FlexVPN HA双集线器配置示例

目录

简介

本文档介绍如何为通过基于IPSec的VPN通过不安全网络介质（如Internet）连接到数据中心的远程办公室配置完全冗余设计。

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技术组件：

- 边界网关协议(BGP)，作为数据中心内以及VPN重叠中分支和集线器之间的路由协议。

- 双向转发检测(BFD)，作为一种机制，可检测仅在数据中心内运行（而不是通过重叠隧道）的下行链路（路由器关闭）。
- 集线器和辐条之间的Cisco IOS® FlexVPN，通过短切交换启用分支到分支功能。
- 两个集线器之间的通用路由封装(GRE)隧道，以便实现分支到分支通信，即使分支连接到不同的集线器。
- 增强的对象跟踪和与跟踪对象关联的静态路由。

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。

背景信息

当您为数据中心设计远程访问解决方案时，高可用性(HA)通常是任务关键型用户应用的关键要求。

本文档中提供的解决方案允许快速检测和从故障场景中恢复，在故障场景中，其中一个VPN终端集线器因重新加载、升级或电源问题而关闭。所有远程办公室路由器（分支）在检测到此类故障后立即使用另一个运行中心。

以下是此设计的优点：

- 从VPN集线器关闭场景快速恢复网络
- VPN集线器之间没有复杂的状态同步(如IPSec安全关联(SA)、互联网安全关联和密钥管理协议(ISAKMP)SA和加密路由)
- 由于封装安全负载(ESP)序列号与IPSec状态HA同步出现延迟，因此没有反重播问题
- VPN集线器可以使用不同的基于Cisco IOS/IOS-XE的硬件或软件
- BGP作为VPN重叠中运行的路由协议，可灵活选择负载均衡实施
- 在所有设备上清除可读路由，且没有在后台运行的隐藏机制
- 直接分支到分支连接
- 所有FlexVPN优势，包括身份验证、授权和记帐(AAA)集成和每通道服务质量(QoS)

