目录

简介

本文档通过开放最短路径优先 (OSPF)、网络地址转换 (NAT) 和 Cisco IOS® 防火墙使用基于 IPSec 的通用路由封装 (GRE) 提供了动态多点 VPN (DMVPN) 的示例配置。

先决条件

要求

必须先使用 **crypto isakmp policy** 命令定义 Internet 密钥交换 (IKE) 策略，然后才能创建多点 GRE (mGRE) 和 IPsec 隧道。

注意： 使用命令查找工具（仅限注册用户）可获取有关本部分所使用命令的详细信息。

使用的组件

本文档中的信息基于以下软件和硬件版本：

- 中心路由器上的 Cisco IOS® 软件版本 12.2(15)T1 和分支路由器上的 Cisco IOS 软件版本 12.3(1.6)
- Cisco 3620 作为中心路由器，两个 Cisco 1720 路由器和一个 Cisco 3620 路由器作为分支路由器

本文档中的信息都是基于特定实验室环境中的设备编写的。本文档中使用的所有设备最初均采用原始（默认）配置。如果您使用的是真实网络，请确保您已经了解所有命令的潜在影响。

规则

有关文档规则的详细信息，请参阅 Cisco 技术提示规则。

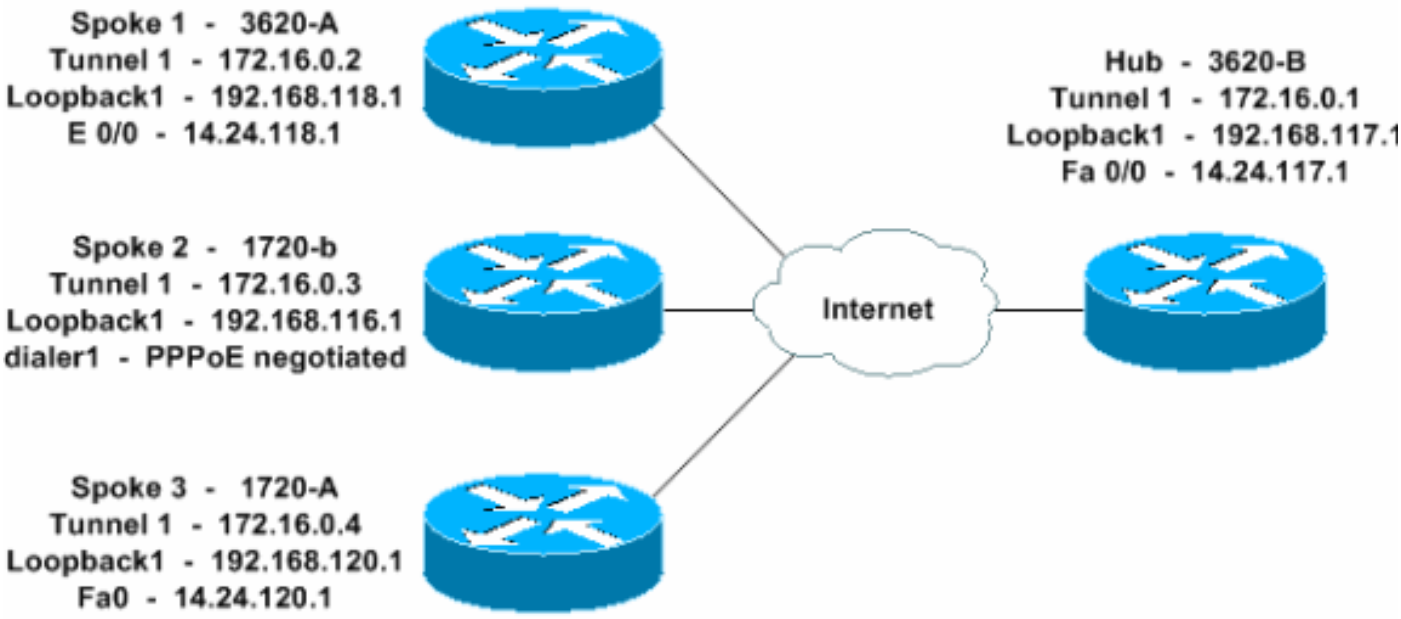
配置

本部分提供有关如何配置本文档所述功能的信息。

注意： 使用命令查找工具（仅限注册用户）可获取有关本部分所使用命令的详细信息。

网络图

本文档使用此网络设置。



配置

本文档使用以下配置。

- 中心 - 3620-B
- 分支 1 - 3620-A
- 分支 2 - 1720-b
- 分支 3 - 1720-A

中心 - 3620-B

```
W2N-6.16-3620-B#write terminalBuilding
configuration...Current configuration : 2613 bytes!version
12.2service timestamps debug datetime msecservice timestamps
log datetime msecno service password-encryption!hostname W2N-
6.16-3620-B!logging queue-limit 100!memory-size iomem 10ip
subnet-zero!!ip cefno ip domain lookup!!--- This is the Cisco
IOS Firewall configuration and what to inspect. !--- This is
applied outbound on the external interface.ip inspect name
in2out rcmdip inspect name in2out ftpip inspect name in2out
tftpip inspect name in2out tcp timeout 43200ip inspect name
in2out httpip inspect name in2out udpip audit po max-events
100!!!!--- Create an Internet Security Association and Key
Management !--- Protocol (ISAKMP) policy for Phase 1
negotiations.crypto isakmp policy 5 authentication pre-share
group 2!--- Add dynamic pre-shared key.crypto isakmp key
dmvpnkey address 0.0.0.0 0.0.0.0crypto isakmp nat keepalive
20!!!--- Create the Phase 2 policy for actual data
encryption.crypto ipsec transform-set dmvpnset esp-3des esp-
sha-hmac!!--- Create an IPsec profile to be applied
dynamically !--- to the GRE over IPsec tunnels.crypto ipsec
profile dmvpnprof set transform-set dmvpnset!!!!!!!!!!no
voice hpi capture bufferno voice hpi capture destination!!mta
```

```
receive maximum-recipients 0!!!!--- This is the inbound
interface.interface Loopback1 ip address 192.168.117.1
255.255.255.0 ip nat inside!!--- Create a GRE tunnel template
