

Configuring Dynamic Multipoint VPN (DMVPN) using GRE over IPsec between Multiple Routers

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Introduction

The Dynamic Multipoint VPN (DMVPN) feature allows users to better scale large and small IPsec VPNs by combining generic routing encapsulation (GRE) tunnels, IPsec encryption, and Next Hop Resolution Protocol (NHRP) to provide users with easy configuration through crypto profiles, which override the requirement for defining static crypto maps, and dynamic discovery of tunnel endpoints.

Prerequisites

Requirements

There are no specific requirements for this document.

Components Used

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

- Cisco 2691 and 3725 routers
- Cisco IOS® Software Release 12.3(3)

Note: Multiple IPsec pass-through is only supported on Cisco IOS Software releases 12.2.(2)XK and 12.2.(13)T and later.

Output from the **show version** command on the router is shown below:

```
sv9-4#show version
Cisco Internetwork Operating System Software
IOS (tm) 2600 Software (C2691-IK9S-M), Version 12.3(3),
    RELEASE SOFTWARE (fc2)
Copyright (c) 1986-2003 by Cisco Systems, Inc.
Compiled Tue 19-Aug-03 05:52 by dchih
Image text-base: 0x60008954, data-base: 0x61D08000
```

ROM: System Bootstrap, Version 12.2(8r)T2,
RELEASE SOFTWARE (fcl)

sv9-4 uptime is 1 hour, 39 minutes
System returned to ROM by reload
System image file is "flash:c2691-ik9s-mz.123-3.bin"

This product contains cryptographic features and is subject to United States and local country laws governing import, export, transfer and use. Delivery of Cisco cryptographic products does not imply third-party authority to import, export, distribute or use encryption. Importers, exporters, distributors and users are responsible for compliance with U.S. and local country laws. By using this product you agree to comply with applicable laws and regulations. If you are unable to comply with U.S. and local laws, return this product immediately.

A summary of U.S. laws governing Cisco cryptographic products may be found at:
<http://www.cisco.com/wwl/export/crypto/tool/stqrg.html>

If you require further assistance please contact us by sending email to export@cisco.com.

cisco 2691 (R7000) processor (revision 0.1)
with 98304K/32768K bytes of memory.
Processor board ID JMX0710L5CE
R7000 CPU at 160Mhz, Implementation 39,
Rev 3.3, 256KB L2 Cache
Bridging software.
X.25 software, Version 3.0.0.
SuperLAT software (copyright 1990 by Meridian Technology Corp).
2 FastEthernet/IEEE 802.3 interface(s)
2 Serial(sync/async) network interface(s)
1 ATM network interface(s)
1 Virtual Private Network (VPN) Module(s)
DRAM configuration is 64 bits wide with parity disabled.
55K bytes of non-volatile configuration memory.
125184K bytes of ATA System CompactFlash (Read/Write)

Configuration register is 0x2102

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.

Background Theory

The feature works according to the following rules.

- Each spoke has a permanent IPSec tunnel to the hub, not to the other spokes within the network. Each spoke registers as clients of the NHRP server.
- When a spoke needs to send a packet to a destination (private) subnet on another spoke, it queries the NHRP server for the real (outside) address of the destination (target) spoke.
- After the originating spoke learns the peer address of the target spoke, it can initiate a dynamic IPSec tunnel to the target spoke.
- The spoke-to-spoke tunnel is built over the multipoint GRE (mGRE) interface.
- The spoke-to-spoke links are established on demand whenever there is traffic between the spokes. Thereafter, packets are able to bypass the hub and use the spoke-to-spoke tunnel.

The following definitions apply to the rule set.

- NHRP A client and server protocol where the hub is the server and the spokes are the clients. The hub maintains an NHRP database of the public interface addresses of the each spoke. Each spoke registers its real address when it boots and queries the NHRP database for real addresses of the destination spokes in order to build direct tunnels.
- mGRE Tunnel Interface Allows a single GRE interface to support multiple IPSec tunnels and simplifies the size and complexity of the configuration.

Note: After a preconfigured amount of inactivity on the spoke-to-spoke tunnels, the router will tear down those tunnels to save resources (IPSec security associations [SA]).

Note: The traffic profile should follow the 80–20 percent rule: 80 percent of the traffic consists of spoke-to-hub traffic, and 20 percent of the traffic consists of spoke-to-spoke traffic.

Conventions

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

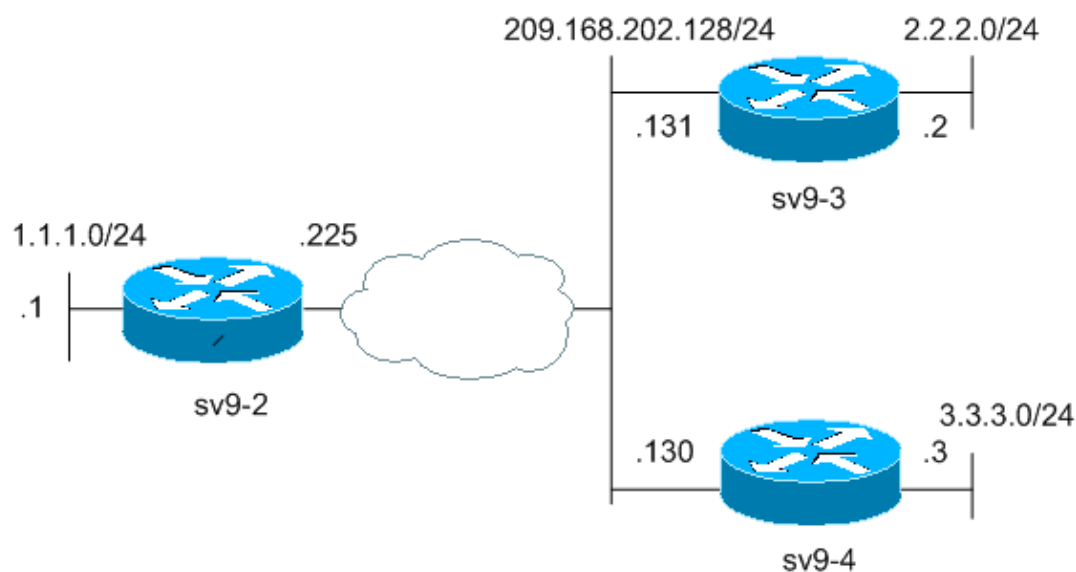
Configure

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.

