

# Configuring PIX-to-PIX-to-PIX IPsec (Hub and Spoke)

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## Introduction

This configuration allows a central Cisco Secure PIX Firewall to communicate with networks behind two other PIX Firewall boxes through VPN tunnels over the Internet or any public network using IPsec. The two outlying networks have no need to communicate with each other, but there is connectivity to the central network. The two outlying networks are not able to communicate with each other by going through the central PIX because the PIX does not route traffic received on one interface back out the same interface. If there is a need for the outlying networks to communicate with each other, you need a fully meshed configuration, instead of the hub and spoke configuration shown in this document. There might already be **nat 1**, **global**, **static**, and **conduit** statements present on the PIXes. This example only shows the addition of encryption.

## Prerequisites

### Requirements

For IPsec to work, you *must* establish connectivity between tunnel endpoints before you start this configuration.

### Components Used

The information in this document is based on PIX Firewall versions 5.1.x , 5.2.x, and 6.3.3.

**Note:** The **show version** command must show that encryption is enabled.

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.

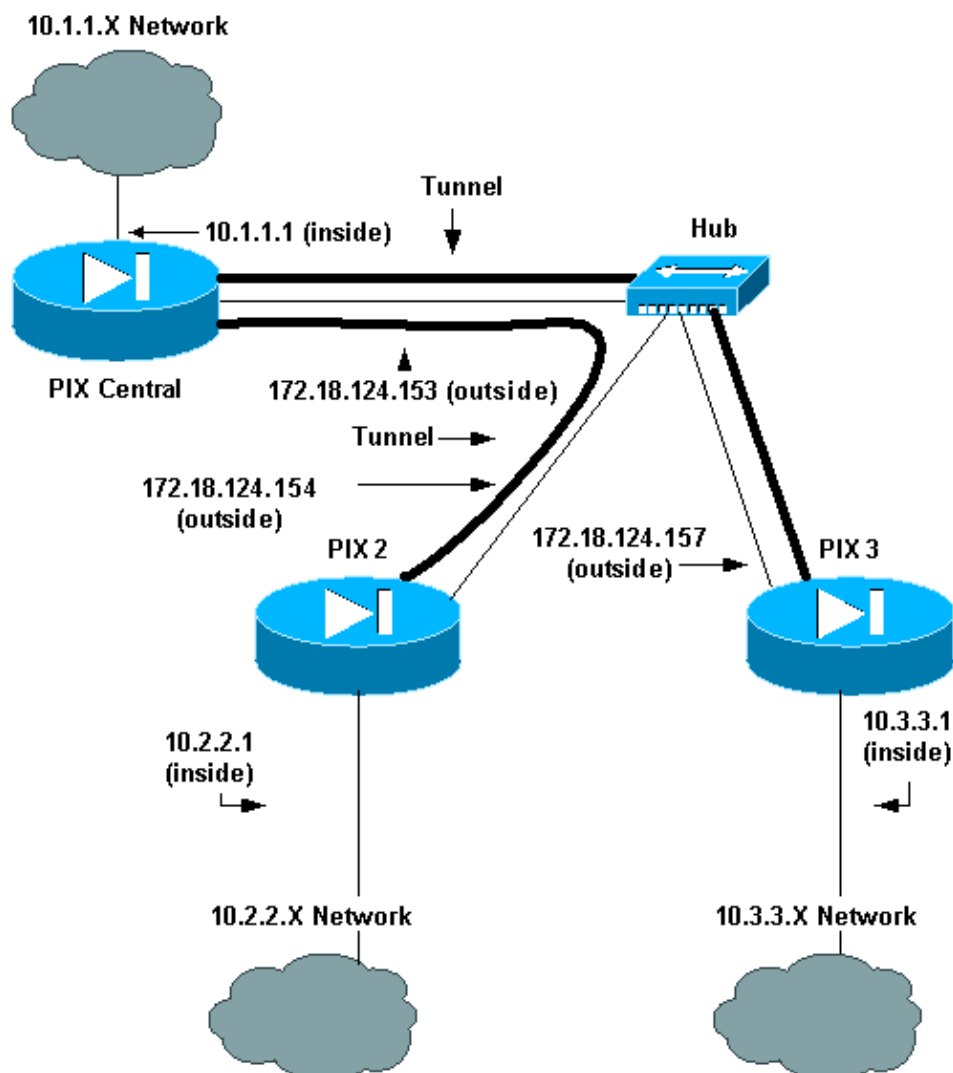
## Configure

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:



## Configurations

This document uses these configurations:

- PIX Central
- PIX 2

• PIX 3

## PIX Central

```
Building configuration...
: Saved
:
PIX Version 6.3(3)
interface ethernet0 auto
interface ethernet1 auto
nameif ethernet0 outside security0
nameif ethernet1 inside security100
enable password 8Ry2YjIyt7RRXU24 encrypted
passwd 2KFQnbNIdI.2KYOU encrypted
hostname pix-central
fixup protocol dns maximum-length 512
fixup protocol ftp 21
fixup protocol h323 h225 1720
fixup protocol h323 ras 1718-1719
fixup protocol http 80
fixup protocol rsh 514
fixup protocol rtsp 554
fixup protocol sip 5060
fixup protocol sip udp 5060
fixup protocol skinny 2000
fixup protocol smtp 25
fixup protocol sqlnet 1521
fixup protocol tftp 69
names

!--- This is traffic to PIX 2.

access-list 120 permit ip 10.1.1.0 255.255.255.0 10.2.2.0 255.255.255.0

!--- This is traffic to PIX 3.

access-list 130 permit ip 10.1.1.0 255.255.255.0 10.3.3.0 255.255.255.0

!--- Do not do Network Address Translation (NAT) on traffic to other PIXes.

access-list 100 permit ip 10.1.1.0 255.255.255.0 10.2.2.0 255.255.255.0
access-list 100 permit ip 10.1.1.0 255.255.255.0 10.3.3.0 255.255.255.0
pager lines 24
logging on
mtu outside 1500
mtu inside 1500
ip address outside 172.18.124.153 255.255.255.0
ip address inside 10.1.1.1 255.255.255.0
ip audit info action alarm
ip audit attack action alarm
pdm history enable
arp timeout 14400

!--- Do not do NAT on traffic to other PIXes.

nat (inside) 0 access-list 100
route outside 0.0.0.0 0.0.0.0 172.18.124.1 1
timeout xlate 3:00:00
timeout conn 1:00:00 half-closed 0:10:00 udp 0:02:00 rpc 0:10:00 h225 1:00:00
timeout h323 0:05:00 mgcp 0:05:00 sip 0:30:00 sip_media 0:02:00
timeout uauth 0:05:00 absolute
aaa-server TACACS+ protocol tacacs+
aaa-server RADIUS protocol radius
aaa-server LOCAL protocol local
no snmp-server location
no snmp-server contact
```

```
snmp-server community public
snmp-server enable traps
floodguard enable
sysopt connection permit-ipsec
crypto ipsec transform-set myset esp-des esp-md5-hmac
```

```
!--- This is traffic to PIX 2.
```

```
crypto map newmap 20 ipsec-isakmp
crypto map newmap 20 match address 120
crypto map newmap 20 set peer 172.18.124.154
crypto map newmap 20 set transform-set myset
```

```
!--- This is traffic to PIX 3.
```

```
crypto map newmap 30 ipsec-isakmp
crypto map newmap 30 match address 130
crypto map newmap 30 set peer 172.18.124.157
crypto map newmap 30 set transform-set myset
crypto map newmap interface outside
isakmp enable outside
isakmp key ***** address 172.18.124.154 netmask 255.255.255.255
    no-xauth no-config-mode
isakmp key ***** address 172.18.124.157 netmask 255.255.255.255
    no-xauth no-config-mode
isakmp identity address
isakmp policy 10 authentication pre-share
isakmp policy 10 encryption des
isakmp policy 10 hash md5
isakmp policy 10 group 1
isakmp policy 10 lifetime 1000
telnet timeout 5
ssh timeout 5
console timeout 0
terminal width 80
Cryptochecksum:d41d8cd98f00b204e9800998ecf8427e
: end
```

