

Configurazione di un tunnel GRE su IPsec con OSPF

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Introduzione

Le normali configurazioni IPsec non possono trasferire protocolli di routing, ad esempio EIGRP (Enhanced Interior Gateway Routing Protocol) e OSPF (Open Shortest Path First), o traffico non IP, ad esempio IPX (Internetwork Packet Exchange) e AppleTalk. In questo documento viene spiegato come effettuare il routing tra diverse reti che usano un protocollo di routing e il traffico non IP con IPsec. In questo esempio viene usato il protocollo GRE (Generic Routing Encapsulation) per eseguire il routing tra le diverse reti.

Fare riferimento a [PIX/ASA 7.x e versioni successive: Esempio di configurazione VPN/IPsec con OSPF](#) per ulteriori informazioni su come configurare una VPN/IPsec con Open Shortest Path First (OSPF) senza un tunnel GRE sul software Cisco PIX Security Appliance versione 7.x o Cisco Adaptive Security Appliance (ASA).

Per informazioni su come configurare il progetto IPsec [hub e spoke](#) tra tre router, fare riferimento a [Configurazione](#) di un hub-router e spoke con comunicazione tra gli spoke.

Per informazioni su come configurare la configurazione di base del firewall Cisco IOS[®] su un tunnel GRE con Network Address Translation (NAT), fare riferimento a [Configurazione](#) del firewall da router a router [IPSec \(chiavi precondivise\)](#) sul tunnel GRE.

Prerequisiti

Requisiti

Prima di provare questa configurazione, accertarsi di soddisfare i seguenti requisiti:

- Verificare che il tunnel funzioni prima di applicare le mappe crittografiche.
- Per informazioni su possibili problemi relativi alla MTU (Maximum Transmission Unit), fare riferimento alla sezione [Regolazione della MTU IP, del valore TCP MSS e della funzionalità PMTUD sui sistemi Windows e Sun.](#)

Componenti usati

Le informazioni fornite in questo documento si basano sulle seguenti versioni software e hardware:

- Cisco 3600 con software Cisco IOS versione 12.4(8)
- Cisco 2600 con software Cisco IOS versione 12.4(8)
- Software PIX Firewall (Lion) versione 6.3(5)
- Software PIX Firewall (Tiger) versione 6.3(5)

Le informazioni discusse in questo documento fanno riferimento a dispositivi usati in uno specifico ambiente di emulazione. Su tutti i dispositivi menzionati nel documento la configurazione è stata ripristinata ai valori predefiniti. Se la rete è operativa, valutare attentamente eventuali conseguenze derivanti dall'uso dei comandi.

Convenzioni

Per ulteriori informazioni sulle convenzioni usate, consultare il documento [Cisco sulle convenzioni nei suggerimenti tecnici.](#)