- Hub Router (sv9-2) Configuration


```
!  
!  
!  
no voice hpi capture buffer  
no voice hpi capture destination  
!  
!  
!  
!  
!  
!  
!  
!  
  
!--- Create a GRE tunnel template which will be applied to  
!--- all the dynamically created GRE tunnels.  
  
interface Tunnel0  
ip address 192.168.1.1 255.255.255.0  
no ip redirects  
ip mtu 1440  
ip nhrp authentication cisco123  
ip nhrp map multicast dynamic  
ip nhrp network-id 1  
no ip split-horizon eigrp 90  
tunnel source FastEthernet0/0  
tunnel mode gre multipoint  
tunnel key 0  
tunnel protection ipsec profile cisco  
!  
  
!--- This is the outbound interface.  
  
interface FastEthernet0/0  
ip address 209.168.202.225 255.255.255.224  
duplex auto  
speed auto  
!  
  
!--- This is the inbound interface.  
  
interface FastEthernet0/1  
ip address 1.1.1.1 255.255.255.0  
duplex auto  
speed auto  
!  
interface BRI1/0  
no ip address  
shutdown  
!  
interface BRI1/1  
no ip address  
shutdown  
!  
interface BRI1/2  
no ip address  
shutdown  
!  
interface BRI1/3  
no ip address  
shutdown  
!  
  
!--- Enable a routing protocol to send and receive  
!--- dynamic updates about the private networks.  
  
router eigrp 90
```

```
network 1.1.1.0 0.0.0.255
network 192.168.1.0
no auto-summary
!
ip http server
no ip http secure-server
ip classless
ip route 0.0.0.0 0.0.0.0 10.66.79.193
!
!
!
!
!
!
!
!
!
!
line con 0
exec-timeout 0 0
transport preferred all
transport output all
escape-character 27
line aux 0
transport preferred all
transport output all
line vty 0 4
password cisco
login
transport preferred all
transport input all
transport output all
!
!
end
```

Spoke #1 (sv9-3) Configuration

```
sv9-3#show run
Building configuration...

Current configuration : 1993 bytes
!
version 12.3
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname sv9-3
!
boot-start-marker
boot system flash:c3725-ik9s-mz.123-3.bin
boot-end-marker
!
!
no aaa new-model
ip subnet-zero
!
!
no ip domain lookup
!
ip ssh break-string
!
!
```

```

/--- Create an ISAKMP policy for Phase 1 negotiations.

crypto isakmp policy 10
hash md5
authentication pre-share

/--- Add dynamic pre-shared keys for all the remote VPN
/--- routers and the hub router.

crypto isakmp key cisco123 address 0.0.0.0 0.0.0.0
!
!

/--- Create the Phase 2 policy for actual data encryption.

crypto ipsec transform-set strong esp-3des esp-md5-hmac
!

/--- Create an IPSec profile to be applied dynamically to
/--- the GRE over IPSec tunnels.

crypto ipsec profile cisco
set security-association lifetime seconds 120
set transform-set strong
!
!
!
!
!
!
!
!
!
!
!
no voice hpi capture buffer
no voice hpi capture destination
!
!
fax interface-type fax-mail
!
!
!
!

/--- Create a GRE tunnel template to be applied to
/--- all the dynamically created GRE tunnels.

interface Tunnel0
ip address 192.168.1.2 255.255.255.0
no ip redirects
ip mtu 1440
ip nhrp authentication cisco123
ip nhrp map multicast dynamic
ip nhrp map 192.168.1.1 209.168.202.225
ip nhrp map multicast 209.168.202.225
ip nhrp network-id 1
ip nhrp nhs 192.168.1.1
tunnel source FastEthernet0/0
tunnel mode gre multipoint
tunnel key 0
tunnel protection ipsec profile cisco
!

```



```
transport output all
line vty 0 4
login
transport preferred all
transport input all
transport output all
!
!
end
```

Spoke #2 (sv9-4) Configuration

```
sv9-4#show run
Building configuration...

Current configuration : 1994 bytes
!
version 12.3
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname sv9-4
!
boot-start-marker
boot system flash:c2691-ik9s-mz.123-3.bin
boot-end-marker
!
!
no aaa new-model
ip subnet-zero
!
!
no ip domain lookup
!
ip ssh break-string
!
!
!

!--- Create an ISAKMP policy for Phase 1 negotiations.

crypto isakmp policy 10
hash md5
authentication pre-share

!--- Add dynamic pre-shared keys for all the remote VPN
!--- routers and the hub router.

crypto isakmp key cisco123 address 0.0.0.0 0.0.0.0
!
!

!--- Create the Phase 2 policy for actual data encryption.

crypto ipsec transform-set strong esp-3des esp-md5-hmac
!

!--- Create an IPSec profile to be applied dynamically to
!--- the GRE over IPSec tunnels.

crypto ipsec profile cisco
set security-association lifetime seconds 120
set transform-set strong
!
```

```
!  
!  
!  
!  
!  
!  
!  
!  
!  
!  
no voice hpi capture buffer  
no voice hpi capture destination  
!  
!  
!  
!  
!  
!  
!  
  
!--- Create a GRE tunnel template to be applied to  
!--- all the dynamically created GRE tunnels.  
  
interface Tunnel0  
ip address 192.168.1.3 255.255.255.0  
no ip redirects  
ip mtu 1440  
ip nhrp authentication cisco123  
ip nhrp map multicast dynamic  
ip nhrp map 192.168.1.1 209.168.202.225  
ip nhrp map multicast 209.168.202.225  
ip nhrp network-id 1  
ip nhrp nhs 192.168.1.1  
tunnel source FastEthernet0/0  
tunnel mode gre multipoint  
tunnel key 0  
tunnel protection ipsec profile cisco  
!  
  
!--- This is the outbound interface.  
  
interface FastEthernet0/0  
ip address 209.168.202.130 255.255.255.224  
duplex auto  
speed auto  
!  
interface Serial0/0  
no ip address  
shutdown  
clockrate 2000000  
no fair-queue  
!  
  
!--- This is the inbound interface.  
  
interface FastEthernet0/1  
ip address 3.3.3.3 255.255.255.0  
duplex auto  
speed auto  
!  
interface Serial0/1  
no ip address  
shutdown  
clockrate 2000000  
!  
interface ATM1/0
```


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 ipsec** Displays IPsec events.
- **debug crypto isakmp** Displays messages about Internet Key Exchange (IKE) events.
- **debug crypto engine** Displays information from the crypto engine.