## PIX 2

```
Building configuration...
: Saved
:
PIX Version 6.3(3)
interface ethernet0 auto
interface ethernet1 auto
nameif ethernet0 outside security0
nameif ethernet1 inside security100
enable password 8Ry2YjIyt7RRXU24 encrypted
passwd 2KFQnbNIdI.2KYOU encrypted
hostname pix2
fixup protocol dns maximum-length 512
fixup protocol ftp 21
fixup protocol h323 h225 1720
fixup protocol h323 ras 1718-1719
fixup protocol http 80
fixup protocol rsh 514
fixup protocol rtsp 554
fixup protocol sip 5060
fixup protocol sip udp 5060
fixup protocol skinny 2000
fixup protocol smtp 25
fixup protocol sqlnet 1521
fixup protocol tftp 69
names
```

```
!--- This is traffic to PIX Central.

access-list 110 permit ip 10.2.2.0 255.255.255.0 10.1.1.0 255.255.255.0

!--- Do not do NAT on traffic to PIX Central.

access-list 100 permit ip 10.2.2.0 255.255.255.0 10.1.1.0 255.255.255.0
pager lines 24
logging on
mtu outside 1500
mtu inside 1500
ip address outside 172.18.124.154 255.255.255.0
ip address inside 10.2.2.1 255.255.255.0
ip audit info action alarm
ip audit attack action alarm
no failover
failover timeout 0:00:00
failover poll 15
no failover ip address outside
no failover ip address inside
pdm history enable
arp timeout 14400

!--- Do not do NAT on traffic to PIX Central.

nat (inside) 0 access-list 100
route outside 0.0.0.0 0.0.0.0 172.18.124.1 1
timeout xlate 3:00:00
timeout conn 1:00:00 half-closed 0:10:00 udp 0:02:00 rpc 0:10:00 h225 1:00:00
timeout h323 0:05:00 mgcp 0:05:00 sip 0:30:00 sip_media 0:02:00
timeout uauth 0:05:00 absolute
aaa-server TACACS+ protocol tacacs+
aaa-server RADIUS protocol radius
aaa-server LOCAL protocol local
no snmp-server location
no snmp-server contact
snmp-server community public
no snmp-server enable traps
floodguard enable
sysopt connection permit-ipsec
crypto ipsec transform-set myset esp-des esp-md5-hmac

!--- This is traffic to PIX Central.

crypto map newmap 10 ipsec-isakmp
crypto map newmap 10 match address 110
crypto map newmap 10 set peer 172.18.124.153
crypto map newmap 10 set transform-set myset
crypto map newmap interface outside
isakmp enable outside
isakmp key ***** address 172.18.124.153 netmask 255.255.255.255
    no-xauth no-config-mode
isakmp identity address
isakmp policy 10 authentication pre-share
isakmp policy 10 encryption des
isakmp policy 10 hash md5
isakmp policy 10 group 1
isakmp policy 10 lifetime 1000
telnet timeout 5
ssh timeout 5
console timeout 0
terminal width 80
Cryptochecksum:d41d8cd98f00b204e9800998ecf8427e
: end
```

## PIX 3

Building configuration...

: Saved

:

PIX Version 6.3(3)

