在一台使用VPN服务模块的Catalyst 6500和Cisco IOS路由器之间的IPSec LAN到LAN隧道配置示例

目录

简介

本文档介绍如何在含有 VPN 加速服务模块的 Cisco Catalyst 6500 系列交换机与 Cisco IOS® 路由器之间创建 IPSec LAN 到 LAN 隧道。

先决条件

要求

本文档没有任何特定的要求。

使用的组件

本文档中的信息基于以下软件和硬件版本：

- 适用于含 IPSec VPN 服务模块的 Catalyst 6000 Supervisor 引擎的 Cisco IOS 软件 12.2(14)SY2 版
- 运行 Cisco IOS 软件 12.3(4)T 版的 Cisco 3640 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。

背景信息

Catalyst 6500 VPN 服务模块有两个千兆以太网 (GE) 端口，无外部可见的接头。这些端口只在配置时是可寻址的。端口 1 始终为内部端口。此端口处理从和到网络内部的所有业务量。第二个端口(端口2)处理所有业务量从和对广域网或外部网络。这两个端口在802.1q中继模式下总是配置。VPN服务模块对数据包流使用称线内冲突(BITW)的技术。

数据包由一对 VLAN 处理：一个第 3 层内部 VLAN 和一个第 2 层外部 VLAN。从内部传到外部的包，通过一种称为对内部VLAN的编码地址识别逻辑(EARL)的方法进行寻址。该方法将数据包加密之后，VPN 服务模块将使用相应的外部 VLAN。在解密过程中，使用外部 VLAN 将从外部到内部的数据包桥接到 VPN 服务模块。VPN 服务模块将数据包解密并将 VLAN 映射到相应的内部 VLAN 之后，EARL 将数据包路由到适当的 LAN 端口。第 3 层内部 VLAN 和第 2 层外部 VLAN 通过发出 **crypto connect vlan 命令连接在一起。**在Catalyst 6500系列交换机中有三种类型的端口：

- **路由端口** — 默认情况下，所有以太网端口都是路由端口。这些端口有一个与它联系的隐藏 VLAN。
- **接入端口 - 这些端口有一个外部 VLAN 或 VLAN 中继协议 (VTP) VLAN 与其关联。**您能关联超过一个端口到默认的VLAN。
- **中继端口 - 这些端口承载许多外部 VLAN 或 VTP VLAN，上面所有数据包都以 802.1Q 报头进行封装。**

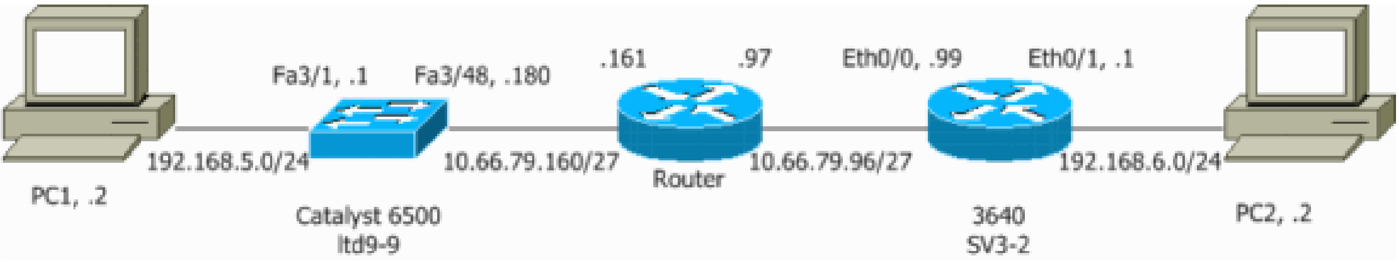
配置

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(仅限注册客户)可查找有关本文档中使用的命令的详细信息。

网络图

本文档使用此图中所示的网络设置：



使用第 2 层接入或中继端口配置 IPSec

执行以下这些步骤，在外部物理接口作为第 2 层接入或中继端口的情况下配置 IPSec。

1. 将内部 VLAN 添加到 VPN 服务模块的内部端口。假设VPN服务模块在插槽4上。使用VLAN 100作为内部VLAN，使用VLAN 209作为外部VLAN。按如下所示配置 VPN 服务模块的 GE 端