Additional information on troubleshooting IPsec can be found at IP Security Troubleshooting – Understanding and Using debug commands.

Sample Debug Output

- NHRP Debugs
- ISAKMP and IPsec Negotiation Debugs

NHRP Debugs

The following debug output shows the NHRP request and NHRP resolution response. The debugs were captured from spokes sv9-4 and sv9-3 and hub sv9-2.

```
sv9-4#show debug
NHRP:
NHRP protocol debugging is on

sv9-4#ping 2.2.2.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2.2.2.2, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 4/4/4 ms
sv9-4#
*Mar 1 02:06:01.667: NHRP: Sending packet to NHS 192.168.1.1 on Tunnel0
*Mar 1 02:06:01.671: NHRP: Sending packet to NHS 192.168.1.1 on Tunnel0
*Mar 1 02:06:01.675: NHRP: Sending packet to NHS 192.168.1.1 on Tunnel0
*Mar 1 02:06:01.679: NHRP: Encapsulation succeeded.
    Tunnel IP addr 209.168.202.225
*Mar 1 02:06:01.679: NHRP: Send Resolution Request via Tunnel0,
    packet size: 84
*Mar 1 02:06:01.679: src: 192.168.1.3, dst: 192.168.1.1
*Mar 1 02:06:01.679: NHRP: 84 bytes out Tunnel0
*Mar 1 02:06:01.679: NHRP: Sending packet to NHS 192.168.1.1 on Tunnel0
*Mar 1 02:06:01.683: NHRP: Sending packet to NHS 192.168.1.1 on Tunnel0
*Mar 1 02:06:03.507: NHRP: Encapsulation succeeded.
    Tunnel IP addr 209.168.202.225
*Mar 1 02:06:03.507: NHRP: Send Resolution Request via Tunnel0,
    packet size: 84
*Mar 1 02:06:03.507: src: 192.168.1.3, dst: 192.168.1.1
*Mar 1 02:06:03.507: NHRP: 84 bytes out Tunnel0
*Mar 1 02:06:03.511: NHRP: Receive Resolution Reply via Tunnel0,
    packet size: 132
*Mar 1 02:06:03.511: NHRP: netid_in = 0, to_us = 1
*Mar 1 02:06:03.511: NHRP: No need to delay processing of resolution
    event nbma src:209.168.202.130 nbma dst:209.168.202.131
```

sv9-3#
05:31:12: NHRP: Sending packet to NHS 192.168.1.1 on Tunnel0
05:31:12: NHRP: Sending packet to NHS 192.168.1.1 on Tunnel0
05:31:12: NHRP: Sending packet to NHS 192.168.1.1 on Tunnel0
05:31:12: NHRP: Encapsulation succeeded. Tunnel IP addr 209.168.202.225
05:31:12: NHRP: Send Resolution Request via Tunnel0, packet size: 84
05:31:12: src: 192.168.1.2, dst: 192.168.1.1
05:31:12: NHRP: 84 bytes out Tunnel0
05:31:12: NHRP: Sending packet to NHS 192.168.1.1 on Tunnel0
05:31:12: NHRP: Receive Resolution Request via Tunnel0, packet size: 104
05:31:12: NHRP: netid_in = 1, to_us = 0
05:31:12: NHRP: Delaying resolution request nbma src:209.168.202.131
nbma dst:209.168.202.130 reason:IPSEC-IFC: need to wait for IPsec SAs.
05:31:12: NHRP: Receive Resolution Reply via Tunnel0, packet size: 112
05:31:12: NHRP: netid_in = 0, to_us = 1
05:31:12: NHRP: Resolution request is already being processed (delayed).
05:31:12: NHRP: Resolution Request not queued.
Already being processed (delayed).
05:31:12: NHRP: Sending packet to NHS 192.168.1.1 on Tunnel0
05:31:13: NHRP: Process delayed resolution request src:192.168.1.3
dst:2.2.2.2
05:31:13: NHRP: No need to delay processing of resolution event
nbma src:209.168.202.131 nbma dst:209.168.202.130

sv9-2#
*Mar 1 06:03:40.174: NHRP: Forwarding packet within same fabric
Tunnel0 -> Tunnel0
*Mar 1 06:03:40.174: NHRP: Forwarding packet within same fabric
Tunnel0 -> Tunnel0
*Mar 1 06:03:40.178: NHRP: Forwarding packet within same fabric
Tunnel0 -> Tunnel0
***Mar 1 06:03:40.182: NHRP: Receive Resolution Request via Tunnel0,**
packet size: 84
*Mar 1 06:03:40.182: NHRP: netid_in = 1, to_us = 0
*Mar 1 06:03:40.182: NHRP: No need to delay processing of resolution
event nbma src:209.168.202.225 nbma dst:209.168.202.130
***Mar 1 06:03:40.182: NHRP: nhrp_rtlookup yielded Tunnel0**
***Mar 1 06:03:40.182: NHRP: netid_out 1, netid_in 1**
***Mar 1 06:03:40.182: NHRP: nhrp_cache_lookup_comp returned 0x0**
***Mar 1 06:03:40.182: NHRP: calling nhrp_forward**
***Mar 1 06:03:40.182: NHRP: Encapsulation succeeded.**
Tunnel IP addr 209.168.202.131
***Mar 1 06:03:40.182: NHRP: Forwarding Resolution Request via Tunnel0,**
packet size: 104
*Mar 1 06:03:40.182: src: 192.168.1.1, dst: 2.2.2.2
*Mar 1 06:03:40.182: NHRP: 104 bytes out Tunnel0
*Mar 1 06:03:40.182: NHRP: Forwarding packet within same fabric
Tunnel0 -> Tunnel0
*Mar 1 06:03:40.182: NHRP: Receive Resolution Request via Tunnel0,
packet size: 84
*Mar 1 06:03:40.182: NHRP: netid_in = 1, to_us = 0
*Mar 1 06:03:40.182: NHRP: No need to delay processing of resolution
event nbma src:209.168.202.225 nbma dst:209.168.202.131
***Mar 1 06:03:40.182: NHRP: nhrp_rtlookup yielded Tunnel0**
***Mar 1 06:03:40.182: NHRP: netid_out 1, netid_in 1**
***Mar 1 06:03:40.182: NHRP: nhrp_cache_lookup_comp returned 0x63DE9498**
***Mar 1 06:03:40.182: NHRP: Encapsulation succeeded.**
Tunnel IP addr 209.168.202.131
***Mar 1 06:03:40.182: NHRP: Send Resolution Reply via Tunnel0,**
packet size: 112
*Mar 1 06:03:40.186: src: 192.168.1.1, dst: 192.168.1.2
*Mar 1 06:03:40.186: NHRP: 112 bytes out Tunnel0
*Mar 1 06:03:40.186: NHRP: Forwarding packet within same fabric
Tunnel0 -> Tunnel0
*Mar 1 06:03:42.010: NHRP: Receive Resolution Request via Tunnel0,
packet size: 84

```
*Mar 1 06:03:42.010: NHRP: netid_in = 1, to_us = 0
*Mar 1 06:03:42.010: NHRP: No need to delay processing of resolution
event nbma src:209.168.202.225 nbma dst:209.168.202.130
```

