

Configurar el hub and spoke del router a router del IPSec con la comunicación entre el spokes

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[Introducción](#)

Esta configuración de ejemplo muestra un diseño IPsec de hub y spoke entre tres routers. Esta configuración difiere de otras configuraciones de hub y spoke porque en este ejemplo se ha activado la comunicación entre los sitios spoke pasando a través del hub. Es decir, no hay un túnel IPsec directo entre los dos routers spoke. Todos los paquetes se envían a través del túnel al router hub, donde se redistribuyen hacia el túnel IPsec compartido con el otro router spoke. Esta configuración es posible como resultado de la resolución al Id. de bug Cisco [CSCdp09904](#) ([clientes registrados solamente](#)). Este arreglo se integró en Cisco IOS® Software Release 12.2(5) y esta versión es el requisito mínimo para esta configuración.

Para configurar el túnel del Generic Routing Encapsulation (GRE) sobre el IPsec con el OSPF, refiera a [configurar un túnel GRE sobre el IPsec con el OSPF](#).

Para configurar la configuración de escudo de protección básica del [®] del Cisco IOS en un túnel GRE con el Network Address Translation (NAT), refiera a [configurar el IPSEC de router a router \(claves previamente compartidas\) en el túnel GRE con el escudo de protección IOS y el NAT](#).

[prerrequisitos](#)

[Requisitos](#)

Este documento requiere una comprensión básica del Protocolo IPSec. Refiera a una [Introducción al encriptación de seguridad IP \(IPSec\)](#) para aprender más sobre el IPSec.

El objetivo de este documento es asegurarse que el cifrado está hecho entre este Routers:

- 172.16.1.0/24 (spoke 1) a 10.1.1.0/24 (concentrador)
- 192.168.1.0/24 (spoke 2) a 10.1.1.0/24 (concentrador)
- 172.16.1.0/24 (spoke 1) a 192.168.1.0/24 (spoke 2)

Componentes Utilizados

La información que contiene este documento se basa en estas versiones de software y hardware.

- Cisco IOS Software Release 12.2(24a) (c2500-ik8s-l.122-24a.bin)
- Cisco 2500 Router

La información que contiene este documento se creó a partir de los dispositivos en un ambiente de laboratorio específico. Todos los dispositivos que se utilizan en este documento se pusieron en funcionamiento con una configuración verificada (predeterminada). Si la red está funcionando, asegúrese de haber comprendido el impacto que puede tener cualquier comando.

Convenciones

Consulte [Convenciones de Consejos TécnicosCisco](#) para obtener más información sobre las convenciones del documento.

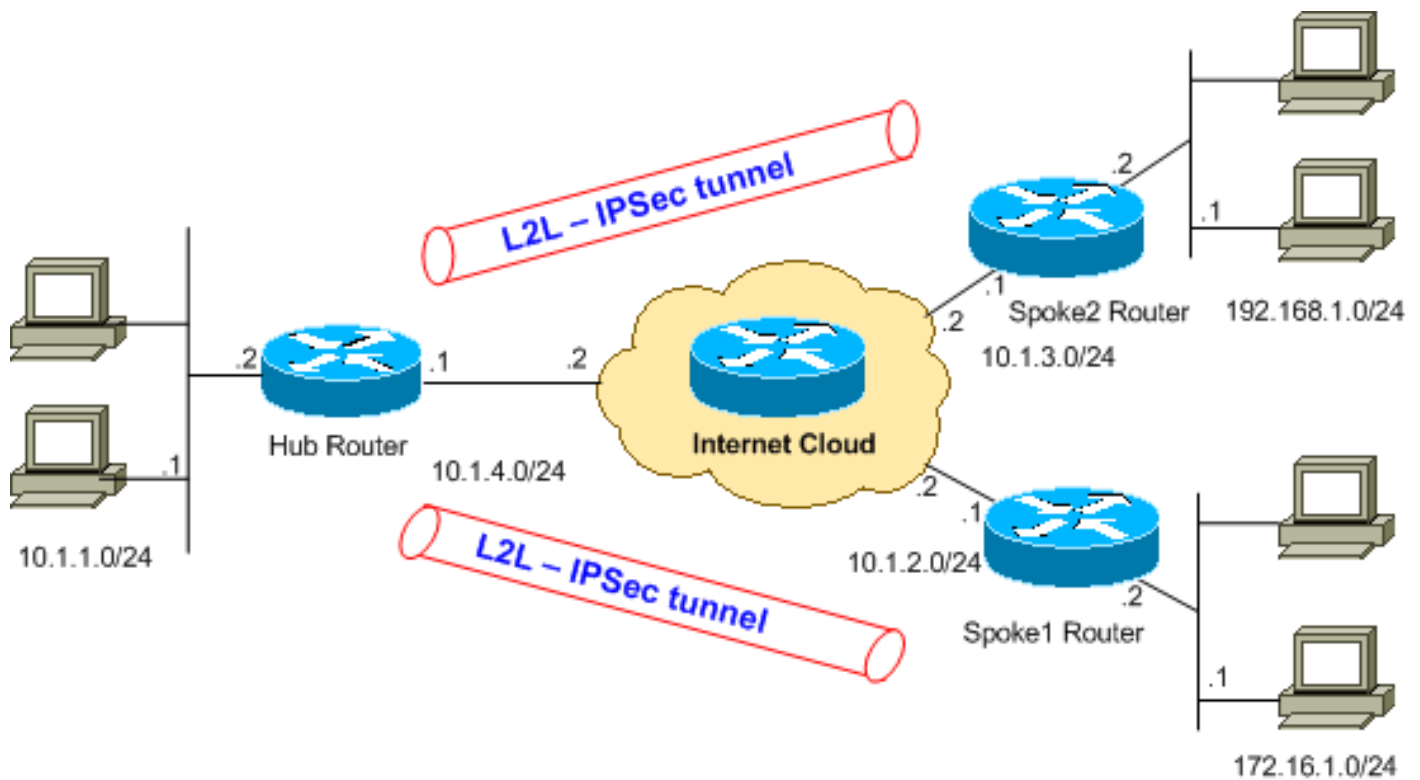
Configurar

En esta sección encontrará la información para configurar las funciones descritas en este documento.

Note: Use la herramienta [Command Lookup Tool](#) ([clientes registrados solamente](#)) para encontrar más información sobre los comandos usados en este documento.

Diagrama de la red

Este documento utiliza la configuración de red que se muestra en el siguiente diagrama.



