

# IPsec Between Two IOS Routers with Overlapping Private Networks Configuration Example

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## Introduction

This document describes how to configure the Cisco IOS router in a site-to-site IPsec VPN with overlapping private network addresses behind VPN gateways.

## Prerequisites

### Requirements

There are no specific requirements for this document.

### Components Used

The information in this document is based on Cisco IOS 3640 routers that run software version 12.4.

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, make sure that you understand the potential impact of any command.

### Conventions

Refer to the Cisco Technical Tips Conventions for more information on document conventions.

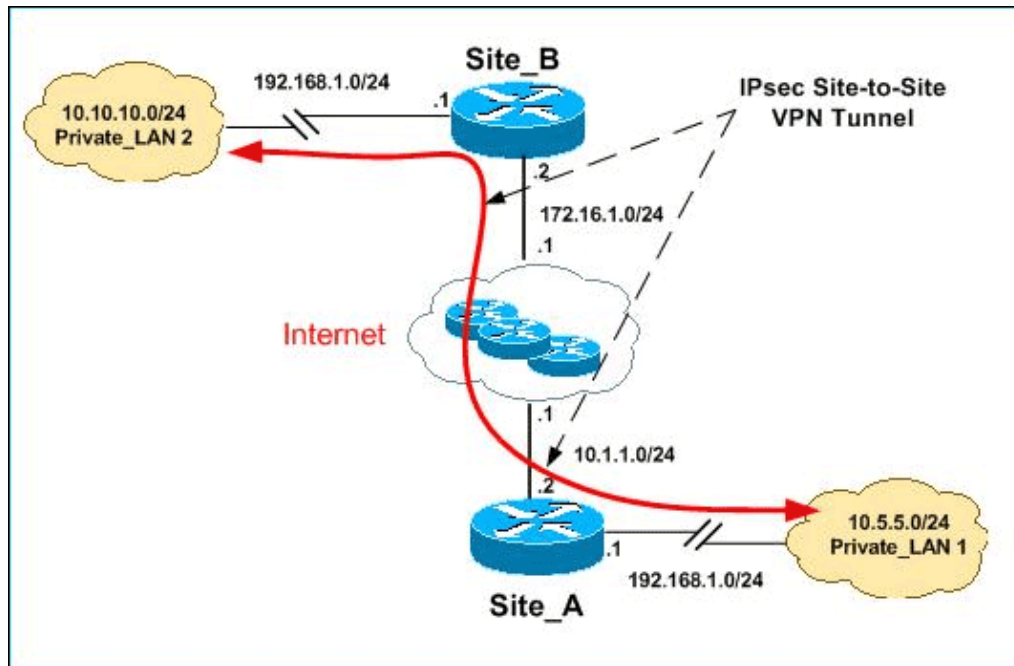
## Configure

In this section, you are presented with the information to configure the features described in this document.

**Note:** Use the Command Lookup Tool (registered customers only) to obtain more information on the commands used in this section.

## Network Diagram

This document uses this network setup:



**Note:** The IP addressing schemes used in this configuration are not legally routable on the Internet. They are RFC 1918 addresses which have been used in a lab environment.

Both Private\_LAN1 and Private\_LAN2 have an IP subnet of 192.168.1.0/24. This simulates the overlapping address space behind each side of the IPsec tunnel.

In this example, the Site\_A router performs a bi-directional translation so that the two private LANs can communicate over the IPsec tunnel. The translation means that Private\_LAN1 "sees" Private\_LAN2 as 10.10.10.0/24 through the IPsec tunnel, and Private\_LAN2 "sees" Private\_LAN1 as 10.5.5.0/24 through the IPsec tunnel.

## Configurations

This document uses these configurations:

- Site\_A Router SDM Configuration
- Site\_A Router CLI Configuration
- Site\_B Router Configuration

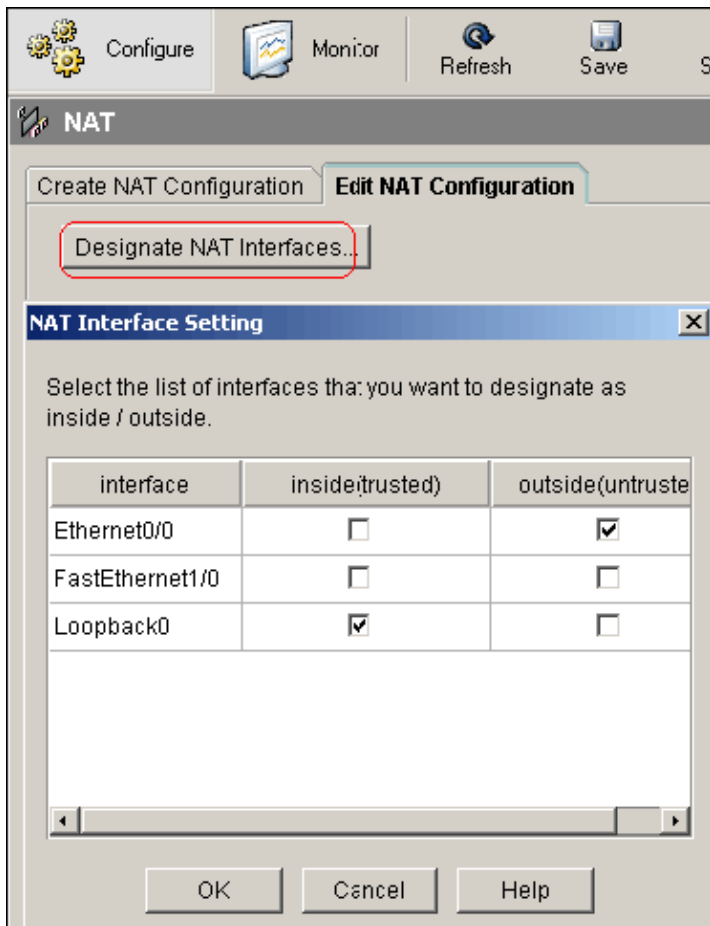
### Site\_A Router SDM Configuration

**Note:** This document assumes that the router is configured with basic settings like interface configuration, etc. Refer to Basic Router Configuration using SDM for more information.