ISAKMP and IPsec Negotiation Debugs

The following debug output shows ISAKMP and IPsec negotiation. The debugs were captured from spokes sv9-4 and sv9-3.

```
sv9-4#ping 2.2.2.2
```

```
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2.2.2.2, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms
sv9-4#
*Mar 1 02:25:37.107: ISAKMP (0:0): received packet from 209.168.202.131
  dport 500 sport 500 Global (N) NEW SA
*Mar 1 02:25:37.107: ISAKMP: local port 500, remote port 500
*Mar 1 02:25:37.107: ISAKMP: insert sa successfully sa = 63B38288
*Mar 1 02:25:37.107: ISAKMP (0:12): Input = IKE_MSG_FROM_PEER,
  IKE_MM_EXCH
*Mar 1 02:25:37.107: ISAKMP (0:12): Old State = IKE_READY
  New State = IKE_R_MM1

*Mar 1 02:25:37.107: ISAKMP (0:12): processing SA payload.
  message ID = 0
*Mar 1 02:25:37.107: ISAKMP (0:12): processing vendor id payload
*Mar 1 02:25:37.107: ISAKMP (0:12): vendor ID seems Unity/DPD but
  major 157 mismatch
*Mar 1 02:25:37.107: ISAKMP (0:12): vendor ID is NAT-T v3
*Mar 1 02:25:37.107: ISAKMP (0:12): processing vendor id payload
*Mar 1 02:25:37.107: ISAKMP (0:12): vendor ID seems Unity/DPD but
  major 123 mismatch
*Mar 1 02:25:37.107: ISAKMP (0:12): vendor ID is NAT-T v2
*Mar 1 02:25:37.107: ISAKMP: Looking for a matching key for
  209.168.202.131 in default : success
*Mar 1 02:25:37.107: ISAKMP (0:12): found peer pre-shared key
  matching 209.168.202.131
*Mar 1 02:25:37.107: ISAKMP (0:12) local preshared key found
*Mar 1 02:25:37.107: ISAKMP : Scanning profiles for xauth ...
*Mar 1 02:25:37.107: ISAKMP (0:12): Checking ISAKMP transform 1
  against priority 10 policy
*Mar 1 02:25:37.107: ISAKMP: encryption DES-CBC
*Mar 1 02:25:37.107: ISAKMP: hash MD5
*Mar 1 02:25:37.107: ISAKMP: default group 1
*Mar 1 02:25:37.107: ISAKMP: auth pre-share
*Mar 1 02:25:37.107: ISAKMP: life type in seconds
*Mar 1 02:25:37.107: ISAKMP: life duration (VPI) of 0x0 0x1 0x51 0x80
*Mar 1 02:25:37.107: ISAKMP (0:12): atts are acceptable.
  Next payload is 0
*Mar 1 02:25:37.115: ISAKMP (0:12): processing vendor id payload
*Mar 1 02:25:37.115: ISAKMP (0:12): vendor ID seems Unity/DPD but
  major 157 mismatch
*Mar 1 02:25:37.115: ISAKMP (0:12): vendor ID is NAT-T v3
*Mar 1 02:25:37.115: ISAKMP (0:12): processing vendor id payload
*Mar 1 02:25:37.115: ISAKMP (0:12): vendor ID seems Unity/DPD but
  major 123 mismatch
*Mar 1 02:25:37.115: ISAKMP (0:12): vendor ID is NAT-T v2
*Mar 1 02:25:37.115: ISAKMP (0:12): Input = IKE_MSG_INTERNAL,
  IKE_PROCESS_MAIN_MODE
*Mar 1 02:25:37.115: ISAKMP (0:12): Old State = IKE_R_MM1
  New State = IKE_R_MM1

*Mar 1 02:25:37.115: ISAKMP (0:12): constructed NAT-T vendor-03 ID
```

*Mar 1 02:25:37.115: ISAKMP (0:12): sending packet to 209.168.202.131
my_port 500 peer_port 500 (R) MM_SA_SETUP

*Mar 1 02:25:37.115: ISAKMP (0:12): Input = IKE_MSG_INTERNAL,
IKE_PROCESS_COMPLETE

*Mar 1 02:25:37.115: ISAKMP (0:12): Old State = IKE_R_MM1
New State = IKE_R_MM2

*Mar 1 02:25:37.123: ISAKMP (0:12): received packet from 209.168.202.131
dport 500 sport 500 Global (R) MM_SA_SETUP

*Mar 1 02:25:37.123: ISAKMP (0:12): Input = IKE_MSG_FROM_PEER,
IKE_MM_EXCH

*Mar 1 02:25:37.123: ISAKMP (0:12): Old State = IKE_R_MM2
New State = IKE_R_MM3

*Mar 1 02:25:37.123: ISAKMP (0:12): processing KE payload.
message ID = 0

*Mar 1 02:25:37.131: ISAKMP (0:12): processing NONCE payload.
message ID = 0

***Mar 1 02:25:37.131: ISAKMP: Looking for a matching key for
209.168.202.131 in default : success**

***Mar 1 02:25:37.131: ISAKMP (0:12): found peer pre-shared key matching
209.168.202.131**

***Mar 1 02:25:37.131: ISAKMP: Looking for a matching key for
209.168.202.131 in default : success**

***Mar 1 02:25:37.131: ISAKMP (0:12): found peer pre-shared key
matching 209.168.202.131**

*Mar 1 02:25:37.135: ISAKMP (0:12): SKEYID state generated

*Mar 1 02:25:37.135: ISAKMP (0:12): processing vendor id payload

*Mar 1 02:25:37.135: ISAKMP (0:12): vendor ID is Unity

*Mar 1 02:25:37.135: ISAKMP (0:12): processing vendor id payload

*Mar 1 02:25:37.135: ISAKMP (0:12): vendor ID is DPD

*Mar 1 02:25:37.135: ISAKMP (0:12): processing vendor id payload

*Mar 1 02:25:37.135: ISAKMP (0:12): speaking to another IOS box!