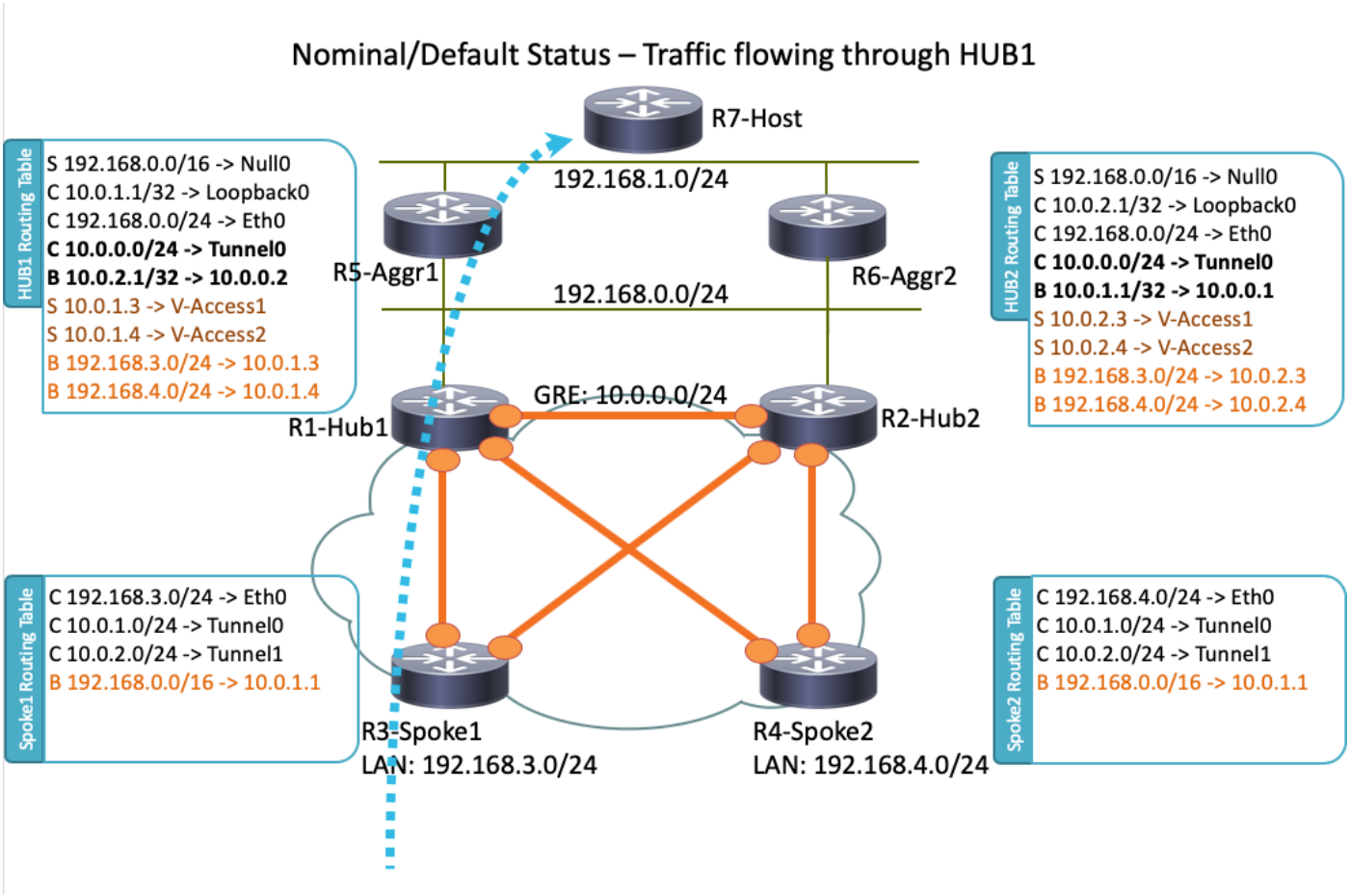
配置

本节提供示例场景并介绍如何为通过基于IPSec的VPN通过不安全网络介质连接到数据中心的远程办公室配置完全冗余设计。

> **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

本文档中使用的网络拓扑如下：



> **注意**：此拓扑中使用的所有路由器都运行Cisco IOS版本15.2(4)M1，而互联网云使用地址方案172.16.0.0/24。

常规操作场景

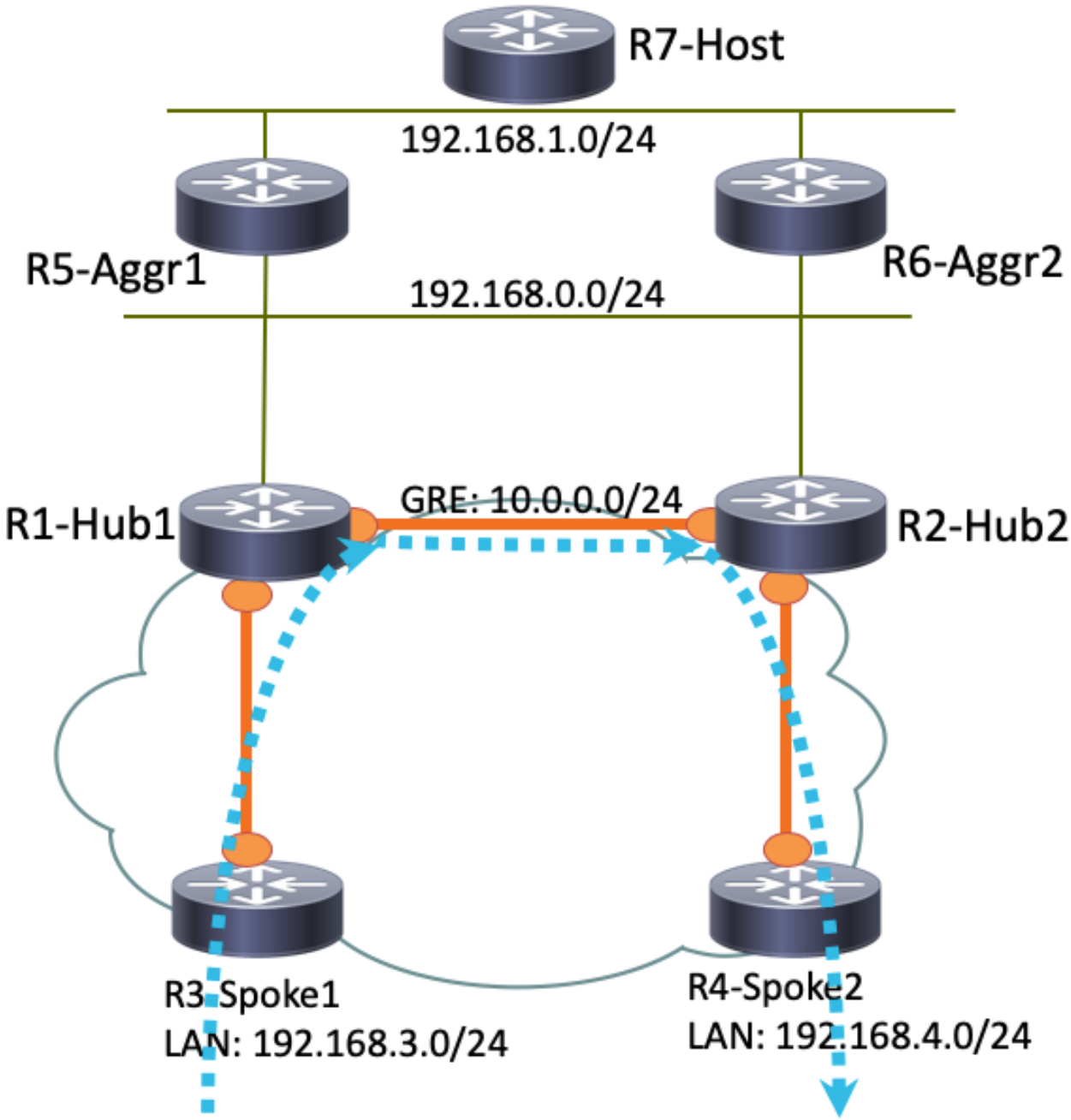
在正常运行情景中，当所有路由器都正常运行时，所有分支路由器都通过默认中心(R1-HUB1)路由所有流量。 当默认BGP本地优先级设置为200时，即可实现此路由首选项（有关详细信息，请参阅以下各节）。这可以根据部署要求（如流量负载均衡）进行调整。

