

# Configuring GRE and IPSec with IPX Routing

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## Introduction

This document illustrates an IP Security (IPSec) configuration using a generic routing encapsulation (GRE) tunnel between two routers. IPSec can be used to encrypt GRE tunnels to provide network layer security for non-IP traffic, such as Novell Internetwork Packet Exchange (IPX), AppleTalk, and so forth. The GRE tunnel in this example is purely used for transporting non-IP traffic. Hence, the tunnel does not have any IP address configured. Here are some configuration considerations:

- With IOS 12.2(13)T software and later (higher numbered T-train software, 12.3 and later), the configured IPSec crypto map only needs to be applied to the physical interface and is no longer required to be applied on the GRE tunnel interface. In software versions prior to this release, IPSec crypto maps need to be applied to both the tunnel interface and the physical interface. Having the crypto map on the physical and tunnel interface when using the 12.2.(13)T software and later should still work; however, Cisco highly recommends that you apply it just on the physical interface.
- Make sure that the GRE tunnel works before applying the crypto maps.
- The crypto access control list (ACL) should have GRE as the permitted protocol. For example, **access-list 101 permit gre host #.#.#.# host #.#.#.#** (where the first host number is the IP address of the tunnel source of the GRE tunnel and the second host number is the IP address of the tunnel destination).
- Use the physical interface (or the loopback interface) IP addresses to identify Internet Key Exchange (IKE) peers.
- In certain earlier versions of Cisco IOS release, fast switching on the tunnel interface has to be disabled for it to work, due to a bug. Turn off fast switching on the tunnel interface. You can view the bug details for this issue at CSCdm10376 (registered customers only) .

## Before You Begin

### Prerequisites

Before attempting this configuration, please ensure that you meet the following prerequisites:

- knowledge of IPX configuration and routing
- knowledge and configuration of GRE tunnels
- working knowledge and configuration of IPSec

## Components Used

The information in this document is based on the software and hardware versions below.

- Cisco IOS® Software Release 12.2(7)
- Cisco 3600 Series Routers

The information presented in this document was created from devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If you are working in a live network, ensure that you understand the potential impact of any command before using it.

## Conventions

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

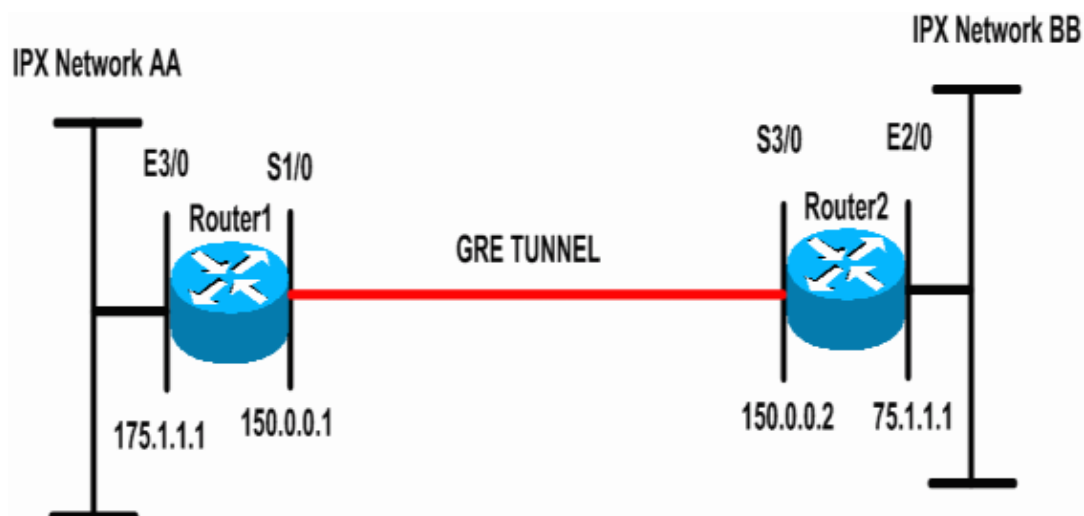
## Configure

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

**Note:** To find additional information on the commands used in this document, use the Command Lookup Tool (registered customers only) .

## Network Diagram

This document uses the network setup shown in the diagram below.



## Configurations

This document uses the configurations shown below.