*Mar 1 02:25:37.135: ISAKMP:received payload type 17

*Mar 1 02:25:37.135: ISAKMP:received payload type 17

*Mar 1 02:25:37.135: ISAKMP (0:12): Input = IKE_MSG_INTERNAL,
IKE_PROCESS_MAIN_MODE

*Mar 1 02:25:37.135: ISAKMP (0:12): Old State = IKE_R_MM3
New State = IKE_R_MM3

*Mar 1 02:25:37.135: ISAKMP (0:12): sending packet to 209.168.202.131
my_port 500 peer_port 500 (R) MM_KEY_EXCH

*Mar 1 02:25:37.135: ISAKMP (0:12): Input = IKE_MSG_INTERNAL,
IKE_PROCESS_COMPLETE

*Mar 1 02:25:37.135: ISAKMP (0:12): Old State = IKE_R_MM3
New State = IKE_R_MM4

*Mar 1 02:25:37.147: ISAKMP (0:12): received packet from 209.168.202.131
dport 500 sport 500 Global (R) MM_KEY_EXCH

*Mar 1 02:25:37.151: ISAKMP (0:12): Input = IKE_MSG_FROM_PEER,
IKE_MM_EXCH

*Mar 1 02:25:37.151: ISAKMP (0:12): Old State = IKE_R_MM4
New State = IKE_R_MM5

*Mar 1 02:25:37.151: ISAKMP (0:12): processing ID payload.
message ID = 0

*Mar 1 02:25:37.151: ISAKMP (0:12): peer matches *none* of the profiles

*Mar 1 02:25:37.151: ISAKMP (0:12): processing HASH payload.
message ID = 0

*Mar 1 02:25:37.151: ISAKMP (0:12): processing NOTIFY INITIAL_CONTACT
protocol 1 spi 0, message ID = 0, sa = 63B38288

*Mar 1 02:25:37.151: ISAKMP (0:12): Process initial contact,
bring down existing phase 1 and 2 SA's with local 209.168.202.130
remote 209.168.202.131 remote port 500

*Mar 1 02:25:37.151: ISAKMP (0:12): SA has been authenticated with
209.168.202.131

*Mar 1 02:25:37.151: ISAKMP (0:12): peer matches *none* of the profiles
*Mar 1 02:25:37.151: ISAKMP (0:12): Input = IKE_MESG_INTERNAL,
IKE_PROCESS_MAIN_MODE
*Mar 1 02:25:37.151: ISAKMP (0:12): Old State = IKE_R_MM5
New State = IKE_R_MM5

*Mar 1 02:25:37.151: IPSEC(key_engine): got a queue event...
*Mar 1 02:25:37.151: ISAKMP (0:12): SA is doing pre-shared key
authentication using id type ID_IPV4_ADDR
*Mar 1 02:25:37.151: ISAKMP (12): ID payload
next-payload : 8
type : 1
addr : 209.168.202.130
protocol : 17
port : 500
length : 8
*Mar 1 02:25:37.151: ISAKMP (12): Total payload length: 12
*Mar 1 02:25:37.155: ISAKMP (0:12): sending packet to 209.168.202.131
my_port 500 peer_port 500 (R) MM_KEY_EXCH
*Mar 1 02:25:37.155: ISAKMP (0:12): Input = IKE_MESG_INTERNAL,
IKE_PROCESS_COMPLETE
*Mar 1 02:25:37.155: ISAKMP (0:12): Old State = IKE_R_MM5
New State = IKE_P1_COMPLETE

*Mar 1 02:25:37.155: ISAKMP (0:12): Input = IKE_MESG_INTERNAL,
IKE_PHASE1_COMPLETE
*Mar 1 02:25:37.155: ISAKMP (0:12): Old State = IKE_P1_COMPLETE
New State = IKE_P1_COMPLETE

*Mar 1 02:25:37.159: ISAKMP (0:12): received packet from 209.168.202.131
dport 500 sport 500 Global (R) QM_IDLE
*Mar 1 02:25:37.159: ISAKMP: set new node -1682446278 to QM_IDLE
*Mar 1 02:25:37.159: ISAKMP (0:12): processing HASH payload.
message ID = -1682446278
*Mar 1 02:25:37.159: ISAKMP (0:12): processing SA payload.
message ID = -1682446278
*Mar 1 02:25:37.159: ISAKMP (0:12): Checking IPsec proposal 1
*Mar 1 02:25:37.159: ISAKMP: transform 1, ESP_3DES
*Mar 1 02:25:37.159: ISAKMP: attributes in transform:
*Mar 1 02:25:37.159: ISAKMP: encaps is 1
*Mar 1 02:25:37.159: ISAKMP: SA life type in seconds
*Mar 1 02:25:37.159: ISAKMP: SA life duration (basic) of 120
*Mar 1 02:25:37.159: ISAKMP: SA life type in kilobytes
*Mar 1 02:25:37.159: ISAKMP: SA life duration (VPI) of 0x0 0x46 0x50 0x0
*Mar 1 02:25:37.159: ISAKMP: authenticator is HMAC-MD5
*Mar 1 02:25:37.159: ISAKMP (0:12): atts are acceptable.
*Mar 1 02:25:37.163: IPSEC(validate_proposal_request): proposal part #1,
(key eng. msg.) INBOUND local= 209.168.202.130, remote= 209.168.202.131,
local_proxy= 209.168.202.130/255.255.255.255/47/0 (type=1),
remote_proxy= 209.168.202.131/255.255.255.255/47/0 (type=1),
protocol= ESP, transform= esp-3des esp-md5-hmac ,
lifedur= 0s and 0kb,
spi= 0x0(0), conn_id= 0, keysize= 0, flags= 0x2
*Mar 1 02:25:37.163: IPSEC(kei_proxy): head = Tunnel0-head-0,
map->ivrf = , kei->ivrf =
*Mar 1 02:25:37.163: IPSEC(kei_proxy): head = Tunnel0-head-0,
map->ivrf = , kei->ivrf =
*Mar 1 02:25:37.163: ISAKMP (0:12): processing NONCE payload.
message ID = -1682446278
*Mar 1 02:25:37.163: ISAKMP (0:12): processing ID payload.
message ID = -1682446278
*Mar 1 02:25:37.163: ISAKMP (0:12): processing ID payload.
message ID = -1682446278
*Mar 1 02:25:37.163: ISAKMP (0:12): asking for 1 spis from ipsec
*Mar 1 02:25:37.163: ISAKMP (0:12): Node -1682446278,
Input = IKE_MESG_FROM_PEER, IKE_QM_EXCH

