Cisco IOS GETVPN VRF-Aware GDOI GM Solution Deployment Guide

Introduction to GETVPN

The Cisco IOS GETVPN is a tunnel-less VPN technology that provides end-to-end security for network traffic in a native mode and maintaining the fully meshed topology. It uses the core network's ability to route and replicate the packets between various sites within the enterprise. Cisco IOS GETVPN preserves the original source and destination IP addresses information in the header of the encrypted packet for optimal routing. Hence, it is largely suited for an enterprise running over a private IP-enabled network such as MPLS VPN, VPLS, or FR/ATM. It is also better suited to encrypt IP-based multicast and broadcast traffic which might traverse a satellite network or IP multicast enabled core.

Cisco IOS GET VPN uses the IETF's standard RFC-3547 Group Domain of Interpretation (GDOI) as the key management protocol and RFC-2406 for IPSec for encryption.

VRF-Aware GDOI Group Member (GM)

Virtual Routing and Forwarding (VRF) is a technology that allows multiple instances of a routing table to co-exist within the same router at the same time. In a normal GETVPN deployment, both data and control traffic (such as registration and re-key) use the same VRF. In a VRF-aware GDOI GM configuration, control traffic can be separated from data traffic using a separate VRF. The GM has the ability to route control traffic (registration & rekeys) through a VRF that is different from the VRF used for routing encrypted data traffic. Basically registration & rekeys are routed through one VRF and the policies downloaded are applied to a crypto-map applied in a different VRF. A service provider may assign the key management control traffic to a management VRF on a GM where separate designated VRF's are used to service individual customer's encrypted traffic. An enterprise could use it for departmental VPNs so they don't have to replicate the key server infrastructure for every department.

Purpose and Scope

This document provides basic deployment guidelines to enable Cisco IOS Group Encrypted Transport VPN (GETVPN) with VRF-Aware GDOI feature in an enterprise network. This document does not cover in-depth technical details about various features comprising Cisco IOS GETVPN. Please refer to the References section for additional documents.

Recommended Platforms and Images

Images based on Cisco IOS Software Release 15.0(1) M or above are required for group member routers while it is recommended for key server routers. The recommended image subset is `advipservicesk9 ‘for both the key server and the group member routers.

- **Key server:** Cisco 2800/3800 Series Integrated Service Routers, Cisco 7200 Series Routers, Cisco 7301 Routers
- **Group member:** 1800/2800/3800 Series Integrated Service Routers (ISR), Cisco 7200 Series Routers, Cisco 7301 Routers, and 1900/2900/3900 ISR-G2 platforms.

Deployment

A new CLI is introduced to configure the registration interface under the GDOI group. This registration interface is used to route the GDOI registrations through the VRF configured on that interface for this particular group and registration requests would be sourced with the IP address configured on the register address interface. After successful registration the IPSec policy will be applied to the interface where the crypto map is applied.

Example:

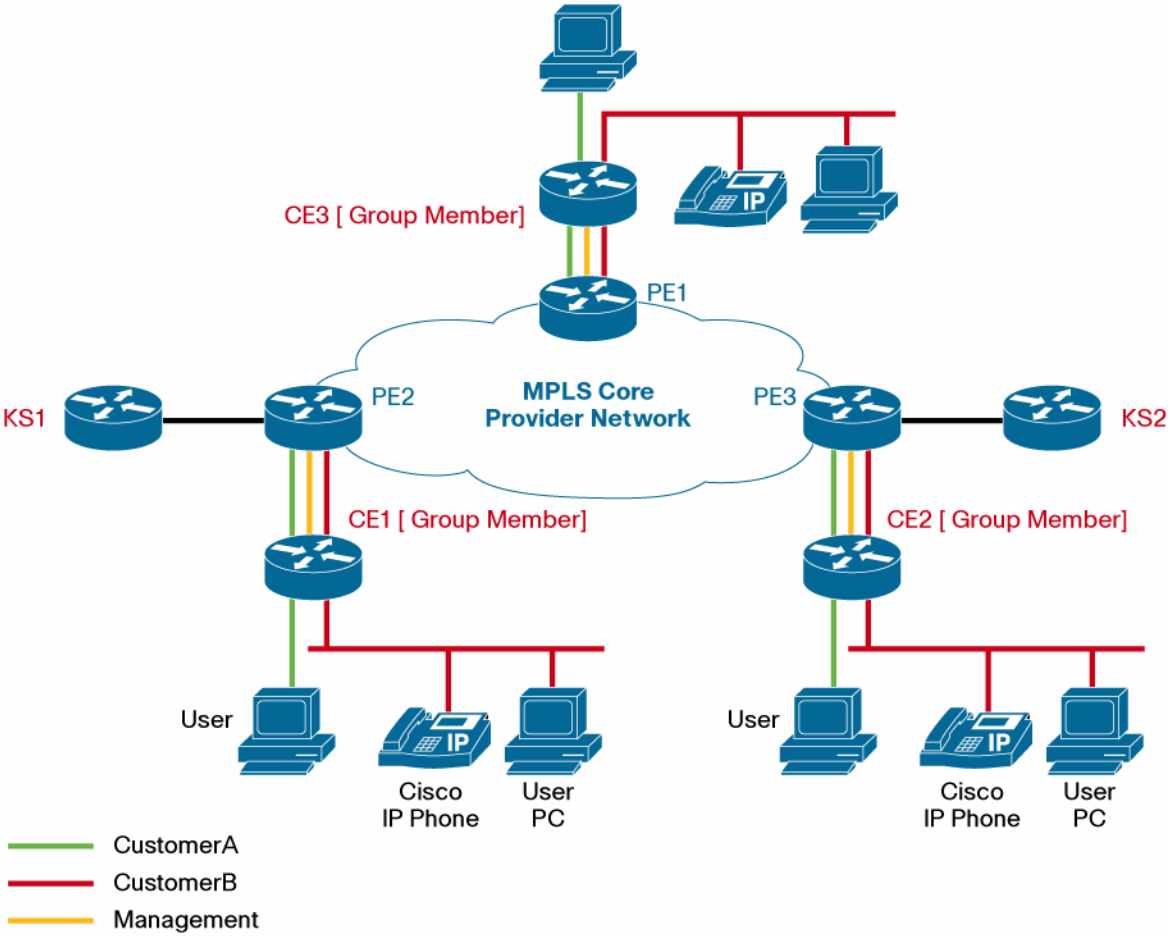
```
crypto gdoi group GET-GROUP1
 identity number 1357924680
 server address ipv4 10.32.178.23
 server address ipv4 10.32.178.56
 client registration interface FastEthernet0.3
```

Here the Group member will use ‘FastEthernet0.3’ interface to register the group ‘GET-GROUP1’ with configured Key Servers. The future registration and rekey will happen through this interface. If this interface cannot reach any of the configured Key servers, registration of the group will fail.

If client registration interface under a GDOI group is not configured, GM will use the either the specified local-address configured for the crypto map or the IP address associated with the interface where the crypto-map is applied. If client registration interface is not specified then, by default, the registration would happen through the default interface/VRF where the crypto map is applied and VRF-aware GDOI is inherently disabled.

Topology

Figure 1. VRF-Aware GETVPN Topology



In this setup different crypto map applied to different interfaces, each interface is in a different VRF context namely CustomerA and CustomerB. All these groups are accessing the same key servers (coop) and these key servers are accessible through separate control traffic VRF named ‘management’.

Sample GM Configuration (For Unicast Rekey)