口：

```
interface GigabitEthernet4/1
 no ip address
 flowcontrol receive on
 flowcontrol send off
 switchport
 switchport trunk encapsulation dot1q
 switchport trunk allowed vlan 1,100,1002-1005
 switchport mode trunk
 cdp enable

interface GigabitEthernet4/2
 no ip address
 flowcontrol receive on
 flowcontrol send off
 switchport
 switchport trunk encapsulation dot1q
 switchport trunk allowed vlan 1,209,1002-1005
 switchport mode trunk
 cdp enable
 spanning-tree portfast trunk
```

2. 添加 VLAN 100 接口和隧道终止处的接口（本例中为 `interface Vlan 209`，如下所示）。

```
interface Vlan100
 ip address 10.66.79.180 255.255.255.224

interface Vlan209
 no ip address
 crypto connect vlan 100
```

3. 配置外部物理端口作为接入或中继端口（本例中为 `FastEthernet 3/48`，如下所示）。

```
!--- This is the configuration that uses an access port. interface FastEthernet3/48
 no ip address
 switchport
 switchport access vlan 209
 switchport mode access

!--- This is the configuration that uses a trunk port. interface FastEthernet3/48
 no ip address switchport
 switchport trunk encapsulation dot1q
 switchport mode trunk
```

4. 创建旁路 NAT。将以下条目添加到 no nat 语句以免除在这些网络之间的 NAT：

```
access-list inside_nat0_outbound permit ip 192.168.5.0 0.0.0.255
192.168.6.0 0.0.0.255
global (outside) 1 interface
nat (inside) 0 access-list inside_nat0_outbound
nat (inside) 1 192.168.5.0 255.255.255.0
```

5. 创建您的加密配置以及定义将被加密的流量的访问控制列表 (ACL)。按如下所示，创建用于定义从内部网络 192.168.5.0/24 到远程网络 192.168.6.0/24 的流量的 ACL（本例中为 ACL 100）：

```
access-list 100 permit ip 192.168.5.0 0.0.0.255 192.168.6.0 0.0.0.255
```

按如下所示定义您的 Internet 安全连接和密钥管理协议 (ISAKMP) 策略方案：

```
crypto isakmp policy 1
hash md5
```

```
authentication pre-share
group 2
```

发出下面这个命令（在本例中）以使用和定义预共享密钥。

```
crypto isakmp key cisco address 10.66.79.99
```

按如下所示定义您的 IPSec 方案：

```
crypto ipsec transform-set cisco esp-des esp-md5-hmac
```

按如下所示创建您的加密映射语句：

```
crypto map cisco 10 ipsec-isakmp
set peer 10.66.79.99
set transform-set cisco
match address 100
```