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*Mar 1 02:25:37.163: ISAKMP (0:12): Old State = IKE_QM_READY
  New State = IKE_QM_SPI_STARVE
*Mar 1 02:25:37.163: IPSEC(key_engine): got a queue event...
*Mar 1 02:25:37.163: IPSEC(spi_response): getting spi 3935077313
  for SA from 209.168.202.130 to 209.168.202.131 for prot 3
*Mar 1 02:25:37.163: ISAKMP: received ke message (2/1)
*Mar 1 02:25:37.415: ISAKMP (0:12): sending packet to 209.168.202.131
  my_port 500 peer_port 500 (R) QM_IDLE
*Mar 1 02:25:37.415: ISAKMP (0:12): Node -1682446278,
  Input = IKE_MSG_FROM_IPSEC, IKE_SPI_REPLY
*Mar 1 02:25:37.415: ISAKMP (0:12): Old State = IKE_QM_SPI_STARVE
  New State = IKE_QM_R_QM2
*Mar 1 02:25:37.427: ISAKMP (0:12): received packet from
  209.168.202.131 dport 500 sport 500 Global (R) QM_IDLE
*Mar 1 02:25:37.439: ISAKMP (0:12): Creating IPsec SAs
*Mar 1 02:25:37.439: inbound SA from 209.168.202.131 to
  209.168.202.130 (f/i) 0/ 0
(proxy 209.168.202.131 to 209.168.202.130)
*Mar 1 02:25:37.439: has spi 0xEA8C83C1 and conn_id 5361 and flags 2
*Mar 1 02:25:37.439: lifetime of 120 seconds
*Mar 1 02:25:37.439: lifetime of 4608000 kilobytes
*Mar 1 02:25:37.439: has client flags 0x0
*Mar 1 02:25:37.439: outbound SA from 209.168.202.130 to
  209.168.202.131 (f/i) 0/ 0 (proxy 209.168.202.130 to 209.168.202.131)
*Mar 1 02:25:37.439: has spi 1849847934 and conn_id 5362 and flags A
*Mar 1 02:25:37.439: lifetime of 120 seconds
*Mar 1 02:25:37.439: lifetime of 4608000 kilobytes
*Mar 1 02:25:37.439: has client flags 0x0
*Mar 1 02:25:37.439: ISAKMP (0:12): deleting node -1682446278 error
  FALSE reason "quick mode done (await)"
*Mar 1 02:25:37.439: ISAKMP (0:12): Node -1682446278,
  Input = IKE_MSG_FROM_PEER, IKE_QM_EXCH
*Mar 1 02:25:37.439: ISAKMP (0:12): Old State = IKE_QM_R_QM2
  New State = IKE_QM_PHASE2_COMPLETE
*Mar 1 02:25:37.439: IPSEC(key_engine): got a queue event...
*Mar 1 02:25:37.439: IPSEC(initialize_sas): ,
(key eng. msg.) INBOUND local= 209.168.202.130, remote= 209.168.202.131,
local_proxy= 209.168.202.130/0.0.0.0/47/0 (type=1),
remote_proxy= 209.168.202.131/0.0.0.0/47/0 (type=1),
protocol= ESP, transform= esp-3des esp-md5-hmac ,
lifedur= 120s and 4608000kb,
spi= 0xEA8C83C1(3935077313), conn_id= 5361, keysize= 0, flags= 0x2
*Mar 1 02:25:37.439: IPSEC(initialize_sas): ,
(key eng. msg.) OUTBOUND local= 209.168.202.130, remote= 209.168.202.131,
local_proxy= 209.168.202.130/0.0.0.0/47/0 (type=1),
remote_proxy= 209.168.202.131/0.0.0.0/47/0 (type=1),
protocol= ESP, transform= esp-3des esp-md5-hmac ,
lifedur= 120s and 4608000kb,
spi= 0x6E42707E(1849847934), conn_id= 5362, keysize= 0, flags= 0xA
*Mar 1 02:25:37.439: IPSEC(kei_proxy): head = Tunnel0-head-0,
  map->ivrf = , kei->ivrf =
*Mar 1 02:25:37.439: IPSEC(kei_proxy): head = Tunnel0-head-0,
  map->ivrf = , kei->ivrf =
*Mar 1 02:25:37.439: IPSEC(add mtree): src 209.168.202.130,
  dest 209.168.202.131, dest_port 0

*Mar 1 02:25:37.439: IPSEC(create_sa): sa created,
(sa) sa_dest= 209.168.202.130, sa_prot= 50,
sa_spi= 0xEA8C83C1(3935077313),
sa_trans= esp-3des esp-md5-hmac , sa_conn_id= 5361
*Mar 1 02:25:37.439: IPSEC(create_sa): sa created,
(sa) sa_dest= 209.168.202.131, sa_prot= 50,
sa_spi= 0x6E42707E(1849847934),
sa_trans= esp-3des esp-md5-hmac , sa_conn_id= 5362
sv9-4#
*Mar 1 02:25:55.183: ISAKMP (0:10): purging node 180238748

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*Mar 1 02:25:55.323: ISAKMP (0:10): purging node -1355110639
sv9-4#

sv9-3#

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05:50:48: ISAKMP: received ke message (1/1)
05:50:48: ISAKMP (0:0): SA request profile is (NULL)
05:50:48: ISAKMP: local port 500, remote port 500
05:50:48: ISAKMP: set new node 0 to QM_IDLE
05:50:48: ISAKMP: insert sa successfully sa = 62DB93D0
05:50:48: ISAKMP (0:26): Can not start Aggressive mode, trying Main mode.
05:50:48: ISAKMP: Looking for a matching key for 209.168.202.130
    in default : success
05:50:48: ISAKMP (0:26): found peer pre-shared key
    matching 209.168.202.130
05:50:48: ISAKMP (0:26): constructed NAT-T vendor-03 ID
05:50:48: ISAKMP (0:26): constructed NAT-T vendor-02 ID
05:50:48: ISAKMP (0:26): Input = IKE_MSG_FROM_IPSEC, IKE_SA_REQ_MM
05:50:48: ISAKMP (0:26): Old State = IKE_READY New State = IKE_I_MM1