interface ethernet0 auto

interface ethernet1 auto

nameif ethernet0 outside security0

nameif ethernet1 inside security100

enable password 8Ry2YjIyt7RRXU24 encrypted

passwd 2KFQnbNIdI.2KYOU encrypted

hostname pix3

fixup protocol dns maximum-length 512

fixup protocol ftp 21

fixup protocol h323 h225 1720

fixup protocol h323 ras 1718-1719

fixup protocol http 80

fixup protocol rsh 514

fixup protocol rtsp 554

fixup protocol sip 5060

fixup protocol sip udp 5060

fixup protocol skinny 2000

fixup protocol smtp 25

fixup protocol sqlnet 1521

fixup protocol tftp 69

names

*!--- This is traffic to PIX Central.*

**access-list 110 permit ip 10.3.3.0 255.255.255.0 10.1.1.0 255.255.255.0**

*!--- Do not do NAT on traffic to PIX Central.*

**access-list 100 permit ip 10.3.3.0 255.255.255.0 10.1.1.0 255.255.255.0**

pager lines 24

logging on

mtu outside 1500

mtu inside 1500

ip address outside 172.18.124.157 255.255.255.0

ip address inside 10.3.3.1 255.255.255.0

ip audit info action alarm

ip audit attack action alarm

no failover

failover timeout 0:00:00

failover poll 15

no failover ip address outside

no failover ip address inside

pdm history enable

arp timeout 14400

*!--- Do not do NAT on traffic to PIX Central.*

**nat (inside) 0 access-list 100**

route outside 0.0.0.0 0.0.0.0 172.18.124.1 1

timeout xlate 3:00:00

timeout conn 1:00:00 half-closed 0:10:00 udp 0:02:00 rpc 0:10:00 h225 1:00:00

timeout h323 0:05:00 mgcp 0:05:00 sip 0:30:00 sip\_media 0:02:00

timeout uauth 0:05:00 absolute

aaa-server TACACS+ protocol tacacs+

aaa-server RADIUS protocol radius

aaa-server LOCAL protocol local

no snmp-server location

no snmp-server contact

snmp-server community public

no snmp-server enable traps

```

floodguard enable
sysopt connection permit-ipsec
crypto ipsec transform-set myset esp-des esp-md5-hmac

!--- This is traffic to PIX Central.

crypto map newmap 10 ipsec-isakmp
crypto map newmap 10 match address 110
crypto map newmap 10 set peer 172.18.124.153
crypto map newmap 10 set transform-set myset
crypto map newmap interface outside
isakmp enable outside
isakmp key ***** address 172.18.124.153 netmask 255.255.255.255
    no-xauth no-config-mode
isakmp identity address
isakmp policy 10 authentication pre-share
isakmp policy 10 encryption des
isakmp policy 10 hash md5
isakmp policy 10 group 1
isakmp policy 10 lifetime 1000
telnet timeout 5
ssh timeout 5
console timeout 0
terminal width 80
Cryptochecksum:aa3bbd8c6275d214b153e1e0bc0173e4
: end

```

## Verify

Use this section to confirm that your configuration works 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 ipsec sa** Displays the current status of the IPsec security associations (SAs) and is useful in determining if traffic is encrypted.

```

pix-central#show crypto ipsec sa

interface: outside
    Crypto map tag: newmap, local addr. 172.18.124.153

    local ident (addr/mask/prot/port): (10.1.1.0/255.255.255.0/0/0)
    remote ident (addr/mask/prot/port): (10.3.3.0/255.255.255.0/0/0)
    current_peer: 172.18.124.157:500
        PERMIT, flags={origin_is_acl,}

!--- This verifies that encrypted packets are sent
!--- and received without any errors.

    #pkts encaps: 4, #pkts encrypt: 4, #pkts digest 4
    #pkts decaps: 4, #pkts decrypt: 4, #pkts verify 4
    #pkts compressed: 0, #pkts decompressed: 0
    #pkts not compressed: 0, #pkts compr. failed: 0,
    #pkts decompress failed: 0, #send errors 0, #recv errors 0

    local crypto endpt.: 172.18.124.153,
    remote crypto endpt.: 172.18.124.157
    path mtu 1500, ipsec overhead 56, media mtu 1500
    current outbound spi: 3bcb6913

!--- Shows inbound SAs that are established.