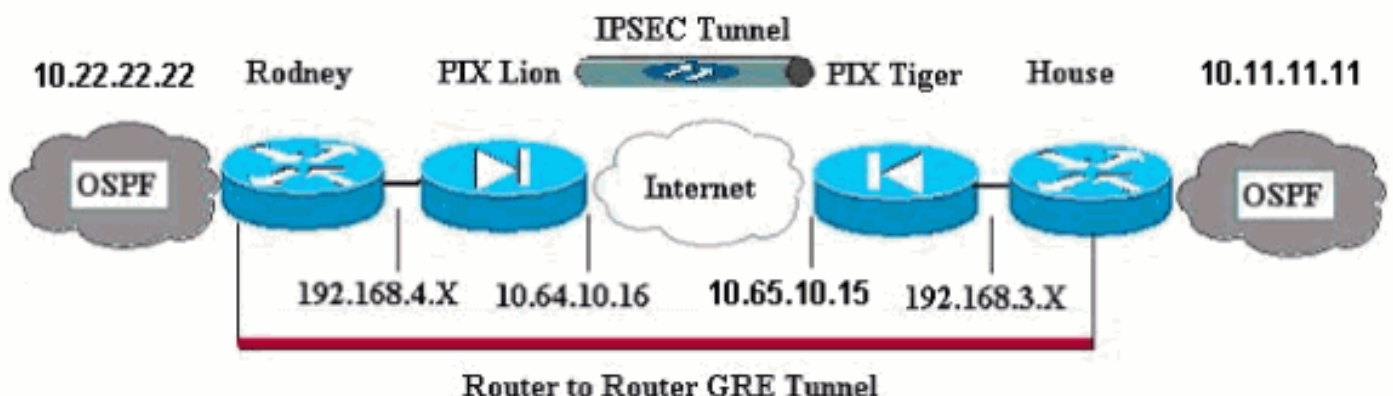
Configurazione

In questa sezione vengono presentate le informazioni utilizzate per configurare le funzionalità descritte più avanti nel documento.

Nota: per ulteriori informazioni sui comandi menzionati in questo documento, usare lo [strumento di ricerca](#) dei comandi (solo utenti [registrati](#)).

Esempio di rete

Nel documento viene usata questa impostazione di rete:



Nota: gli schemi di indirizzamento IP utilizzati in questa configurazione non sono legalmente instradabili su Internet. Questi sono indirizzi [RFC 1918](#) usati in un ambiente lab.

Nota: Crypto non supporta i router Cisco serie 7600. Per il corretto funzionamento di questa procedura, potrebbe essere necessario installare il modulo VPN.

Configurazioni

Nel documento vengono usate queste configurazioni:

- [Leone PIX](#)
- [PIX Tiger](#)
- [Router Rodney](#)
- [Router House](#)

Leone PIX

```
PIX Version 6.3(5)
interface ethernet0 auto
interface ethernet1 auto
interface ethernet2 auto shutdown
interface ethernet3 auto shutdown
interface ethernet4 auto shutdown
interface ethernet5 auto shutdown
nameif ethernet0 outside security0
nameif ethernet1 inside security100
nameif ethernet2 intf2 security4
nameif ethernet3 intf3 security6
nameif ethernet4 intf4 security8
nameif ethernet5 intf5 security10
enable password 8Ry2YjIyt7RRXU24 encrypted
passwd 2KFQnbNIdI.2KYOU encrypted
hostname Lion
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
!--- Defines interesting traffic that is protected by
the IPsec tunnel. access-list 101 permit gre 192.168.4.0
255.255.255.0 192.168.3.0 255.255.255.0

!--- Do not perform NAT for traffic to other PIX
Firewall. access-list nonat permit ip 192.168.4.0
255.255.255.0 192.168.3.0 255.255.255.0
pager lines 24
mtu outside 1500
mtu inside 1500
mtu intf2 1500
mtu intf3 1500
```

```
mtu intf4 1500
mtu intf5 1500
ip address outside 10.64.10.16 255.255.255.224
ip address inside 192.168.4.1 255.255.255.0
!--- Output suppressed. global (outside) 1 interface !---
- Do not Network Address Translate (NAT) traffic. nat
(inside) 0 access-list nonat
nat (inside) 1 0.0.0.0 0.0.0.0 0 0
route outside 0.0.0.0 0.0.0.0 10.64.10.1 1
timeout xlate 3:00:00
timeout conn 1:00:00 half-closed 0:10:00 udp 0:02:00 rpc
0:10:00 h323 0:05:00 s0
timeout h323 0:05:00 mgcp 0:05:00 sip 0:30:00 sip_media
0:02:00
timeout sip-disconnect 0:02:00 sip-invite 0:03:00
timeout uauth 0:05:00 absolute
aaa-server TACACS+ protocol tacacs+
aaa-server TACACS+ max-failed-attempts 3
aaa-server TACACS+ deadtime 10
aaa-server RADIUS protocol radius
aaa-server RADIUS max-failed-attempts 3
aaa-server RADIUS deadtime 10
aaa-server LOCAL protocol local
no snmp-server location
no snmp-server contact
snmp-server community public
no snmp-server enable traps
floodguard enable
!--- Trust IPsec traffic and avoid going through !---
access control lists (ACLs)/NAT. sysopt connection
permit-ipsec

!--- IPsec configuration. crypto ipsec transform-set
pixset esp-des esp-md5-hmac
crypto map pixmap 20 ipsec-isakmp
crypto map pixmap 20 match address 101
crypto map pixmap 20 set peer 10.65.10.15
crypto map pixmap 20 set transform-set pixset
crypto map pixmap interface outside
isakmp enable outside
!--- IKE parameters. isakmp key ***** address
10.65.10.15 netmask 255.255.255.255
isakmp identity address
isakmp policy 20 authentication pre-share
isakmp policy 20 encryption des
isakmp policy 20 hash md5
isakmp policy 20 group 1
isakmp policy 20 lifetime 3600
telnet timeout 5
ssh 10.104.205.124 255.255.255.255 outside
ssh timeout 5
terminal width 80
Cryptochecksum:d39b3d449563c7cd434b43f82f0f0a21
: end
```

