

# Configuring GRE Over IPSec Between a Cisco IOS Router and a VPN 5000 Concentrator Using RIP and CVC

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Cisco has announced the end of sales for the Cisco VPN 5000 Series Concentrators. For more information, please see the End-of-Sales Announcement.

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## Introduction

This sample configuration describes how to configure Generic Routing Encapsulation (GRE) over IPSec between a Cisco VPN 5000 Concentrator and a Cisco IOS® router. The GRE-over-IPSec feature is introduced in the VPN 5000 Concentrator 6.0(19) software release.

The Routing Information Protocol (RIP) is used as the dynamic routing protocol in this sample to route traffic across the VPN tunnel.

## Prerequisites

### Requirements

There are no specific requirements for this document.

### Components Used

The information in this document is based on these software and hardware versions:

- Cisco IOS Software Release 12.1(5)T7
- VPN 5000 Concentrator Software Release 6.0(19)

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, make sure

that you understand the potential impact of any command.

## Conventions

For more information on document conventions, refer to Cisco Technical Tips Conventions.

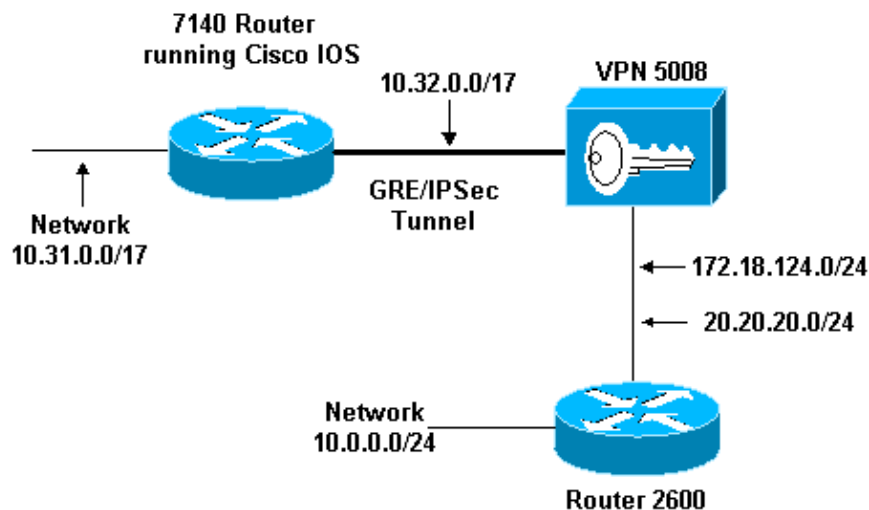
## Configure

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 this diagram.



GRE over IPsec is configured between the Cisco IOS router (7140) and the Cisco VPN 5008 Concentrator. Behind these devices, multiple networks are advertised via RIP, which runs within the GRE tunnel between 7140 and VPN 5008.

Networks behind the Cisco 7140 are:

- 10.31.0.0/17

Networks behind the VPN 5008 are:

- 172.18.124.0.0/24
- 20.20.20.0/24
- 10.0.0.0/24

## Configurations

This document uses the configurations shown here.

- Cisco IOS Router
- VPN 5000 Concentrator
- CVC

### Cisco IOS Router

```

Building configuration...

Current configuration : 1607 bytes
!
version 12.1
no service single-slot-reload-enable
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname 03-vpn-7140
!
boot system flash disk1:c7100-ik8s-mz.122-3
logging rate-limit console 10 except errors
enable password <removed>
!
ip subnet-zero
ip cef
!
!
no ip finger
!
!
!--- Define phase 1 policy.

crypto isakmp policy 10
authentication pre-share

!--- Define the PreShared Key for the Remote peer
!--- (5000 ) in this example.

crypto isakmp key cisco123 address 10.32.1.161
!

!--- Define Phase 2 policy.
!--- Make sure that Transport Mode is enabled.

crypto ipsec transform-set www esp-des esp-sha-hmac
mode transport
!

!--- Define the crypto map that is later
!--- applied on the outbound interface.

crypto map temp 10 ipsec-isakmp
set peer 10.32.1.161
set transform-set www
match address 100
!
call rsvp-sync
!
!
!
!
!
!
!
controller ISA 5/1

