configure secret on router
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 the routers in area 0
R1(config)# router ospf 1
R1(config-router)# area 0 authentication message-digest
R2(config)# router ospf 1
R2(config-router)# area 0 authentication message-digest
R3(config)# router ospf 1
R3(config-router)# area 0 authentication message-digest

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.

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 NTPpa55 for 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

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 the 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

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

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

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

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
```

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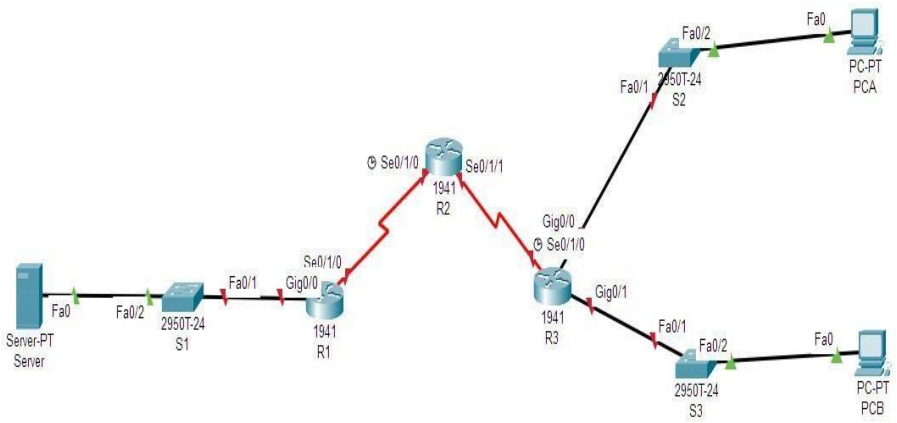
SEMESTER VI
INFORMATION SECURITY (USIT6P2)

Seat No: _____ Max. Marks: 50

<table>
<tr><td>1.</td><td>Create the following topology using static routing and
▪ Configure, apply and verify an ACL that will block ICMP access on R1
 

<table>
<tr><th>Device</th><th>Interface</th><th>IPv6 Address/Prefix</th><th>Default Gateway</th></tr>
<tr><td>Server</td><td>NIC</td><td>2001:DB8:1:10::30/64</td><td>FE80::1</td></tr>
<tr><td rowspan="2">R1</td><td>gig0/0</td><td>2001:DB8:1:10::1/64</td><td>FE80::1</td></tr>
<tr><td>se0/1/0</td><td>2001:DB8:1:1::1/64</td><td>FE80::1</td></tr>
<tr><td rowspan="2">R2</td><td>se0/1/0</td><td>2001:DB8:1:1::2/64</td><td>FE80::2</td></tr>
<tr><td>se0/1/1</td><td>2001:DB8:1:2::2/64</td><td>FE80::2</td></tr>
<tr><td rowspan="3">R3</td><td>gig0/0</td><td>2001:DB8:1:30::1/64</td><td>FE80::3</td></tr>
<tr><td>gig0/1</td><td>2001:DB8:1:31::1/64</td><td>FE80::3</td></tr>
<tr><td>se0/1/0</td><td>2001:DB8:1:2::1/64</td><td>FE80::3</td></tr>
<tr><td>PCA</td><td>NIC</td><td>2001:DB8:1:30::10/64</td><td>FE80::3</td></tr>
<tr><td>PCB</td><td>NIC</td><td>2001:DB8:1:31::11/64</td><td>FE80::3</td></tr>
</table>
Addressing Table</td><td>40</td></tr>
<tr><td>2.</td><td>Viva</td><td>5</td></tr>
<tr><td>3.</td><td>Journal</td><td>5</td></tr>
</table>

Practical 4b: Configure IPv6 ACLs to Mitigate Attacks

Objectives: Configure, apply, and verify IPv6 ACLs.

Topology: R1, R2, R3, PC1, PC2, Server with IPv6 configurations.

Topology

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
R1	se0/1/0	2001:DB8:1:1::1/64	FE80::1
R1	gig0/1	2001:DB8:1:11::1/64	FE80::1
R2	se0/1/0	2001:DB8:1:1::2/64	FE80::2
R2	se0/1/1	2001:DB8:1:2::2/64	FE80::2
R3	gig0/0	2001:DB8:1:30::1/64	FE80::3
R3	se0/1/0	2001:DB8:1:2::1/64	FE80::3
Server	NIC	2001:DB8:1:30::30/64	FE80::3

Objectives

- **Configure, Apply, and Verify an IPv6 ACL**
- **Configure, Apply, and Verify a Second IPv6 ACL**

Steps