PIX Tiger

```
PIX Version 6.3(5)
interface ethernet0 auto
interface ethernet1 auto
interface ethernet2 auto shutdown
interface ethernet3 auto shutdown
interface ethernet4 auto shutdown
```

```
interface ethernet5 auto shutdown
nameif ethernet0 outside security0
nameif ethernet1 inside security100
nameif ethernet2 intf2 security4
nameif ethernet3 intf3 security6
nameif ethernet4 intf4 security8
nameif ethernet5 intf5 security10
enable password 8Ry2YjIyt7RRXU24 encrypted
passwd 2KFQnbNIdI.2KYOU encrypted
hostname Tiger
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
access-list 101 permit gre 192.168.3.0 255.255.255.0
192.168.4.0 255.255.255.0

access-list nonat permit ip 192.168.3.0 255.255.255.0
192.168.4.0 255.255.255.0
mtu outside 1500
mtu inside 1500
mtu intf2 1500
mtu intf3 1500
mtu intf4 1500
mtu intf5 1500
ip address outside 10.65.10.15 255.255.255.224
ip address inside 192.168.3.1 255.255.255.0
!--- Output suppressed. global (outside) 1 interface !--
- Do not NAT traffic. nat (inside) 0 access-list nonat
nat (inside) 1 0.0.0.0 0.0.0.0 0 0
route outside 0.0.0.0 0.0.0.0 10.64.10.1 1
timeout xlate 3:00:00
timeout conn 1:00:00 half-closed 0:10:00 udp 0:02:00 rpc
0:10:00 h323 0:05:00 s0
timeout h323 0:05:00 mgcp 0:05:00 sip 0:30:00 sip_media
0:02:00
timeout sip-disconnect 0:02:00 sip-invite 0:03:00
timeout uauth 0:05:00 absolute
aaa-server TACACS+ protocol tacacs+
aaa-server TACACS+ max-failed-attempts 3
aaa-server TACACS+ deadtime 10
aaa-server RADIUS protocol radius
aaa-server RADIUS max-failed-attempts 3
aaa-server RADIUS deadtime 10
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
!--- IPsec parameters. crypto ipsec transform-set pixset
esp-des esp-md5-hmac
crypto map pixmap 20 ipsec-isakmp
```

```
crypto map pixmap 20 match address 101
crypto map pixmap 20 set peer 10.64.10.16
crypto map pixmap 20 set transform-set pixset
crypto map pixmap interface outside
!--- IKE parameters. isakmp enable outside
isakmp key ***** address 10.64.10.16 netmask
255.255.255.255
isakmp identity address
isakmp policy 20 authentication pre-share
isakmp policy 20 encryption des
isakmp policy 20 hash md5
isakmp policy 20 group 1
isakmp policy 20 lifetime 3600
telnet timeout 5
ssh timeout 5
terminal width 80
Cryptochecksum:a0a7ac847b05d9d080d1c442ef053a0b
: end
```