to be applied !--- to all the dynamically created GRE
tunnels.interface Tunnel1 description MULTI-POINT GRE TUNNEL
for BRANCHES bandwidth 1000 ip address 172.16.0.1
255.255.255.0 no ip redirects ip mtu 1416 ip nhrp
authentication dmvpn ip nhrp map multicast dynamic ip nhrp
network-id 99 ip nhrp holdtime 300 no ip route-cache ip ospf
network broadcast no ip mroute-cache delay 1000 tunnel source
FastEthernet0/0 tunnel mode gre multipoint tunnel key 100000
tunnel protection ipsec profile dmvpnprof!!--- This is the
outbound interface.interface FastEthernet0/0 ip address
14.24.117.1 255.255.0.0 ip nat outside ip access-group 100 in
ip inspect in2out out no ip mroute-cache duplex auto speed
auto!interface Serial0/0 no ip address shutdown clockrate
2000000 no fair-queue!interface FastEthernet0/1 no ip address
no ip mroute-cache duplex auto speed auto!!--- Enable a
routing protocol to send/receive dynamic !--- updates about
the private networks.router ospf 1 log-adjacency-changes
network 172.16.0.0 0.0.0.255 area 0 network 192.168.117.0
0.0.0.255 area 0!!--- Except the private network traffic from
the NAT process.ip nat inside source route-map nonat
interface FastEthernet0/0 overloadip http serverno ip http
secure-serverip classlessip route 0.0.0.0 0.0.0.0 14.24.1.1ip
route 2.0.0.0 255.0.0.0 14.24.121.1!!!!--- Allow ISAKMP, ESP,
and GRE traffic inbound. !--- Cisco IOS Firewall opens other
inbound access as needed.access-list 100 permit udp any host
14.24.117.1 eq 500access-list 100 premit esp any host
14.24.117.1access-list 100 permit gre any host 14.24.117.1
access-list 100 deny ip any any !--- Except the private
network traffic from the NAT process. access-list 110 deny ip
192.168.117.0 0.0.0.255 192.168.118.0 0.0.0.255access-list
110 deny ip 192.168.117.0 0.0.0.255 192.168.116.0
0.0.0.255access-list 110 deny ip 192.168.117.0 0.0.0.255
192.168.120.0 0.0.0.255access-list 110 permit ip
192.168.117.0 0.0.0.255 any!!--- Except the private network
traffic from the NAT process.route-map nonat permit 10 match
ip address 110!call rsvp-sync!!mgcp profile default!dial-peer
cor custom!!!!!line con 0 exec-timeout 0 0line aux 0line vty
0 4 login!!endW2N-6.16-3620-B#
```