### NAT Configuration

Complete these steps in order to use NAT to configure SDM on the Site\_A router:

1. Choose **Configure > NAT > Edit NAT Configuration**, and click **Designate NAT Interfaces** in order to define trusted and untrusted interfaces as shown.



2. Click **OK**.
3. Click **Add** in order to configure the NAT translation from inside to outside direction as shown.

**Add Address Translation Rule**

Static       Dynamic

Direction: **From inside to outside**

Translate from interface

Inside Interface(s): Loopback0

IP address: 192.168.1.0

Network Mask(optional): 255.255.255.0 or 24

Translate to interface

Outside Interface(s): Ethernet0/0

Type: IP address

Interface: Ethernet0/0

IP address: 10.5.5.0

Redirect Port

TCP       UDP

Original Port:      Translated Port:

OK      Cancel      Help

4. Click **OK**.

Network Address Translation Rules

Inside Interface(s): Loopback0

Outside Interface(s): Ethernet0/0

Original address	Translated address	Rule Type	Add...
192.168.1.0-192.168.1.255	10.5.5.0-10.5.5.255	Static	

5. Once again, click **Add** in order to configure the NAT translation from outside to inside direction as shown.

**Add Address Translation Rule**

Static       Dynamic

Direction: From outside to inside

Translate from interface

Outside Interface(s): Ethernet0/0

IP address: 10.10.10.0

Network Mask(optional): 255.255.255.0 or 24

Translate to interface

Inside Interface(s): Loopback0

IP address: 192.168.1.0

Redirect Port

TCP       UDP

Original Port:      Translated Port:

OK      Cancel      Help

6. Click **OK**.

Network Address Translation Rules

Inside Interface(s): Loopback0

Outside Interface(s): Ethernet0/0

	Original address	Translated address	Rule Type
	192.168.1.0-192.168.1.255	10.5.5.0-10.5.5.255	Static
	192.168.1.0-192.168.1.255	10.10.10.0-10.10.10.255	Static

**Note:** Here is the equivalent CLI configuration:

Equivalent CLI Configuration
<pre> interface Loopback0  ip nat inside interface Ethernet0/0  ip nat inside ip nat inside source static network 192.168.1.0 10.5.5.0 /24 ip nat outside source static network 192.168.1.0 10.10.10.0 /24           </pre>

## VPN Configuration

Complete these steps in order to use VPN to configure SDM on the Site\_A router:

1. Choose **Configure > VPN > VPN Components >IKE > IKE Policies > Add** in order to define the IKE policies as shown in this image.

Configure IKE Policy

Priority: 10

Authentication: PRE\_SHARE

Encryption: DES

D-H Group: group1

Hash: MD5

Lifetime: 24 0 0 HH:MM:SS

OK Cancel Help

2. Click **OK**.

IKE Policies						
Priority	Encryption	Hash	D-H Group	Authentication	Type	
10	DES	MD5	group1	PRE SHARE	User Defined	

**Note:** Here is the equivalent CLI configuration:

```

Equivalent CLI Configuration

crypto isakmp policy 10
encr des
hash md5
authentication pre-share
group1
  
```

3. Choose **Configure > VPN > VPN Components >IKE > Pre-shared Keys > Add** in order to set the pre-shared key value with peer IP address.

Key: \*\*\*\*\*

Re-enter Key: \*\*\*\*\*

Host/Network

Type: IP Address

IP Address: 172.16.1.2

Subnet Mask: 255.255.255.0 24

User Authentication (XAuth)

OK Cancel Help

4. Click **OK**.

Pre-shared Keys		
Peer IP/Name	Subnet Mask	pre-shared key
172.16.1.2	255.255.255.0	*****

**Note:** Here is the equivalent CLI configuration:

```
crypto isakmp key 6 L2L12345 address 172.16.1.2 255.255.255.0
```

5. Choose **Configure > VPN > VPN Components > IPsec > Transform Sets > Add** in order to create a transform set *myset* as shown in this image.

**Add Transform Set**

Name:

Data integrity with encryption (ESP)

Integrity Algorithm:

Encryption Algorithm:

Show Advanced

OK Cancel Help

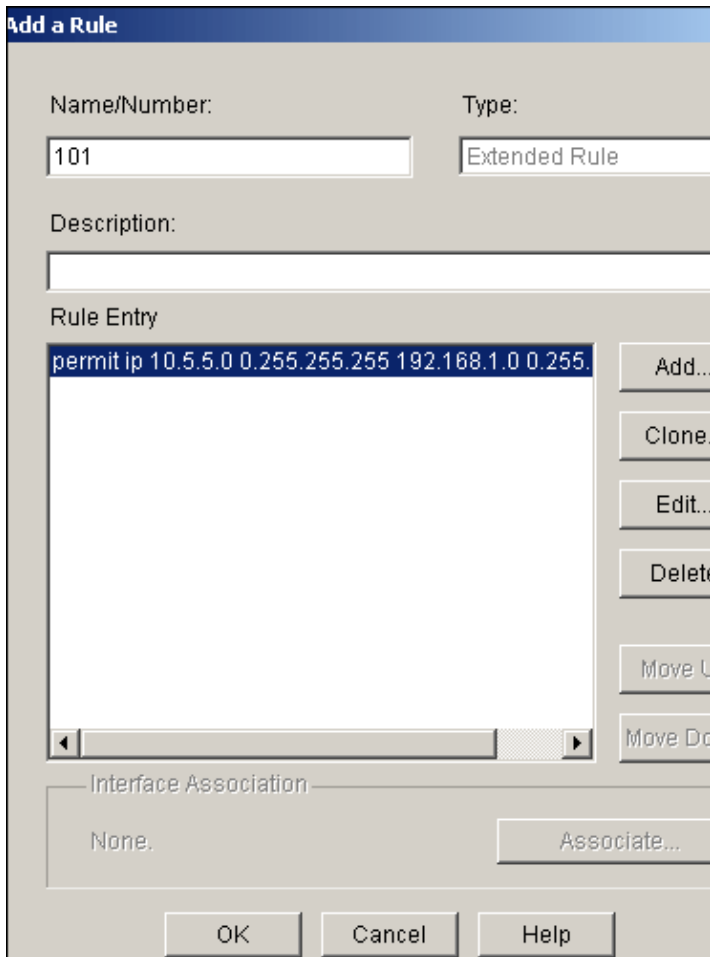
6. Click **OK**.