Note: Los esquemas de direccionamiento IP usados en esta configuración no son legalmente enrutables en Internet. Son las direcciones [RFC1918](#) que se han utilizado en un entorno de laboratorio.

Configuraciones

Este documento usa estas configuraciones.

[El comando show running-config](#) visualiza la configuración corriente en el router.

- [Router del eje de conexión](#)
- [Router Spoke1](#)
- [Router Spoke2](#)

Router del eje de conexión

```

Hub#show running-config
Building configuration...
Current configuration : 1466 bytes
!
version 12.2

service timestamps debug datetime msec
service timestamps log uptime
no service password-encryption
!
hostname Hub
!

!
ip subnet-zero
!

```

```

!
!--- Configuration for IKE policies. crypto isakmp
policy 10
!--- Enables the IKE policy configuration (config-
isakmp) !--- command mode, where you can specify the
parameters that !--- are used during an IKE negotiation.
hash md5
authentication pre-share
crypto isakmp key cisco123 address 10.1.2.1
crypto isakmp key cisco123 address 10.1.3.1
!--- Specifies the preshared key "cisco123" which should
!--- be identical at both peers. This is a global !---
configuration mode command. ! !--- Configuration for
IPsec policies. crypto ipsec transform-set myset esp-des
esp-md5-hmac
!--- Enables the crypto transform configuration mode, !-
-- where you can specify the transform sets that are
used !--- during an IPsec negotiation. ! crypto map
mymap 10 ipsec-isakmp
!--- Indicates that IKE is used to establish !--- the
IPsec security association for protecting the !---
traffic specified by this crypto map entry. set peer
10.1.2.1
!--- Sets the IP address of the remote end. set
transform-set myset
!--- Configures IPsec to use the transform-set !---
"myset" defined earlier in this configuration. match
address 110
!--- Specifies the traffic to be encrypted. crypto map
mymap 20 ipsec-isakmp
set peer 10.1.3.1
set transform-set myset
match address 120
!
!
!
!
interface Ethernet0
ip address 10.1.1.1 255.255.255.0
!
interface Ethernet1
ip address 10.1.4.1 255.255.255.0
no ip route-cache
!--- You must enable process switching for IPsec !--- to
encrypt outgoing packets. This command disables fast
switching. no ip mroute-cache crypto map mymap
!--- Configures the interface to use the !--- crypto map
"mymap" for IPsec. ! !--- Output suppressed. ip
classless ip route 172.16.1.0 255.255.255.0 Ethernet1
ip route 192.168.1.0 255.255.255.0 Ethernet1
ip route 10.1.0.0 255.255.0.0 Ethernet1
ip http server
!
access-list 110 permit ip 10.1.1.0 0.0.0.255 172.16.1.0
0.0.0.255
access-list 110 permit ip 192.168.1.0 0.0.0.255
172.16.1.0 0.0.0.255
access-list 120 permit ip 10.1.1.0 0.0.0.255 192.168.1.0
0.0.0.255
access-list 120 permit ip 172.16.1.0 0.0.0.255
192.168.1.0 0.0.0.255
!--- This crypto ACL-permit identifies the !--- matching
traffic flows to be protected via encryption.

```

Router Spoke1

```
Spoke1#show running-config
Building configuration...
Current configuration : 1203 bytes
!
version 12.2

service timestamps debug datetime msec
service timestamps log uptime
no service password-encryption
!
hostname Spoke1
!
enable secret 5 $1$DOX3$rIrxEnTVTw/7LNbxi.akz0

!
ip subnet-zero
no ip domain-lookup
!
!
crypto isakmp policy 10
hash md5
authentication pre-share
crypto isakmp key cisco123 address 10.1.4.1
!
!
crypto ipsec transform-set myset esp-des esp-md5-hmac
!
crypto map mymap 10 ipsec-isakmp
set peer 10.1.4.1
set transform-set myset
match address 110
!
!
!
!
interface Ethernet0
ip address 172.16.1.1 255.255.255.0
!
interface Ethernet1
ip address 10.1.2.1 255.255.255.0
no ip route-cache
no ip mroute-cache
crypto map mymap
!
.
.
!--- Output suppressed. . . ip classless
ip route 192.168.1.0 255.255.255.0 Ethernet1
ip route 10.1.0.0 255.255.0.0 Ethernet1
no ip http server

!
access-list 110 permit ip 172.16.1.0 0.0.0.255 10.1.1.0
0.0.0.255
access-list 110 permit ip 172.16.1.0 0.0.0.255
192.168.1.0 0.0.0.255
!
end
```

2509a#

Router Spoke2

```
Spoke2#show running-config
Building configuration...
Current configuration : 1117 bytes
!
version 12.2

service timestamps debug datetime msec
service timestamps log uptime
service password-encryption
!
hostname Spoke2
!
!
ip subnet-zero
no ip domain-lookup
!
!
crypto isakmp policy 10
hash md5
authentication pre-share
crypto isakmp key cisco123 address 10.1.4.1
!
!
crypto ipsec transform-set myset esp-des esp-md5-hmac
!
crypto map mymap 10 ipsec-isakmp
set peer 10.1.4.1
set transform-set myset
match address 120
!
!
!
!
interface Ethernet0
ip address 192.168.1.1 255.255.255.0
!
interface Ethernet1
ip address 10.1.3.1 255.255.255.0
!--- No ip route-cache. no ip mroute-cache crypto map
mymap
!
.
.
!--- Output suppressed. . . ip classless
ip route 172.16.0.0 255.255.0.0 Ethernet1
ip route 10.1.0.0 255.255.0.0 Ethernet1
no ip http server
!
access-list 120 permit ip 192.168.1.0 0.0.0.255
172.16.1.0 0.0.0.255
access-list 120 permit ip 192.168.1.0 0.0.0.255 10.1.1.0
0.0.0.255
!
end
```

[Agregue otro spoke](#)

Si usted necesita agregar a otro router radial (spoke3) al router de eje de conexión existente además de spoke1 y de spoke2, toda se requiere que es la creación de un nuevo túnel del LAN a LAN (L2L) del concentrador a spoke3. Sin embargo, puesto que puede solamente una correspondencia de criptografía configurado por la interfaz física, usted debe utilizar el mismo nombre de correspondencia de criptografía al agregar este túnel. Esto es posible cuando usted utiliza diversos números de línea para cada sitio remoto.

Note: La correspondencia de criptografía pudo necesitar ser quitado y ser reaplicado a la interfaz cuando se agrega la nueva entrada del túnel. Cuando se quita la correspondencia de criptografía se borran todos los túneles activos.