```

```

!

!--- Define the GRE tunnel on the router.
!--- Tunnel source is the outbound interface
!--- and tunnel destination is VPN 5000.

interface Tunnel0
ip address 10.1.1.2 255.255.255.0
tunnel source FastEthernet0/0
tunnel destination 10.32.1.161
crypto map temp
!

!--- Outbound Interface that is connected to the Internet.

interface FastEthernet0/0
ip address 10.32.1.162 255.255.128.0
duplex auto
speed auto
crypto map temp
!
!
!--- Inside interface.

interface FastEthernet0/1
ip address 10.31.100.1 255.255.128.0
no keepalive
duplex auto
speed auto
!
interface Serial1/0
no ip address
shutdown
framing c-bit
cablelength 10
dsu bandwidth 44210
!
interface Serial1/1
no ip address
shutdown
framing c-bit
cablelength 10
dsu bandwidth 44210
!

!--- Define RIP Routing Protocol on the router.
!--- This example shows Version 2 for classless routing.

router rip
version 2
network 10.0.0.0
no auto-summary
!
ip classless
ip route 0.0.0.0 0.0.0.0 10.32.1.1
no ip http server
!

!--- Encryption access-list that is used
!--- to encrypt the GRE packets.

access-list 100 permit gre host 10.32.1.162 host 10.32.1.161
!
!
line con 0
exec-timeout 0 0

```

```
transport input none
line aux 0
line vty 5 15
!
end
```

### VPN 5000 Concentrator

```
show configuration
Edited Configuration not Present, using Running
[ IP Ethernet 0:0 ]
SubnetMask = 255.255.255.0
IPAddress = 1.1.1.1

[ IP Ethernet 1:0 ]Mode = Routed
SubnetMask = 255.255.128.0
IPAddress = 10.32.1.161

[ General ]
VPNGateway = 10.32.1.1
EnablePassword = <removed>
Password = <removed>
EthernetAddress = 00:00:a5:e9:c8:00
DeviceType = VPN 5002/8 Concentrator
ConfiguredOn = Timeserver not configured
ConfiguredFrom = Command Line, from Console

[ IKE Policy ]
Protection = SHA_DES_G1

[ IP Static ]
0.0.0.0 0.0.0.0 10.32.1.1 1 redistrib=none

[ Context List ]
flash://rip.cfg

[ Logging ]
Enabled = On
Level = 7

Configuration size is 822 out of 65500 bytes.
VPN5002_8_A5E9C800: Main#
```

### CVC

```
show configuration
Edited Configuration not Present, using Running

[ General ]
Context = "rip"

[ IP Ethernet 1:0.1 ]
VLANID = 124
Encapsulation = dot1q
Mode = Routed
SubnetMask = 255.255.255.0
IPAddress = 172.18.124.219

[ IP Static ]

[ Tunnel Partner VPN 1 ]
InactivityTimeout = 120
Transform = esp sha,des
```

```

KeyManage = ReliablePeer = "10.31.0.0/17"
LocalAccess = "10.5.1.0/24"
SharedKey = "cisco123"
Mode = Main
TunnelType = GREinIPSec
BindTo = "Ethernet 1:0"
Partner = 10.32.1.162

[ IP VPN 1 ]
RIPIn = On
RIPOut = On
RIPVersion = V2
DirectedBroadcast = Off
Numbered = On
Mode = Routed
SubnetMask = 255.255.255.0
IPAddress = 10.1.1.1

[ IP Ethernet 1:0.2 ]
Mode = Routed
SubnetMask = 255.255.255.0
IPAddress = 20.20.20.20

Configuration size is 1127 out of 65500 bytes.

VPN5002_8_A5E9C800: rip#

```

## 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 ip route** Shows the current state of the routing table.
- **show crypto engine connection active** Shows the packet encryption/decryption counter per IPSec security association.
- **show crypto ipsec sa** Shows all current IPSec security associations.
- **show system log buffer** Shows basic syslog information.
- **vpn trace dump** Shows detailed information on VPN processes.

```
03-vpn-7140#show ip route
```

```

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

