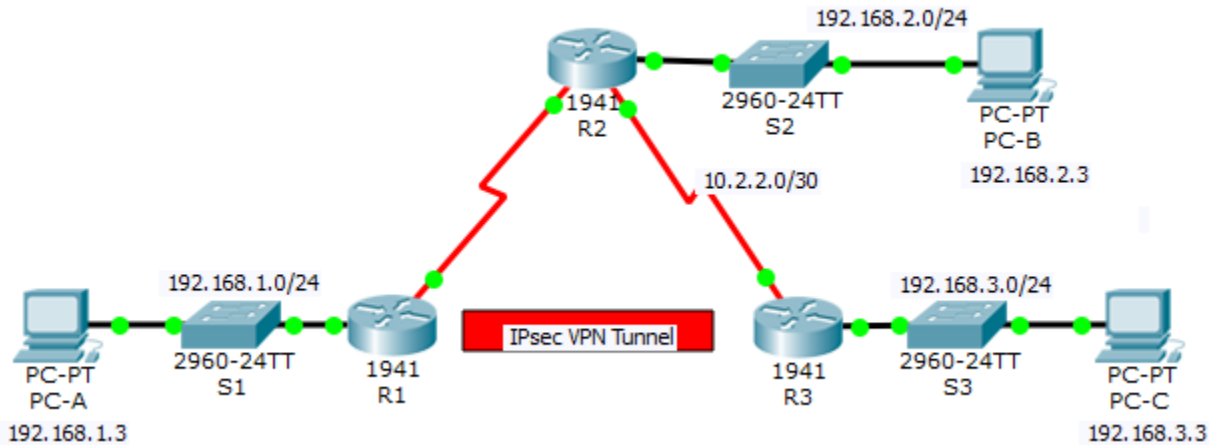


Packet Tracer - Configure and Verify a Site-to-Site IPsec VPN Using CLI (Instructor Version)

Instructor Note: Red font color or gray highlights indicate text that appears in the instructor copy only.

Topology



Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway	Switch Port
R1	G0/0	192.168.1.1	255.255.255.0	N/A	S1 F0/1
	S0/0/0 (DCE)	10.1.1.2	255.255.255.252	N/A	N/A
R2	G0/0	192.168.2.1	255.255.255.0	N/A	S2 F0/2
	S0/0/0	10.1.1.1	255.255.255.252	N/A	N/A
	S0/0/1 (DCE)	10.2.2.1	255.255.255.252	N/A	N/A
R3	G0/0	192.168.3.1	255.255.255.0	N/A	S3 F0/5
	S0/0/1	10.2.2.2	255.255.255.252	N/A	N/A
PC-A	NIC	192.168.1.3	255.255.255.0	192.168.1.1	S1 F0/2
PC-B	NIC	192.168.2.3	255.255.255.0	192.168.2.1	S2 F0/1
PC-C	NIC	192.168.3.3	255.255.255.0	192.168.3.1	S3 F0/18

Objectives

- Verify connectivity throughout the network.
- Configure R1 to support a site-to-site IPsec VPN with R3.

Background / Scenario

The network topology shows three routers. Your task is to configure R1 and R3 to support a site-to-site IPsec VPN when traffic flows between their respective LANs. The IPsec VPN tunnel is from R1 to R3 via R2. R2

acts as a pass-through and has no knowledge of the VPN. IPsec provides secure transmission of sensitive information over unprotected networks, such as the Internet. IPsec operates at the network layer and protects and authenticates IP packets between participating IPsec devices (peers), such as Cisco routers.

ISAKMP Phase 1 Policy Parameters

Parameters		R1	R3
Key Distribution Method	Manual or ISAKMP	ISAKMP	ISAKMP
Encryption Algorithm	DES , 3DES, or AES	AES 256	AES 256
Hash Algorithm	MD5 or SHA-1	SHA-1	SHA-1
Authentication Method	Pre-shared keys or RSA	pre-share	pre-share
Key Exchange	DH Group 1, 2, or 5	DH 5	DH 5
IKE SA Lifetime	86400 seconds or less	86400	86400
ISAKMP Key		vpnpa55	vpnpa55

Note: Bolded parameters are defaults. Only unbolded parameters have to be explicitly configured.

IPsec Phase 2 Policy Parameters

Parameters	R1	R3
Transform Set Name	VPN-SET	VPN-SET
ESP Transform Encryption	esp-aes	esp-aes
ESP Transform Authentication	esp-sha-hmac	esp-sha-hmac
Peer IP Address	10.2.2.2	10.1.1.2
Traffic to be Encrypted	access-list 110 (source 192.168.1.0 dest 192.168.3.0)	access-list 110 (source 192.168.3.0 dest 192.168.1.0)
Crypto Map Name	VPN-MAP	VPN-MAP
SA Establishment	ipsec-isakmp	ipsec-isakmp

The routers have been pre-configured with the following:

- Password for console line: **ciscoconpa55**
- Password for vty lines: **ciscovtypa55**
- Enable password: **ciscoenpa55**
- SSH username and password: **SSHadmin / ciscosshpa55**
- OSPF 101

Part 1: Configure IPsec Parameters on R1

Step 1: Test connectivity.

Ping from PC-A to PC-C.

Step 2: Enable the Security Technology package.