分支到分支（快捷方式）

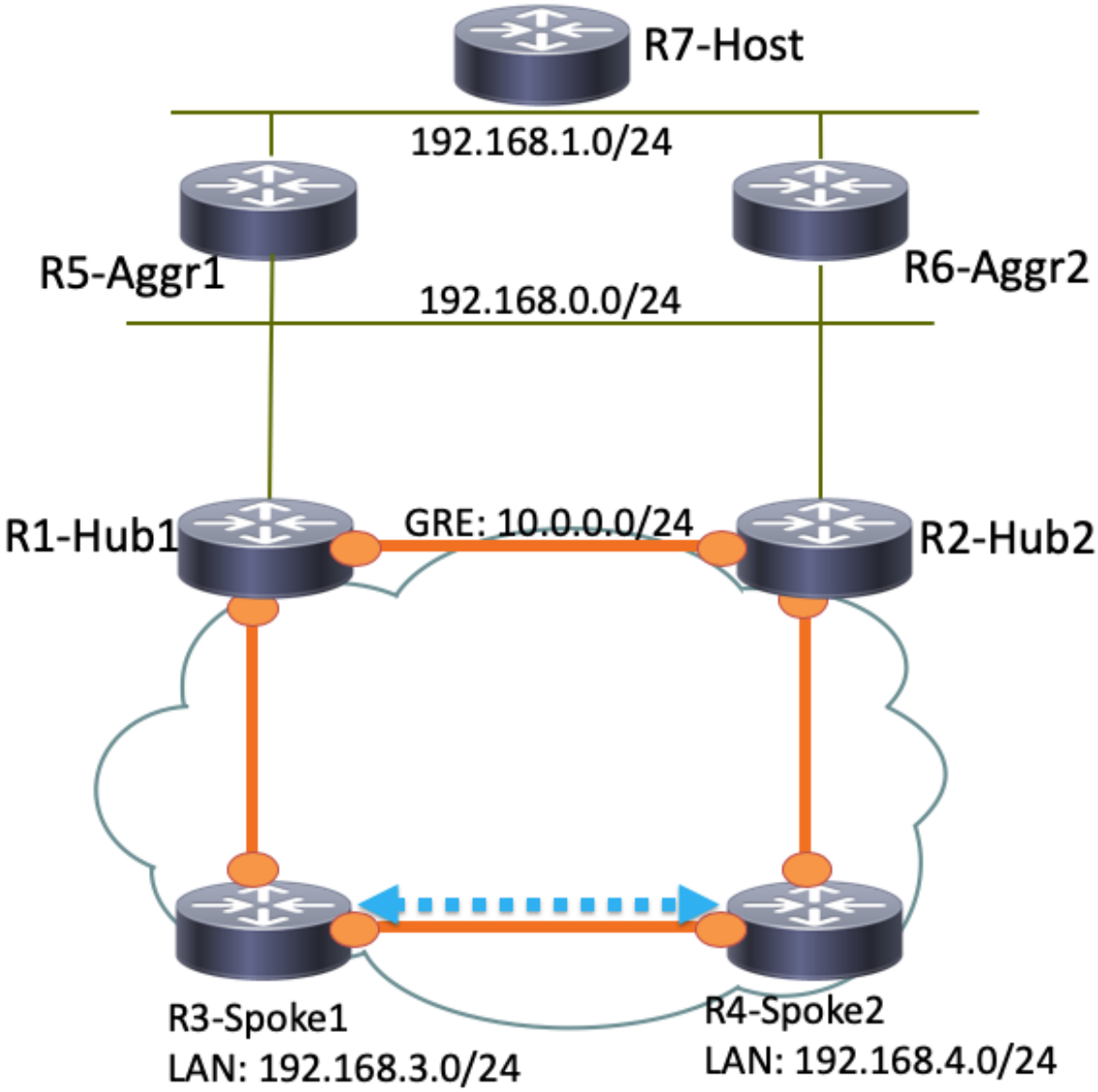
如果R3-Spoke1启动到R4-Spoke2的连接，则使用短切交换配置创建动态分支到分支隧道。

> **提示**：有关详细信息，请参阅配置FlexVPN分支到分支配置指南。

如果R3-Spoke1仅连接到R1-HUB1，而R4-Spoke2仅连接到R2-HUB2，则仍可通过在集线器之间运行的点对点GRE隧道实现直接分支到分支连接。在这种情况下，R3-Spoke1和R4-Spoke2之间的初始流量路径如下所示：