Router del eje de conexión

```
Hub#show running-config
Building configuration...
Current configuration : 1466 bytes
!
version 12.2

service timestamps debug datetime msec
service timestamps log uptime
no service password-encryption
!
hostname Hub
!

!
ip subnet-zero
!

!
crypto isakmp policy 10

hash md5
authentication pre-share
crypto isakmp key cisco123 address 10.1.2.1
crypto isakmp key cisco123 address 10.1.3.1
crypto isakmp key cisco123 address 10.1.5.1
!

crypto ipsec transform-set myset esp-des esp-md5-hmac
!
crypto map mymap 10 ipsec-isakmp
set peer 10.1.2.1
set transform-set myset
match address 110

crypto map mymap 20 ipsec-isakmp
set peer 10.1.3.1
set transform-set myset
match address 120

!--- It is important to specify crypto map line number
30 for !--- the Spoke 3 router with the same crypto map
```

```
name "mymap" crypto map mymap 30 ipsec-isakmp
set peer 10.1.5.1
set transform-set myset
match address 130
!
!
!
!
interface Ethernet0
ip address 10.1.1.1 255.255.255.0
!
interface Ethernet1
ip address 10.1.4.1 255.255.255.0
no ip route-cache
no ip mroute-cache

!--- It is important to remove and re-apply the crypto
!--- map to this interface if it is used for the
termination of other !--- spoke VPN tunnels. crypto map
mymap
!

!--- Output suppressed. ip classless ip route 172.16.1.0
255.255.255.0 Ethernet1 ip route 192.168.1.0
255.255.255.0 Ethernet1 ip route 10.1.0.0 255.255.0.0
Ethernet1 ip route 172.16.2.0 255.255.255.0 Ethernet1 ip
http server ! access-list 110 permit ip 10.1.1.0
0.0.0.255 172.16.1.0 0.0.0.255 access-list 110 permit ip
192.168.1.0 0.0.0.255 172.16.1.0 0.0.0.255 access-list
110 permit ip 172.16.2.0 0.0.0.255 172.16.1.0 0.0.0.255
access-list 120 permit ip 10.1.1.0 0.0.0.255 192.168.1.0
0.0.0.255 access-list 120 permit ip 172.16.2.0 0.0.0.255
192.168.1.0 0.0.0.255 access-list 120 permit ip
172.16.1.0 0.0.0.255 192.168.1.0 0.0.0.255 access-list
130 permit ip 10.1.1.0 0.0.0.255 172.16.2.0 0.0.0.255
access-list 130 permit ip 192.168.1.0 0.0.0.255
172.16.2.0 0.0.0.255
access-list 130 permit ip 172.16.1.0 0.0.0.255
172.16.2.0 0.0.0.255
```

3 Router del spoke

```
Spoke3#show running-config
Building configuration...
Current configuration : 1117 bytes
!
version 12.2

service timestamps debug datetime msec
service timestamps log uptime
service password-encryption
!
hostname Spoke3
!
!
ip subnet-zero
no ip domain-lookup
!
!
crypto isakmp policy 10
hash md5
```



```

authentication pre-share
crypto isakmp key cisco123 address 10.1.4.1
!
!
crypto ipsec transform-set myset esp-des esp-md5-hmac
!
crypto map mymap 10 ipsec-isakmp
set peer 10.1.4.1
set transform-set myset
match address 130
!
!
!
!
interface Ethernet0
ip address 172.16.2.1 255.255.255.0
!
interface Ethernet1
ip address 10.1.5.1 255.255.255.0
no ip mroute-cache
crypto map mymap
!
.
.
!--- Output suppressed. . . ip classless
ip route 172.16.0.0 255.255.0.0 Ethernet1
ip route 10.1.0.0 255.255.0.0 Ethernet1
no ip http server
!
access-list 130 permit ip 172.168.2.0 0.0.0.255
172.16.1.0 0.0.0.255
access-list 130 permit ip 172.168.2.0 0.0.0.255 10.1.1.0
0.0.0.255
access-list 130 permit ip 172.168.2.0 0.0.0.255
192.168.1.0 0.0.0.255
!
end
VPN2509#

```

Verificación

Use esta sección para confirmar que su configuración funciona correctamente.

[La herramienta Output Interpreter Tool \(clientes registrados solamente\)](#) (OIT) soporta ciertos comandos show. Utilice la OIT para ver un análisis del resultado del comando show.

Para verificar esta configuración, intente un originado del direccionamiento de la interfaz ethernet1 en el Spoke1, destinado para el direccionamiento de la interfaz ethernet1 en el Spoke2.

- ping —Se utiliza para diagnosticar la conectividad básica de la red.

```

Spoke1#ping
Protocol [ip]:
Target IP address: 192.168.1.1
Repeat count [5]:
Datagram size [100]:
Timeout in seconds [2]:
Extended commands [n]: y

```

```
Source address or interface: 172.16.1.1
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 192.168.1.1, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 64/64/68 ms
```

- [muestre IPsec crypto sa](#) — Muestra las configuraciones usadas por las asociaciones de seguridad actuales (del IPsec) (SA).
- [show crypto isakmp sa](#) — Muestra todas las IKE SAs actuales en un par.
- **active del** [show crypto engine connections](#) — Muestra el número de paquetes transmitidos a través cada IPsec SA.

[Ejemplo de resultado del comando show](#)

Esta salida es del comando `show crypto engine connections active` publicado en el router de eje de conexión.

```
Hub#show crypto engine connections active
```

```
ID Interface IP-Address State Algorithm Encrypt Decrypt
5 Ethernet0 10.1.4.1 set HMAC_MD5+DES_56_CB 0 0
6 <none> <none> set HMAC_MD5+DES_56_CB 0 0
2000 Ethernet0 10.1.4.1 set HMAC_MD5+DES_56_CB 0 10
2001 Ethernet0 10.1.4.1 set HMAC_MD5+DES_56_CB 10 0
2002 Ethernet0 10.1.4.1 set HMAC_MD5+DES_56_CB 0 10
2003 Ethernet0 10.1.4.1 set HMAC_MD5+DES_56_CB 10 0
```

De este ejemplo, usted puede ver que cada túnel ha cifrado y ha descifrado 10 paquetes, que prueba que el tráfico vino a través del router de eje de conexión.

Note: Dos SA de IPsec se crea para cada par (uno en cada dirección). Por ejemplo, en el router de eje de conexión hay cuatro SA de IPsec creado para dos pares.