分支 1 - 3620-A

```
W2N-6.16-3620-A#write terminalBuilding
configuration...Current configuration : 2678 bytes!version
12.2service timestamps debug uptimeservice timestamps log
uptimeno service password-encryption!hostname W2N-6.16-3620-
A!boot system flash slot0:c3620-ik9o3s7-mz.122-
15.T1.binlogging queue-limit 100!memory-size iomem 15ip
subnet-zero!!ip cefno ip domain lookup!!--- This is the Cisco
IOS Firewall configuration and what to inspect. !--- This is
applied outbound on the external interface.ip inspect name
in2out rcmdip inspect name in2out tftpip inspect name in2out
udpip inspect name in2out tcp timeout 43200ip inspect name
in2out realaudioip inspect name in2out vdoliveip inspect name
in2out netshowip audit po max-events 100!!!!--- Create an
ISAKMP policy for !--- Phase 1 negotiations.crypto isakmp
policy 5 authentication pre-share group 2!--- Add dynamic
pre-shared key.crypto isakmp key dmvpnkey address 0.0.0.0
0.0.0.0!!!--- Create the Phase 2 policy for actual data
encryption.crypto ipsec transform-set dmvpnset esp-3des esp-
sha-hmac!!--- Create an IPsec profile to be applied
dynamically !--- to the GRE over IPsec tunnels.crypto ipsec
```

```
profile dmvpnprof set transform-set dmvpnset!!!!!!!!!!no
voice hpi capture bufferno voice hpi capture destination!!mta
receive maximum-recipients 0!!!!--- This is the inbound
interface.interface Loopback1 ip address 192.168.118.1
255.255.255.0 ip nat inside!!--- Create a GRE tunnel template
to be applied to !--- all the dynamically created GRE
tunnels.interface Tunnel1 description HOST DYNAMIC TUNNEL
bandwidth 1000 ip address 172.16.0.2 255.255.255.0 no ip
redirects ip mtu 1416 ip nhrp authentication dmvpn ip nhrp
map multicast dynamic ip nhrp map 172.16.0.1 14.24.117.1 ip
nhrp map multicast 14.24.117.1 ip nhrp network-id 99 ip nhrp
holdtime 300 ip nhrp nhs 172.16.0.1 no ip route-cache ip ospf
network broadcast no ip mroute-cache delay 1000 tunnel source
Ethernet0/0 tunnel mode gre multipoint tunnel key 100000
tunnel protection ipsec profile dmvpnprof!!--- This is the
outbound interface.interface Ethernet0/0 ip address
14.24.118.1 255.255.0.0 ip nat outside ip access-group 100 in
ip inspect in2out out no ip mroute-cache half-
duplex!interface Ethernet0/1 no ip address half-
duplex!interface Ethernet0/2 no ip address shutdown half-
duplex!interface Ethernet0/3 no ip address shutdown half-
duplex!!--- Enable a routing protocol to send/receive dynamic
!--- updates about the private networks.router ospf 1 log-
adjacency-changes redistribute connected network 172.16.0.0
0.0.0.255 area 0 network 192.168.118.0 0.0.0.255 area 0!!---
Except the private network traffic from the NAT process. ip
nat inside source route-map nonat interface Ethernet0/0
overloadip http serverno ip http secure-serverip classlessip
route 0.0.0.0 0.0.0.0 14.24.1.1ip route 2.0.0.0 255.0.0.0
14.24.121.1!!!!--- Allow ISAKMP, ESP, and GRE traffic
inbound. !--- Cisco IOS Firewall opens inbound access as
needed.access-list 100 permit udp any host 14.24.118.1 eq
500access-list 100 premit esp any host 14.24.118.1access-list
100 permit gre any host 14.24.118.1 access-list 100 deny ip
any any!--- Except the private network traffic from the NAT
process. access-list 110 deny ip 192.168.118.0 0.0.0.255
192.168.117.0 0.0.0.255access-list 110 deny ip 192.168.118.0
0.0.0.255 192.168.116.0 0.0.0.255access-list 110 deny ip
192.168.118.0 0.0.0.255 192.168.120.0 0.0.0.255access-list
110 permit ip 192.168.118.0 0.0.0.255 any!!--- Except the
private network traffic from the NAT process. route-map nonat
permit 10 match ip address 110!call rsvp-sync!!mgcp profile
default!dial-peer cor custom!!!!!line con 0 exec-timeout 0
0line aux 0line vty 0 4 login!!endW2N-6.16-3620-A#
```