6. 按如下所示将加密映射应用于 VLAN 100 接口：

```
interface vlan100
crypto map cisco
```

使用以下这些配置。

- Catalyst 6500
- Cisco IOS 路由器

Catalyst 6500

```


!--- Define the Phase 1 policy. crypto isakmp policy 1
 hash md5
 authentication pre-share
 group 2
crypto isakmp key cisco address 10.66.79.99
!
!
!--- Define the encryption policy for this setup. crypto
ipsec transform-set cisco esp-des esp-md5-hmac
!
!--- Define a static crypto map entry for the peer !---
with mode ipsec-isakmp. !--- This indicates that
Internet Key Exchange (IKE) !--- is used to establish
the IPsec !--- security associations (SAs) to protect
the traffic !--- specified by this crypto map entry.
crypto map cisco 10 ipsec-isakmp
 set peer 10.66.79.99
 set transform-set cisco
 match address 100
!
!
no spanning-tree vlan 100
!
!
!
interface FastEthernet3/1
 ip address 192.168.5.1 255.255.255.0
```

```
!
!--- This is the outside Layer 2 port that allows VLAN
!--- 209 traffic to enter. interface FastEthernet3/48 no
ip address switchport switchport trunk encapsulation
dot1q switchport mode trunk ! interface
GigabitEthernet4/1 no ip address flowcontrol receive on
flowcontrol send off switchport switchport trunk
encapsulation dot1q !--- VLAN 100 is defined as the
Interface VLAN (IVLAN).  switchport trunk allowed vlan
1,100,1002-1005
 switchport mode trunk
 cdp enable
!
interface GigabitEthernet4/2
 no ip address
 flowcontrol receive on
 flowcontrol send off
 switchport
 switchport trunk encapsulation dot1q
!--- The Port VLAN (PVLAN) configuration is handled
transparently by !--- the VPN service module without
user configuration !--- or involvement. It also is not
shown in the configuration. !--- Note: For every IVLAN,
a corresponding PVLAN exists.

 switchport trunk allowed vlan 1,209,1002-1005
 switchport mode trunk
 cdp enable
 spanning-tree portfast trunk
!
interface Vlan1
no ip address
shutdown
!
!--- This is the IVLAN that is configured to intercept
the traffic !--- destined to the secure port on which
the inside port !--- of the VPN service module is the
only port present. interface Vlan100 ip address
10.66.79.180 255.255.255.224  crypto map cisco
!--- This is the secure port that is a virtual Layer 3
interface. !--- This interface purposely does not have a
Layer 3 IP address !--- configured. This is normal for
the BITW process. !--- The IP address is moved from this
interface to VLAN 100 to !--- accomplish BITW. This
brings the VPN service module into !--- the packet path.
interface Vlan209 no ip address  crypto connect vlan 100
!
ip classless
!--- Configure the routing so that the device !--- is
directed to reach its destination network. ip route
0.0.0.0 0.0.0.0 10.66.79.161
global (outside) 1 interface
!--- NAT 0 prevents NAT for networks specified in the
ACL inside_nat0_outbound. nat (inside) 0 access-list
inside_nat0_outbound nat (inside) 1 192.168.5.0
255.255.255.0 !--- This access list
(inside_nat0_outbound) is used with the nat zero
command. !--- This prevents traffic which matches the
access list from undergoing !--- network address
translation (NAT). The traffic specified by this ACL is
!--- traffic that is to be encrypted and !--- sent
across the VPN tunnel. This ACL is intentionally !---
the same as (100). !--- Two separate access lists should
always be used in this configuration.
```

```
access-list inside_nat0_outbound permit ip 192.168.5.0
0.0.0.255 192.168.6.0 0.0.0.255

!--- This is the crypto ACL. access-list 100 permit ip
192.168.5.0 0.0.0.255 192.168.6.0 0.0.0.255
```

Cisco IOS 路由器

```
SV3-2#show run
Building configuration...

Current configuration : 1268 bytes
!
version 12.3
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname SV3-2
!
boot-start-marker
boot-end-marker
!
!
no aaa new-model
ip subnet-zero
!
ip audit notify log
ip audit po max-events 100
ip ssh break-string
no ftp-server write-enable
!
!--- Define the Phase 1 policy. crypto isakmp policy 1
 hash md5
 authentication pre-share
 group 2
crypto isakmp key cisco address 10.66.79.180
!
!
!--- Define the encryption policy for this setup. crypto
ipsec transform-set cisco esp-des esp-md5-hmac
!
!--- Define a static crypto map entry for the peer !---
with mode ipsec-isakmp. This indicates that IKE !--- is
used to establish the IPsec !--- SAs to protect the
traffic !--- specified by this crypto map entry. crypto
map cisco 10 ipsec-isakmp
 set peer 10.66.79.180
 set transform-set cisco
 match address 100
!
!
!--- Apply the crypto map to the interface. interface
Ethernet0/0 ip address 10.66.79.99 255.255.255.224 half-
duplex crypto map cisco
!
interface Ethernet0/1
 ip address 192.168.6.1 255.255.255.0
 half-duplex
 no keepalive
!
!
```

```
ip http server
no ip http secure-server
ip classless
!--- Configure the routing so that the device !--- is
directed to reach its destination network. ip route
0.0.0.0 0.0.0.0 10.66.79.97
!
!
!--- This is the crypto ACL. access-list 100 permit ip
192.168.6.0 0.0.0.255 192.168.5.0 0.0.0.255
!
!
control-plane
!
!
line con 0
line aux 0
line vty 0 4
!
end
```

使用路由端口配置 IPSec

执行以下这些步骤，在外部物理接口作为第 3 层路由端口的情况下配置 IPSec。

1. 将内部 VLAN 添加到 VPN 服务模块的内部端口。假设VPN服务模块在插槽4上。使用VLAN 100作为内部VLAN，使用VLAN 209作为外部VLAN。按如下所示配置 VPN 服务模块的 GE 端口：