[Troubleshooting](#)

En esta sección encontrará información que puede utilizar para solucionar problemas de configuración.

[Comandos para resolución de problemas](#)

Note: Consulte [Información Importante sobre Comandos de Debug](#) antes de usar un **comando debug**.

- [IPsec del debug crypto](#) — Muestra los IPsec Negotiations de la fase 2.
- [debug crypto isakmp](#) — muestra las negociaciones ISAKMP para la fase 1.
- [debug crypto engine](#) — muestra el tráfico codificado.
- [borre el isakmp crypto](#) — Borra los SA relacionados con la fase 1.
- [borre el sa crypto](#) — Borra los SA relacionados con la fase 2.

Ejemplo de resultado del comando debug

Éste es el router de eje de conexión hecho salir de los comandos debug crypto ipsec y debug crypto isakmp.

```
*Mar 1 00:03:46.887: ISAKMP (0:0): received packet
  from 10.1.2.1 (N) NEW SA
*Mar 1 00:03:46.887: ISAKMP: local port 500, remote port 500
*Mar 1 00:03:46.899: ISAKMP (0:1): processing SA payload. message ID = 0
*Mar 1 00:03:46.899: ISAKMP (0:1): found peer pre-shared key matching 10.1.2.1
*Mar 1 00:03:46.903: ISAKMP (0:1): Checking ISAKMP transform 1 against priority
  10 policy
*Mar 1 00:03:46.903: ISAKMP:      encryption DES-CBC
*Mar 1 00:03:46.907: ISAKMP:      hash MD5
*Mar 1 00:03:46.907: ISAKMP:      default group 1
*Mar 1 00:03:46.911: ISAKMP:      auth pre-share
*Mar 1 00:03:46.911: ISAKMP:      life type in seconds
*Mar 1 00:03:46.911: ISAKMP:      life duration (VPI) of 0x0 0x1 0x51 0x80
*Mar 1 00:03:46.915: ISAKMP (0:1): atts are acceptable. Next payload is 0
!--- The initial IKE parameters have been !--- successfully exchanged between Spoke 1 and Hub.
*Mar 1 00:03:48.367: ISAKMP (0:1): SA is doing pre-shared key authentication using id type
ID_IPV4_ADDR *Mar 1 00:03:48.371: ISAKMP (0:1): sending packet to 10.1.2.1 (R) MM_SA_SETUP *Mar
1 00:03:56.895: ISAKMP (0:1): received packet from 10.1.2.1 (R) MM_SA_SETUP *Mar 1 00:03:56.899:
ISAKMP (0:1): phase 1 packet is a duplicate of a previous packet. *Mar 1 00:03:56.899: ISAKMP
(0:1): retransmitting due to retransmit phase 1 *Mar 1 00:03:56.903: ISAKMP (0:1):
retransmitting phase 1 MM_SA_SETUP... *Mar 1 00:03:57.403: ISAKMP (0:1): retransmitting phase 1
MM_SA_SETUP... *Mar 1 00:03:57.403: ISAKMP (0:1): incrementing error counter on sa: retransmit
phase 1 *Mar 1 00:03:57.407: ISAKMP (0:1): retransmitting phase 1 MM_SA_SETUP *Mar 1
00:03:57.407: ISAKMP (0:1): sending packet to 10.1.2.1 (R) MM_SA_SETUP *Mar 1 00:03:58.923:
ISAKMP (0:1): received packet from 10.1.2.1 (R) MM_SA_SETUP *Mar 1 00:03:58.931: ISAKMP (0:1):
processing KE payload. message ID = 0 *Mar 1 00:04:00.775: ISAKMP (0:1): processing NONCE
payload. message ID = 0 *Mar 1 00:04:00.783: ISAKMP (0:1): found peer pre-shared key matching
10.1.2.1 *Mar 1 00:04:00.795: ISAKMP (0:1): SKEYID state generated *Mar 1 00:04:00.799: ISAKMP
(0:1): processing vendor id payload *Mar 1 00:04:00.803: ISAKMP (0:1): speaking to another IOS
box! *Mar 1 00:04:00.811: ISAKMP (0:1): sending packet to 10.1.2.1 (R) MM_KEY_EXCH *Mar 1
00:04:02.751: ISAKMP (0:1): received packet from 10.1.2.1 (R) MM_KEY_EXCH *Mar 1 00:04:02.759:
ISAKMP (0:1): processing ID payload. message ID = 0 *Mar 1 00:04:02.759: ISAKMP (0:1):
processing HASH payload. message ID = 0 *Mar 1 00:04:02.767: ISAKMP (0:1): SA has been
authenticated with 10.1.2.1 *Mar 1 00:04:02.771: ISAKMP (1): ID payload next-payload : 8 type :
1 protocol : 17 port : 500 length : 8 *Mar 1 00:04:02.775: ISAKMP (1): Total payload length: 12
*Mar 1 00:04:02.783: ISAKMP (0:1): sending packet to 10.1.2.1 (R) QM_IDLE *Mar 1 00:04:02.871:
ISAKMP (0:1): received packet from 10.1.2.1 (R) QM_IDLE
!--- IKE phase 1 SA has been successfully negotiated !--- between Spoke 1 and Hub. *Mar 1
00:04:02.891: ISAKMP (0:1): processing HASH payload. message ID = 581713929 *Mar 1 00:04:02.891:
ISAKMP (0:1): processing SA payload. message ID = 581713929 *Mar 1 00:04:02.895: ISAKMP (0:1):
Checking IPsec proposal 1
!--- IKE exchanges IPsec phase 2 parameters !--- between Spoke 1 and Hub. *Mar 1 00:04:02.895:
ISAKMP: transform 1, ESP_DES *Mar 1 00:04:02.899: ISAKMP: attributes in transform: *Mar 1
00:04:02.899: ISAKMP: encaps is 1 *Mar 1 00:04:02.899: ISAKMP: SA life type in seconds *Mar 1
00:04:02.903: ISAKMP: SA life duration (basic) of 3600 *Mar 1 00:04:02.903: ISAKMP: SA life type
in kilobytes *Mar 1 00:04:02.907: ISAKMP: SA life duration (VPI) of 0x0 0x46 0x50 0x0 *Mar 1
00:04:02.911: ISAKMP: authenticator is HMAC-MD5 *Mar 1 00:04:02.915: ISAKMP (0:1): atts are
acceptable.
!--- IPsec phase 2 parameters have been !--- successfully exchanged between Spoke 1 and Hub.
*Mar 1 00:04:02.915: IPSEC(validate_proposal_request): proposal part #1, (key eng. msg.) INBOUND
local= 10.1.4.1, remote= 10.1.2.1, local_proxy= 192.168.1.0/255.255.255.0/0/0 (type=4),
remote_proxy= 172.16.1.0/255.255.255.0/0/0 (type=4), protocol= ESP, transform= esp-des esp-md5-
hmac , lifedur= 0s and 0kb, spi= 0x0(0), conn_id= 0, keysize= 0, flags= 0x4 *Mar 1 00:04:02.931:
ISAKMP (0:1): processing NONCE payload. message ID = 581713929 *Mar 1 00:04:02.935: ISAKMP
(0:1): processing ID payload. message ID = 581713929 *Mar 1 00:04:02.935: ISAKMP (0:1):
processing ID payload. message ID = 581713929 *Mar 1 00:04:02.939: ISAKMP (0:1): asking for 1
```