由于R1-Hub1在虚拟访问接口上收到数据包，该接口与GRE隧道具有相同的下一跳解析协议(NHRP)网络ID，因此流量指示将发送到R3-Spoke1。这将触发分支到分支的动态隧道创建：



常规运行场景的路由表和输出

以下是常规运行场景中的R1-HUB1路由表：

```
R1-HUB1# show ip route
Codes: L - local, C - connected, S - static, 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
       i - IS-IS, su - IS-IS summary, 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, H - NHRP, l - LISP
       a - application route
       + - replicated route, % - next hop override

Gateway of last resort is not set

      10.0.0.0/8 is variably subnetted, 11 subnets, 3 masks
```

```
S        10.0.0.0/8 is directly connected, Null0
C        10.0.0.0/24 is directly connected, Tunnel0
L        10.0.0.1/32 is directly connected, Tunnel0
C        10.0.1.1/32 is directly connected, Loopback0
S        10.0.1.2/32 is directly connected, Virtual-Access1
S        10.0.1.3/32 is directly connected, Virtual-Access2
B        10.0.2.1/32 [200/0] via 10.0.0.2, 00:05:40
B        10.0.2.3/32 [200/0] via 10.0.0.2, 00:05:40
B        10.0.2.4/32 [200/0] via 10.0.0.2, 00:05:40
B        10.0.5.1/32 [200/0] via 192.168.0.5, 00:05:40
B        10.0.6.1/32 [200/0] via 192.168.0.6, 00:05:40
     172.16.0.0/16 is variably subnetted, 2 subnets, 2 masks
C        172.16.0.0/24 is directly connected, Ethernet0/0
L        172.16.0.1/32 is directly connected, Ethernet0/0
S     192.168.0.0/16 is directly connected, Null0
     192.168.0.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.0.0/24 is directly connected, Ethernet0/2
L        192.168.0.1/32 is directly connected, Ethernet0/2
B     192.168.1.0/24 [200/0] via 192.168.0.5, 00:05:40
B     192.168.3.0/24 [200/0] via 10.0.1.4, 00:05:24
B     192.168.4.0/24 [200/0] via 10.0.1.5, 00:05:33
```

在创建具有R4-SPOKE2的分支到分支隧道后，在常规操作场景中，R3-SPOKE1的路由表如下：

```
R3-SPOKE1#  show ip route
Codes: L - local, C - connected, S - static, 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
       i - IS-IS, su - IS-IS summary, 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, H - NHRP, l - LISP
       a - application route
       + - replicated route, % - next hop override

Gateway of last resort is not set

     10.0.0.0/8 is variably subnetted, 8 subnets, 2 masks
B        10.0.0.0/8 [200/0] via 10.0.1.1, 00:06:27
H        10.0.0.1/32 is directly connected, 00:06:38, Tunnel1
S   %    10.0.1.1/32 is directly connected, Tunnel0
C        10.0.1.3/32 is directly connected, Tunnel0
H        10.0.1.4/32 is directly connected, 00:01:30, Virtual-Access1
S        10.0.2.1/32 is directly connected, Tunnel1
C        10.0.2.3/32 is directly connected, Tunnel1
H        10.0.2.4/32 [250/1] via 10.0.2.3, 00:01:30, Virtual-Access1
     172.16.0.0/16 is variably subnetted, 2 subnets, 2 masks
C        172.16.0.0/24 is directly connected, Ethernet0/0
L        172.16.0.3/32 is directly connected, Ethernet0/0
B     192.168.0.0/16 [200/0] via 10.0.1.1, 00:06:27
     192.168.3.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.3.0/24 is directly connected, Ethernet0/1
L        192.168.3.3/32 is directly connected, Ethernet0/1
     192.168.4.0/32 is subnetted, 1 subnets
H        192.168.4.4 [250/1] via 10.0.1.3, 00:01:30, Virtual-Access1
```

在R3-Spoke1上，BGP表具有两个用于具有不同本地首**选项的**192.168.0.0/16网络的条目（首选R1-Hub1）：

```
R3-SPOKE1#show ip bgp 192.168.0.0/16
BGP routing table entry for 192.168.0.0/16, version 8
Paths: (2 available, best #2, table default)
```

```
 Not advertised to any peer
 Refresh Epoch 1
 Local
   10.0.2.1 from 10.0.2.1 (10.0.2.1)
     Origin incomplete, metric 0, localpref 100, valid, internal
     rx pathid: 0, tx pathid: 0
 Refresh Epoch 1
  Local
    10.0.1.1 from 10.0.1.1 (10.0.1.1)
     Origin incomplete, metric 0, localpref 200, valid, internal, best
     rx pathid: 0, tx pathid: 0x0
```