   ```
   interface GigabitEthernet4/1
    no ip address
    flowcontrol receive on
    flowcontrol send off
    switchport
    switchport trunk encapsulation dot1q
    switchport trunk allowed vlan 1,100,1002-1005
    switchport mode trunk
    cdp enable

   interface GigabitEthernet4/2
    no ip address
    flowcontrol receive on
    flowcontrol send off
    switchport
    switchport trunk encapsulation dot1q
    switchport trunk allowed vlan 1,209,1002-1005
    switchport mode trunk
    cdp enable
    spanning-tree portfast trunk
   ```

2. 添加 VLAN 100 接口和隧道终止处的接口（本例中为 `FastEthernet3/48`，如下所示）。

   ```
   interface Vlan100
    ip address 10.66.79.180 255.255.255.224

   interface FastEthernet3/48
    no ip address
    crypto connect vlan 100
   ```

3. 创建旁路 NAT。将以下条目添加到 no nat 语句以免除在这些网络之间的 NAT：

   ```
   access-list inside_nat0_outbound permit ip 192.168.5.0 0.0.0.255
   ```

```
192.168.6.0 0.0.0.255
global (outside) 1 interface
nat (inside) 0 access-list inside_nat0_outbound
nat (inside) 1 192.168.5.0 255.255.255.0
```

4. 创建您的加密配置以及用于定义被加密的流量的 ACL。按如下所示，创建用于定义从内部网络 192.168.5.0/24 到远程网络 192.168.6.0/24 的流量的 ACL（本例中为 ACL 100）：

   ```
   access-list 100 permit ip 192.168.5.0 0.0.0.255 192.168.6.0 0.0.0.255
   ```

   按如下所示定义您的 ISAKMP 策略方案：

   ```
   crypto isakmp policy 1
   hash md5
   authentication pre-share
   group 2
   ```

   发出下面这个命令（在本例中）以使用和定义预共享密钥：

   ```
   crypto isakmp key cisco address 10.66.79.99
   ```

   按如下所示定义您的 IPSec 方案：

   ```
   crypto ipsec transform-set cisco esp-des esp-md5-hmac
   ```

   按如下所示创建您的加密映射语句：

   ```
   crypto map cisco 10 ipsec-isakmp
    set peer 10.66.79.99
    set transform-set cisco
    match address 100
   ```

5. 按如下所示将加密映射应用于 VLAN 100 接口：

   ```
   interface vlan100
   crypto map cisco
   ```

使用以下这些配置。

- Catalyst 6500
- Cisco IOS 路由器

Catalyst 6500

```
!--- Define the Phase 1 policy. crypto isakmp policy 1
 hash md5
 authentication pre-share
 group 2
crypto isakmp key cisco address 10.66.79.99
!
!
!--- Define the encryption policy for this setup. crypto
ipsec transform-set cisco esp-des esp-md5-hmac
!
!--- Define a static crypto map entry for the peer !---
with mode ipsec-isakmp. This indicates that IKE !--- is
used to establish the IPsec !--- SAs to protect the
```

```
traffic !--- specified by this crypto map entry. crypto
map cisco 10 ipsec-isakmp
 set peer 10.66.79.99
 set transform-set cisco
 match address 100
!
!
no spanning-tree vlan 100
!
!
!
interface FastEthernet3/1
 ip address 192.168.5.1 255.255.255.0
!--- This is the secure port that is configured in
routed port mode. !--- This routed port mode does not
have a Layer 3 IP address !--- configured. This is
normal for the BITW process. !--- The IP address is
moved from this interface to the VLAN 100 to !---
accomplish BITW. This brings the VPN service module into
!--- the packet path. This is the Layer 2 port VLAN on
which the !--- outside port of the VPN service module
also belongs. interface FastEthernet3/48 no ip address
crypto connect vlan 100
!
interface GigabitEthernet4/1
 no ip address
 flowcontrol receive on
 flowcontrol send off
 switchport
 switchport trunk encapsulation dot1q
!--- VLAN 100 is defined as the IVLAN. switchport trunk
allowed vlan 1,100,1002-1005
 switchport mode trunk
 cdp enable
!
interface GigabitEthernet4/2
 no ip address
 flowcontrol receive on
 flowcontrol send off
 switchport
 switchport trunk encapsulation dot1q
!--- The PVLAN configuration is handled transparently by
the !--- VPN service module without user configuration
!--- or involvement. It also is not shown in the
configuration. !--- Note: For every IVLAN, a
corresponding PVLAN exists.

 switchport trunk allowed vlan 1,209,1002-1005
 switchport mode trunk
 cdp enable
 spanning-tree portfast trunk
!
interface Vlan1
no ip address
shutdown
!
!--- This is the IVLAN that is configured to intercept
the traffic !--- destined to the secure port on which
the inside port of the !--- VPN service module is the
only port present. interface Vlan100 ip address
10.66.79.180 255.255.255.224 crypto map cisco
!
ip classless
!--- Configure the routing so that the device !--- is
```

```
directed to reach its destination network. ip route
0.0.0.0 0.0.0.0 10.66.79.161
!
global (outside) 1 interface
!--- NAT 0 prevents NAT for networks specified in the
ACL inside_nat0_outbound. nat (inside) 0 access-list
inside_nat0_outbound nat (inside) 1 192.168.5.0
255.255.255.0 !--- This access list
(inside_nat0_outbound) is used with the nat zero
command. !--- This prevents traffic which matches the
access list from undergoing !--- network address
translation (NAT). The traffic specified by this ACL is
!--- traffic that is to be encrypted and !--- sent
across the VPN tunnel. This ACL is intentionally !---
the same as (100). !--- Two separate access lists should
always be used in this configuration.

access-list inside_nat0_outbound permit ip 192.168.5.0
0.0.0.255 192.168.6.0 0.0.0.255

!--- This is the crypto ACL. access-list 100 permit ip
192.168.5.0 0.0.0.255 192.168.6.0 0.0.0.255
```