spis from ipsec *Mar 1 00:04:02.943: IPSEC(key_engine): got a queue event... *Mar 1
00:04:02.951: IPSEC(spi_response): getting spi 4208568169 for SA from 10.1.4.1 to 10.1.2.1 for
prot 3 *Mar 1 00:04:02.955: ISAKMP: received ke message (2/1) *Mar 1 00:04:03.207: ISAKMP (0:1):
sending packet to 10.1.2.1 (R) QM_IDLE *Mar 1 00:04:03.351: ISAKMP (0:1): received packet from
10.1.2.1 (R) QM_IDLE *Mar 1 00:04:03.387: ISAKMP (0:1): Creating IPsec SAs *Mar 1 00:04:03.387:
inbound SA from 10.1.2.1 to 10.1.4.1 (proxy 172.16.1.0 to 192.168.1.0) *Mar 1 00:04:03.391: has
spi 0xFAD9A769 and conn_id 2000 and flags 4 *Mar 1 00:04:03.395: lifetime of 3600 seconds *Mar 1
00:04:03.395: lifetime of 4608000 kilobytes *Mar 1 00:04:03.399: outbound SA from 10.1.4.1 to
10.1.2.1 (proxy 192.168.1.0 to 172.16.1.0) *Mar 1 00:04:03.403: has spi -732960388 and conn_id
2001 and flags C *Mar 1 00:04:03.407: lifetime of 3600 seconds *Mar 1 00:04:03.407: lifetime of
4608000 kilobytes *Mar 1 00:04:03.411: ISAKMP (0:1): deleting node 581713929 error FALSE reason
" quick mode done (await())" *Mar 1 00:04:03.415: IPSEC(key_engine): got a queue event... *Mar 1
00:04:03.415: IPSEC(initialize_sas): , (key eng. msg.) INBOUND local= 10.1.4.1, remote=
10.1.2.1, local_proxy= 192.168.1.0/255.255.255.0/0/0 (type=4), remote_proxy=
172.16.1.0/255.255.255.0/0/0 (type=4), protocol= ESP, transform= esp-des esp-md5-hmac , lifedur=
3600s and 4608000kb, spi= 0xFAD9A769(4208568169), conn_id= 2000, keysizes= 0, flags= 0x4 *Mar 1
00:04:03.427: IPSEC(initialize_sas): , (key eng. msg.) OUTBOUND local= 10.1.4.1, remote=
10.1.2.1, local_proxy= 192.168.1.0/255.255.255.0/0/0 (type=4), remote_proxy=
172.16.1.0/255.255.255.0/0/0 (type=4), protocol= ESP, transform= esp-des esp-md5-hmac , lifedur=
3600s and 4608000kb, spi= 0xD44FE97C(3562006908), conn_id= 2001, keysizes= 0, flags= 0xC *Mar 1
00:04:03.443: **IPSEC(create_sa): sa created,**
 (sa) **sa_dest= 10.1.4.1, sa_prot= 50,**
 sa_spi= 0xFAD9A769(4208568169),
 sa_trans= esp-des esp-md5-hmac , sa_conn_id= 2000
*Mar 1 00:04:03.447: **IPSEC(create_sa): sa created,**
 (sa) **sa_dest= 10.1.2.1, sa_prot= 50,**
 sa_spi= 0xD44FE97C(3562006908),
 sa_trans= esp-des esp-md5-hmac , sa_conn_id= 2001
*!--- IPsec tunnel has been created between !--- routers Spoke 1 and Hub. *Mar 1 00:05:02.387:*
IPSEC(sa_request): , *!--- Since an IPsec tunnel is created between Spoke 1 !--- and Spoke 2*
through the Hub, the Hub router !--- initializes a new IPsec tunnel between itself and Spoke 2.
(key eng. msg.) OUTBOUND local= 10.1.4.1, remote= 10.1.3.1, local_proxy=
172.16.1.0/255.255.255.0/0/0 (type=4), remote_proxy= 192.168.1.0/255.255.255.0/0/0 (type=4),
protocol= ESP, transform= esp-des esp-md5-hmac , lifedur= 3600s and 4608000kb, spi=
0x1B7A414E(460996942), conn_id= 0, keysizes= 0, flags= 0x400C *Mar 1 00:05:02.399: ISAKMP:
received ke message (1/1) *Mar 1 00:05:02.403: ISAKMP: local port 500, remote port 500 *Mar 1
00:05:02.411: ISAKMP (0:2): beginning Main Mode exchange *Mar 1 00:05:02.415: ISAKMP (0:2):
sending packet to 10.1.3.1 (I) MM_NO_STATE *Mar 1 00:05:12.419: ISAKMP (0:2): retransmitting
phase 1 MM_NO_STATE... *Mar 1 00:05:12.419: ISAKMP (0:2): incrementing error counter on sa:
retransmit phase 1 *Mar 1 00:05:12.423: ISAKMP (0:2): retransmitting phase 1 MM_NO_STATE *Mar 1
00:05:12.423: ISAKMP (0:2): sending packet to 10.1.3.1 (I) MM_NO_STATE *Mar 1 00:05:22.427:
ISAKMP (0:2): retransmitting phase 1 MM_NO_STATE... *Mar 1 00:05:22.427: ISAKMP (0:2):
incrementing error counter on sa: retransmit phase 1 *Mar 1 00:05:22.431: ISAKMP (0:2):
retransmitting phase 1 MM_NO_STATE *Mar 1 00:05:22.431: ISAKMP (0:2): sending packet to 10.1.3.1
(I) MM_NO_STATE *Mar 1 00:05:22.967: ISAKMP (0:2): received packet from 10.1.3.1 (I) MM_NO_STATE
*Mar 1 00:05:22.975: ISAKMP (0:2): processing SA payload. message ID = 0 *Mar 1 00:05:22.975:
ISAKMP (0:2): found peer pre-shared key matching 10.1.3.1 *Mar 1 00:05:22.979: ISAKMP (0:2):
Checking ISAKMP transform 1 against priority 10 policy *Mar 1 00:05:22.979: ISAKMP: encryption
DES-CBC *Mar 1 00:05:22.983: ISAKMP: hash MD5 *Mar 1 00:05:22.983: ISAKMP: default group 1 *Mar
1 00:05:22.987: ISAKMP: auth pre-share *Mar 1 00:05:22.987: ISAKMP: life type in seconds *Mar 1
00:05:22.987: ISAKMP: life duration (VPI) of 0x0 0x1 0x51 0x80 *Mar 1 00:05:22.991: ISAKMP
(0:2): **atts are acceptable.**
Next payload is 0
*!--- IKE phase 1 parameters have been successfully !--- exchanged between Hub and Spoke 2. *Mar*
1 00:05:24.447: ISAKMP (0:2): SA is doing pre-shared key authentication using id type
ID_IPV4_ADDR *Mar 1 00:05:24.455: ISAKMP (0:2): sending packet to 10.1.3.1 (I) MM_SA_SETUP *Mar
1 00:05:26.463: ISAKMP (0:2): received packet from 10.1.3.1 (I) MM_SA_SETUP *Mar 1 00:05:26.471:
ISAKMP (0:2): processing KE payload. message ID = 0 *Mar 1 00:05:28.303: ISAKMP (0:2):
processing NONCE payload. message ID = 0 *Mar 1 00:05:28.307: ISAKMP (0:2): found peer pre-
shared key matching 10.1.3.1 *Mar 1 00:05:28.319: ISAKMP (0:2): SKEYID state generated *Mar 1
00:05:28.323: ISAKMP (0:2): processing vendor id payload *Mar 1 00:05:28.327: ISAKMP (0:2):
speaking to another IOS box! *Mar 1 00:05:28.331: ISAKMP (2): ID payload next-payload : 8 type :
1 protocol : 17 port : 500 length : 8 *Mar 1 00:05:28.335: ISAKMP (2): Total payload length: 12
*Mar 1 00:05:28.343: ISAKMP (0:2): sending packet to 10.1.3.1 (I) MM_KEY_EXCH *Mar 1