分支 2 - 1720-b

```
1720-b#write terminalBuilding configuration...Current
configuration : 2623 bytes!version 12.2service timestamps
debug uptimeservice timestamps log uptimeno service password-
encryption!hostname 1720-b!logging queue-limit 100enable
password cisco!username 7206-B password 0 ciscoip subnet-
zero!!no ip domain lookup!ip cef!--- This is the Cisco IOS
Firewall configuration and what to inspect. !--- This is
applied outbound on the external interface.ip inspect name
in2out rcmdip inspect name in2out tftpip inspect name in2out
udpip inspect name in2out tcp timeout 43200ip inspect name
in2out realaudioip inspect name in2out vdoliveip inspect name
in2out netshowip audit po max-events 100vpdn-group 1 request-
dialin protocol pppoe!!!!!!--- Create an ISAKMP policy for !-
-- Phase 1 negotiations.crypto isakmp policy 5 authentication
pre-share group 2!--- Add dynamic pre-shared key.crypto
isakmp key dmvpnkey address 0.0.0.0 0.0.0.0!!!--- Create the
Phase 2 policy for actual data encryption.crypto ipsec
```

```
transform-set dmvpnset esp-3des esp-sha-hmac!--- Create an IPsec profile to be applied dynamically !--- to the GRE over IPsec tunnels.crypto ipsec profile dmvpnprof set transform-set dmvpnset!!!!!!--- This is the inbound interface.interface Loopback1 ip address 192.168.116.1 255.255.255.0 ip nat inside!--- Create a GRE tunnel template to be applied to !--- all the dynamically created GRE tunnels.interface Tunnel1 description HOST DYNAMIC TUNNEL bandwidth 1000 ip address 172.16.0.3 255.255.255.0 no ip redirects ip mtu 1416 ip nhrp authentication dmvpn ip nhrp map multicast dynamic ip nhrp map 172.16.0.1 14.24.117.1 ip nhrp map multicast 14.24.117.1 ip nhrp network-id 99 ip nhrp holdtime 300 ip nhrp nhs 172.16.0.1 no ip route-cache ip ospf network broadcast no ip mroute-cache delay 1000 tunnel source Dialer1 tunnel mode gre multipoint tunnel key 100000 tunnel protection ipsec profile dmvpnprof!interface Ethernet0 no ip address half-duplex!interface FastEthernet0 no ip address no ip mroute-cache speed auto pppoe enable pppoe-client dial-pool-number 1!!--- This is the outbound interface.interface Dialer1 ip address 2.2.2.10 255.255.255.0 ip inspect in2out out ip access-group 100 in encapsulation ppp dialer pool 1 dialer-group 1 ppp authentication pap chap callin!!--- Enable a routing protocol to send/receive dynamic !--- updates about the private networks.router ospf 1 log-adjacency-changes redistribute connected network 172.16.0.0 0.0.0.255 area 0 network 192.168.116.0 0.0.0.255 area 0!!--- Except the private network traffic from the NAT process. ip nat inside source route-map nonat interface Dialer1 overloadip classlessip route 0.0.0.0 0.0.0.0 14.24.1.1ip route 0.0.0.0 0.0.0.0 Dialer1no ip http serverno ip http secure-server!!!!--- Allow ISAKMP, ESP, and GRE traffic inbound. !--- Cisco IOS Firewall opens inbound access as needed.access-list 100 permit udp any host 14.24.116.1 eq 500access-list 100 premit esp any host 14.24.116.1access-list 100 permit gre any host 14.24.116.1 access-list 100 deny ip any any!--- Except the private network traffic from the NAT process. access-list 110 deny ip 192.168.116.0 0.0.0.255 192.168.117.0 0.0.0.255access-list 110 deny ip 192.168.116.0 0.0.0.255 192.168.118.0 0.0.0.255access-list 110 deny ip 192.168.116.0 0.0.0.255 192.168.120.0 0.0.0.255access-list 110 permit ip 192.168.116.0 0.0.0.255 anydialer-list 1 protocol ip permit!!--- Except the private network traffic from the NAT process. route-map nonat permit 10 match ip address 110!!line con 0 exec-timeout 0 0line aux 0line vty 0 4 login!no scheduler allocateend1720-b#
```