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)

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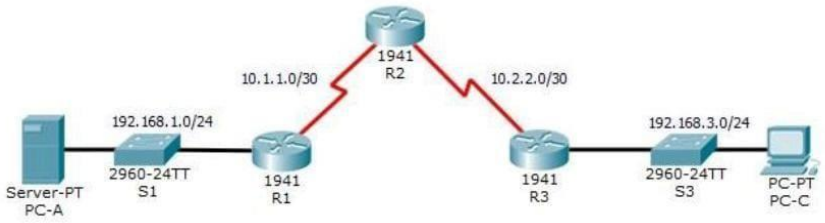
INFORMATION SECURITY (USIT6P2)

Seat No: _____ Max. Marks: 50

<table>
<tr><td>1.</td><td>Create the following topology to Configure IP ACLs to Mitigate Attacks.
 

Addressing Table
<table>
<tr><th>Device</th><th>Interface</th><th>IP Address</th><th>Subnet Mask</th><th>Default Gateway</th><th>Switch Port</th></tr>
<tr><td rowspan="2">R1</td><td>G0/1</td><td>192.168.1.1</td><td>255.255.255.0</td><td>N/A</td><td>S1 F0/5</td></tr>
<tr><td>S0/0/0 (DCE)</td><td>10.1.1.1</td><td>255.255.255.252</td><td>N/A</td><td>N/A</td></tr>
<tr><td rowspan="3">R2</td><td>S0/0/0</td><td>10.1.1.2</td><td>255.255.255.252</td><td>N/A</td><td>N/A</td></tr>
<tr><td>S0/0/1 (DCE)</td><td>10.2.2.2</td><td>255.255.255.252</td><td>N/A</td><td>N/A</td></tr>
<tr><td>Lo0</td><td>192.168.2.1</td><td>255.255.255.0</td><td>N/A</td><td>N/A</td></tr>
<tr><td rowspan="2">R3</td><td>G0/1</td><td>192.168.3.1</td><td>255.255.255.0</td><td>N/A</td><td>S3 F0/5</td></tr>
<tr><td>S0/0/1</td><td>10.2.2.1</td><td>255.255.255.252</td><td>N/A</td><td>N/A</td></tr>
<tr><td>PC-A</td><td>NIC</td><td>192.168.1.3</td><td>255.255.255.0</td><td>192.168.1.1</td><td>S1 F0/6</td></tr>
<tr><td>PC-C</td><td>NIC</td><td>192.168.3.3</td><td>255.255.255.0</td><td>192.168.3.1</td><td>S3 F0/18</td></tr>
</table>
</td><td>40</td></tr>
<tr><td>2.</td><td>Viva</td><td>5</td></tr>
<tr><td>3.</td><td>Journal</td><td>5</td></tr>
</table>

Practical 4: Configure IP ACLs to Mitigate Attacks
Objectives: Use ACLs to secure remote access and mitigate attacks.
Topology: R1, R2, R3, PC-A, PC-C with specific IP configurations.
Topology

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	gig0/0	192.168.1.1	255.255.255.0	N/A
R1	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
R2	Se0/1/1 (DCE)	10.2.2.2	255.255.255.252	N/A
R2	Lo0	192.168.2.1	255.255.255.0	N/A
R3	gig0/0	192.168.3.1	255.255.255.0	N/A
R3	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.**

Steps
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)# 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

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 gig0/0
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

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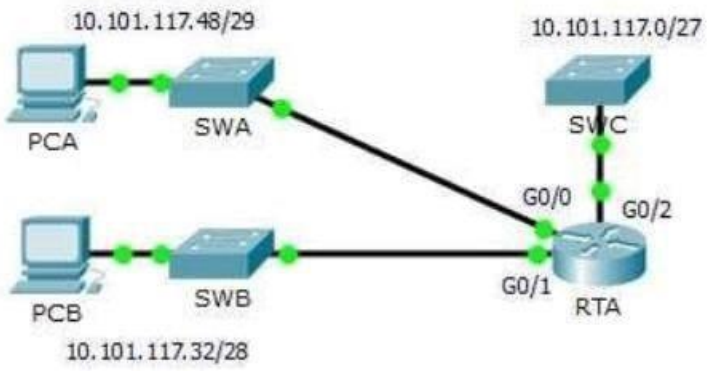
SEMESTER VI
INFORMATION SECURITY (USIT6P2)

Seat No: _____ Max. Marks: 50

<table>
<tr><td>1.</td><td>Create the following topology using static routing
1. Configure the extended ACL
2. Verify the extended ACL implementation.

Addressing Table
<table>
<tr><th>Device</th><th>Interface</th><th>IP Address</th><th>Subnet Mask</th><th>Default Gateway</th></tr>
<tr><td rowspan="3">RTA</td><td>G0/0</td><td>10.101.117.49</td><td>255.255.255.248</td><td>N/A</td></tr>