以下是常规操作场景中的R5-AGGR1路由表：

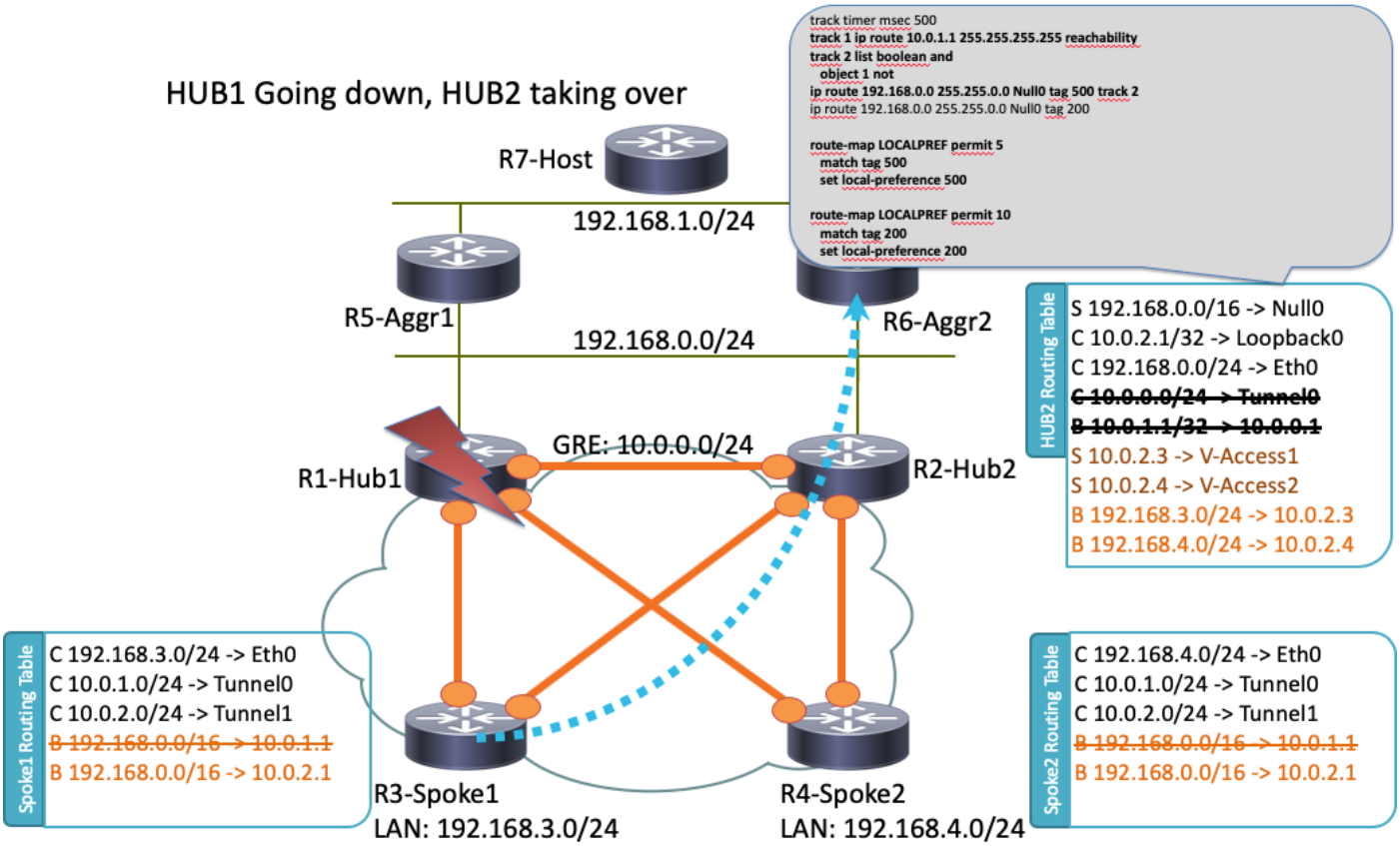
```
R5-LAN1#show ip route
     10.0.0.0/8 is variably subnetted, 10 subnets, 3 masks
B        10.0.0.0/8 [200/0] via 192.168.0.1, 00:07:22
B        10.0.0.0/24 [200/0] via 192.168.0.1, 00:07:22
B        10.0.1.1/32 [200/0] via 192.168.0.1, 00:07:22
B        10.0.1.3/32 [200/0] via 192.168.0.1, 00:07:17
B        10.0.1.4/32 [200/0] via 192.168.0.1, 00:07:16
B        10.0.2.1/32 [200/0] via 192.168.0.2, 15:44:13
B        10.0.2.3/32 [200/0] via 192.168.0.2, 15:44:13
B        10.0.2.4/32 [200/0] via 192.168.0.2, 15:44:13
C        10.0.5.1/32 is directly connected, Loopback0
B        10.0.6.1/32 [200/0] via 192.168.0.6, 00:07:22
     172.16.0.0/24 is subnetted, 1 subnets
B        172.16.0.0 [200/0] via 192.168.0.1, 00:07:22
B     192.168.0.0/16 [200/0] via 192.168.0.1, 00:07:22
     192.168.0.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.0.0/24 is directly connected, Ethernet0/0
L        192.168.0.5/32 is directly connected, Ethernet0/0
     192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.1.0/24 is directly connected, Ethernet0/1
L        192.168.1.5/32 is directly connected, Ethernet0/1
B     192.168.3.0/24 [200/0] via 10.0.1.3, 00:07:06
B     192.168.4.0/24 [200/0] via 10.0.1.4, 00:07:15
```