Router 1
Current configuration: 1300 bytes

```
!  
version 12.2  
service timestamps debug datetime msec  
service timestamps log datetime msec  
no service password-encryption  
!  
hostname Router1  
!  
ip subnet-zero  
!  
  
!--- Enables IPX routing.  
  
ipx routing 00e0.b064.258e  
!  
  
!--- Defines the IKE policy identifying the parameters for building IKE SAs.  
  
crypto isakmp policy 10  
  authentication pre-share  
  group 2  
  lifetime 3600  
  
!--- Defines the pre-shared key for the remote peer.  
  
crypto isakmp key cisco address 200.1.1.1  
!  
  
!--- Defines the transform set to be used for IPSec SAs.  
  
crypto ipsec transform-set tunnelset esp-des esp-md5-hmac  
!  
  
!--- Configures the router to use the address of Loopback0 interface  
!--- for IKE and IPSec traffic.  
  
crypto map toBB local-address Loopback0  
  
!--- Defines a crypto map to be used for establishing IPSec SAs.  
  
crypto map toBB 10 ipsec-isakmp  
  set peer 200.1.1.1  
  set transform-set tunnelset  
  match address 101  
!  
interface Loopback0  
  ip address 100.1.1.1 255.255.255.0  
!  
  
!--- Configures a GRE tunnel for transporting IPX traffic.  
  
interface Tunnel0  
  no ip address  
  
ipx network CC  
  tunnel source Serial1/0  
  tunnel destination 150.0.0.2  
  
!  
interface Serial1/0  
  ip address 150.0.0.1 255.255.255.0
```

```

!--- Applies the crypto map to the physical interface used
!--- for carrying GRE tunnel traffic.

crypto map toBB
!
interface Ethernet3/0
 ip address 175.1.1.1 255.255.255.0
ipx network AA

!--- Output suppressed.

ip classless
ip route 0.0.0.0 0.0.0.0 150.0.0.2
no ip http server
!

!--- Configures GRE tunnel traffic to be encrypted using IPSec.

access-list 101 permit gre host 150.0.0.1 host 150.0.0.2
!
line con 0
 transport input none
line aux 0
line vty 0 4
 login
!
end

```

## Router 2

```

Current configuration:1525 bytes
!
version 12.2
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname Router2
!
ip subnet-zero
!

!--- Enables IPX routing.

ipx routing 0010.7b37.c8ae
!

!--- Defines the IKE policy identifying the parameters for building IKE SAs.

crypto isakmp policy 10
 authentication pre-share
 group 2
 lifetime 3600

!--- Defines the pre-shared key for the remote peer.

crypto isakmp key cisco address 100.1.1.1
!

!--- Defines the transform set to be used for IPSec SAs.

```

```
crypto ipsec transform-set tunnelset esp-des esp-md5-hmac
!

!--- Configures the router to use the address of Loopback0 interface
!--- for IKE and IPSec traffic.

crypto map toAA local-address Loopback0

!--- Defines a crypto map to be used for establishing IPSec SAs.

crypto map toAA 10 ipsec-isakmp
  set peer 100.1.1.1
  set transform-set tunnelset
  match address 101
!
interface Loopback0
 ip address 200.1.1.1 255.255.255.0
!

!--- Configures a GRE tunnel for transporting IPX traffic

interface Tunnel0
 no ip address

 ipx network CC
 tunnel source Serial3/0
 tunnel destination 150.0.0.1
!
interface Ethernet2/0
 ip address 75.1.1.1 255.255.255.0
 ipx network BB
!
interface Serial3/0
 ip address 150.0.0.2 255.255.255.0
 clockrate 9600

!--- Applies the crypto map to the physical interface used
!--- for carrying GRE tunnel traffic.

crypto map toAA
!

!--- Output suppressed.

ip classless
ip route 0.0.0.0 0.0.0.0 150.0.0.1
no ip http server
!

!--- Configures GRE tunnel traffic to be encrypted using IPSec.

access-list 101 permit gre host 150.0.0.2 host 150.0.0.1
!
line con 0
  transport input none
line aux 0
line vty 0 4
  login
!
```

## Verify

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

Certain **show** commands are supported by the Output Interpreter Tool (registered customers only), which allows you to view an analysis of **show** command output.

- **show ipx interface** Displays the status and parameters of the IPX interfaces configured on the device such as the IPX network and node address.
- **show ipx route** Displays the contents of the IPX routing table.
- **show crypto isakmp sa** Shows the phase 1 security associations by displaying the router's IKE SA. The state displayed should be QM\_IDLE for an IKE SA to be considered up and functioning.
- **show crypto ipsec sa** Shows the phase 2 security associations by displaying a detailed list of the router's active IPsec SAs.
- **show crypto map** Displays the crypto maps configured on the router along with its details such as crypto access lists, transform sets, peers etc.
- **show crypto engine connections active** Displays a list of active SAs with their associated interfaces, transforms and counters.