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00:05:28.399: ISAKMP (0:2): received packet from 10.1.3.1 (I) MM_KEY_EXCH *Mar 1 00:05:28.407:
ISAKMP (0:2): processing ID payload. message ID = 0 *Mar 1 00:05:28.411: ISAKMP (0:2):
processing HASH payload. message ID = 0 *Mar 1 00:05:28.419: ISAKMP (0:2): SA has been
authenticated with 10.1.3.1 *Mar 1 00:05:28.419: ISAKMP (0:2): beginning Quick Mode exchange, M-
ID of -1872859789 *Mar 1 00:05:28.439: ISAKMP (0:2): sending packet to 10.1.3.1 (I) QM_IDLE *Mar
1 00:05:28.799: ISAKMP (0:2): received packet from 10.1.3.1 (I) QM_IDLE
!--- The IKE phase 1 SA has been successfully !--- negotiated between Hub and Spoke 2. *Mar 1
00:05:28.815: ISAKMP (0:2): processing HASH payload. message ID = -1872859789 *Mar 1
00:05:28.815: ISAKMP (0:2): processing SA payload. message ID = -1872859789 *Mar 1 00:05:28.819:
ISAKMP (0:2): Checking IPsec proposal 1
!--- IKE exchanges IPsec phase 2 parameters !--- between Hub and Spoke 2. *Mar 1 00:05:28.819:
ISAKMP: transform 1, ESP_DES *Mar 1 00:05:28.823: ISAKMP: attributes in transform: *Mar 1
00:05:28.823: ISAKMP: encaps is 1 *Mar 1 00:05:28.827: ISAKMP: SA life type in seconds *Mar 1
00:05:28.827: ISAKMP: SA life duration (basic) of 3600 *Mar 1 00:05:28.827: ISAKMP: SA life type
in kilobytes *Mar 1 00:05:28.831: ISAKMP: SA life duration (VPI) of 0x0 0x46 0x50 0x0 *Mar 1
00:05:28.835: ISAKMP: authenticator is HMAC-MD5 *Mar 1 00:05:28.839: ISAKMP (0:2): atts are
acceptable.
!--- IPsec phase 2 parameters have been successfully !--- exchanged between Hub and Spoke 2.
*Mar 1 00:05:28.843: IPSEC(validate_proposal_request): proposal part #1, (key eng. msg.) INBOUND
local= 10.1.4.1, remote= 10.1.3.1, local_proxy= 172.16.1.0/255.255.255.0/0/0 (type=4),
remote_proxy= 192.168.1.0/255.255.255.0/0/0 (type=4), protocol= ESP, transform= esp-des esp-md5-
hmac , lifedur= 0s and 0kb, spi= 0x0(0), conn_id= 0, keysize= 0, flags= 0x4 *Mar 1 00:05:28.855:
ISAKMP (0:2): processing NONCE payload. message ID = -1872859789 *Mar 1 00:05:28.859: ISAKMP
(0:2): processing ID payload. message ID = -1872859789 *Mar 1 00:05:28.863: ISAKMP (0:2):
processing ID payload. message ID = -1872859789 *Mar 1 00:05:28.891: ISAKMP (0:2): Creating
IPsec SAs *Mar 1 00:05:28.891: inbound SA from 10.1.3.1 to 10.1.4.1 (proxy 192.168.1.0 to
172.16.1.0) *Mar 1 00:05:28.895: has spi 0x1B7A414E and conn_id 2002 and flags 4 *Mar 1
00:05:28.899: lifetime of 3600 seconds *Mar 1 00:05:28.899: lifetime of 4608000 kilobytes *Mar 1
00:05:28.903: outbound SA from 10.1.4.1 to 10.1.3.1 (proxy 172.16.1.0 to 192.168.1.0 ) *Mar 1
00:05:28.907: has spi -385025107 and conn_id 2003 and flags C *Mar 1 00:05:28.911: lifetime of
3600 seconds *Mar 1 00:05:28.911: lifetime of 4608000 kilobytes *Mar 1 00:05:28.915: ISAKMP
(0:2): sending packet to 10.1.3.1 (I) QM_IDLE *Mar 1 00:05:28.919: ISAKMP (0:2): deleting node -
1872859789 error FALSE reason "" *Mar 1 00:05:28.923: IPSEC(key_engine): got a queue event...
*Mar 1 00:05:28.927: IPSEC(initialize_sas): , (key eng. msg.) INBOUND local= 10.1.4.1, remote=
10.1.3.1, local_proxy= 172.16.1.0/255.255.255.0/0/0 (type=4), remote_proxy=
192.168.1.0/255.255.255.0/0/0 (type=4), protocol= ESP, transform= esp-des esp-md5-hmac ,
lifedur= 3600s and 4608000kb, spi= 0x1B7A414E(460996942), conn_id= 2002, keysize= 0, flags= 0x4
*Mar 1 00:05:28.939: IPSEC(initialize_sas): , (key eng. msg.) OUTBOUND local= 10.1.4.1, remote=
10.1.3.1, local_proxy= 172.16.1.0/255.255.255.0/0/0 (type=4), remote_proxy=
192.168.1.0/255.255.255.0/0/0 (type=4), protocol= ESP, transform= esp-des esp-md5-hmac ,
lifedur= 3600s and 4608000kb, spi= 0xE90CFBAD(3909942189), conn_id= 2003, keysize= 0, flags= 0xC
*Mar 1 00:05:28.951: IPSEC(create_sa): sa created,
(sa) sa_dest= 10.1.4.1, sa_prot= 50,
sa_spi= 0x1B7A414E(460996942),
sa_trans= esp-des esp-md5-hmac , sa_conn_id= 2002
*Mar 1 00:05:28.959: IPSEC(create_sa): sa created,
(sa) sa_dest= 10.1.3.1, sa_prot= 50,
sa_spi= 0xE90CFBAD(3909942189),
sa_trans= esp-des esp-md5-hmac , sa_conn_id= 2003
!--- IPsec tunnel has been created between routers !--- Hub and Spoke 2. This establishes a
tunnel between Spoke 1 !--- and Spoke 2 through Hub.