```

```
Gateway of last resort is 10.32.1.1 to network 0.0.0.0
```

```
20.0.0.0/24 is subnetted, 1 subnets
```

```
R 20.20.20.0 [120/1] via 10.1.1.1, 00:00:10, Tunnel0
```

```
172.18.0.0/16 is variably subnetted, 2 subnets, 2 masks
```

```
R 172.18.124.0/24 [120/1] via 10.1.1.1, 00:00:10, Tunnel0
```

```
10.0.0.0/8 is variably subnetted, 4 subnets, 2 masks
```

```
R 10.0.0.0/24 [120/2] via 10.1.1.1, 00:00:10, Tunnel0
```

```
C 10.1.1.0/24 is directly connected, Tunnel0
```

```
C 10.31.0.0/17 is directly connected, FastEthernet0/1
```

```
C 10.32.0.0/17 is directly connected, FastEthernet0/0
```

S\* 0.0.0.0/0 [1/0] via 10.32.1.1  
03-vpn-7140#

03-vpn-7140#show crypto engine connection active

```
ID Interface IP-Address State Algorithm Encrypt Decrypt
3 FastEthernet0/0 10.32.1.162 set HMAC_SHA+DES_56_CB 0 0
4 FastEthernet0/0 10.32.1.162 set HMAC_SHA+DES_56_CB 0 0
5 FastEthernet0/0 10.32.1.162 set HMAC_SHA+DES_56_CB 0 0
2098 FastEthernet0/0 10.32.1.162 set HMAC_SHA+DES_56_CB 0 1892
2099 FastEthernet0/0 10.32.1.162 set HMAC_SHA+DES_56_CB 11552 0
```

03-vpn-7140#show crypto ipsec sa

```
interface: FastEthernet0/0
Crypto map tag: temp, local addr. 10.32.1.162

local ident (addr/mask/prot/port): (10.32.1.162/255.255.255.255/0/0)
remote ident (addr/mask/prot/port): (10.32.1.161/255.255.255.255/0/0)
current_peer: 10.32.1.161
PERMIT, flags={transport_parent,}
#pkts encaps: 0, #pkts encrypt: 0, #pkts digest 0
#pkts decaps: 0, #pkts decrypt: 0, #pkts verify 0
#pkts compressed: 0, #pkts decompressed: 0
#pkts not compressed: 0, #pkts compr. failed: 0, #pkts decompress failed: 0
#send errors 0, #recv errors 0
```

```
local crypto endpt.: 10.32.1.162, remote crypto endpt.: 10.32.1.161
path mtu 1500, media mtu 1500
current outbound spi: 0
```

inbound esp sas:

inbound ah sas:

inbound pcp sas:

outbound esp sas:

outbound ah sas:

outbound pcp sas:

```
local ident (addr/mask/prot/port): (10.32.1.162/255.255.255.255/47/0)
remote ident (addr/mask/prot/port): (10.32.1.161/255.255.255.255/47/0)
current_peer: 10.32.1.161
PERMIT, flags={origin_is_acl,transport_parent,}
#pkts encaps: 12912, #pkts encrypt: 12912, #pkts digest 12912
#pkts decaps: 2382, #pkts decrypt: 2382, #pkts verify 2382
#pkts compressed: 0, #pkts decompressed: 0
#pkts not compressed: 0, #pkts compr. failed: 0, #pkts decompress failed: 0
#send errors 0, #recv errors 0
```

```
local crypto endpt.: 10.32.1.162, remote crypto endpt.: 10.32.1.161
path mtu 1500, media mtu 1500
current outbound spi: 101
```

inbound esp sas:

spi: 0x4624F3AD(1176826797)

transform: esp-des esp-sha-hmac ,

in use settings ={Transport, }

slot: 0, conn id: 2098, flow\_id: 69, crypto map: temp

sa timing: remaining key lifetime (k/sec): (1048130/3179)  
IV size: 8 bytes  
replay detection support: Y

inbound ah sas:

inbound pcp sas:

outbound esp sas:  
spi: 0x101(257)  
transform: esp-des esp-sha-hmac ,  
in use settings ={Transport, }  
slot: 0, conn id: 2099, flow\_id: 70, crypto map: temp  
sa timing: remaining key lifetime (k/sec): (1046566/3179)  
IV size: 8 bytes  
replay detection support: Y

outbound ah sas:

outbound pcp sas:

interface: Tunnel0  
Crypto map tag: temp, local addr. 10.32.1.162

local ident (addr/mask/prot/port): (10.32.1.162/255.255.255.255/0/0)  
remote ident (addr/mask/prot/port): (10.32.1.161/255.255.255.255/0/0)  
current\_peer: 10.32.1.161  
PERMIT, flags={transport\_parent,}  
#pkts encaps: 0, #pkts encrypt: 0, #pkts digest 0  
#pkts decaps: 0, #pkts decrypt: 0, #pkts verify 0  
#pkts compressed: 0, #pkts decompressed: 0  
#pkts not compressed: 0, #pkts compr. failed: 0, #pkts decompress failed: 0  
#send errors 0, #recv errors 0

local crypto endpt.: 10.32.1.162, remote crypto endpt.: 10.32.1.161  
path mtu 1500, media mtu 1500  
current outbound spi: 0

inbound esp sas:

inbound ah sas:

inbound pcp sas:

outbound esp sas:

outbound ah sas:

outbound pcp sas:

local ident (addr/mask/prot/port): (10.32.1.162/255.255.255.255/47/0)  
remote ident (addr/mask/prot/port): (10.32.1.161/255.255.255.255/47/0)  
current\_peer: 10.32.1.161  
PERMIT, flags={origin\_is\_acl,transport\_parent,}  
#pkts encaps: 13017, #pkts encrypt: 13017, #pkts digest 13017  
#pkts decaps: 2410, #pkts decrypt: 2410, #pkts verify 2410  
#pkts compressed: 0, #pkts decompressed: 0  
#pkts not compressed: 0, #pkts compr. failed: 0, #pkts decompress failed: 0  
#send errors 0, #recv errors 0

local crypto endpt.: 10.32.1.162, remote crypto endpt.: 10.32.1.161  
path mtu 1500, media mtu 1500



```

current outbound spi: 101

inbound esp sas:
spi: 0x4624F3AD(1176826797)
transform: esp-des esp-sha-hmac ,
in use settings ={Transport, }
slot: 0, conn id: 2098, flow_id: 69, crypto map: temp
sa timing: remaining key lifetime (k/sec): (1048124/3176)
IV size: 8 bytes
replay detection support: Y

inbound ah sas:

inbound pcp sas:

outbound esp sas:
spi: 0x101(257)
transform: esp-des esp-sha-hmac ,
in use settings ={Transport, }
slot: 0, conn id: 2099, flow_id: 70, crypto map: temp
sa timing: remaining key lifetime (k/sec): (1046566/3176)
IV size: 8 bytes
replay detection support: Y

outbound ah sas:

outbound pcp sas:

```

## Troubleshoot

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

## Troubleshooting Commands

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

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

- **debug crypto isakmp** (Cisco IOS Router) Displays detailed information on Internet Key Exchange (IKE) phase I (Main Mode) negotiation.
- **debug crypto ipsec** (Cisco IOS Router) Displays detailed information on IKE phase II (Quick Mode) negotiation.
- **debug crypto engine** (Cisco IOS Router) Debugs the packet encryption/decryption and Diffie–Hellman (DH) process.
- **debug ip rip** (Cisco IOS Router) Debugs the RIP routing protocol.

Issue the **show ip routing** command from the VPN 5000 Concentrator.

```

VPN5002_8_A5E9C800: rip#show ip routing

IP Routing Table for rip
Directly Connected Routes:
Destination Mask Ref Uses Type Interface
10.1.1.0 FFFFFFFF00 5 STIF VPN0:1
10.1.1.0 FFFFFFFF 0 STIF Local
10.1.1.1 @FFFFFFF 5 LocalLocal
10.1.1.255 FFFFFFFF 0 STIF Local
20.20.20.0 FFFFFFFF00 1352 STIF Ether1:0.2
20.20.20.0 FFFFFFFF 0 STIF Local