## Sample Show Output

This section captures the **show** command outputs on the device Router1 when the IPX **ping** command is executed on Router1 destined for Router2. The outputs on Router2 are similar. The key parameters in the output are indicated in **bold**. For explanation on the command outputs, refer to the IP Security Troubleshooting – Understanding and Using debug Commands document.

```
Router1#show ipx interface ethernet 3/0
Ethernet3/0 is up, line protocol is up
  IPX address is AA.00b0.64cb.eab1, NOVELL-ETHER [up]
  Delay of this IPX network, in ticks is 1 throughput 0 link delay 0
  IPXWAN processing not enabled on this interface.

!--- Output suppressed.

Router2#show ipx interface ethernet 2/0
Ethernet2/0 is up, line protocol is up
  IPX address is BB.0002.16ae.c161, NOVELL-ETHER [up]
  Delay of this IPX network, in ticks is 1 throughput 0 link delay 0
  IPXWAN processing not enabled on this interface.

!--- Output suppressed.

Router1#show ipx route
Codes: C - Connected primary network,      c - Connected secondary network
       S - Static, F - Floating static, L - Local (internal), W - IPXWAN
       R - RIP, E - EIGRP, N - NLSP, X - External, A - Aggregate
       s - seconds, u - uses, U - Per-user static/Unknown, H - Hold-down

3 Total IPX routes. Up to 1 parallel paths and 16 hops allowed.

No default route known.

C          AA (NOVELL-ETHER),  Et3/0
C          CC (TUNNEL),        Tu0
R          BB [151/01] via          CC.0010.7b37.c8ae,    56s, Tu0
```

```
Router2#show ipx route
Codes: C - Connected primary network, c - Connected secondary network
       S - Static, F - Floating static, L - Local (internal), W - IPXWAN
       R - RIP, E - EIGRP, N - NLSP, X - External, A - Aggregate
       s - seconds, u - uses, U - Per-user static/Unknown, H - Hold-down
```

3 Total IPX routes. Up to 1 parallel paths and 16 hops allowed.

No default route known.

```
C      BB (NOVELL-ETHER), Et2/0
C      CC (TUNNEL), Tu0
R      AA [151/01] via CC.00e0.b064.258e, 8s, Tu0
```

```
Router1#ping ipx BB.0010.7b37.c8ae
```

Type escape sequence to abort.

```
Sending 5, 100-byte IPX Novell Echoes to BB.0002.16ae.c161, timeout is 2 seconds:
!!!!!
```

Success rate is 100 percent (5/5), round-trip min/avg/max = 52/53/56 ms

```
Router2#ping ipx AA.00b0.64cb.eab1
```

Type escape sequence to abort.

```
Sending 5, 100-byte IPX Novell Echoes to AA.00b0.64cb.eab1, timeout is 2 seconds:
!!!!!
```

Success rate is 100 percent (5/5), round-trip min/avg/max = 52/53/56 ms

```
Router1#show crypto isakmp sa
```

dst	src	state	conn-id	slot
200.1.1.1	100.1.1.1	QM_IDLE	5	0

```
Router1#show crypto ipsec sa detail
```

interface: Serial1/0

**Crypto map tag: toBB, local addr. 100.1.1.1**

**local ident (addr/mask/prot/port): (150.0.0.1/255.255.255.255/47/0)**

**remote ident (addr/mask/prot/port): (150.0.0.2/255.255.255.255/47/0)**

**current\_peer: 200.1.1.1**

PERMIT, flags={origin\_is\_acl,}

#pkts encaps: 343, #pkts encrypt: 343, #pkts digest 343

#pkts decaps: 343, #pkts decrypt: 343, #pkts verify 343

#pkts compressed: 0, #pkts decompressed: 0

#pkts not compressed: 0, #pkts compr. failed: 0, #pkts decompress failed: 0

#pkts no sa (send) 1, #pkts invalid sa (rcv) 0

#pkts encaps failed (send) 0, #pkts decaps failed (rcv) 0

#pkts invalid prot (rcv) 0, #pkts verify failed: 0

#pkts invalid identity (rcv) 0, #pkts invalid len (rcv) 0

#pkts replay rollover (send): 0, #pkts replay rollover (rcv) 0

##pkts replay failed (rcv): 0

#pkts internal err (send): 0, #pkts internal err (rcv) 0

local crypto endpt.: 100.1.1.1, remote crypto endpt.: 200.1.1.1

path mtu 1500, ip mtu 1500, ip mtu interface Serial1/0

current outbound spi: CB6F6DA6

inbound esp sas:

spi: 0xFD6F387(265745287)

transform: esp-des esp-md5-hmac ,

in use settings = {Tunnel, }

slot: 0, conn id: 2010, flow\_id: 11, crypto map: toBB

sa timing: remaining key lifetime (k/sec): (4607994/1892)

```

IV size: 8 bytes
replay detection support: Y

inbound ah sas:

inbound pcp sas:

outbound esp sas:
spi: 0xCB6F6DA6(3413077414)
transform: esp-des esp-md5-hmac ,
in use settings ={Tunnel, }
slot: 0, conn id: 2011, flow_id: 12, crypto map: toBB
sa timing: remaining key lifetime (k/sec): (4607994/1892)
IV size: 8 bytes
replay detection support: Y

outbound ah sas:

outbound pcp sas:

```

```

Router1#show crypto map
Crypto Map: "toBB" idb: Loopback0 local address: 100.1.1.1

Crypto Map "toBB" 10 ipsec-isakmp
Peer = 200.1.1.1
Extended IP access list 101
    access-list 101 permit gre host 150.0.0.1 host 150.0.0.2
Current peer: 200.1.1.1
Security association lifetime: 4608000 kilobytes/3600 seconds
PFS (Y/N): N
Transform sets={ tunnelset, }
Interfaces using crypto map toBB:
    Serial1/0

```

```

Router1#show crypto engine connections active

```

ID	Interface	IP-Address	State	Algorithm	Encrypt	Decrypt
5	<none>	<none>	set	HMAC_SHA+DES_56_CB	0	0
2010	Serial1/0	150.0.0.1	set	HMAC_MD5+DES_56_CB	0	40
2011	Serial1/0	150.0.0.1	set	HMAC_MD5+DES_56_CB	45	0

## Troubleshoot

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

## Troubleshooting Commands

**Note:** Before issuing **debug** commands, please see Important Information on Debug Commands.

- **debug crypto engine** Shows information about the crypto engine performing encryption and decryption process.
- **debug crypto ipsec** View the IPSec negotiations of phase 2.
- **debug crypto isakmp** View the IKE negotiations of phase 1.



## Sample Debug Output

This section captures the debug command outputs on the routers configured with IPsec. The **IPX ping** command is executed on router1 destined for router2.

- Router1
- Router2

### Router1

```
Router1#show debug
```

```
Cryptographic Subsystem:  
  Crypto ISAKMP debugging is on  
  Crypto Engine debugging is on  
  Crypto IPSEC debugging is on  
Router1#
```

```
!--- GRE traffic matching crypto ACL triggers IPsec processing
```

```
*Mar  2 00:41:17.593: IPSEC(sa_request): ,  
  (key eng. msg.) OUTBOUND local= 100.1.1.1, remote= 200.1.1.1,  
  local_proxy= 150.0.0.1/255.255.255.255/47/0 (type=1),  
  remote_proxy= 150.0.0.2/255.255.255.255/47/0 (type=1),  
  protocol= ESP, transform= esp-des esp-md5-hmac ,  
  lifedur= 3600s and 4608000kb,  
  spi= 0x9AAD0079(2595029113), conn_id= 0, keysize= 0, flags= 0x400C  
*Mar  2 00:41:17.597: ISAKMP: received ke message (1/1)
```

```
!--- IKE uses UDP port 500, begins main mode exchange.
```

```
*Mar  2 00:41:17.597: ISAKMP: local port 500, remote port 500  
*Mar  2 00:41:17.597: ISAKMP (0:1): beginning Main Mode exchange  
*Mar  2 00:41:17.597: ISAKMP (0:1): sending packet to 200.1.1.1 (I) MM_NO_STATE  
*Mar  2 00:41:17.773: ISAKMP (0:1): received packet from 200.1.1.1 (I) MM_NO_STATE  
*Mar  2 00:41:17.773: ISAKMP (0:1): processing SA payload. message ID = 0  
*Mar  2 00:41:17.773: ISAKMP (0:1): found peer pre-shared key matching 200.1.1.1  
*Mar  2 00:41:17.773: ISAKMP (0:1): Checking ISAKMP transform 1 against priority 10 policy
```

```
!--- IKE SAs are negotiated.
```

```
*Mar  2 00:41:17.773: ISAKMP:      encryption DES-CBC  
*Mar  2 00:41:17.773: ISAKMP:      hash SHA  
*Mar  2 00:41:17.773: ISAKMP:      default group 2  
*Mar  2 00:41:17.773: ISAKMP:      auth pre-share  
*Mar  2 00:41:17.773: ISAKMP:      life type in seconds  
*Mar  2 00:41:17.773: ISAKMP:      life duration (basic) of 3600  
*Mar  2 00:41:17.773: ISAKMP (0:1): atts are acceptable. Next payload is 0  
*Mar  2 00:41:17.773: CryptoEngine0: generate alg parameter  
*Mar  2 00:41:17.905: CRYPTO_ENGINE: Dh phase 1 status: 0  
*Mar  2 00:41:17.905: CRYPTO_ENGINE: Dh phase 1 status: 0  
*Mar  2 00:41:17.905: ISAKMP (0:1): SA is doing pre-shared key authentication using id type  
ADDR  
*Mar  2 00:41:17.905: ISAKMP (0:1): sending packet to 200.1.1.1 (I) MM_SA_SETUP  
*Mar  2 00:41:18.149: ISAKMP (0:1): received packet from 200.1.1.1 (I) MM_SA_SETUP  
*Mar  2 00:41:18.153: ISAKMP (0:1): processing KE payload. message ID = 0  
*Mar  2 00:41:18.153: CryptoEngine0: generate alg parameter  
*Mar  2 00:41:18.317: ISAKMP (0:1): processing NONCE payload. message ID = 0  
*Mar  2 00:41:18.317: ISAKMP (0:1): found peer pre-shared key matching 200.1.1.1  
*Mar  2 00:41:18.317: CryptoEngine0: create ISAKMP SKEYID for conn id 1  
*Mar  2 00:41:18.321: ISAKMP (0:1): SKEYID state generated  
*Mar  2 00:41:18.321: ISAKMP (0:1): processing vendor id payload  
*Mar  2 00:41:18.321: ISAKMP (0:1): speaking to another IOS box!  
*Mar  2 00:41:18.321: ISAKMP (1): ID payload  
      next-payload : 8
```

```
type          : 1
protocol      : 17
port         : 500
length       : 8
*Mar 2 00:41:18.321: ISAKMP (1): Total payload length: 12
*Mar 2 00:41:18.321: CryptoEngine0: generate hmac context for conn id 1
*Mar 2 00:41:18.321: ISAKMP (0:1): sending packet to 200.1.1.1 (I) MM_KEY_EXCH
*Mar 2 00:41:18.361: ISAKMP (0:1): received packet from 200.1.1.1 (I) MM_KEY_EXCH
*Mar 2 00:41:18.361: ISAKMP (0:1): processing ID payload. message ID = 0
*Mar 2 00:41:18.361: ISAKMP (0:1): processing HASH payload. message ID = 0
*Mar 2 00:41:18.361: CryptoEngine0: generate hmac context for conn id 1
```