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Ésta es salida del router del Spoke1 de los comandos debug crypto isakmp y debug crypto ipsec.

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*Mar 1 00:03:28.771: IPSEC(sa_request): ,
(key eng. msg.) OUTBOUND local= 10.1.2.1, remote= 10.1.4.1,
local_proxy= 172.16.1.0/255.255.255.0/0/0 (type=4),
remote_proxy= 192.168.1.0/255.255.255.0/0/0 (type=4),
protocol= ESP, transform= esp-des esp-md5-hmac ,
lifedur= 3600s and 4608000kb,
spi= 0xD44FE97C(3562006908), conn_id= 0, keysize= 0, flags= 0x400C
!--- Request sent after the ping. *Mar 1 00:03:28.787: ISAKMP: received ke message (1/1) *Mar 1
00:03:28.791: ISAKMP: local port 500, remote port 500 *Mar 1 00:03:28.799: ISAKMP (0:1):

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beginning Main Mode exchange

!--- Initial IKE phase 1 parameters are exchanged !--- between Spoke 1 and Hub. *Mar 1
00:03:28.803: ISAKMP (0:1): sending packet to 10.1.4.1 (I) MM_NO_STATE. *Mar 1 00:03:38.807:
ISAKMP (0:1): retransmitting phase 1 MM_NO_STATE... *Mar 1 00:03:38.807: ISAKMP (0:1):
incrementing error counter on sa: retransmit phase 1 *Mar 1 00:03:38.811: ISAKMP (0:1):
retransmitting phase 1 MM_NO_STATE *Mar 1 00:03:38.811: ISAKMP (0:1): sending packet to 10.1.4.1
(I) MM_NO_STATE *Mar 1 00:03:48.815: ISAKMP (0:1): retransmitting phase 1 MM_NO_STATE... *Mar 1
00:03:48.815: ISAKMP (0:1): incrementing error counter on sa: retransmit phase 1 *Mar 1
00:03:48.819: ISAKMP (0:1): retransmitting phase 1 MM_NO_STATE *Mar 1 00:03:48.819: ISAKMP
(0:1): sending packet to 10.1.4.1 (I) MM_NO_STATE *Mar 1 00:03:49.355: ISAKMP (0:1): received
packet from 10.1.4.1 (I) MM_NO_STATE *Mar 1 00:03:49.363: ISAKMP (0:1): processing SA payload.
message ID = 0 *Mar 1 00:03:49.363: ISAKMP (0:1): found peer pre-shared key matching 10.1.4.1
*Mar 1 00:03:49.367: ISAKMP (0:1): Checking ISAKMP transform 1 against priority 10 policy *Mar 1
00:03:49.367: ISAKMP: encryption DES-CBC *Mar 1 00:03:49.371: ISAKMP: hash MD5 *Mar 1
00:03:49.371: ISAKMP: default group 1 *Mar 1 00:03:49.375: ISAKMP: auth pre-share *Mar 1
00:03:49.375: ISAKMP: life type in seconds *Mar 1 00:03:49.375: ISAKMP: life duration (VPI) of
0x0 0x1 0x51 0x80 *Mar 1 00:03:49.379: ISAKMP (0:1): **atts are acceptable.**