Name	ESP Encryption	ESP Integrity	AH Integrity
myset	ESP_DES	ESP_MD5_HMAC	

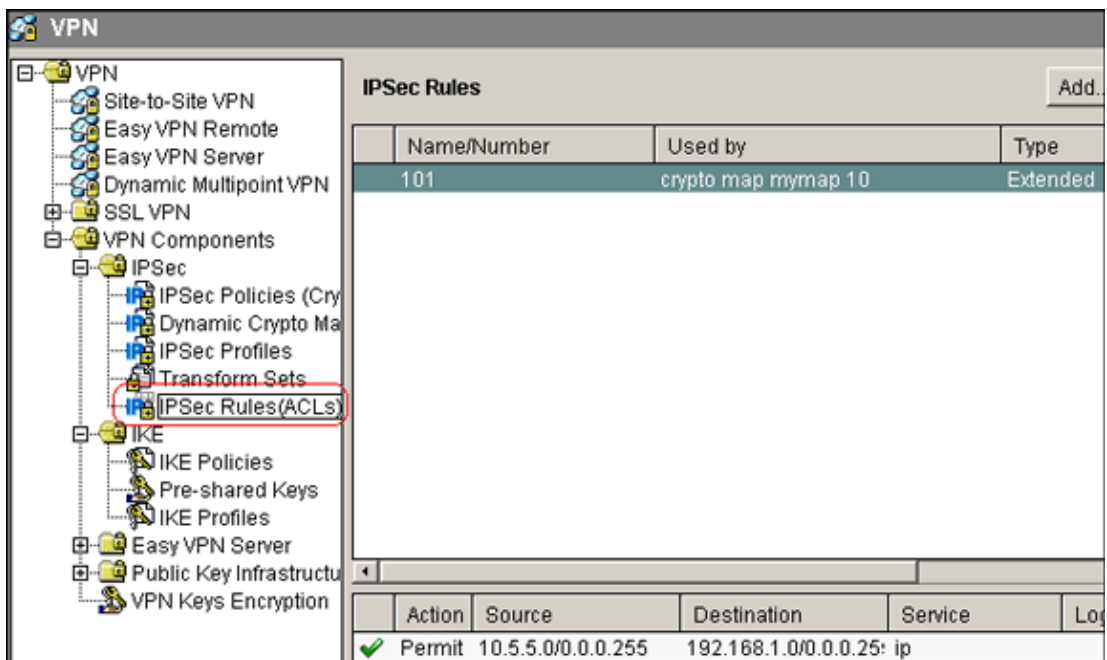
**Note:** Here is the equivalent CLI configuration:

```
crypto ipsec transform-set myset esp-des esp-md5-hmac
```

7. Choose **Configure > VPN > VPN Components > IPsec > IPsec Rules(ACLs) > Add** in order to create a crypto Access Control List(ACL) *101*.



8. Click **OK**.



**Note:** Here is the equivalent CLI configuration:

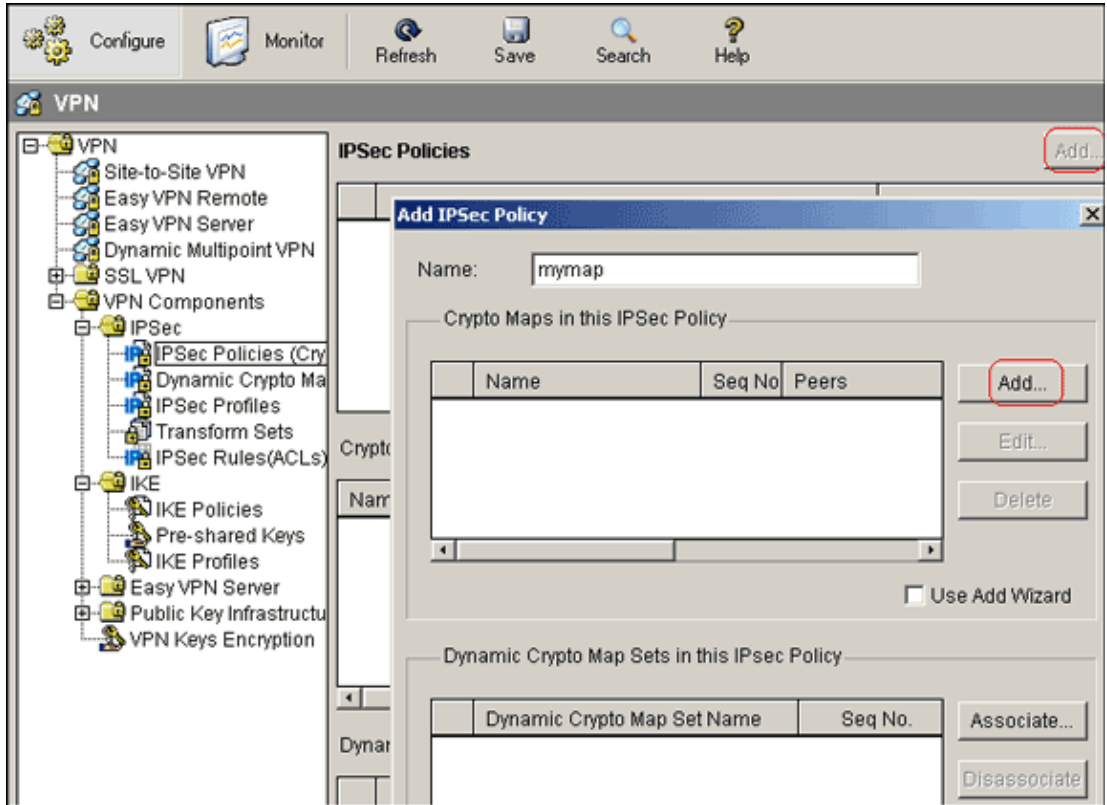
```

Equivalent CLI Configuration
access-list 101 permit ip 10.5.5.0 0.0.0.255 192.168.1.0 0.0.0.255