*!--- Peer is authenticated.*

**\*Mar 2 00:41:18.361: ISAKMP (0:1): SA has been authenticated with 200.1.1.1**

*!--- Begins quick mode exchange.*

```
*Mar 2 00:41:18.361: ISAKMP (0:1): beginning Quick Mode exchange, M-ID of -2078851837
*Mar 2 00:41:18.365: CryptoEngine0: generate hmac context for conn id 1
*Mar 2 00:41:18.365: ISAKMP (0:1): sending packet to 200.1.1.1 (I) QM_IDLE
*Mar 2 00:41:18.365: CryptoEngine0: clear dh number for conn id 1
*Mar 2 00:41:18.681: ISAKMP (0:1): received packet from 200.1.1.1 (I) QM_IDLE
*Mar 2 00:41:18.681: CryptoEngine0: generate hmac context for conn id 1
*Mar 2 00:41:18.685: ISAKMP (0:1): processing HASH payload. message ID = -2078851837
*Mar 2 00:41:18.685: ISAKMP (0:1): processing SA payload. message ID = -2078851837
```

*!--- Negotiates IPsec SA.*

```
*Mar 2 00:41:18.685: ISAKMP (0:1): Checking IPsec proposal 1
*Mar 2 00:41:18.685: ISAKMP: transform 1, ESP_DES
*Mar 2 00:41:18.685: ISAKMP:   attributes in transform:
*Mar 2 00:41:18.685: ISAKMP:     encaps is 1
*Mar 2 00:41:18.685: ISAKMP:     SA life type in seconds
*Mar 2 00:41:18.685: ISAKMP:     SA life duration (basic) of 3600
*Mar 2 00:41:18.685: ISAKMP:     SA life type in kilobytes
*Mar 2 00:41:18.685: ISAKMP:     SA life duration (VPI) of 0x0 0x46 0x50 0x0
*Mar 2 00:41:18.685: ISAKMP:     authenticator is HMAC-MD5
*Mar 2 00:41:18.685: validate proposal 0
*Mar 2 00:41:18.685: ISAKMP (0:1): atts are acceptable.
*Mar 2 00:41:18.685: IPSEC(validate_proposal_request): proposal part #1,
(key eng. msg.) INBOUND local= 100.1.1.1, remote= 200.1.1.1,
local_proxy= 150.0.0.1/255.255.255.255/47/0 (type=1),
remote_proxy= 150.0.0.2/255.255.255.255/47/0 (type=1),
protocol= ESP, transform= esp-des esp-md5-hmac ,
lifedur= 0s and 0kb,
spi= 0x0(0), conn_id= 0, keysize= 0, flags= 0x4
*Mar 2 00:41:18.689: validate proposal request 0
*Mar 2 00:41:18.689: ISAKMP (0:1): processing NONCE payload. message ID = -2078851837
*Mar 2 00:41:18.689: ISAKMP (0:1): processing ID payload. message ID = -2078851837
*Mar 2 00:41:18.689: ISAKMP (0:1): processing ID payload. message ID = -2078851837
*Mar 2 00:41:18.689: CryptoEngine0: generate hmac context for conn id 1
*Mar 2 00:41:18.689: ipsec allocate flow 0
*Mar 2 00:41:18.689: ipsec allocate flow 0
```