05:50:48: ISAKMP (0:26): beginning Main Mode exchange
05:50:48: ISAKMP (0:26): sending packet to 209.168.202.130 my_port 500
    peer_port 500 (I) MM_NO_STATE
05:50:48: ISAKMP (0:26): received packet from 209.168.202.130 dport 500
    sport 500 Global (I) MM_NO_STATE
05:50:48: ISAKMP (0:26): Input = IKE_MSG_FROM_PEER, IKE_MM_EXCH
05:50:48: ISAKMP (0:26): Old State = IKE_I_MM1 New State = IKE_I_MM2

05:50:48: ISAKMP (0:26): processing SA payload. message ID = 0
05:50:48: ISAKMP (0:26): processing vendor id payload
05:50:48: ISAKMP (0:26): vendor ID seems Unity/DPD
    but major 157 mismatch
05:50:48: ISAKMP (0:26): vendor ID is NAT-T v3
05:50:48: ISAKMP: Looking for a matching key for 209.168.202.130
    in default : success
05:50:48: ISAKMP (0:26): found peer pre-shared key
    matching 209.168.202.130
05:50:48: ISAKMP (0:26): local preshared key found
05:50:48: ISAKMP : Scanning profiles for xauth ...
05:50:48: ISAKMP (0:26): Checking ISAKMP transform 1 against
    priority 10 policy
05:50:48: ISAKMP: encryption DES-CBC
05:50:48: ISAKMP: hash MD5
05:50:48: ISAKMP: default group 1
05:50:48: ISAKMP: auth pre-share
05:50:48: ISAKMP: life type in seconds
05:50:48: ISAKMP: life duration (VPI) of 0x0 0x1 0x51 0x80
05:50:48: ISAKMP (0:26): atts are acceptable. Next payload is 0
05:50:48: ISAKMP (0:26): processing vendor id payload
05:50:48: ISAKMP (0:26): vendor ID seems Unity/DPD
    but major 157 mismatch
05:50:48: ISAKMP (0:26): vendor ID is NAT-T v3
05:50:48: ISAKMP (0:26): Input = IKE_MSG_INTERNAL,
    IKE_PROCESS_MAIN_MODE
05:50:48: ISAKMP (0:26): Old State = IKE_I_MM2
    New State = IKE_I_MM2

05:50:48: ISAKMP (0:26): sending packet to 209.168.202.130 my_port 500
    peer_port 500 (I) MM_SA_SETUP
05:50:48: ISAKMP (0:26): Input = IKE_MSG_INTERNAL, IKE_PROCESS_COMPLETE
05:50:48: ISAKMP (0:26): Old State = IKE_I_MM2 New State = IKE_I_MM3

05:50:48: ISAKMP (0:26): received packet from 209.168.202.130 dport 500
    sport 500 Global (I) MM_SA_SETUP
05:50:48: ISAKMP (0:26): Input = IKE_MSG_FROM_PEER, IKE_MM_EXCH
05:50:48: ISAKMP (0:26): Old State = IKE_I_MM3 New State = IKE_I_MM4
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05:50:48: ISAKMP (0:26): processing KE payload. message ID = 0
05:50:48: ISAKMP (0:26): processing NONCE payload. message ID = 0
05:50:48: ISAKMP: Looking for a matching key for 209.168.202.130
in default : success
05:50:48: ISAKMP (0:26): found peer pre-shared key
matching 209.168.202.130
05:50:48: ISAKMP: Looking for a matching key for 209.168.202.130
in default : success
05:50:48: ISAKMP (0:26): found peer pre-shared key
matching 209.168.202.130
05:50:48: ISAKMP (0:26): SKEYID state generated
05:50:48: ISAKMP (0:26): processing vendor id payload
05:50:48: ISAKMP (0:26): vendor ID is Unity
05:50:48: ISAKMP (0:26): processing vendor id payload
05:50:48: ISAKMP (0:26): vendor ID is DPD
05:50:48: ISAKMP (0:26): processing vendor id payload
05:50:48: ISAKMP (0:26): speaking to another IOS box!
05:50:48: ISAKMP:received payload type 17
05:50:48: ISAKMP:received payload type 17
05:50:48: ISAKMP (0:26): Input = IKE_MESG_INTERNAL,
IKE_PROCESS_MAIN_MODE
05:50:48: ISAKMP (0:26): Old State = IKE_I_MM4
New State = IKE_I_MM4

05:50:48: ISAKMP (0:26): Send initial contact
05:50:48: ISAKMP (0:26): SA is doing pre-shared key authentication
using id type ID_IPV4_ADDR
05:50:48: ISAKMP (26): ID payload
next-payload : 8
type : 1
addr : 209.168.202.131
protocol : 17
port : 500
length : 8
05:50:48: ISAKMP (26): Total payload length: 12
05:50:48: ISAKMP (0:26): sending packet to 209.168.202.130 my_port 500
peer_port 500 (I) MM_KEY_EXCH
05:50:48: ISAKMP (0:26): Input = IKE_MESG_INTERNAL,
IKE_PROCESS_COMPLETE
05:50:48: ISAKMP (0:26): Old State = IKE_I_MM4
New State = IKE_I_MM5

05:50:48: ISAKMP (0:26): received packet from 209.168.202.130 dport 500
sport 500 Global (I) MM_KEY_EXCH
05:50:48: ISAKMP (0:26): Input = IKE_MESG_FROM_PEER,
IKE_MM_EXCH
05:50:48: ISAKMP (0:26): Old State = IKE_I_MM5
New State = IKE_I_MM6

05:50:48: ISAKMP (0:26): processing ID payload. message ID = 0
05:50:48: ISAKMP (0:26): processing HASH payload. message ID = 0
05:50:48: ISAKMP (0:26): SA has been authenticated with 209.168.202.130
05:50:48: ISAKMP (0:26): peer matches *none* of the profiles
05:50:48: ISAKMP (0:26): Input = IKE_MESG_INTERNAL,
IKE_PROCESS_MAIN_MODE
05:50:48: ISAKMP (0:26): Old State = IKE_I_MM6
New State = IKE_I_MM6