Router Rodney

```
version 12.4
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname rodney
!
memory-size iomem 15
ip subnet-zero
!
ip audit notify log
ip audit po max-events 100
!
!
interface Loopback1
ip address 10.22.22.22 255.255.255.0
!
interface Tunnel0
ip address 10.1.1.2 255.255.255.0
!--- Tunnel source. tunnel source Ethernet0/1
!--- Tunnel destination. tunnel destination 192.168.3.2
!
interface Ethernet0/0
no ip address
!
interface Serial0/0
no ip address
shutdown
!
interface Ethernet0/1
ip address 192.168.4.2 255.255.255.0
!
interface Serial0/1
no ip address
shutdown
!
router ospf 22
log-adjacency-changes
network 10.1.1.0 0.0.0.255 area 0
network 10.22.22.0 0.0.0.255 area 0
!
ip classless
```

```
ip route 0.0.0.0 0.0.0.0 192.168.4.1
!--- The 10.11.11.0 traffic is passed through !--- the
GRE tunnel. ip route 10.11.11.0 255.255.255.0 Tunnel0 no
ip http server ! line con 0 line aux 0 line vty 0 4
login ! end! End
```

Router House

```
version 12.4
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname house
!
ip subnet-zero
no ip domain-lookup
!
!
interface Loopback1
ip address 10.11.11.11 255.255.255.0
!
interface Tunnel0
ip address 10.1.1.1 255.255.255.0
!--- Tunnel source. tunnel source FastEthernet0/1
!--- Tunnel destination. tunnel destination 192.168.4.2
!
interface FastEthernet0/0
no ip address
shutdown
duplex auto
speed auto
!
interface FastEthernet0/1
ip address 192.168.3.2 255.255.255.0
duplex auto
speed auto
!
interface FastEthernet4/0
no ip address
shutdown
duplex auto
speed auto
!
router ospf 11
log-adjacency-changes
network 10.1.1.0 0.0.0.255 area 0
network 10.11.11.0 0.0.0.255 area 0
!
ip classless
ip route 0.0.0.0 0.0.0.0 192.168.3.1
!--- The 10.22.22.0 traffic is passed through !--- the
GRE tunnel. ip route 10.22.22.0 255.255.255.0 Tunnel0
ip http server
!
line con 0
line aux 0
line vty 0 4
```

[Verifica](#)

Attualmente non è disponibile una procedura di verifica per questa configurazione.

Risoluzione dei problemi

Le informazioni contenute in questa sezione permettono di risolvere i problemi relativi alla configurazione.

Per ulteriori informazioni sulla risoluzione dei problemi di tunnel PIX e IPsec, consultare il documento sulla [risoluzione dei problemi del PIX per il passaggio del traffico di dati su un tunnel IPsec stabilito](#).

Comandi per la risoluzione dei problemi

Lo [strumento Output Interpreter](#) (solo utenti [registrati](#)) (OIT) supporta alcuni comandi **show**. Usare l'OIT per visualizzare un'analisi dell'output del comando **show**.

Nota: consultare le [informazioni importanti sui comandi di debug](#) prima di usare i comandi di **debug**.

Debug corretto IPsec PIX

- **show crypto isakmp sa:** visualizza la Security Association (SA) di Internet Security Association Protocol (ISAKMP) creata tra peer.

```
Lion#show crypto isakmp sa
Total : 1
Embryonic : 0
dst src state pending created
10.65.10.15 10.64.10.16 QM_IDLE 0 1
```

```
Tiger#show crypto isakmp sa
Total SAs : 1
Embryonic : 0
dst src state pending created
10.65.10.15 10.64.10.16 QM_IDLE 0 1
```

- **show crypto engine connection active:** visualizza ciascuna SA di fase 2 creata e la quantità di traffico inviato.

```
Lion#show crypto engine connection active
Crypto Engine Connection Map:
size = 8, free = 6, used = 2, active = 2
```

```
Tiger#show crypto engine connection active
Crypto Engine Connection Map:
size = 8, free = 6, used = 2, active = 2
```