Cisco IOS 路由器

```

SV3-2# show run
Building configuration...

Current configuration : 1268 bytes
!
version 12.3
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname SV3-2
!
boot-start-marker
boot-end-marker
!
!
no aaa new-model
ip subnet-zero
!
ip audit notify log
ip audit po max-events 100
ip ssh break-string
no ftp-server write-enable
!
!--- Define the Phase 1 policy. crypto isakmp policy 1
 hash md5
 authentication pre-share
 group 2
crypto isakmp key cisco address 10.66.79.180
!
!
!--- Define the encryption policy for this setup. crypto
ipsec transform-set cisco esp-des esp-md5-hmac
!
!--- Define a static crypto map entry for the peer !---
with mode ipsec-isakmp. This indicates that IKE !--- is
used to establish the IPsec !--- SAs to protect the
traffic !--- specified by this crypto map entry. crypto
```

```
map cisco 10 ipsec-isakmp
 set peer 10.66.79.180
 set transform-set cisco
 match address 100
!
!
!--- Apply the crypto map to the interface. interface
Ethernet0/0 ip address 10.66.79.99 255.255.255.224 half-
duplex crypto map cisco
!
interface Ethernet0/1
 ip address 192.168.6.1 255.255.255.0
 half-duplex
 no keepalive
!
!
ip http server
no ip http secure-server
ip classless
!--- Configure the routing so that the device !--- is
directed to reach its destination network. ip route
0.0.0.0 0.0.0.0 10.66.79.97
!
!
!--- This is the crypto ACL. access-list 100 permit ip
192.168.6.0 0.0.0.255 192.168.5.0 0.0.0.255
!
!
control-plane
!
!
line con 0
line aux 0
line vty 0 4
!
end
```

验证

本部分提供的信息有助于确认配置是否正常运行。

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 ipsec sa - 显示当前的 IPSec SA 所采用的设置。**
- **show crypto isakmp sa** — 显示对等体上的所有当前IKE SA。
- **show crypto vlan - 显示与加密配置关联的 VLAN。**
- **show crypto eli - 显示 VPN 服务模块的统计信息。**

有关验证和排除 IPSec 故障的其他信息，请参阅 IP 安全故障排除 - 了解和使用 debug 命令。

故障排除

此部分提供信息故障排除您的配置。

故障排除命令

注意：在发出debug命**令**之前，请参阅有关debug命令的重要信息。

- **debug crypto ipsec - 显示第 2 阶段的 IPsec 协商。**
- **debug crypto isakmp - 显示第 1 阶段的 ISAKMP 协商。**
- **debug crypto engine - 显示已加密的数据流。**
- **clear crypto isakmp - 清除与第 1 阶段相关的 SA。**
- **clear crypto sa - 清除与第 2 阶段相关的 SA。**

有关验证和排除 IPSec 故障的其他信息，请参阅 IP 安全故障排除 - 了解和使用 debug 命令。

相关信息

- IPSec 支持页面
- 配置 IPSec 网络安全
- 配置 Internet 密钥交换安全协议
- 技术支持 - Cisco Systems