05:50:48: ISAKMP (0:26): Input = IKE_MESG_INTERNAL,
IKE_PROCESS_COMPLETE
05:50:48: ISAKMP (0:26): Old State = IKE_I_MM6
New State = IKE_P1_COMPLETE

05:50:48: ISAKMP (0:26): beginning Quick Mode exchange,
M-ID of -1682446278

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05:50:48: ISAKMP (0:26): sending packet to 209.168.202.130 my_port 500
peer_port 500 (I) QM_IDLE
05:50:48: ISAKMP (0:26): Node -1682446278, Input = IKE_MSG_INTERNAL,
IKE_INIT_QM
05:50:48: ISAKMP (0:26): Old State = IKE_QM_READY
New State = IKE_QM_I_QM1
05:50:48: ISAKMP (0:26): Input = IKE_MSG_INTERNAL,
IKE_PHASE1_COMPLETE
05:50:48: ISAKMP (0:26): Old State = IKE_P1_COMPLETE
New State = IKE_P1_COMPLETE

05:50:48: ISAKMP (0:26): received packet from 209.168.202.130 dport 500
sport 500 Global (I) QM_IDLE
05:50:48: ISAKMP (0:26): processing HASH payload.
message ID = -1682446278
05:50:48: ISAKMP (0:26): processing SA payload.
message ID = -1682446278
05:50:48: ISAKMP (0:26): Checking IPsec proposal 1
05:50:48: ISAKMP: transform 1, ESP_3DES
05:50:48: ISAKMP: attributes in transform:
05:50:48: ISAKMP: encaps is 1
05:50:48: ISAKMP: SA life type in seconds
05:50:48: ISAKMP: SA life duration (basic) of 120
05:50:48: ISAKMP: SA life type in kilobytes
05:50:48: ISAKMP: SA life duration (VPI) of 0x0 0x46 0x50 0x0
05:50:48: ISAKMP: authenticator is HMAC-MD5
05:50:48: ISAKMP (0:26): atts are acceptable.
05:50:48: IPSEC(validate_proposal_request): proposal part #1,
(key eng. msg.) INBOUND local= 209.168.202.131,
remote= 209.168.202.130,
local_proxy= 209.168.202.131/255.255.255.255/47/0 (type=1),
remote_proxy= 209.168.202.130/255.255.255.255/47/0 (type=1),
protocol= ESP, transform= esp-3des esp-md5-hmac ,
lifedur= 0s and 0kb,
spi= 0x0(0), conn_id= 0, keysize= 0, flags= 0x2
05:50:48: IPSEC(kei_proxy): head = Tunnel0-head-0,
map->ivrf = , kei->ivrf =
05:50:48: IPSEC(kei_proxy): head = Tunnel0-head-0,
map->ivrf = , kei->ivrf =
05:50:48: ISAKMP (0:26): processing NONCE payload.
message ID = -1682446278
05:50:48: ISAKMP (0:26): processing ID payload.
message ID = -1682446278
05:50:48: ISAKMP (0:26): processing ID payload.
message ID = -1682446278
05:50:48: ISAKMP (0:26): Creating IPsec SAs
05:50:48: inbound SA from 209.168.202.130 to
209.168.202.131 (f/i) 0/ 0
(proxy 209.168.202.130 to 209.168.202.131)
05:50:48: has spi 0x6E42707E and conn_id 5547 and flags 2
05:50:48: lifetime of 120 seconds
05:50:48: lifetime of 4608000 kilobytes
05:50:48: has client flags 0x0
05:50:48: outbound SA from 209.168.202.131 to 209.168.202.130
(f/i) 0/ 0 (proxy 209.168.202.131 to 209.168.202.130)
05:50:48: has spi -359889983 and conn_id 5548 and flags A
05:50:48: lifetime of 120 seconds
05:50:48: lifetime of 4608000 kilobytes
05:50:48: has client flags 0x0
05:50:48: IPSEC(key_engine): got a queue event...
05:50:48: IPSEC(initialize_sas): ,
(key eng. msg.) INBOUND local= 209.168.202.131,
remote= 209.168.202.130,
local_proxy= 209.168.202.131/0.0.0.0/47/0 (type=1),
remote_proxy= 209.168.202.130/0.0.0.0/47/0 (type=1),
protocol= ESP, transform= esp-3des esp-md5-hmac ,
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lifedur= 120s and 4608000kb,
spi= 0x6E42707E(1849847934), conn_id= 5547, keysize= 0, flags= 0x2
05:50:48: IPSEC(initialize_sas): ,
(key eng. msg.) OUTBOUND local= 209.168.202.131,
remote= 209.168.202.130,
local_proxy= 209.168.202.131/0.0.0.0/47/0 (type=1),
remote_proxy= 209.168.202.130/0.0.0.0/47/0 (type=1),
protocol= ESP, transform= esp-3des esp-md5-hmac ,
lifedur= 120s and 4608000kb,
spi= 0xEA8C83C1(3935077313), conn_id= 5548, keysize= 0, flags= 0xA
05:50:48: IPSEC(kei_proxy): head = Tunnel0-head-0,
map->ivrf = , kei->ivrf =
05:50:48: IPSEC(kei_proxy): head = Tunnel0-head-0,
map->ivrf = , kei->ivrf =
05:50:48: IPSEC(add mtree): src 209.168.202.131, dest 209.168.202.130,
dest_port 0

05:50:48: IPSEC(create_sa): sa created,
(sa) sa_dest= 209.168.202.131, sa_prot= 50,
sa_spi= 0x6E42707E(1849847934),
sa_trans= esp-3des esp-md5-hmac , sa_conn_id= 5547
05:50:48: IPSEC(create_sa): sa created,
(sa) sa_dest= 209.168.202.130, sa_prot= 50,
sa_spi= 0xEA8C83C1(3935077313),
sa_trans= esp-3des esp-md5-hmac , sa_conn_id= 5548
05:50:48: ISAKMP (0:26): sending packet to 209.168.202.130 my_port 500
peer_port 500 (I) QM_IDLE
05:50:48: ISAKMP (0:26): deleting node -1682446278 error FALSE reason ""
05:50:48: ISAKMP (0:26): Node -1682446278, Input = IKE_MSG_FROM_PEER,
IKE_QM_EXCH
05:50:48: ISAKMP (0:26): Old State = IKE_QM_I_QM1
New State = IKE_QM_PHASE2_COMPLETE
05:50:49: ISAKMP (0:21): purging node 334570133
sv9-3#
```

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