以下是常规运行场景中的R7-HOST路由表：

```
R7-HOST#show ip route
S*    0.0.0.0/0 [1/0] via 192.168.1.254
     192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.1.0/24 is directly connected, Ethernet0/0
L        192.168.1.7/32 is directly connected, Ethernet0/0
```

HUB1故障场景

以下是R1-HUB1关闭场景（由于停电或升级等操作）：



在此场景中，会发生以下事件序列：

1. R2-HUB2和LAN聚合路由器R5-AGGR1和R6-AGGR2上的BFD检测R1-HUB1的关闭状态。因此，BGP邻居关系立即断开。

2. 检测R1-HUB1环回存在的R2-HUB2的跟踪对象检测关闭（示例配置中的跟踪1）。

3. 此被关闭的跟踪对象触发另一个跟踪上升（逻辑非）。 在本例中，每当路径1发生故障时，路径2就会上升。

4. 这会触发一个静态IP路由条目，该条目将由于值低于默认管理距离而添加到路由表中。以下是相关配置：

```
! Routes added when second HUB is down
ip route 10.0.0.0 255.0.0.0 Null0 tag 500 track 2
ip route 192.168.0.0 255.255.0.0 Null0 tag 500 track 2

! Default static routes are with Tag 200 and admin distance of 150
ip route 10.0.0.0 255.0.0.0 Null0 150 tag 200
ip route 192.168.0.0 255.255.0.0 Null0 150 tag 200
```

5. R2-HUB2使用大于为R1-HUB1设置的值的BGP本地优先级重分发这些静态路由。在本例中，在故障场景中使用本地优先级500，而不是R1-HUB1设置的200:

```
route-map LOCALPREF permit 5
 match tag 500
 set local-preference 500
!
route-map LOCALPREF permit 10
```

```
 match tag 200
 set local-preference 200
!
```

在R3-Spoke1上，您可以在BGP输出中看到这一点。请注意，R1的条目仍然存在，但未使用：

```
R3-SPOKE1#show ip bgp 192.168.0.0/16
BGP routing table entry for 192.168.0.0/16, version 10
Paths: (2 available, best #1, table default)
 Not advertised to any peer
 Refresh Epoch 1
 Local
   10.0.2.1 from 10.0.2.1 (10.0.2.1)
      Origin incomplete, metric 0, localpref 500, valid, internal, best
      rx pathid: 0, tx pathid: 0x0
 Refresh Epoch 1
 Local
   10.0.1.1 from 10.0.1.1 (10.0.1.1)
     Origin incomplete, metric 0, localpref 200, valid, internal
     rx pathid: 0, tx pathid: 0
```

6. 此时，两个分支（R3-Spoke1和R4-Spoke2）都开始向R2-HUB2发送流量。所有这些步骤都应在一秒内完成。以下是辐条3上的路由表：

```
R3-SPOKE1#show ip route
     10.0.0.0/8 is variably subnetted, 5 subnets, 2 masks
B        10.0.0.0/8 [200/0] via 10.0.2.1, 00:00:01
S        10.0.1.1/32 is directly connected, Tunnel0
C        10.0.1.3/32 is directly connected, Tunnel0
S        10.0.2.1/32 is directly connected, Tunnel1
C        10.0.2.3/32 is directly connected, Tunnel1
     172.16.0.0/16 is variably subnetted, 2 subnets, 2 masks
C        172.16.0.0/24 is directly connected, Ethernet0/0
L        172.16.0.3/32 is directly connected, Ethernet0/0
B     192.168.0.0/16 [200/0] via 10.0.2.1, 00:00:01
     192.168.3.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.3.0/24 is directly connected, Ethernet0/1
L        192.168.3.3/32 is directly connected, Ethernet0/1
```

7. 后来分支与R1-HUB1之间的BGP会话断开，失效对等体检测(DPD)删除在R1-HUB1上终止的IPSec隧道。但是，这不会影响流量转发，因为R2-HUB2已用作主隧道终止网关：

```
R3-SPOKE1#show ip bgp 192.168.0.0/16
BGP routing table entry for 192.168.0.0/16, version 10
Paths: (1 available, best #1, table default)
 Not advertised to any peer
 Refresh Epoch 1
 Local
   10.0.2.1 from 10.0.2.1 (10.0.2.1)
     Origin incomplete, metric 0, localpref 500, valid, internal, best
     rx pathid: 0, tx pathid: 0x0
```