- On R1, issue the **show version** command to view the Security Technology package license information.
- If the Security Technology package has not been enabled, use the following command to enable the package.

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

- Accept the end-user license agreement.
- Save the running-config and reload the router to enable the security license.
- Verify that the Security Technology package has been enabled by using the **show version** command.

Step 3: Identify interesting traffic on R1.

Configure ACL 110 to identify the traffic from the LAN on R1 to the LAN on R3 as interesting. This interesting traffic will trigger the IPsec VPN to be implemented when there is traffic between the R1 to R3 LANs. All other traffic sourced from the LANs will not be encrypted. Because of the implicit **deny all**, there is no need to configure a **deny ip any any** statement.

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

Step 4: Configure the IKE Phase 1 ISAKMP policy on R1.

Configure the **crypto ISAKMP policy 10** properties on R1 along with the shared crypto key **vpnpa55**. Refer to the ISAKMP Phase 1 table for the specific parameters to configure. Default values do not have to be configured. Therefore, only the encryption method, key exchange method, and DH method must be configured.

Note: The highest DH group currently supported by Packet Tracer is group 5. In a production network, you would configure at least DH 14.

```
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 5: Configure the IKE Phase 2 IPsec policy on R1.

- Create the transform-set VPN-SET to use **esp-aes** and **esp-sha-hmac**.

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

- Create the crypto map VPN-MAP that binds all of the Phase 2 parameters together. Use sequence number 10 and identify it as an ipsec-isakmp map.

```
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 6: Configure the crypto map on the outgoing interface.

Bind the **VPN-MAP** crypto map to the outgoing Serial 0/0/0 interface.

```
R1(config)# interface s0/0/0
R1(config-if)# crypto map VPN-MAP
```

Part 2: Configure IPsec Parameters on R3

Step 1: Enable the Security Technology package.

- On R3, issue the **show version** command to verify that the Security Technology package license information has been enabled.
- If the Security Technology package has not been enabled, enable the package and reload R3.

Step 2: Configure router R3 to support a site-to-site VPN with R1.

Configure reciprocating parameters on R3. Configure ACL 110 identifying the traffic from the LAN on R3 to the LAN on R1 as interesting.

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

Step 3: Configure the IKE Phase 1 ISAKMP properties on R3.

Configure the crypto ISAKMP policy 10 properties on R3 along with the shared crypto key vpnpa55.

```
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 4: Configure the IKE Phase 2 IPsec policy on R3.

- Create the transform-set VPN-SET to use **esp-aes** and **esp-sha-hmac**.
- Create the crypto map VPN-MAP that binds all of the Phase 2 parameters together. Use sequence number 10 and identify it as an ipsec-isakmp map.

```
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 5: Configure the crypto map on the outgoing interface.

Bind the VPN-MAP crypto map to the outgoing Serial 0/0/1 interface. **Note:** This is not graded.

```
R3(config)# interface s0/0/1
R3(config-if)# crypto map VPN-MAP
```

Part 3: Verify the IPsec VPN

Step 1: Verify the tunnel prior to interesting traffic.

Issue the **show crypto ipsec sa** command on R1. Notice that the number of packets encapsulated, encrypted, decapsulated, and decrypted are all set to 0.

Step 2: Create interesting traffic.

Ping PC-C from PC-A.

Step 3: Verify the tunnel after interesting traffic.

On R1, re-issue the **show crypto ipsec sa** command. Notice that the number of packets is more than 0, which indicates that the IPsec VPN tunnel is working.

Step 4: Create uninteresting traffic.

Ping PC-B from PC-A. **Note:** Issuing a ping from router R1 to PC-C or R3 to PC-A is not interesting traffic.

Step 5: Verify the tunnel.

On R1, re-issue the **show crypto ipsec sa** command. Notice that the number of packets has not changed, which verifies that uninteresting traffic is not encrypted.

Step 6: Check results.

Your completion percentage should be 100%. Click **Check Results** to see feedback and verification of which required components have been completed.

!!! Script for R1

```
config t
license boot module c1900 technology-package securityk9
yes
end
copy running-config startup-config

reload

config t
access-list 110 permit ip 192.168.1.0 0.0.0.255 192.168.3.0 0.0.0.255
crypto isakmp policy 10
 encryption aes 256
 authentication pre-share
 group 5
 exit
crypto isakmp key vpnpa55 address 10.2.2.2
crypto ipsec transform-set VPN-SET esp-aes esp-sha-hmac
crypto map VPN-MAP 10 ipsec-isakmp
 description VPN connection to R3
 set peer 10.2.2.2
 set transform-set VPN-SET
 match address 110
 exit
```

```
interface S0/0/0  
crypto map VPN-MAP
```

!!! Script for R3

```
config t  
access-list 110 permit ip 192.168.3.0 0.0.0.255 192.168.1.0 0.0.0.255  
crypto isakmp policy 10  
  encryption aes 256  
  authentication pre-share  
  group 5  
exit  
crypto isakmp key vpnpa55 address 10.1.1.2  
crypto ipsec transform-set VPN-SET esp-aes esp-sha-hmac  
crypto map VPN-MAP 10 ipsec-isakmp  
  description VPN connection to R1  
  set peer 10.1.1.2  
  set transform-set VPN-SET  
  match address 110  
exit  
interface S0/0/1  
crypto map VPN-MAP
```