- **show debug:** visualizza l'output del comando debug.

```
Lion#show debug
debug crypto ipsec
debug crypto isakmp
debug crypto engine
crypto_isakmp_process_block: src 10.65.10.15, dest 10.64.10.16
OAK_MM exchange
ISAKMP (0): processing SA payload. message ID = 0
```

```
ISAKMP (0): Checking ISAKMP transform 1 against priority 20 policy
ISAKMP: encryption DES-CBC
```



```
ISAKMP: hash MD5
ISAKMP: default group 1
ISAKMP: auth pre-share
ISAKMP: life type in seconds
ISAKMP: life duration (basic) of 3600
ISAKMP (0): atts are acceptable. Next payload is 0
ISAKMP (0): SA is doing pre-shared key authentication using id type ID_IPV4_ADDR
return status is IKMP_NO_ERROR#
crypto_isakmp_process_block: src 10.65.10.15, dest 10.64.10.16
OAK_MM exchange
ISAKMP (0): processing KE payload. message ID = 0

ISAKMP (0): processing NONCE payload. message ID = 0

ISAKMP (0): processing vendor id payload

ISAKMP (0): speaking to another IOS box!

ISAKMP (0): ID payload
next-payload : 8
type : 1
protocol : 17
port : 500
length : 8
ISAKMP (0): Total payload length: 12
return status is IKMP_NO_ERROR
crypto_isakmp_process_block: src 10.65.10.15, dest 10.64.10.16
OAK_MM exchange
ISAKMP (0): processing ID payload. message ID = 0
ISAKMP (0): processing HASH payload. message ID = 0
ISAKMP (0): SA has been authenticated

ISAKMP (0): beginning Quick Mode exchange, M-ID of 1220019031:48b80357IPSEC(key.
IPSEC(spi_response): getting spi 0xa67177c5(2792454085) for SA
from 10.65.10.15 to 10.64.10.16 for prot 3

return status is IKMP_NO_ERROR
crypto_isakmp_process_block: src 10.65.10.15, dest 10.64.10.16
OAK_QM exchange
oakley_process_quick_mode:
OAK_QM_IDLE
ISAKMP (0): processing SA payload. message ID = 1220019031

ISAKMP : Checking IPSec proposal 1

ISAKMP: transform 1, ESP_DES
ISAKMP: attributes in transform:
ISAKMP: encaps is 1
ISAKMP: SA life type in seconds
ISAKMP: SA life duration (basic) of 28800
ISAKMP: SA life type in kilobytes
ISAKMP: SA life duration (VPI) of 0x0 0x46 0x50 0x0
ISAKMP: authenticator is HMAC-MD5
ISAKMP (0): atts are acceptable.IPSEC(validate_proposal_request): proposal part,
(key eng. msg.) dest= 10.65.10.15, src= 10.64.10.16,
dest_proxy= 192.168.3.0/255.255.255.0/0/0 (type=4),
src_proxy= 192.168.4.0/255.255.255.0/0/0 (type=4),
protocol= ESP, transform= esp-des esp-md5-hmac ,
lifedur= 0s and 0kb,
spi= 0x0(0), conn_id= 0, keysize= 0, flags= 0x4

ISAKMP (0): processing NONCE payload. message ID = 1220019031

ISAKMP (0): processing ID payload. message ID = 1220019031
```

```
ISAKMP (0): processing ID payload. message ID = 1220019031map_alloc_entry: allo2
map_alloc_entry: allocating entry 1
```

```
ISAKMP (0): Creating IPsec SAs
inbound SA from 10.65.10.15 to 10.64.10.16 (proxy 192.168.3)
has spi 2792454085 and conn_id 2 and flags 4
lifetime of 28800 seconds
lifetime of 4608000 kilobytes
outbound SA from 10.64.10.16 to 10.65.10.15 (proxy 192.168.)
has spi 285493108 and conn_id 1 and flags 4
lifetime of 28800 seconds
lifetime of 4608000 kilobytesIPSEC(key_engine): got a queue event...
IPSEC(initialize_sas): ,
(key eng. msg.) dest= 10.64.10.16, src= 10.65.10.15,
dest_proxy= 192.168.4.0/255.255.255.0/0/0 (type=4),
src_proxy= 192.168.3.0/255.255.255.0/0/0 (type=4),
protocol= ESP, transform= esp-des esp-md5-hmac ,
lifedur= 28800s and 4608000kb,
spi= 0xa67177c5(2792454085), conn_id= 2, keysizes= 0, flags= 0x4
IPSEC(initialize_sas): ,
(key eng. msg.) src= 10.64.10.16, dest= 10.65.10.15,
src_proxy= 192.168.4.0/255.255.255.0/0/0 (type=4),
dest_proxy= 192.168.3.0/255.255.255.0/0/0 (type=4),
protocol= ESP, transform= esp-des esp-md5-hmac ,
lifedur= 28800s and 4608000kb,
spi= 0x11044774(285493108), conn_id= 1, keysizes= 0, flags= 0x4
```

```
return status is IKMP_NO_ERROR
```