```

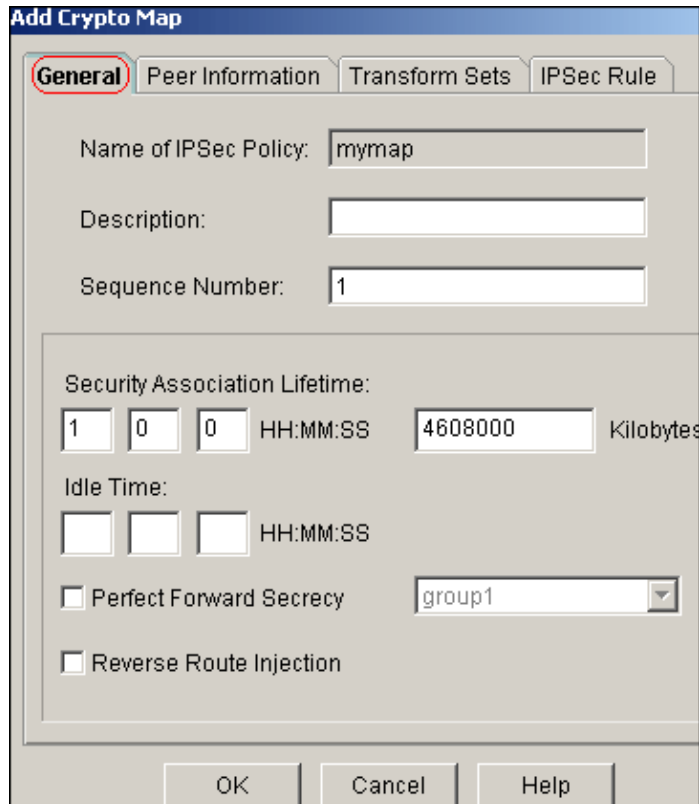


9. Choose **Configure > VPN > VPN Components > IPSec > IPSec Policies > Add** in order to create crypto map *mymap* as shown in this image.

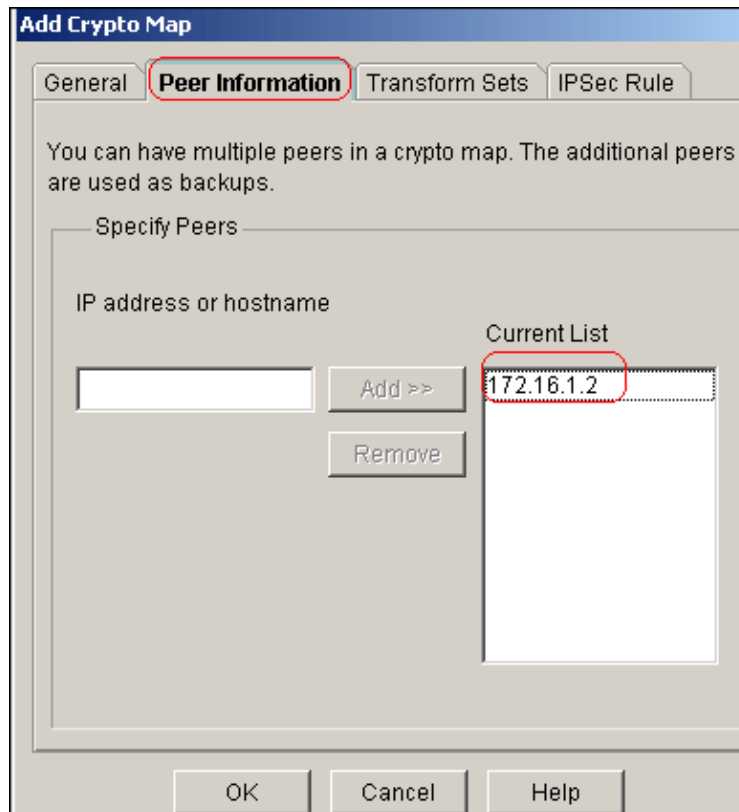


10. Click **Add**.

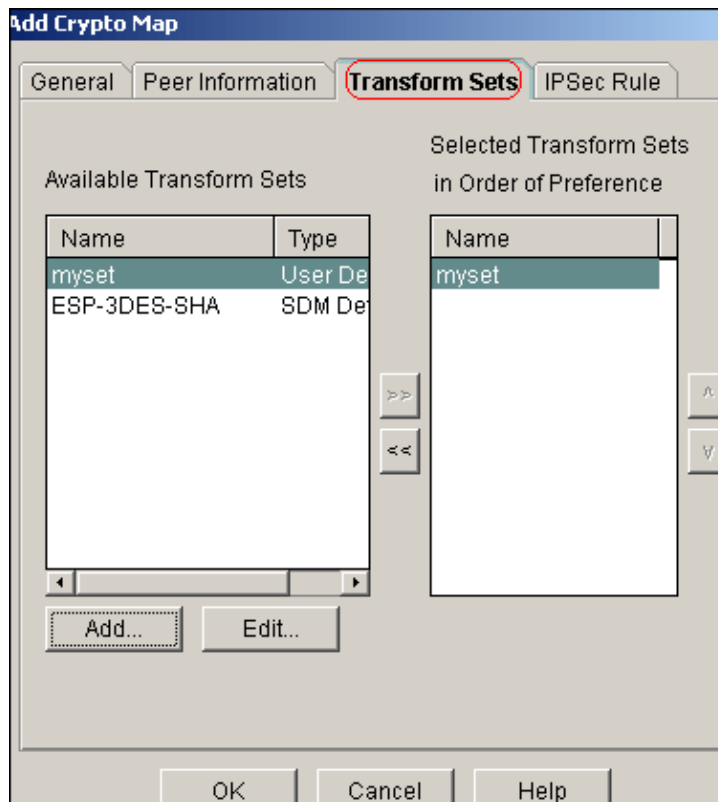
- a. Click the **General** tab and retain the default settings.