Next payload is 0

!--- IKE phase 1 parameters have been sucessfully !--- negotiated between Spoke 1 and Hub. *Mar 1
00:03:50.835: ISAKMP (0:1): SA is doing pre-shared key authentication using id type
ID_IPV4_ADDR *Mar 1 00:03:50.851: ISAKMP (0:1): sending packet to 10.1.4.1 (I) MM_SA_SETUP *Mar 1
00:03:52.759: ISAKMP (0:1): received packet from 10.1.4.1 (I) MM_SA_SETUP *Mar 1 00:03:52.763:
ISAKMP (0:1): processing KE payload. message ID = 0 *Mar 1 00:03:54.635: ISAKMP (0:1):
processing NONCE payload. message ID = 0 *Mar 1 00:03:54.639: ISAKMP (0:1): found peer pre-
shared key matching 10.1.4.1 *Mar 1 00:03:54.651: ISAKMP (0:1): SKEYID state generated *Mar 1
00:03:54.655: ISAKMP (0:1): processing vendor id payload *Mar 1 00:03:54.663: ISAKMP (0:1):
speaking to another IOS box! *Mar 1 00:03:54.663: ISAKMP (1): ID payload next-payload : 8 type :
1 protocol : 17 port : 500 length : 8 *Mar 1 00:03:54.667: ISAKMP (1): Total payload length: 12
*Mar 1 00:03:54.675: ISAKMP (0:1): sending packet to 10.1.4.1 (I) MM_KEY_EXCH *Mar 1
00:03:54.759: ISAKMP (0:1): received packet from 10.1.4.1 (I) MM_KEY_EXCH *Mar 1 00:03:54.767:
ISAKMP (0:1): processing ID payload. message ID = 0 *Mar 1 00:03:54.767: ISAKMP (0:1):
processing HASH payload. message ID = 0 *Mar 1 00:03:54.775: ISAKMP (0:1): SA has been
authenticated with 10.1.4.1 *Mar 1 00:03:54.779: ISAKMP (0:1): beginning Quick Mode exchange, M-
ID of 581713929 *Mar 1 00:03:54.799: ISAKMP (0:1): sending packet to 10.1.4.1 (I) QM_IDLE *Mar 1
00:03:55.155: ISAKMP (0:1): received packet from 10.1.4.1 (I) QM_IDLE *Mar 1 00:03:55.171:
ISAKMP (0:1): processing HASH payload. message ID = 581713929 *Mar 1 00:03:55.175: ISAKMP (0:1):
processing SA payload. message ID = 581713929 *Mar 1 00:03:55.179: ISAKMP (0:1): **Checking IPsec
proposal 1**

!--- IKE exchanges the IPsec phase 2 parameters between !--- Spoke 1 and Hub. *Mar 1
00:03:55.179: ISAKMP: transform 1, ESP_DES *Mar 1 00:03:55.183: ISAKMP: attributes in transform:
*Mar 1 00:03:55.183: ISAKMP: encaps is 1 *Mar 1 00:03:55.183: ISAKMP: SA life type in seconds
*Mar 1 00:03:55.187: ISAKMP: SA life duration (basic) of 3600 *Mar 1 00:03:55.187: ISAKMP: SA
life type in kilobytes *Mar 1 00:03:55.191: ISAKMP: SA life duration (VPI) of 0x0 0x46 0x50 0x0
*Mar 1 00:03:55.195: ISAKMP: authenticator is HMAC-MD5 *Mar 1 00:03:55.199: ISAKMP (0:1): **atts
are acceptable.**

!--- IKE has successfully negotiated phase 2 IPsec !--- SA between Hub and Spoke 2. *Mar 1
00:03:55.203: IPSEC(validate_proposal_request): proposal part #1, (key eng. msg.) INBOUND local=
10.1.2.1, remote= 10.1.4.1, local_proxy= 172.16.1.0/255.255.255.0/0/0 (type=4), remote_proxy=
192.168.1.0/255.255.255.0/0/0 (type=4), protocol= ESP, transform= esp-des esp-md5-hmac ,
lifedur= 0s and 0kb, spi= 0x0(0), conn_id= 0, keysize= 0, flags= 0x4 *Mar 1 00:03:55.219: ISAKMP
(0:1): processing NONCE payload. message ID = 581713929 *Mar 1 00:03:55.219: ISAKMP (0:1):
processing ID payload. message ID = 581713929 *Mar 1 00:03:55.223: ISAKMP (0:1): processing ID
payload. message ID = 581713929 *Mar 1 00:03:55.251: ISAKMP (0:1): Creating IPsec SAs *Mar 1
00:03:55.255: inbound SA from 10.1.4.1 to 10.1.2.1 (proxy 192.168.1.0 to 172.16.1.0) *Mar 1
00:03:55.259: has spi 0xD44FE97C and conn_id 2000 and flags 4 *Mar 1 00:03:55.263: lifetime of
3600 seconds *Mar 1 00:03:55.263: lifetime of 4608000 kilobytes *Mar 1 00:03:55.267: outbound SA
from 10.1.2.1 to 10.1.4.1 (proxy 172.16.1.0 to 192.168.1.0) *Mar 1 00:03:55.271: has spi -
86399127 and conn_id 2001 and flags C *Mar 1 00:03:55.271: lifetime of 3600 seconds *Mar 1
00:03:55.275: lifetime of 4608000 kilobytes *Mar 1 00:03:55.279: ISAKMP (0:1): sending packet to
10.1.4.1 (I) QM_IDLE *Mar 1 00:03:55.283: ISAKMP (0:1): deleting node 581713929 error FALSE
reason " " *Mar 1 00:03:55.287: IPSEC(key_engine): got a queue event... *Mar 1 00:03:55.291:
IPSEC(initialize_sas): , (key eng. msg.) INBOUND local= 10.1.2.1, remote= 10.1.4.1, local_proxy=
172.16.1.0/255.255.255.0/0/0 (type=4), remote_proxy= 192.168.1.0/255.255.255.0/0/0 (type=4),
protocol= ESP, transform= esp-des esp-md5-hmac , lifedur= 3600s and 4608000kb, spi=

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0xD44FE97C(3562006908), conn_id= 2000, keysize= 0, flags= 0x4 *Mar 1 00:03:55.303:
IPSEC(initialize_sas): , (key eng. msg.) OUTBOUND local= 10.1.2.1, remote= 10.1.4.1,
local_proxy= 172.16.1.0/255.255.255.0/0/0 (type=4), remote_proxy= 192.168.1.0/255.255.255.0/0/0
(type=4), protocol= ESP, transform= esp-des esp-md5-hmac , lifedur= 3600s and 4608000kb, spi=
0xFAD9A769(4208568169), conn_id= 2001, keysize= 0, flags= 0xC *Mar 1 00:03:55.319:
IPSEC(create_sa): sa created,
  (sa) sa_dest= 10.1.2.1, sa_prot= 50,
    sa_spi= 0xD44FE97C(3562006908),
    sa_trans= esp-des esp-md5-hmac , sa_conn_id= 2000
*Mar 1 00:03:55.323: IPSEC(create_sa): sa created,
  (sa) sa_dest= 10.1.4.1, sa_prot= 50,
    sa_spi= 0xFAD9A769(4208568169),
    sa_trans= esp-des esp-md5-hmac , sa_conn_id= 2001
!--- The IPsec tunnel between Spoke 1 and Hub is set up.
```

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- [Resolución de problemas de seguridad de IP – Información y uso de los comandos de depuración](#)
- [Ejemplos de la configuración IPsec](#)
- [IPsec Negotiation/IKE Protocol](#)
- [Soporte Técnico y Documentación - Cisco Systems](#)