/!!!! Only the necessary commands required to enable VRF-Aware GETVPN are shown here. For more VRF details, refer the Full Configuration section!!!!/

```
crypto isakmp policy 1
 encr aes
 group 2
 lifetime 300
!
crypto gdoi group GET-GROUP1
 identity number 1357924680
 server address ipv4 10.32.178.23
 server address ipv4 10.32.178.56
 client registration interface FastEthernet0.3
!
```

```
crypto gdoi group GET-GROUP2
 identity number 4567
 server address ipv4 10.32.178.23
 server address ipv4 10.32.178.56
 client registration interface FastEthernet0.3
!
!
crypto map getvpn-map1 1 gdoi
 set group GET-GROUP1
!
crypto map getvpn-map2 1 gdoi
 set group GET-GROUP2
!
interface FastEthernet0.1
 encapsulation dot1Q 1
 ip vrf forwarding CustomerA
 ip address 10.32.178.98 255.255.255.252
 duplex auto
 speed auto
 crypto map getvpn-map1
 !
!
interface FastEthernet0.2
 encapsulation dot1Q 10
 ip vrf forwarding CustomerB
 ip address 10.32.178.70 255.255.255.252
 ip pim sparse-mode
 crypto map getvpn-map2
!
interface FastEthernet0.3
 encapsulation dot1Q 20
 ip vrf forwarding management
 ip address 10.32.178.109 255.255.255.252
!
```

Here the registration interface for both groups is the same. There is one registration through the interface FastEthernet0.3 for every group configured and associated with a crypto map. There are two registrations for the above example given. Note that there will be only one IKE SA established for these registrations.