配置

本节提供此拓扑中使用的集线器和辐条的示例配置。

R1-HUB配置

```
version 15.4
!
hostname R1-HUB1
!
aaa new-model
!
aaa authorization network default local
!
aaa session-id common
!
! setting track timers to the lowest possible (the lower this value is
! the faster router will react
track timer ip route msec 500
!
! Monitoring of HUB2's loopback present in routing table
! If it is present it will mean that HUB2 is alive
track 1 ip route 10.0.2.1 255.255.255.255 reachability
!
! Monitoring of loopback of R5-AGGR-1
track 3 ip route 10.0.5.1 255.255.255.255 reachability
!
! Monitoring of loopback of R6-AGGR-2
track 4 ip route 10.0.6.1 255.255.255.255 reachability
!
! Track 2 should be UP only when HUB2 is not available and both AGGRE routers are up
!
track 2 list boolean and
 object 1 not
 object 3
 object 4
!

! IKEv2 Config Exchange configuration (IP addresses for spokes are assigned from pool)
crypto ikev2 authorization policy default
 pool SPOKES
 route set interface
 route accept any tag 20
!
!
! IKEv2 profile for Spokes - Smart Defaults used
crypto ikev2 profile default
 match identity remote any
 authentication remote pre-share key cisco
 authentication local pre-share key cisco
 aaa authorization group psk list default default
 virtual-template 1
!
interface Loopback0
 ip address 10.0.1.1 255.255.255.255
!
! GRE Tunnel configured to second HUB. It is required for spoke-to-spoke connectivity
! to work in all possible circumstances
! no BFD echo configuration is required to avoid Traffic Indication sent by remote HUB
! (BFD echo is having the same source and destination IP address)
!
interface Tunnel0
 ip address 10.0.0.1 255.255.255.0
 ip nhrp network-id 1
 ip nhrp redirect
```

```
 bfd interval 50 min_rx 50 multiplier 3
 no bfd echo
 tunnel source Ethernet0/2
 tunnel destination 192.168.0.2
!
interface Ethernet0/0
 ip address 172.16.0.1 255.255.255.0
!
interface Ethernet0/2
 ip address 192.168.0.1 255.255.255.0
 bfd interval 50 min_rx 50 multiplier 5
!
interface Virtual-Template1 type tunnel
 ip unnumbered Loopback0
 ip nhrp network-id 1
 ip nhrp redirect
 tunnel protection ipsec profile default
!
! BGP Configuration
router bgp 1
 bgp log-neighbor-changes
! dynamic peer-groups are used for AGGR routers and SPOKES
 bgp listen range 192.168.0.0/24 peer-group DC
 bgp listen range 10.0.1.0/24 peer-group SPOKES
! BGP timers configured
 timers bgp 15 30
 neighbor SPOKES peer-group
 neighbor SPOKES remote-as 1
 neighbor DC peer-group
 neighbor DC remote-as 1
! Within DC BFD is used to determine neighbour status
 neighbor DC fall-over bfd
 neighbor 10.0.0.2 remote-as 1
! BFD is used to detect HUB2 status
 neighbor 10.0.0.2 fall-over bfd
 !
 address-family ipv4
 redistribute connected
! route-map which determines what should be the local-pref
 redistribute static route-map LOCALPREF
 neighbor SPOKES activate
! to spokes only Aggregate/Summary routes are sent
 neighbor SPOKES route-map AGGR out
 neighbor DC activate
 neighbor DC route-reflector-client
 neighbor 10.0.0.2 activate
 neighbor 10.0.0.2 route-reflector-client
 exit-address-family
!
ip local pool SPOKES 10.0.1.2 10.0.1.254
!
! When HUB2 goes down Static Routes with Tag 500 are added and admin distance of 1
ip route 10.0.0.0 255.0.0.0 Null0 tag 500 track 2
ip route 192.168.0.0 255.255.0.0 Null0 tag 500 track 2
! Default static routes are with Tag 200 and admin distance of 150
ip route 10.0.0.0 255.0.0.0 Null0 150 tag 200
ip route 192.168.0.0 255.255.0.0 Null0 150 tag 200
!
!
ip prefix-list AGGR seq 5 permit 192.168.0.0/16
ip prefix-list AGGR seq 10 permit 10.0.0.0/8
!
route-map AGGR permit 10
 match ip address prefix-list AGGR
```

```
!
route-map LOCALPREF permit 5
 match tag 500
 set local-preference 500
!
route-map LOCALPREF permit 10
 match tag 200
 set local-preference 200
!
route-map LOCALPREF permit 15
 match tag 20
```