*!--- IPsec SAs are generated for inbound and outbound traffic.*

```
*Mar 2 00:41:18.693: ISAKMP (0:1): Creating IPsec SAs
*Mar 2 00:41:18.693:   inbound SA from 200.1.1.1 to 100.1.1.1
(proxy 150.0.0.2 to 150.0.0.1)
*Mar 2 00:41:18.693:   has spi 0x9AAD0079 and conn_id 2000 and flags 4
*Mar 2 00:41:18.693:   lifetime of 3600 seconds
*Mar 2 00:41:18.693:   lifetime of 4608000 kilobytes
*Mar 2 00:41:18.693:   outbound SA from 100.1.1.1 to 200.1.1.1 (proxy 1
to 150.0.0.2 )
*Mar 2 00:41:18.693:   has spi -1609905338 and conn_id 2001 and flags C
```

```

*Mar 2 00:41:18.693:          lifetime of 3600 seconds
*Mar 2 00:41:18.693:          lifetime of 4608000 kilobytes
*Mar 2 00:41:18.697: ISAKMP (0:1): sending packet to 200.1.1.1 (I) QM_IDLE
*Mar 2 00:41:18.697: ISAKMP (0:1): deleting node -2078851837 error FALSE reason ""
*Mar 2 00:41:18.697: IPSEC(key_engine): got a queue event...
*Mar 2 00:41:18.697: IPSEC(initialize_sas): ,
    (key eng. msg.) INBOUND local= 100.1.1.1, remote= 200.1.1.1,
    local_proxy= 150.0.0.1/0.0.0.0/47/0 (type=1),
    remote_proxy= 150.0.0.2/0.0.0.0/47/0 (type=1),
    protocol= ESP, transform= esp-des esp-md5-hmac ,
    lifedur= 3600s and 4608000kb,
    spi= 0x9AAD0079(2595029113), conn_id= 2000, keysizes= 0, flags= 0x4
*Mar 2 00:41:18.697: IPSEC(initialize_sas): ,
    (key eng. msg.) OUTBOUND local= 100.1.1.1, remote= 200.1.1.1,
    local_proxy= 150.0.0.1/0.0.0.0/47/0 (type=1),
    remote_proxy= 150.0.0.2/0.0.0.0/47/0 (type=1),
    protocol= ESP, transform= esp-des esp-md5-hmac ,
    lifedur= 3600s and 4608000kb,
    spi= 0xA00ACB46(2685061958), conn_id= 2001, keysizes= 0, flags= 0xC
*Mar 2 00:41:18.697: IPSEC(create_sa): sa created,
    (sa) sa_dest= 100.1.1.1, sa_prot= 50,
    sa_spi= 0x9AAD0079(2595029113),
    sa_trans= esp-des esp-md5-hmac , sa_conn_id= 2000
*Mar 2 00:41:18.701: IPSEC(create_sa): sa created,
    (sa) sa_dest= 200.1.1.1, sa_prot= 50,
    sa_spi= 0xA00ACB46(2685061958),
    sa_trans= esp-des esp-md5-hmac , sa_conn_id= 2001

```

Router1#

## Router2

Router2#**show debug**

```

Cryptographic Subsystem:
  Crypto ISAKMP debugging is on
  Crypto Engine debugging is on
  Crypto IPSEC debugging is on
Router2#

```

*!--- IKE processing begins here.*

```

*Mar 2 00:30:26.093: ISAKMP (0:0): received packet from 100.1.1.1 (N) NEW SA
*Mar 2 00:30:26.093: ISAKMP: local port 500, remote port 500
*Mar 2 00:30:26.093: ISAKMP (0:1): processing SA payload. message ID = 0
*Mar 2 00:30:26.093: ISAKMP (0:1): found peer pre-shared key matching 100.1.1.1