Routing e ping del passaggio GRE del router

- **show ip route**: visualizza le voci della tabella di routing IP.

```
rodney#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
* - candidate default, U - per-user static route, o - ODR
P - periodic downloaded static route
```

```
Gateway of last resort is 192.168.4.1 to network 0.0.0.0
```

```
10.0.0.0/24 is subnetted, 1 subnets
C 10.1.1.0 is directly connected, Tunnel0
10.0.0.0/24 is subnetted, 1 subnets
C 10.20.20.0 is directly connected, Loopback0
10.0.0.0/24 is subnetted, 1 subnets
C 10.22.22.0 is directly connected, Loopback1
C 192.168.4.0/24 is directly connected, Ethernet0/1
10.0.0.0/24 is subnetted, 1 subnets
S 10.10.10.0 is directly connected, Tunnel0
10.0.0.0/32 is subnetted, 1 subnets
O 10.11.11.11 [110/11112] via 10.1.1.1, 03:34:01, Tunnel0
S* 0.0.0.0/0 [1/0] via 192.168.4.1
rodney#
rodney#ping 10.11.11.11
```

```
Type escape sequence to abort.
```

```
Sending 5, 100-byte ICMP Echos to 10.11.11.11, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms
```

```
house#show ip route
```

```
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP  
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area  
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2  
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP  
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area  
* - candidate default, U - per-user static route, o - ODR  
P - periodic downloaded static route
```

```
Gateway of last resort is 192.168.3.1 to network 0.0.0.0
```

```
10.0.0.0/24 is subnetted, 1 subnets  
C 1.1.1.0 is directly connected, Tunnel0  
10.0.0.0/24 is subnetted, 1 subnets  
S 10.20.20.0 is directly connected, Tunnel0  
10.0.0.0/32 is subnetted, 1 subnets  
O 10.22.22.22 [110/11112] via 10.1.1.2, 03:33:39, Tunnel0  
10.0.0.0/24 is subnetted, 1 subnets  
C 10.10.10.0 is directly connected, Loopback0  
10.0.0.0/24 is subnetted, 1 subnets  
C 10.11.11.0 is directly connected, Loopback1  
C 192.168.3.0/24 is directly connected, FastEthernet0/1  
S* 0.0.0.0/0 [1/0] via 192.168.3.1
```

```
house#ping 10.22.22.22
```

```
Type escape sequence to abort.
```

```
Sending 5, 100-byte ICMP Echos to 10.22.22.22, timeout is 2 seconds:
```

```
!!!!
```

```
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/3/4 ms
```

[Informazioni correlate](#)

- [Negoziazione IPSec/protocolli IKE](#)
- [Riferimenti per i comandi di Cisco Secure PIX Firewall](#)
- [Supporto dei prodotti PIX](#)
- [Documentazione e supporto tecnico – Cisco Systems](#)