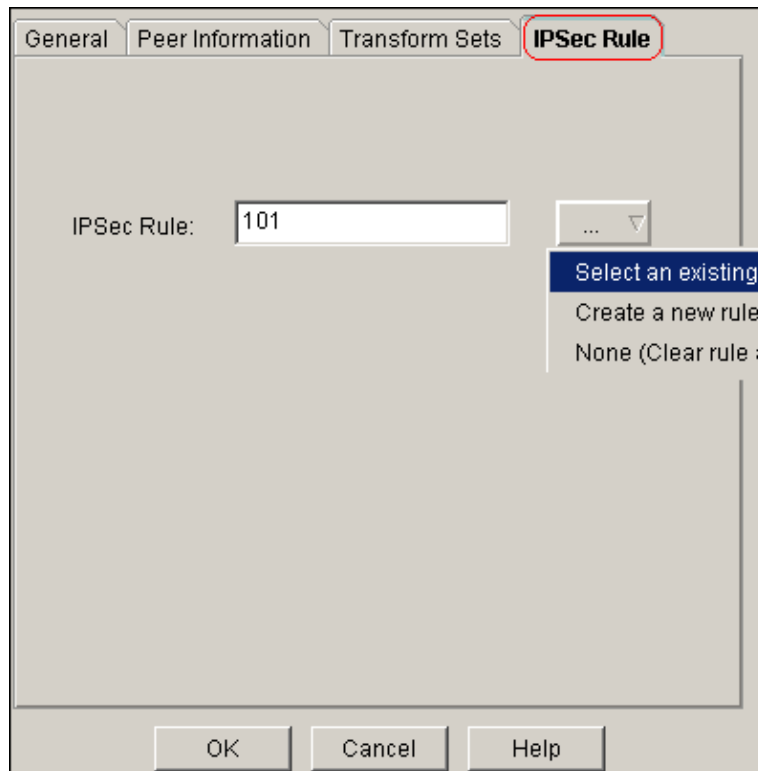
- b. Click the **Peer Information** tab in order to add the peer IP address 172.16.1.2.



c. Click the **Transform Sets** tab in order to select the desired transform set *myset*.



d. Click the **IPSec Rule** tab in order to select the existing crypto ACL 101.

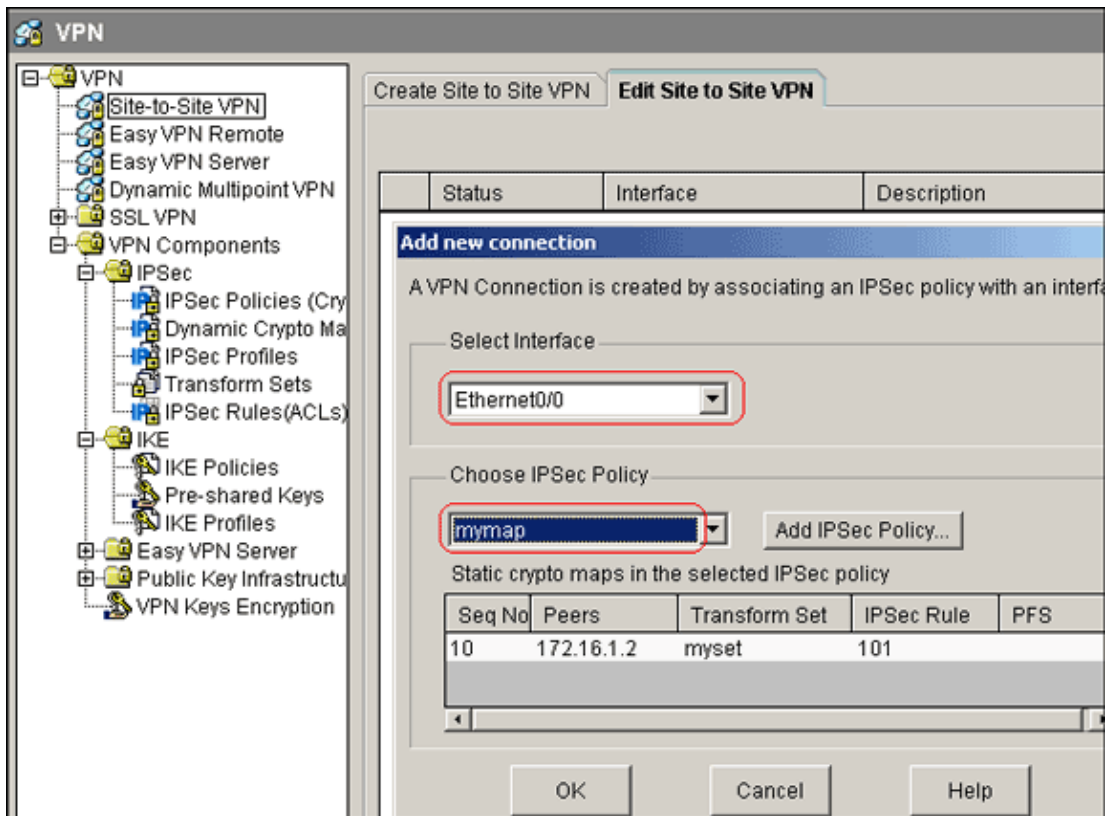


e. Click **OK**.

**Note:** Here is the equivalent CLI configuration:

Equivalent CLI Configuration
<pre>crypto map mymap 10 ipsec-isakmp set peer 172.16.1.2 set transform-set myset match address 101</pre>

11. Choose **Configure > VPN > Site-to-Site VPN > Edit Site-to-Site VPN > Add** in order to apply crypto map *mymap* to the interface Ethernet0/0.