For group GET-GROUP1 we have the registration interface as FastEthernet0.3, this would represent one Group Member. After successful registration, policies would be downloaded and associated with the crypto map on the interface FastEthernet0.1

For group GET-GROUP2 also has the registration interface as FastEthernet0.3, this would represent another GM. After successful registration, policies would be downloaded and associated with the crypto map on the interface FastEthernet0.2

If both registrations are successful with the first Key Server configured, then there would be only one IKE SA established for both the registrations to that key server.

Sample KS Configuration (For Unicast Rekey)

```
crypto isakmp policy 1
 encr aes
 group 2
crypto isakmp keepalive 15 periodic
!
!
crypto ipsec transform-set aes256 esp-aes 256 esp-sha-hmac
!
crypto ipsec profile profile1
 set security-association lifetime seconds 900
 set transform-set aes256
!
crypto ipsec profile profile2
 set security-association lifetime seconds 900
 set transform-set aes256
!
!
crypto gdoi group GET-GROUP1
 identity number 1357924680
 server local
  rekey algorithm aes 256
  rekey lifetime seconds 14400
  rekey retransmit 10 number 3
  rekey authentication mypubkey rsa rekeyA
  rekey transport unicast
  sa ipsec 1
   profile profile1
   match address ipv4 getA-acl
   no replay
  address ipv4 10.32.178.23
  redundancy
   local priority 50
   peer address ipv4 10.32.178.56
   peer address ipv4 10.32.178.57
!
crypto gdoi group GET-GROUP2
 identity number 4567
 server local
  rekey algorithm aes 256
  rekey lifetime seconds 14400
  rekey retransmit 10 number 3
  rekey authentication mypubkey rsa rekeyB
  rekey transport unicast
  sa ipsec 1
   profile profile2
   match address ipv4 getB-acl
   no replay
  address ipv4 10.32.178.23
```

```
 redundancy
  local priority 5
  peer address ipv4 10.32.178.56
  peer address ipv4 10.32.178.57
!
```

Verification

PING to the Key Server with client registration interface as source.

GM1#ping vrf management 10.32.178.56 source fastEthernet 0.3

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.32.178.56, timeout is 2 seconds:

Packet sent with a source address of 10.32.178.110

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/4 ms

Trace route to the Key Server

GM1#traceroute vrf management 10.32.178.56

Type escape sequence to abort.

Tracing the route to 10.32.178.56

1 10.32.178.109 [AS 65004] 0 msec 4 msec 0 msec

2 10.32.178.54 [AS 65004] 0 msec * 0 msec

GM1#

show crypto isakmp sa

This command displays the active ISAKMP sessions on the router and is common for standard IPSec and GEVPN. The output below is from a Group Member. The ISAKMP SAs with 'GDOI_IDLE' status are created as result of GMs registration with KS. Registration SA is same for both GDOI groups as the GM uses the same interface for registration. The SA labeled "GDOI_REKEY" is used for rekey. There will be a separate REKEY SA for each group.

GM1#sh cry isa sa

IPv4 Crypto ISAKMP SA

dst src state conn-id status

10.32.178.109 10.32.178.23 GDOI_REKEY 2020 ACTIVE

10.32.178.23 10.32.178.109 GDOI_IDLE 2019 ACTIVE

10.32.178.109 10.32.178.23 GDOI_REKEY 2021 ACTIVE

IPv6 Crypto ISAKMP SA

GM1#

Show crypto gdoi

This command displays the all basic details about the GETVPN status. The output is different for Key Server and Group Member.

On Group Member:

The output shows the GM used the same VRF for registering both groups.

```
GM1#show  crypto  gdoi

GROUP INFORMATION


   Group Name              : GET-GROUP1

   Group Identity          : 1357924680

   Rekeys received         : 93

   IPSec SA Direction      : Both


    Group Server list      : 10.32.178.23

                             10.32.178.56


   Group member            : 10.32.178.109    vrf: management

     Registration status   : Registered

     Registered with       : 10.32.178.23

     Re-registers in       : 790 sec

     Succeeded registration: 1

     Attempted registration: 1

     Last rekey from       : 10.32.178.23

     Last rekey seq num    : 3

     Unicast rekey received: 93

     Rekey ACKs sent       : 93

     Rekey Rcvd(hh:mm:ss)  : 00:01:01


   Rekeys cumulative

     Total received        : 93

     After latest register : 93

     Rekey Acks sents      : 93
```

```
ACL Downloaded From KS 10.32.178.23:

  <output truncated>


KEK POLICY:

    Rekey Transport Type     : Unicast

    Lifetime (secs)          : 12774

    Encrypt Algorithm        : AES

    Key Size                 : 256

    Sig Hash Algorithm       : HMAC_AUTH_SHA

    Sig Key Length (bits)    : 1024


TEK POLICY for the current KS-Policy ACEs Downloaded:

  FastEthernet0.1:

        IPsec SA:

        spi: 0xAA0BE09C(2852905116)

        transform: esp-256-aes esp-sha-hmac

        sa timing:remaining key lifetime (sec): (838)

        Anti-Replay(Time Based) : 10 sec interval


    Group Name               : GET-GROUP2

    Group Identity           : 4567

    Rekeys received          : 93

    IPSec SA Direction       : Both


     Group Server list       : 10.32.178.23

                               10.32.178.56


    Group member             : 10.32.178.109    vrf: management

      Registration status    : Registered

      Registered with        : 10.32.178.23

      Re-registers in        : 206 sec

      Succeeded registration: 1
```

```
        Attempted registration: 1
        Last rekey from       : 10.32.178.23
        Last rekey seq num    : 4
        Unicast rekey received: 93
        Rekey ACKs sent       : 93
        Rekey Rcvd(hh:mm:ss)  : 00:10:43

      Rekeys cumulative
        Total received        : 93
        After latest register : 93
        Rekey Acks sents      : 93

   ACL Downloaded From KS 10.32.178.23:
     <output truncated>

KEK POLICY:
      Rekey Transport Type     : Unicast
      Lifetime (secs)          : 11550
      Encrypt Algorithm        : AES
      Key Size                 : 256
      Sig Hash Algorithm       : HMAC_AUTH_SHA
      Sig Key Length (bits)    : 1024

TEK POLICY for the current KS-Policy ACEs Downloaded:
    FastEthernet0.2:
      IPsec SA:
        spi: 0xE704734B(3875828555)
        transform: esp-256-aes esp-sha-hmac
        sa timing:remaining key lifetime (sec): (256)
        Anti-Replay(Time Based) : 15 sec interval

GM1#
```

Best Practices

The GETVPN GM requires data plane traffic to enter and exit the same VRF in order for the crypto to be applied properly. VRF-lite means that all the traffic traversing in the particular VRF should be confined to the same VRF after route lookup. GET VPN with VRF-lite support does not address route leaking. Route leaking occurs when traffic enters one routing VRF context and is forwarded in a different VRF routing context. If route leaking is configured on the GM, packets originating in a different route context will be sent out in clear text from the VRF interface where the crypto map is applied.

Following scenarios are not supported:

- Traffic coming from non-VRF global interface to any VRF interface with GDOI crypto map.
- Traffic coming from one VRF and leaving another VRF interface with GDOI crypto map.
- If route leaking is required to make the traffic flow from an interface participating in global routing to another interface with VRF forwarding or vice-versa, the route leaking function must be applied on a router prior to reaching the Group Member router such that traffic entering and exiting the Group Member stays with in the same VRF before and after encryption. See GETVPN Design and Implementation guide at http://www.cisco.com/en/US/prod/collateral/vpndevc/ps6525/ps9370/ps7180/GETVPN_DIG_version_1_0_External.pdf.

Multicast Rekey Configuration

The following sections cover the configuration needs to be incorporated into the basic configuration for enabling multicast rekeying.

Key Server Configuration for Multicast Rekey

This is a sample incremental configuration needed to convert the GEVPN deployment from unicast to multicast rekey.

```
!
! Enable multi-cast routing
ip multi-cast routing
! Enable SSM mode
ip pim ssm range 1
!
! ACL list used in SSM range command
access-list 1 permit 239.192.1.190 0.0.0.0
!
interface GigabitEthernet0/1
  ip pim sparse-mode
!
crypto gdoi group GDOI-GROUP1
 server local
 ! Default rekey method is multicast
 no rekey transport unicast
 ! Multicat group for re-keying. This is specified as a ACL
 rekey address ipv4 getvpn-rekey-multicast-group
 rekey retransmit 10 number 3
!
 ! Add these ACEs in GETVPN policy ACLs
ip access-list extended <acl name>
 deny ip any 224.0.0.0 0.255.255.255
```

```
 deny pim any host 224.0.0.13
!
ip access-list extended getvpn-rekey-multicast-group
 permit ip any host 239.192.1.190
```

Group Member Configuration for Multicast Rekey

Following configuration need to be added to the GMs to receive multicast rekey. This can be used only if multicast routing is enabled on rest of the network. Below configuration uses SSM for multicast. The configuration may need to be changed according to the existing multicast mechanism deployed in the network.

```
!
ip multicast-routing
ip multicast-routing vrf management
! Enable SSM
ip igmp ssm-map enable
ip pim vrf management ssm range 1
! ACL used in ssm range command
access-list 1 permit 239.192.1.190 0.0.0.0
!At client registration interface
interface FastEthernet0.3
 ip pim sparse-mode
! Join for each KS serving the group
 ip igmp join-group 239.192.1.190 source <IP-Addr-of-KS-1>
 ip igmp join-group 239.192.1.190 source <IP-Addr-of-KS-2>
 ...
```