```

**inbound esp sas:**

spi: 0x3efbe540(1056695616)  
transform: **esp-des esp-md5-hmac** ,  
in use settings ={Tunnel, }  
slot: 0, conn id: 3, crypto map: **newmap**  
sa timing: remaining key lifetime (k/sec): (4607999/27330)  
IV size: 8 bytes  
replay detection support: Y

inbound ah sas:

inbound pcp sas:

*!--- Shows outbound SAs that are established.*

**outbound esp sas:**

spi: 0x3bcb6913(1003186451)  
transform: **esp-des esp-md5-hmac** ,  
in use settings ={Tunnel, }  
slot: 0, conn id: 4, crypto map: **newmap**  
sa timing: remaining key lifetime (k/sec): (4607999/27321)  
IV size: 8 bytes  
replay detection support: Y

outbound ah sas:

outbound pcp sas:

local ident (addr/mask/prot/port): (10.1.1.0/255.255.255.0/0/0)  
remote ident (addr/mask/prot/port): (10.2.2.0/255.255.255.0/0/0)  
current\_peer: 172.18.124.154:500  
PERMIT, flags={origin\_is\_acl,}

*!--- This verifies that encrypted packets are sent  
!--- and received without any errors.*

**#pkts encaps: 4, #pkts encrypt: 4, #pkts digest 4**  
**#pkts decaps: 4, #pkts decrypt: 4, #pkts verify 4**  
#pkts compressed: 0, #pkts decompressed: 0  
#pkts not compressed: 0, #pkts compr. failed: 0,  
#pkts decompress failed: 0, #send errors 0, #recv errors 0

local crypto endpt.: 172.18.124.153,  
remote crypto endpt.: 172.18.124.154  
path mtu 1500, ipsec overhead 56, media mtu 1500  
current outbound spi: da8d556

*!--- Shows inbound SAs that are established.*

**inbound esp sas:**

spi: 0x53835c96(1401117846)  
transform: **esp-des esp-md5-hmac** ,  
in use settings ={Tunnel, }  
slot: 0, conn id: 1, crypto map: **newmap**  
sa timing: remaining key lifetime (k/sec): (4607999/27319)  
IV size: 8 bytes  
replay detection support: Y

inbound ah sas:

inbound pcp sas:

*!--- Shows outbound SAs that are established.*

**outbound esp sas:**

spi: 0xda8d556c(3666695532)  
transform: **esp-des esp-md5-hmac** ,



```
in use settings ={Tunnel, }
slot: 0, conn id: 2, crypto map: newmap
sa timing: remaining key lifetime (k/sec): (4607999/27319)
IV size: 8 bytes
replay detection support: Y
```

```
outbound ah sas:
```

```
outbound pcp sas:
```

- **show crypto isakmp sa** Shows the current state of the Internet Key Exchange (IKE) SAs.

```
pix-central#show crypto isakmp sa
Total      : 2
Embryonic  : 0
           dst          src          state      pending   created
172.18.124.153 172.18.124.154 QM_IDLE    0         0
172.18.124.153 172.18.124.157 QM_IDLE    0         0
```

## Troubleshoot

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

## Troubleshooting Commands

**Note:** Refer to Important Information on Debug Commands before you use **debug** commands.

On the PIX (with the **logging monitor debugging** or **logging console debugging** commands running):


- **debug crypto ipsec** Debugs IPsec processing.
- **debug crypto isakmp** Debugs Internet Security Association and Key Management Protocol (ISAKMP) processing.
- **debug crypto engine** Displays debug messages about crypto engines, which perform encryption and decryption.

## Clear Security Associations

Use these commands in the config mode of the PIX:

- **clear [crypto] ipsec sa** Deletes the active IPsec SAs. The keyword **crypto** is optional.
- **clear [crypto] isakmp sa** Deletes the active IKE SAs. The keyword **crypto** is optional.

## Related Information

- [Cisco PIX Firewall Software](#)
- [Cisco Secure PIX Firewall Command References](#)
- [Security Product Field Notices \(including PIX\)](#)
- [Requests for Comments \(RFCs\)](#) 
- [Documentation for PIX Firewall](#)
- [IPsec Negotiation/IKE Protocols](#)
- [Technical Support & Documentation – Cisco Systems](#)