<tr><td>G0/1</td><td>10.101.117.33</td><td>255.255.255.240</td><td>N/A</td></tr>
<tr><td>G0/2</td><td>10.101.117.1</td><td>255.255.255.224</td><td>N/A</td></tr>
<tr><td>PCA</td><td>NIC</td><td>10.101.117.51</td><td>255.255.255.248</td><td>10.101.117.49</td></tr>
<tr><td>PCB</td><td>NIC</td><td>10.101.117.35</td><td>255.255.255.240</td><td>10.101.117.33</td></tr>
<tr><td>SWA</td><td>VLAN 1</td><td>10.101.117.50</td><td>255.255.255.248</td><td>10.101.117.49</td></tr>
<tr><td>SWB</td><td>VLAN 1</td><td>10.101.117.34</td><td>255.255.255.240</td><td>10.101.117.33</td></tr>
<tr><td>SWC</td><td>VLAN 1</td><td>10.101.117.2</td><td>255.255.255.224</td><td>10.101.117.1</td></tr>
</table></td><td>40</td></tr>
<tr><td>2.</td><td>Viva</td><td>5</td></tr>
<tr><td>3.</td><td>Journal</td><td>5</td></tr>
</table>

Practical 3b: Configuring Extended ACLs (SSH Scenario)

Objectives: Configure, apply, and verify an extended numbered ACL.

Topology: RTA, SWA, SWB, SWC, PCA, PCB with specific IP configurations.

Topology

Device	Interface	IP Address	Subnet Mask	Default Gateway
RTA	gig0/0	10.101.117.49	255.255.255.248	N/A
RTA	gig0/1	10.101.117.33	255.255.255.240	N/A
RTA	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

- **Devices on one LAN are allowed to remotely access devices in another LAN using SSH protocol**
- **Besides ICMP, all traffic from other networks is denied**

Steps

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

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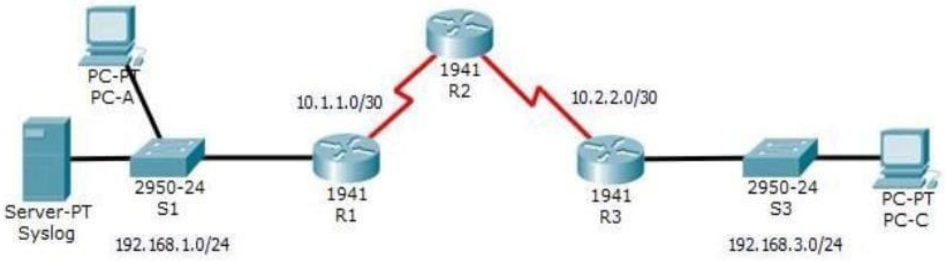
Seat No: _____ Max. Marks: 50

1. Create the following topology to Configure IOS Intrusion Prevention System (IPS) Using the CLI **40**



Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway	Switch Port
R1	G0/1	192.168.1.1	255.255.255.0	N/A	S1 F0/1
	S0/0/0	10.1.1.1	255.255.255.252	N/A	N/A
R2	S0/0/0 (DCE)	10.1.1.2	255.255.255.252	N/A	N/A
	S0/0/1 (DCE)	10.2.2.2	255.255.255.252	N/A	N/A
R3	G0/1	192.168.3.1	255.255.255.0	N/A	S3 F0/1
	S0/0/0	10.2.2.1	255.255.255.252	N/A	N/A
Syslog	NIC	192.168.1.50	255.255.255.0	192.168.1.1	S1 F0/2
PC-A	NIC	192.168.1.2	255.255.255.0	192.168.1.1	S1 F0/3
PC-C	NIC	192.168.3.2	255.255.255.0	192.168.3.1	S3 F0/2

Objectives

2. Viva **5**
3. Journal **5**

Objectives: Enable and configure IOS IPS with logging and signature modification.

Topology: R1, R2, R3, Syslog, PC-A, PC-C with specific IP configurations.

Topology

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	gig0/0	192.168.1.1	255.255.255.0	N/A
R1	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

R2	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
R3	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
R1(config)# license boot module c1900 technology-package securityk9
(Type yes)
R1# copy run start
R1# reload
R1# show version

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-category)# 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