Full Configuration

Group Member Configuration

```
service timestamps debug datetime msec
service timestamps log datetime msec
service password-encryption
!
hostname get-gm
!
boot-start-marker
boot system flash:c181x-advipservicesk9-mz.150-1.M
boot-end-marker
!
logging buffered 100000
enable secret 5 <removed>
enable password 7 <removed>
!
aaa new-model
!
!
aaa authentication login default local
aaa authorization exec default local
!
!
aaa session-id common
```

```
!
!
clock timezone PST -8
clock summer-time PST recurring
!
crypto pki trustpoint beta-ca
 enrollment mode ra
 enrollment url <removed>l
 serial-number
 fingerprint <removed>
 revocation-check none
!
!
crypto pki certificate chain beta-ca
 <removed>
dot11 syslog
ip source-route
!
!
!
ip dhcp pool CustomerA
   vrf CustomerA
   network 10.32.176.152 255.255.255.248
   domain-name a.com
   default-router 10.32.176.153
   netbios-name-server <removed>
   option 150 ip <removed>
   dns-server <removed>
!
!
ip dhcp pool CustomerB
   vrf CustomerB
   network 10.32.176.128 255.255.255.248
   domain-name b.com
   dns-server <removed>
   option 150 ip <removed>
   default-router 10.32.176.129
   netbios-name-server <removed>


ip vrf CustomerA
 rd 1:100
 route-target export 1:100
 route-target import 1:100
!
ip vrf CustomerB
 rd 1:200
 route-target export 1:200
 route-target import 1:200
!
```

```
ip vrf management
 rd 1:299
 route-target export 1:299
 route-target import 1:299
!
ip cef
no ip domain lookup
ip host beta-ca 10.34.250.101
ip name-server <removed>
ip multicast-routing
ip multicast-routing vrf CustomerA
ip multicast-routing vrf CustomerB
ip multicast-routing vrf management
no ip igmp ssm-map query dns
no ipv6 cef
!
multilink bundle-name authenticated
!
archive
 log config
  hidekeys
!
!
crypto isakmp policy 1
 encr aes
 group 2
 lifetime 300
!
crypto gdoi group GET-GROUP1
 identity number 1357924680
 server address ipv4 10.32.178.23
 server address ipv4 10.32.178.56
 client registration interface FastEthernet0.3
!
crypto gdoi group GET-GROUP2
 identity number 4567
 server address ipv4 10.32.178.23
 server address ipv4 10.32.178.56
 client registration interface FastEthernet0.3
!
!
crypto map getvpn-map1 1 gdoi
 set group GET-GROUP1
!
crypto map getvpn-map2 1 gdoi
 set group GET-GROUP2
!
!
interface FastEthernet0.1
 encapsulation dot1Q 1
```

```
 ip vrf forwarding CustomerA
 ip address 10.32.178.98 255.255.255.252
 duplex auto
 speed auto
 crypto map getvpn-map1
 !
!
interface FastEthernet0.2
 encapsulation dot1Q 10
 ip vrf forwarding CustomerB
 ip address 10.32.178.70 255.255.255.252
 ip pim sparse-mode
 crypto map getvpn-map2
!
interface FastEthernet0.3
 encapsulation dot1Q 20
 ip vrf forwarding management
 ip address 10.32.178.109 255.255.255.252
!
interface FastEthernet1
 no ip address
 shutdown
 duplex auto
 speed auto
 !
!
interface FastEthernet2
 switchport access vlan 10
 spanning-tree portfast
 !
!
interface FastEthernet3
 switchport access vlan 10
 !
!
interface FastEthernet4
 switchport access vlan 10
 !
!
interface FastEthernet5
 switchport access vlan 10
 !
!
interface FastEthernet6
 switchport access vlan 10
 spanning-tree portfast
 !
!
interface FastEthernet7
 switchport access vlan 20
```

```
 spanning-tree portfast
 !
!
interface FastEthernet8
 switchport access vlan 20
 spanning-tree portfast
 !
!
!
interface Vlan1
 no ip address
 !
!
interface Vlan10
 ip vrf forwarding CustomerA
 ip address 10.32.176.129 255.255.255.248
 ip pim sparse-mode
 ip tcp adjust-mss 1360
 no autostate
 !
!
interface Vlan20
 ip vrf forwarding CustomerB
 ip address 10.32.176.153 255.255.255.248
 ip pim sparse-mode
 ip tcp adjust-mss 1360
 no autostate
 !
!
interface Async1
 no ip address
 encapsulation slip
 !
!
router bgp 65002
 bgp router-id 10.32.178.98
 bgp log-neighbor-changes
 neighbor 10.32.178.97 remote-as 65001
 !
 address-family ipv4
  no synchronization
  neighbor 10.32.178.97 activate
  no auto-summary
 exit-address-family
 !
 address-family ipv4 vrf CustomerA
  no synchronization
  bgp router-id 10.32.178.98
  network 10.32.176.152 mask 255.255.255.248
  neighbor 10.32.178.97 remote-as 65001
```

```
  neighbor 10.32.178.97 activate
 exit-address-family
 !
 address-family ipv4 vrf CustomerB
  no synchronization
  bgp router-id 10.32.178.70
  network 10.32.176.128 mask 255.255.255.248
  neighbor 10.32.178.69 remote-as 65001
  neighbor 10.32.178.69 activate
 exit-address-family
 !
 address-family ipv4 vrf management
  no synchronization
  redistribute connected
  neighbor 10.32.178.110 remote-as 65001
  neighbor 10.32.178.110 activate
  neighbor 10.32.178.110 as-override
 exit-address-family
!
ip forward-protocol nd
no ip http server
ip http secure-server
!
!
access-list 1 permit 239.192.0.0 0.0.255.255
!
!
!
control-plane
!
!
!
line con 0
 exec-timeout 0 0
line 1
 modem InOut
 stopbits 1
 speed 115200
 flowcontrol hardware
line aux 0
line vty 0 4
 exec-timeout 0 0
 password 7 <removed>
 transport input all
line vty 5 193
 password 7 <removed>
 transport input all
!
exception data-corruption buffer truncate
ntp server 198.123.30.132
```

```
end
```