```

```
20.20.20.20 @FFFFFFFF 14 LocalLocal
20.20.20.255 FFFFFFFF 1318 STIF Local
127.0.0.1 FFFFFFFF 0 STIF Local
172.18.124.0 FFFFFFF0 13789 STIF Ether1:0.1
172.18.124.0 FFFFFFFF 0 STIF Local
172.18.124.219 @FFFFFFFF 6 LocalLocal
172.18.124.255 FFFFFFFF 13547 STIF Local
224.0.0.5 FFFFFFFF 0 STIF Local
224.0.0.6 FFFFFFFF 0 STIF Local
224.0.0.9 FFFFFFFF 15 STIF Local
255.255.255.255 @FFFFFFFF 221 LocalLocal
```

Static Routes:

```
Destination Mask Gateway Metric Ref Uses Type Interface
10.31.0.0 FFFF0000 Interface 1 0 Stat VPN0:1
10.32.1.162 @FFFFFFFF 10.32.1.161 2 0 *Stat VPN0:1
```

Dynamic Routes:

```
Src/
Destination Mask Gateway Metric Ref Uses Type TTL Interface
DEFAULT 10.1.1.2 1 293 RIP2 165 VPN0:1
10.0.0.0 FFFFFFF0 172.18.124.216 1 0 RIP1 160 Ether1:0.1
10.31.0.0 FFFF8000 10.1.1.2 1 0 RIP2 165 VPN0:1
10.32.0.0 FFFF8000 10.1.1.2 1 0 RIP2 165 VPN0:1
```

Configured IP Routes:

```
Destination Mask Gateway Metric IFnum Flags
10.31.0.0 FFFF0000 Interface 1 VPN 0:1 Redist = none
```

Total Routes in use: 23 Mask -> @Host route Type -> Redist \*rip #ospf

VPN5002\_8\_A5E9C800: rip#show vpn stat ver

```
Current In High Running Script Script Script
Active Negot Water Total Starts OK Error
```

```
-----
Users 0 0 0 0 0 0 0
Partners 1 0 1 1 1 0 0
Total 1 0 1 1 1 0 0
```

Stats VPN0:1

```
Wrapped 2697
Unwrapped 14439
BadEncap 0
BadAuth 0
BadEncrypt 0
rx IP 14439
rx IPX 0
rx Other 0
tx IP 2697
tx IPX 0
tx Other 0
IKE rekey 0
```

Input VPN pkts dropped due to no SA: 1

Input VPN pkts dropped due to no free queue entries: 0

IOP slot 1:

```
Current In High Running Script Script Script
Active Negot Water Total Starts OK Error
```

```
-----
Users 0 0 0 0 0 0 0
Partners 0 0 0 0 0 0 0
Total 0 0 0 0 0 0 0
```

Stats  
Wrapped  
Unwrapped  
BadEncap  
BadAuth  
BadEncrypt  
rx IP  
rx IPX  
rx Other  
tx IP  
tx IPX  
tx Other

IKE rekey

Input VPN pkts dropped due to no SA: 0

Input VPN pkts dropped due to no free queue entries: 0

IOP slot 2:

Current In High Running Script Script Script  
Active Negot Water Total Starts OK Error

-----  
Users 0 0 0 0 0 0 0  
Partners 0 0 0 0 0 0 0  
Total 0 0 0 0 0 0 0

Stats  
Wrapped  
Unwrapped  
BadEncap  
BadAuth  
BadEncrypt  
rx IP  
rx IPX  
rx Other  
tx IP  
tx IPX  
tx Other  
IKE rekey

Input VPN pkts dropped due to no SA: 0

Input VPN pkts dropped due to no free queue entries: 0

IOP slot 3:

Current In High Running Script Script Script  
Active Negot Water Total Starts OK Error

-----  
Users 0 0 0 0 0 0 0  
Partners 0 0 0 0 0 0 0  
Total 0 0 0 0 0 0 0

Stats  
Wrapped  
Unwrapped  
BadEncap  
BadAuth  
BadEncrypt  
rx IP  
rx IPX  
rx Other  
tx IP

tx IPX  
tx Other  
IKE rekey

Input VPN pkts dropped due to no SA: 0

Input VPN pkts dropped due to no free queue entries: 0

## Related Information

- [Cisco VPN 5000 Series Concentrators Support Page](#)
  - [Cisco VPN 5000 Client Support Page](#)
  - [IPSec \(IP Security Protocol\) Support Page](#)
  - [Technical Support – Cisco Systems](#)
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