12. Click **OK**.

**Note:** Here is the equivalent CLI configuration:

Equivalent CLI Configuration
<pre>interface Ethernet0/0 crypto map mymap</pre>

### Site\_A Router CLI Configuration

Site_A Router
<pre>Site_A#show running-config *Sep 25 21:15:58.954: %SYS-5-CONFIG_I: Configured from console by console Building configuration...  Current configuration : 1545 bytes ! version 12.4 service timestamps debug datetime msec service timestamps log datetime msec no service password-encryption ! hostname Site_A ! boot-start-marker boot-end-marker ! ! no aaa new-model ! resource policy ! ! !</pre>

```

ip cef
!
!
crypto isakmp policy 10
  hash md5
  authentication pre-share

!--- Defines ISAKMP policy.

crypto isakmp key 6 L2L12345 address 172.16.1.2 255.255.255.0

!--- Defines pre-shared secret used for IKE authentication
!
!
crypto ipsec transform-set myset esp-des esp-md5-hmac

!--- Defines IPSec encryption and authentication algorithms.
!
crypto map mymap 10 ipsec-isakmp
  set peer 172.16.1.2
  set transform-set myset
  match address 101

!--- Defines crypto map.
!
!
!
!
interface Loopback0
  ip address 192.168.1.1 255.255.255.0
  ip nat inside
  ip virtual-reassembly
!
interface Ethernet0/0
  ip address 10.1.1.2 255.255.255.0
  ip nat outside
  ip virtual-reassembly
  half-duplex
  crypto map mymap

!--- Apply crypto map on the outside interface.
!
!

!--- Output Suppressed

!
ip http server
no ip http secure-server
!
ip route 0.0.0.0 0.0.0.0 10.1.1.1
!
ip nat inside source static network 192.168.1.0 10.5.5.0 /24

!--- Static translation defined to translate Private_LAN1
!--- from 192.168.1.0/24 to 10.5.5.0/24.
!--- Note that this translation is used for both
!--- VPN and Internet traffic from Private_LAN1.
!--- A routable global IP address range, or an extra NAT

```

```

!--- at the ISP router (in front of Site_A router), is
!--- required if Private_LAN1 also needs internal access.

ip nat outside source static network 192.168.1.0 10.10.10.0 /24

!--- Static translation defined to translate Private_LAN2
!--- from 192.168.1.0/24 to 10.10.10.0/24.

!
access-list 101 permit ip 10.5.5.0 0.0.0.255 192.168.1.0 0.0.0.255

!--- Defines IPSec interesting traffic.
!--- Note that the host behind Site_A router communicates
!--- to Private_LAN2 using 10.10.10.0/24.
!--- When the packets arrive at the Site_A router, they are first
!--- translated to 192.168.1.0/24 and then encrypted by IPSec.

!
!
control-plane
!
!
line con 0
line aux 0
line vty 0 4
!
!
end
Site_A#

```

## Site\_B Router CLI Configuration

Site_B Router
<pre> Site_B#show running_config Building configuration...  Current configuration : 939 bytes ! version 12.2 service timestamps debug uptime service timestamps log uptime no service password-encryption ! hostname Site_B ! ! ip subnet-zero ! ! crypto isakmp policy 10   hash md5   authentication pre-share crypto isakmp key L2L12345 address 10.1.1.2 255.255.255.0 ! ! crypto ipsec transform-set myset esp-des esp-md5-hmac ! crypto map mymap 10 ipsec-isakmp   set peer 10.1.1.2   set transform-set myset   match address 101 </pre>

```

!
!
!
!
interface Ethernet0
 ip address 192.168.1.1 255.255.255.0
!
interface Ethernet1
 ip address 172.16.1.2 255.255.255.0
 crypto map mymap
!

!--- Output Suppressed

!
ip classless
ip route 0.0.0.0 0.0.0.0 172.16.1.1
ip http server
!
access-list 101 permit ip 192.168.1.0 0.0.0.255 10.5.5.0 0.0.0.255
!
line con 0
line aux 0
line vty 0 4
!
end

Site_B#

```

## Verify

This section provides information you can use to confirm your configuration is working properly.

The Output Interpreter Tool (registered customers only) (OIT) supports certain **show** commands. Use the OIT to view an analysis of **show** command output.

- **show crypto isakmp sa** Displays all current Internet Key Exchange (IKE) security associations (SAs) at a peer.

```

Site_A#show crypto isakmp sa
dst          src          state          conn-id slot status
172.16.1.2   10.1.1.2     QM_IDLE        1      0 ACTIVE

```

- **show crypto isakmp sa detail** Displays the details of all current IKE SAs at a peer.

```

Site_A#show cryto isakmp sa detail
Codes: C - IKE configuration mode, D - Dead Peer Detection
       K - Keepalives, N - NAT-traversal
       X - IKE Extended Authentication
       psk - Preshared key, rsig - RSA signature
       renc - RSA encryption

C-id  Local          Remote          I-VRF    Status Encr Hash Auth DH Lifetime
Cap.
1     10.1.1.2       172.16.1.2     ACTIVE des  md5  psk  1  23:59:42

Connection-id:Engine-id = 1:1(software)

```

- **show crypto ipsec sa** Displays the settings used by current SAs.

```

Site_A#show crypto ipsec sa

interface: Ethernet0/0
Crypto map tag: mymap, local addr 10.1.1.2

```

```

protected vrf: (none)
local ident (addr/mask/prot/port): (10.5.5.0/255.255.255.0/0/0)
remote ident (addr/mask/prot/port): (192.168.1.0/255.255.255.0/0/0)
current_peer 172.16.1.2 port 500
  PERMIT, flags={origin_is_acl,}
  #pkts encaps: 2, #pkts encrypt: 2, #pkts digest: 2
  #pkts decaps: 2, #pkts decrypt: 2, #pkts verify: 2
  #pkts compressed: 0, #pkts decompressed: 0
  #pkts not compressed: 0, #pkts compr. failed: 0
  #pkts not decompressed: 0, #pkts decompress failed: 0
  #send errors 3, #recv errors 0

local crypto endpt.: 10.1.1.2, remote crypto endpt.: 172.16.1.2
path mtu 1500, ip mtu 1500, ip mtu idb Ethernet0/0
current outbound spi: 0x1A9CDC0A(446487562)

inbound esp sas:
  spi: 0x99C7BA58(2580003416)
    transform: esp-des esp-md5-hmac ,
    in use settings = {Tunnel, }
    conn id: 2002, flow_id: SW:2, crypto map: mymap
    sa timing: remaining key lifetime (k/sec): (4478520/3336)
    IV size: 8 bytes
    replay detection support: Y
    Status: ACTIVE

inbound ah sas:

inbound pcp sas:

outbound esp sas:
  spi: 0x1A9CDC0A(446487562)
    transform: esp-des esp-md5-hmac ,
    in use settings = {Tunnel, }
    conn id: 2001, flow_id: SW:1, crypto map: mymap
    sa timing: remaining key lifetime (k/sec): (4478520/3335)
    IV size: 8 bytes
    replay detection support: Y
    Status: ACTIVE

outbound ah sas:

outbound pcp sas:

```

Site\_A#

- **show ip nat translations** Displays translation slot information.

```

Site_A#show ip nat translations
Pro Inside global      Inside local          Outside local         Outside global
--- ---                ---                   ---                   ---
--- ---                ---                   10.10.10.1           192.168.1.1
--- ---                ---                   10.10.10.0           192.168.1.0
--- 10.5.5.1           192.168.1.1          ---                   ---
--- 10.5.5.0           192.168.1.0          ---                   ---

```

- **show ip nat statistics** Displays static information about the translation.

```

Site_A#show ip nat statistics
Total active translations: 4 (2 static, 2 dynamic; 0 extended)
Outside interfaces:
  Ethernet0/0
Inside interfaces:
  Loopback0
Hits: 42 Misses: 2
CEF Translated packets: 13, CEF Punted packets: 0
Expired translations: 7
Dynamic mappings:

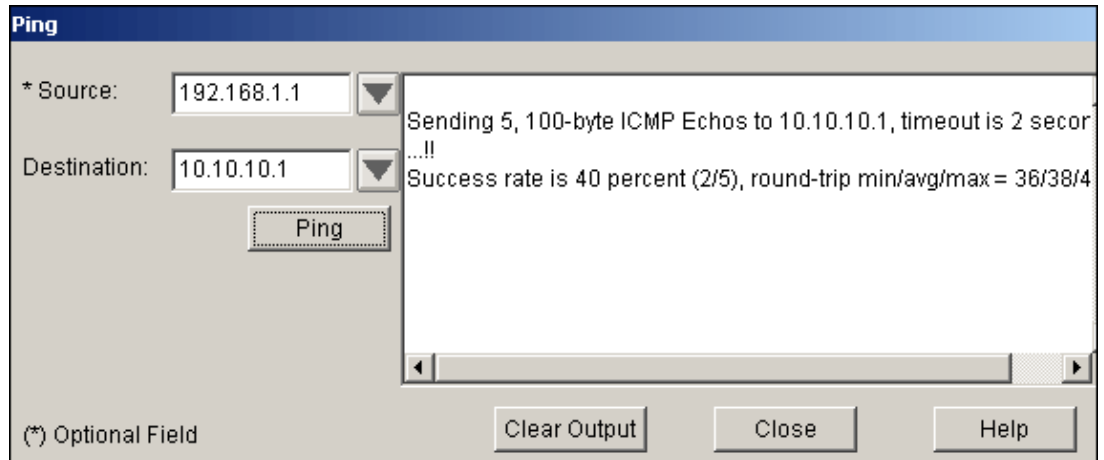
```



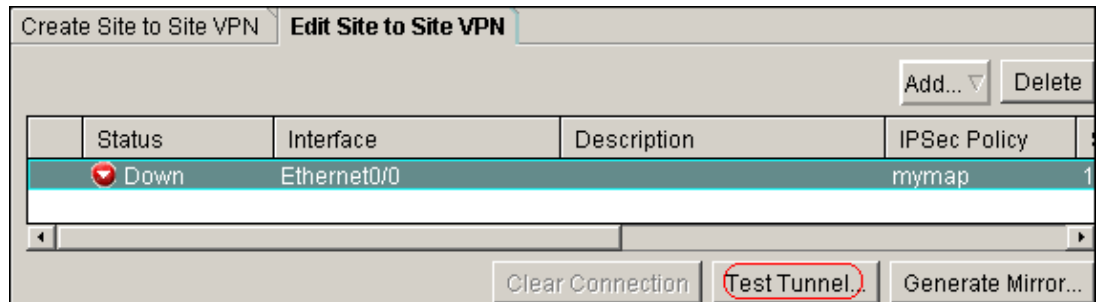
Queued Packets: 0  
Site\_A#

- Complete these steps in order to verify the connection:

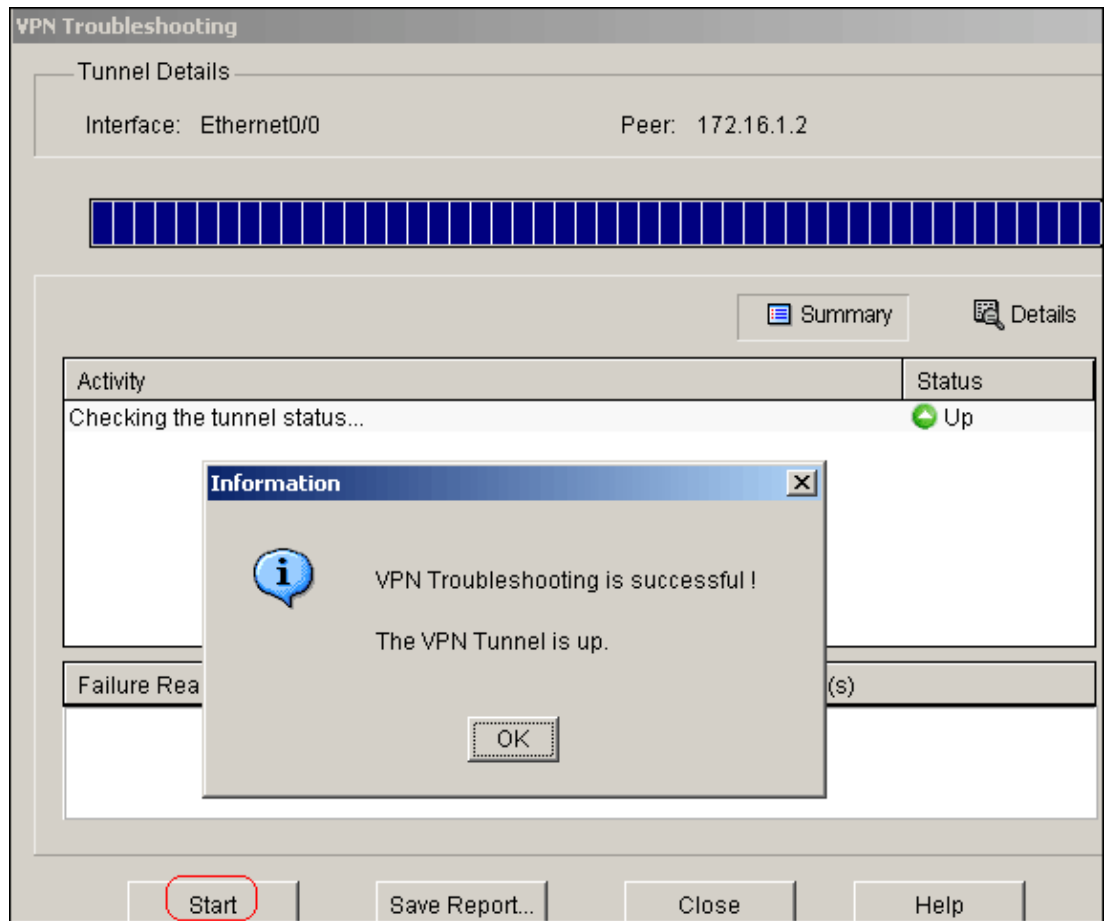
1. In SDM, choose **Tools > Ping** in order to establish the IPsec VPN tunnel with source IP as 192.168.1.1 and destination IP as 10.10.10.1.



2. Click **Test Tunnel** in order to check the IPsec VPN tunnel is established as shown in this image.



3. Click **Start**.



## Troubleshoot

This section provides information you can use to troubleshoot your configuration.

```

Site_A#debug ip packet
IP packet debugging is on
Site_A#ping
Protocol [ip]:
Target IP address: 10.10.10.1
Repeat count [5]:
Datagram size [100]:
Timeout in seconds [2]:
Extended commands [n]: y
Source address or interface: 192.168.1.1
Type of service [0]:
Set DF bit in IP header? [no]:
Validate reply data? [no]:
Data pattern [0xABCD]:
Loose, Strict, Record, Timestamp, Verbose[none]:
Sweep range of sizes [n]:
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.10.10.1, timeout is 2 seconds:
Packet sent with a source address of 192.168.1.1
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 40/45/52 ms
Site_A#
*Sep 30 18:08:10.601: IP: tableid=0, s=192.168.1.1 (local), d=10.10.10.1 (Ethernet0/0), routed via FIB
*Sep 30 18:08:10.601: IP: s=192.168.1.1 (local), d=10.10.10.1 (Ethernet0/0), len 100, sending
*Sep 30 18:08:10.641: IP: tableid=0, s=10.10.10.1 (Ethernet0/0), d=192.168.1.1 (Loopback0), routed via RIB

```

\*Sep 30 18:08:10.641: IP: s=10.10.10.1 (Ethernet0/0), d=192.168.1.1, len 100, rcvd 4  
\*Sep 30 18:08:10.645: IP: tableid=0, s=192.168.1.1 (local), d=10.10.10.1 (Ethernet0/0), routed via FIB  
\*Sep 30 18:08:10.645: IP: s=192.168.1.1 (local), d=10.10.10.1 (Ethernet0/0), len 100, sending  
\*Sep 30 18:08:10.685: IP: tableid=0, s=10.10.10.1 (Ethernet0/0), d=192.168.1.1 (Loopback0), routed via RIB  
\*Sep 30 18:08:10.685: IP: s=10.10.10.1 (Ethernet0/0), d=192.168.1.1, len 100, rcvd 4  
\*Sep 30 18:08:10.685: IP: tableid=0, s=192.168.1.1 (local), d=10.10.10.1 (Ethernet0/0), routed via FIB  
\*Sep 30 18:08:10.689: IP: s=192.168.1.1 (local), d=10.10.10.1 (Ethernet0/0), len 100, sending  
\*Sep 30 18:08:10.729: IP: tableid=0, s=10.10.10.1 (Ethernet0/0), d=192.168.1.1 (Loopback0), routed via RIB  
\*Sep 30 18:08:10.729: IP: s=10.10.10.1 (Ethernet0/0), d=192.168.1.1, len 100, rcvd 4  
\*Sep 30 18:08:10.729: IP: tableid=0, s=192.168.1.1 (local), d=10.10.10.1 (Ethernet0/0), routed via FIB  
\*Sep 30 18:08:10.729: IP: s=192.168.1.1 (local), d=10.10.10.1 (Ethernet0/0), len 100, sending  
\*Sep 30 18:08:10.769: IP: tableid=0, s=10.10.10.1 (Ethernet0/0), d=192.168.1.1 (Loopback0), routed via RIB  
\*Sep 30 18:08:10.769: IP: s=10.10.10.1 (Ethernet0/0), d=192.168.1.1, len 100, rcvd 4  
\*Sep 30 18:08:10.773: IP: tableid=0, s=192.168.1.1 (local), d=10.10.10.1 (Ethernet0/0), routed via FIB  
\*Sep 30 18:08:10.773: IP: s=192.168.1.1 (local), d=10.10.10.1 (Ethernet0/0), len 100, sending  
\*Sep 30 18:08:10.813: IP: tableid=0, s=10.10.10.1 (Ethernet0/0), d=192.168.1.1 (Loopback0), routed via RIB  
\*Sep 30 18:08:10.813: IP: s=10.10.10.1 (Ethernet0/0), d=192.168.1.1, len 100, rcvd 4

## Related Information

- [Most Common L2L and Remote Access IPSec VPN Troubleshooting Solutions](#)
- [IPSec between ASA/PIX and Cisco VPN 3000 Concentrator with Overlapping Private Networks Configuration Example](#)
- [Technical Support & Documentation – Cisco Systems](#)

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