Key Server1 Configuration

```
!
service timestamps debug datetime localtime
service timestamps log datetime localtime
service password-encryption
service internal
!
hostname ks1
!
boot-start-marker
boot system disk2:c7200-advipservicesk9-mz.150-1.M
boot-end-marker
!
logging message-counter syslog
logging buffered 100000
enable secret 5 <removed>
!
aaa new-model
!
aaa group server tacacs+ vty_access
!
aaa authentication login admin group tacacs+ enable
!
!
aaa session-id common
clock timezone pst -8
clock summer-time PDT recurring
ip source-route
ip cef
!
!
no ip domain lookup
ip domain name Cisco.com
ip host beta-ca 10.34.250.101
ip name-server <removed>
ip multicast-routing
ip igmp ssm-map enable
no ipv6 cef
!
multilink bundle-name authenticated
!
!
voice dsp waitstate 24898
!
crypto pki trustpoint beta-ca
 enrollment mode ra
 enrollment url <removed>
```

```
 serial-number
 revocation-check none
 auto-enroll
!
!
crypto pki certificate chain beta-ca
 certificate 10C34F800000000005FD
  <truncated>
log config
  hidekeys
!
!
crypto isakmp policy 1
 encr aes
 group 2
!
crypto ipsec transform-set aes256 esp-aes 256 esp-sha-hmac
!
crypto ipsec profile profile1
 set security-association lifetime seconds 7200
 set transform-set aes256
!
crypto ipsec profile profile2
 set security-association lifetime seconds 7200
 set transform-set aes256
!
!
crypto gdoi group GET-GROUP1
 identity number 1357924680
 server local
  rekey algorithm aes 256
  rekey lifetime seconds 86400
  rekey retransmit 10 number 3
  rekey authentication mypubkey rsa rekeyA
  rekey transport unicast
  sa ipsec 1
   profile profile1
   match address ipv4 customerA-acl
   no replay
  address ipv4 10.32.178.23
  redundancy
   local priority 50
   peer address ipv4 10.32.178.56
   peer address ipv4 10.32.178.57
!
crypto gdoi group GET-GROUP2
 identity number 4567
 server local
  rekey algorithm aes 256
  rekey lifetime seconds 86400
```

```
  rekey retransmit 10 number 3
  rekey authentication mypubkey rsa rekeyB
  rekey transport unicast
  sa ipsec 1
   profile profile2
   match address ipv4 customerB-acl
   no replay
  address ipv4 10.32.178.23
  redundancy
   local priority 5
   peer address ipv4 10.32.178.56
   peer address ipv4 10.32.178.57
!
!
ip ssh version 1
buffers huge size 64000
!
!
interface Loopback0
 ip address 10.32.178.23 255.255.255.255
 ip pim sparse-mode
!
interface GigabitEthernet0/1
 description Connected to pe2
 ip address 10.32.178.26 255.255.255.252
 ip pim sparse-mode
 duplex auto
 speed auto
 media-type rj45
 no negotiation auto
 hold-queue 4096 in
 hold-queue 4096 out
!
router bgp 65002
 bgp log-neighbor-changes
 neighbor 10.32.178.25 remote-as 65001
 !
 address-family ipv4
  neighbor 10.32.178.25 activate
  no auto-summary
  no synchronization
  network 10.32.178.23 mask 255.255.255.255
  network 10.32.178.26 mask 255.255.255.255
 exit-address-family
 !
 address-family ipv4 multicast
  neighbor 10.32.178.25 activate
  no auto-summary
  network 10.32.178.23 mask 255.255.255.255
 exit-address-family
```

```
!
ip forward-protocol nd
ip route 0.0.0.0 0.0.0.0 10.32.178.25
ip http server
ip http secure-server
!
!
ip pim ssm range 1
ip tacacs source-interface Loopback0
!
!
ip access-list extended customerA-acl
 deny   udp any host 10.32.17.19 eq tftp
 deny   udp host 10.32.17.19 eq tftp any
 deny   udp any eq 848 any eq 848
 deny   ip any 224.0.0.0 0.255.255.255
 deny   pim any host 224.0.0.13
 deny   igmp any any
 deny   icmp any any
 deny   tcp any any eq telnet
 deny   tcp any eq telnet any
 deny   tcp any eq bgp any
 deny   tcp any any eq bgp
 deny   eigrp any any
 deny   udp any any eq ntp
 deny   udp any any eq snmp
 deny   udp any eq snmp any
 deny   udp any any eq snmptrap
 deny   udp any any eq syslog
 deny   tcp any any eq tacacs
 deny   tcp any eq tacacs any
 permit ip any any
!
ip access-list extended customerB-acl
 deny   udp any eq 848 any eq 848
 deny   ip any 224.0.0.0 0.255.255.255
 deny   pim any host 224.0.0.13
 deny   igmp any any
 deny   tcp any any eq telnet
 deny   tcp any eq telnet any
 deny   tcp any eq bgp any
 deny   tcp any any eq bgp
 deny   eigrp any any
 deny   udp any any eq ntp
 deny   udp any any eq snmp
 deny   udp any eq snmp any
 deny   udp any any eq snmptrap
 deny   udp any any eq syslog
 deny   tcp any any eq tacacs
 deny   tcp any eq tacacs any
```

```
 permit ip any any
!
!
!
!
tacacs-server host <removed>
tacacs-server host <removed>
tacacs-server timeout 15
tacacs-server directed-request
!
control-plane
!
mgcp fax t38 ecm
mgcp behavior g729-variants static-pt
!
!
line con 0
 password 7 <removed>
 transport output all
 stopbits 1
line aux 0
 transport output all
 stopbits 1
line vty 0 4
 exec-timeout 0 0
 logging synchronous
 login authentication admin
 transport input all
 transport output all
line vty 5 15
 exec-timeout 0 0
 transport input all
 transport output all
!
exception data-corruption buffer truncate
ntp server <removed>
ntp server <removed>
end
```