分支 3 - 1720-A

```
W2N-6.16-1720-A#write terminalBuilding configuration...Current configuration : 2303 bytes!version 12.2service timestamps debug datetime msecservice timestamps log datetime msecno service password-encryption!hostname W2N-6.16-1720-A!logging queue-limit 100!memory-size iomem 25ip subnet-zero!!no ip domain lookup!ip cef!--- This is the Cisco IOS Firewall configuration and what to inspect. !--- This is applied outbound on the external interface.ip inspect name in2out rcmdip inspect name in2out tftpip inspect name in2out udpip inspect name in2out tcp timeout 43200ip inspect name in2out realaudioip inspect name in2out vdoliveip inspect name in2out netshowip audit notify logip audit po max-events 100!!!!!--- Create an ISAKMP policy for !--- Phase 1 negotiations.crypto isakmp policy 5 authentication pre-share group 2!--- Add dynamic pre-shared key.crypto isakmp key dmvpnkey address 0.0.0.0 0.0.0.0!!!--- Create the Phase 2
```

```
policy for actual data encryption.crypto ipsec transform-set
dmvpnset esp-3des esp-sha-hmac!--- Create an IPsec profile
to be applied dynamically !--- to the GRE over IPsec
tunnels.crypto ipsec profile dmvpnprof set transform-set
dmvpnset!!!!!!--- This is the inbound interface.interface
Loopback1 ip address 192.168.120.1 255.255.255.0 ip nat
inside!!--- Create a GRE tunnel template to be applied to !--
- all the dynamically created GRE tunnels.interface Tunnel1
description HOST DYNAMIC TUNNEL bandwidth 1000 ip address
172.16.0.4 255.255.255.0 no ip redirects ip mtu 1416 ip nhrp
authentication dmvpn ip nhrp map multicast dynamic ip nhrp
map 172.16.0.1 14.24.117.1 ip nhrp map multicast 14.24.117.1
ip nhrp network-id 99 ip nhrp holdtime 300 ip nhrp nhs
172.16.0.1 ip ospf network broadcast no ip mroute-cache delay
1000 tunnel source FastEthernet0 tunnel mode gre multipoint
tunnel key 100000 tunnel protection ipsec profile
dmvpnprof!interface Ethernet0 no ip address no ip mroute-
cache half-duplex!!--- This is the outbound
interface.interface FastEthernet0 ip address 14.24.120.1
255.255.0.0 ip nat outside ip inspect in2out out ip access-
group 100 in no ip mroute-cache speed auto!!--- Enable a
routing protocol to send/receive dynamic !--- updates about
the private networks.router ospf 1 log-adjacency-changes
redistribute connected network 172.16.0.0 0.0.0.255 area 0
network 192.168.120.0 0.0.0.255 area 0!!--- Except the
private network traffic from the NAT process.ip nat inside
source route-map nonat interface FastEthernet0 overloadip
classlessip route 0.0.0.0 0.0.0.0 14.24.1.1ip route 2.0.0.0
255.0.0.0 14.24.121.1no ip http serverno ip http secure-
server!!!!--- Allow ISAKMP, ESP, and GRE traffic inbound. !--
- Cisco IOS Firewall opens inbound access as needed.access-
list 100 permit udp any host 14.24.116.1 eq 500access-list
100 premit esp any host 14.24.116.1access-list 100 permit gre
any host 14.24.116.1 access-list 100 deny ip any anyaccess-
list 110 permit ip 192.168.120.0 0.0.0.255 any!--- Except the
private network traffic from the NAT process.access-list 110
deny ip 192.168.120.0 0.0.0.255 192.168.116.0
0.0.0.255access-list 110 deny ip 192.168.120.0 0.0.0.255
192.168.117.0 0.0.0.255access-list 110 deny ip 192.168.120.0
0.0.0.255 192.168.118.0 0.0.0.255access-list 110 permit ip
192.168.120.0 0.0.0.255 any!--- Except the private network
traffic from the NAT process.route-map nonat permit 10 match
ip address 110!!line con 0 exec-timeout 0 0line aux 0line vty
0 4 login!endW2N-6.16-1720-A#
```

验证

使用本部分可确认配置能否正常运行。

命令输出解释程序（仅限注册用户）(OIT) 支持某些 **show** 命令。使用 OIT 可查看对 show 命令输出的分析。

- **show crypto isakmp sa** ？显示ISAKMP安全关联(SA)的状态。
- **show crypto engine connections active** ？显示总计每个SA加密/解密。
- **show crypto ipsec sa** ？显示在活动通道的统计信息。
- **show ip route** ？显示路由表。
- **show ip ospf neighbor** ？显示关于一个单个接口的基本类型的OSPF邻居信息。
- **show ip nhrp** ？显示IP下一跳解析协议(NHRP)缓存，或者被限制对一个特定接口的动态或静态

缓存条目。

故障排除

本部分提供的信息可用于对配置进行故障排除。

故障排除命令

注意： 发出 **debug** 命令之前，请参阅有关 Debug 命令的重要信息。

- **debug crypto ipsec** ？显示IPSec事件。
- **debug crypto isakmp** ？显示关于IKE事件的消息。
- **debug crypto engine** ？显示从加密引擎的信息。

有关 IPsec 故障排除的其他信息，请参阅 IP 安全故障排除 - 了解和使用 debug 命令。

相关信息

- **对 Cisco IOS 防火墙配置进行故障排除**
- **DMVPN 和 Cisco IOS 概述**
- **IPsec 协商/IKE 协议**
- **技术支持和文档 - Cisco Systems**