```

*!--- IKE SAs are negotiated.*

```

*Mar 2 00:30:26.093: ISAKMP (0:1): Checking ISAKMP transform 1 against priority 10 policy
*Mar 2 00:30:26.093: ISAKMP:          encryption DES-CBC
*Mar 2 00:30:26.093: ISAKMP:          hash SHA
*Mar 2 00:30:26.093: ISAKMP:          default group 2
*Mar 2 00:30:26.093: ISAKMP:          auth pre-share
*Mar 2 00:30:26.093: ISAKMP:          life type in seconds
*Mar 2 00:30:26.093: ISAKMP:          life duration (basic) of 3600
*Mar 2 00:30:26.093: ISAKMP (0:1): atts are acceptable. Next payload is 0
*Mar 2 00:30:26.097: CryptoEngine0: generate alg parameter
*Mar 2 00:30:26.229: CRYPTO_ENGINE: Dh phase 1 status: 0
*Mar 2 00:30:26.229: CRYPTO_ENGINE: Dh phase 1 status: 0
*Mar 2 00:30:26.229: ISAKMP (0:1): SA is doing pre-shared key authentication using id type
ADDR
*Mar 2 00:30:26.229: ISAKMP (0:1): sending packet to 100.1.1.1 (R) MM_SA_SETUP
*Mar 2 00:30:26.417: ISAKMP (0:1): received packet from 100.1.1.1 (R) MM_SA_SETUP
*Mar 2 00:30:26.417: ISAKMP (0:1): processing KE payload. message ID = 0
*Mar 2 00:30:26.417: CryptoEngine0: generate alg parameter

```

```

*Mar 2 00:30:26.589: ISAKMP (0:1): processing NONCE payload. message ID = 0
*Mar 2 00:30:26.589: ISAKMP (0:1): found peer pre-shared key matching 100.1.1.1
*Mar 2 00:30:26.593: CryptoEngine0: create ISAKMP SKEYID for conn id 1
*Mar 2 00:30:26.593: ISAKMP (0:1):
SKEYID state generated
*Mar 2 00:30:26.593: ISAKMP (0:1): processing vendor id payload
*Mar 2 00:30:26.593: ISAKMP (0:1): speaking to another IOS box!
*Mar 2 00:30:26.593: ISAKMP (0:1): sending packet to 100.1.1.1 (R) MM_KEY_EXCH
*Mar 2 00:30:26.813: ISAKMP (0:1): received packet from 100.1.1.1 (R) MM_KEY_EXCH
*Mar 2 00:30:26.817: ISAKMP (0:1): processing ID payload. message ID = 0
*Mar 2 00:30:26.817: ISAKMP (0:1): processing HASH payload. message ID = 0
*Mar 2 00:30:26.817: CryptoEngine0: generate hmac context for conn id 1

!--- Peer is authenticated.

*Mar 2 00:30:26.817: ISAKMP (0:1): SA has been authenticated with 100.1.1.1
*Mar 2 00:30:26.817: ISAKMP (1): ID payload
      next-payload : 8
      type          : 1
      protocol      : 17
      port          : 500
      length        : 8
*Mar 2 00:30:26.817: ISAKMP (1): Total payload length: 12
*Mar 2 00:30:26.817: CryptoEngine0: generate hmac context for conn id 1
*Mar 2 00:30:26.817: CryptoEngine0: clear dh number for conn id 1
*Mar 2 00:30:26.821: ISAKMP (0:1): sending packet to 100.1.1.1 (R) QM_IDLE
*Mar 2 00:30:26.869: ISAKMP (0:1): received packet from 100.1.1.1 (R) QM_IDLE
*Mar 2 00:30:26.869: CryptoEngine0: generate hmac context for conn id 1
*Mar 2 00:30:26.869: ISAKMP (0:1): processing HASH payload. message ID = -2078851837
*Mar 2 00:30:26.873: ISAKMP (0:1): processing SA payload. message ID = -2078851837

!--- IPsec SAs are negotiated.

*Mar 2 00:30:26.873: ISAKMP (0:1): Checking IPsec proposal 1
*Mar 2 00:30:26.873: ISAKMP: transform 1, ESP_DES
*Mar 2 00:30:26.873: ISAKMP:   attributes in transform:
*Mar 2 00:30:26.873: ISAKMP:     encaps is 1
*Mar 2 00:30:26.873: ISAKMP:     SA life type in seconds
*Mar 2 00:30:26.873: ISAKMP:     SA life duration (basic) of 3600
*Mar 2 00:30:26.873: ISAKMP:     SA life type in kilobytes
*Mar 2 00:30:26.873: ISAKMP:     SA life duration (VPI) of 0x0 0x46 0x50 0x0
*Mar 2 00:30:26.873: ISAKMP:     authenticator is HMAC-MD5
*Mar 2 00:30:26.873: validate proposal 0
*Mar 2 00:30:26.873: ISAKMP (0:1): atts are acceptable.
*Mar 2 00:30:26.873: IPSEC(validate_proposal_request): proposal part #1,
      (key eng. msg.) INBOUND local= 200.1.1.1, remote= 100.1.1.1,
      local_proxy= 150.0.0.2/255.255.255.255/47/0 (type=1),
      remote_proxy= 150.0.0.1/255.255.255.255/47/0 (type=1),
      protocol= ESP, transform= esp-des esp-md5-hmac ,
      lifedur= 0s and 0kb,
      spi= 0x0(0), conn_id= 0, keysize= 0, flags= 0x4
*Mar 2 00:30:26.873: validate proposal request 0
*Mar 2 00:30:26.877: ISAKMP (0:1): processing NONCE payload. message ID = -2078851837
*Mar 2 00:30:26.877: ISAKMP (0:1): processing ID payload. message ID = -2078851837
*Mar 2 00:30:26.877: ISAKMP (0:1): processing ID payload. message ID = -2078851837
*Mar 2 00:30:26.877: ISAKMP (0:1): asking for 1 spis from ipsec
*Mar 2 00:30:26.877: IPSEC(key_engine): got a queue event...
*Mar 2 00:30:26.877: IPSEC(spi_response): getting spi 2685061958 for SA
      from 200.1.1.1      to 100.1.1.1      for prot 3
*Mar 2 00:30:26.877: ISAKMP: received ke message (2/1)
*Mar 2 00:30:27.129: CryptoEngine0: generate hmac context for conn id 1
*Mar 2 00:30:27.129: ISAKMP (0:1): sending packet to 100.1.1.1 (R) QM_IDLE
*Mar 2 00:30:27.185: ISAKMP (0:1): received packet from 100.1.1.1 (R) QM_IDLE
*Mar 2 00:30:27.189: CryptoEngine0: generate hmac context for conn id 1
*Mar 2 00:30:27.189: ipsec allocate flow 0
*Mar 2 00:30:27.189: ipsec allocate flow 0