Key Server2 Configuration

```
!
service timestamps debug datetime localtime
service timestamps log datetime localtime
service password-encryption
service internal
!
hostname ks2
!
boot-start-marker
```

```
boot system disk2:c7200-advipservicesk9-mz.150-1.M
boot-end-marker
!
logging message-counter syslog
logging queue-limit 100
logging buffered 65555
enable secret 5 <removed>
!
aaa new-model
!
!
aaa group server tacacs+ vty_access
 server <removed>
 server <removed>
!
aaa authentication login admin group tacacs+ enable
aaa authorization exec admin group tacacs+
!
!
aaa session-id common
clock timezone pst -8
clock summer-time PDT recurring
ip source-route
ip cef
!
!
!
!
no ip domain lookup
ip domain name cisco.com
ip host beta-ca 10.34.250.101
ip name-server <removed>
ip multicast-routing
ip igmp ssm-map enable
no ipv6 cef
!
multilink bundle-name authenticated
!
!
voice dsp waitstate 24898
!
crypto pki trustpoint beta-ca
 enrollment mode ra
 enrollment url <removed>
 serial-number
 revocation-check none
 auto-enroll
!
!
crypto pki certificate chain beta-ca
```

```
 certificate 479663B9000100000C3F
< truncated >
username cisco secret 5 <removed>
archive
 log config
  hidekeys
!
!
crypto isakmp policy 1
 encr aes
  group 2
!
crypto isakmp keepalive 15 periodic
!
!
crypto ipsec transform-set aes256 esp-aes 256 esp-sha-hmac
!
crypto ipsec profile profile1
 set security-association lifetime seconds 7200
 set transform-set aes256
!
crypto ipsec profile profile2
 set security-association lifetime seconds 7200
 set transform-set aes256
!
crypto gdoi group GET-GROUP1
 identity number 1357924680
 server local
  rekey algorithm aes 256
  rekey lifetime seconds 84400
  rekey retransmit 10 number 3
  rekey authentication mypubkey rsa rekeyA
  rekey transport unicast
  sa ipsec 1
   profile profile1
   match address ipv4 customerA-acl
   no replay
  address ipv4 10.32.178.56
  redundancy
   local priority 80
   peer address ipv4 10.32.178.23
   peer address ipv4 10.32.178.57
!
crypto gdoi group GET-GROUP2
 identity number 4567
 server local
  rekey algorithm aes 256
  rekey lifetime seconds 84400
  rekey retransmit 10 number 3
  rekey authentication mypubkey rsa rekeyB
```

```
  rekey transport unicast
  sa ipsec 1
   profile profile2
   match address ipv4 customerB-acl
   no replay
  address ipv4 10.32.178.56
  redundancy
   local priority 3
   peer address ipv4 10.32.178.23
   peer address ipv4 10.32.178.57
!
ip ssh version 1
buffers huge size 64000
!
interface Loopback0
 ip address 10.32.178.56 255.255.255.255
 ip pim sparse-mode
!
interface GigabitEthernet0/1
 description Connected to pe1
 ip address 10.32.178.54 255.255.255.252
 ip pim sparse-mode
 duplex full
 speed 1000
 media-type rj45
 no negotiation auto
 hold-queue 4096 in
 hold-queue 4096 out
!
router bgp 65002
 bgp log-neighbor-changes
 neighbor 10.32.178.53 remote-as 65001
 !
 address-family ipv4
  neighbor 10.32.178.53 activate
  no auto-summary
  no synchronization
  network 10.32.178.56 mask 255.255.255.255
 exit-address-family
 !
 address-family ipv4 multicast
  neighbor 10.32.178.53 activate
  no auto-summary
  network 10.32.178.56 mask 255.255.255.255
 exit-address-family
!
ip forward-protocol nd
ip route 0.0.0.0 0.0.0.0 10.32.178.53
no ip http server
ip http secure-server
```

```
!
!
ip pim ssm range 1
ip tacacs source-interface Loopback0
!
!
ip access-list extended customerA-acl
 deny   udp any host 10.32.17.19 eq tftp
 deny   udp host 10.32.17.19 eq tftp any
 deny   udp any eq 848 any eq 848
 deny   ip any 224.0.0.0 0.255.255.255
 deny   pim any host 224.0.0.13
 deny   igmp any any
 deny   icmp any any
 deny   tcp any any eq telnet
 deny   tcp any eq telnet any
 deny   tcp any eq bgp any
 deny   tcp any any eq bgp
 deny   eigrp any any
 deny   udp any any eq ntp
 deny   udp any any eq snmp
 deny   udp any eq snmp any
 deny   udp any any eq snmptrap
 deny   udp any any eq syslog
 deny   tcp any any eq tacacs
 deny   tcp any eq tacacs any
 permit ip any any
ip access-list extended customerB-acl
 deny   udp any eq 848 any eq 848
 deny   ip any 224.0.0.0 0.255.255.255
 deny   pim any host 224.0.0.13
 deny   igmp any any
 deny   tcp any any eq telnet
 deny   tcp any eq telnet any
 deny   tcp any eq bgp any
 deny   tcp any any eq bgp
 deny   eigrp any any
 deny   udp any any eq ntp
 deny   udp any any eq snmp
 deny   udp any eq snmp any
 deny   udp any any eq snmptrap
 deny   udp any any eq syslog
 deny   tcp any any eq tacacs
 deny   tcp any eq tacacs any
 permit ip any any
!
logging alarm informational
!
tacacs-server host <removed>
tacacs-server host <removed>
```

```
tacacs-server timeout 15
tacacs-server directed-request
!
control-plane
!
!
mgcp fax t38 ecm
mgcp behavior g729-variants static-pt
!
!
dial-peer cor custom
!
!
!
line con 0
 exec-timeout 0 0
 stopbits 1
line aux 0
 stopbits 1
line vty 0 4
 exec-timeout 0 0
 login authentication admin
line vty 5 15
 exec-timeout 0 0
 transport input ssh
 transport output all
line vty 16 1869
!
exception data-corruption buffer truncate
ntp server <removed>
ntp server <removed>
end
```

References

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