```

*!--- IPSec SAs are generated for inbound and outbound traffic.*

```
*Mar 2 00:30:27.193: ISAKMP (0:1): Creating IPSec SAs
*Mar 2 00:30:27.193: inbound SA from 100.1.1.1 to 200.1.1.1
    (proxy 150.0.0.1 to 150.0.0.2)
*Mar 2 00:30:27.193: has spi 0xA00ACB46 and conn_id 2000 and flags 4
*Mar 2 00:30:27.193: lifetime of 3600 seconds
*Mar 2 00:30:27.193: lifetime of 4608000 kilobytes
*Mar 2 00:30:27.193: outbound SA from 200.1.1.1 to 100.1.1.1 (proxy 1
    to 150.0.0.1 )
*Mar 2 00:30:27.193: has spi -1699938183 and conn_id 2001 and flags C
*Mar 2 00:30:27.193: lifetime of 3600 seconds
*Mar 2 00:30:27.193: lifetime of 4608000 kilobytes
*Mar 2 00:30:27.193: ISAKMP (0:1): deleting node -2078851837 error FALSE reason "quick mo
wait()"
*Mar 2 00:30:27.193: IPSEC(key_engine): got a queue event...
*Mar 2 00:30:27.193: IPSEC(initialize_sas): ,
    (key eng. msg.) INBOUND local= 200.1.1.1, remote= 100.1.1.1,
    local_proxy= 150.0.0.2/0.0.0.0/47/0 (type=1),
    remote_proxy= 150.0.0.1/0.0.0.0/47/0 (type=1),
    protocol= ESP, transform= esp-des esp-md5-hmac ,
    lifedur= 3600s and 4608000kb,
    spi= 0xA00ACB46(2685061958), conn_id= 2000, keysize= 0, flags= 0x4
*Mar 2 00:30:27.197: IPSEC(initialize_sas): ,
    (key eng. msg.) OUTBOUND local= 200.1.1.1, remote= 100.1.1.1,
    local_proxy= 150.0.0.2/0.0.0.0/47/0 (type=1),
    remote_proxy= 150.0.0.1/0.0.0.0/47/0 (type=1),
    protocol= ESP, transform= esp-des esp-md5-hmac ,
    lifedur= 3600s and 4608000kb,
    spi= 0x9AAD0079(2595029113), conn_id= 2001, keysize= 0, flags= 0xC
*Mar 2 00:30:27.197: IPSEC(create_sa): sa created,
    (sa) sa_dest= 200.1.1.1, sa_prot= 50,
    sa_spi= 0xA00ACB46(2685061958),
    sa_trans= esp-des esp-md5-hmac , sa_conn_id= 2000
*Mar 2 00:30:27.197: IPSEC(create_sa): sa created,
    (sa) sa_dest= 100.1.1.1, sa_prot= 50,
    sa_spi= 0x9AAD0079(2595029113),
    sa_trans= esp-des esp-md5-hmac , sa_conn_id= 2001
```

Router2#

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