R2-HUB2配置

```
hostname R2-HUB2
!
aaa new-model
!
aaa authorization network default local
!
track timer ip route msec 500
!
track 1 ip route 10.0.1.1 255.255.255.255 reachability
!
track 2 list boolean and
 object 1 not
 object 3
 object 4
!
track 3 ip route 10.0.5.1 255.255.255.255 reachability
!
track 4 ip route 10.0.6.1 255.255.255.255 reachability
!
!
crypto ikev2 authorization policy default
 pool SPOKES
 route set interface
 route accept any tag 20
!
!
crypto ikev2 profile default
 match identity remote any
 authentication remote pre-share key cisco
 authentication local pre-share key cisco
 aaa authorization group psk list default default
 virtual-template 1
!
!
interface Loopback0
 ip address 10.0.2.1 255.255.255.255
!
interface Tunnel0
 ip address 10.0.0.2 255.255.255.0
 ip nhrp network-id 1
 ip nhrp redirect
 bfd interval 50 min_rx 50 multiplier 3
 no bfd echo
 tunnel source Ethernet0/2
 tunnel destination 192.168.0.1
!
interface Ethernet0/0
 ip address 172.16.0.2 255.255.255.0
!
```

```
interface Ethernet0/2
 ip address 192.168.0.2 255.255.255.0
 bfd interval 50 min_rx 50 multiplier 5
!
interface Virtual-Template1 type tunnel
 ip unnumbered Loopback0
 ip nhrp network-id 1
 ip nhrp redirect
 tunnel protection ipsec profile default
!
router bgp 1
 bgp log-neighbor-changes
 bgp listen range 192.168.0.0/24 peer-group DC
 bgp listen range 10.0.2.0/24 peer-group SPOKES
 timers bgp 15 30
 neighbor SPOKES peer-group
 neighbor SPOKES remote-as 1
 neighbor DC peer-group
 neighbor DC remote-as 1
 neighbor DC fall-over bfd
 neighbor 10.0.0.1 remote-as 1
 neighbor 10.0.0.1 fall-over bfd
 !
 address-family ipv4
 redistribute connected
 redistribute static route-map LOCALPREF
 neighbor SPOKES activate
 neighbor SPOKES route-map AGGR out
 neighbor DC activate
 neighbor DC route-reflector-client
 neighbor 10.0.0.1 activate
 neighbor 10.0.0.1 route-reflector-client
 exit-address-family
!
ip local pool SPOKES 10.0.2.2 10.0.2.254
ip forward-protocol nd
!
!
ip route 192.168.0.0 255.255.0.0 Null0 tag 500 track 2
ip route 10.0.0.0 255.0.0.0 Null0 tag 500 track 2
ip route 10.0.0.0 255.0.0.0 Null0 150 tag 200
ip route 192.168.0.0 255.255.0.0 Null0 150 tag 200
!
!
ip prefix-list AGGR seq 5 permit 192.168.0.0/16
ip prefix-list AGGR seq 10 permit 10.0.0.0/8
!
route-map AGGR permit 10
 match ip address prefix-list AGGR
!
route-map LOCALPREF permit 5
 match tag 500
 set local-preference 500
!
route-map LOCALPREF permit 10
 match tag 200
 set local-preference 100
!
route-map LOCALPREF permit 15
 match tag 20
```

R3-SPOKE1配置

```
hostname R3-SPOKE1
!
aaa new-model
!
aaa authorization network default local
!
!
crypto ikev2 authorization policy default
 route set interface
!
!
crypto ikev2 profile default
 match identity remote any
 authentication remote pre-share key cisco
 authentication local pre-share key cisco
 dpd 10 2 on-demand
 aaa authorization group psk list default default
!
! Tunnel to the HUB1
!
interface Tunnel0
 ip address negotiated
 ip nhrp network-id 1
 ip nhrp shortcut virtual-template 2
 tunnel source Ethernet0/0
 tunnel destination 172.16.0.1
 tunnel protection ipsec profile default
!
! Tunnel to the HUB2
!
interface Tunnel1
 ip address negotiated
 ip nhrp network-id 1
 ip nhrp shortcut virtual-template 2
 tunnel source Ethernet0/0
 tunnel destination 172.16.0.2
 tunnel protection ipsec profile default
!
interface Ethernet0/0
description INTERNET-CLOUD
 ip address 172.16.0.3 255.255.255.0
!
interface Ethernet0/1
description LAN
 ip address 192.168.3.3 255.255.255.0
!
interface Virtual-Template2 type tunnel
 ip unnumbered Ethernet0/1
 ip nhrp network-id 1
 ip nhrp shortcut virtual-template 2
 tunnel protection ipsec profile default
!
router bgp 1
 bgp log-neighbor-changes
 timers bgp 15 30
 neighbor 10.0.1.1 remote-as 1
 neighbor 10.0.2.1 remote-as 1
 !
 address-family ipv4
 network 192.168.3.0
 neighbor 10.0.1.1 activate
 neighbor 10.0.2.1 activate
 exit-address-family
```

R4-SPOKE2配置

```
hostname R4-SPOKE2
!
aaa new-model
!
aaa authorization network default local
!
!
crypto ikev2 authorization policy default
 route set interface
!
crypto ikev2 profile default
 match identity remote any
 authentication remote pre-share key cisco
 authentication local pre-share key cisco
 dpd 10 2 on-demand
 aaa authorization group psk list default default
!
interface Tunnel0
 ip address negotiated
 ip nhrp network-id 1
 ip nhrp shortcut virtual-template 2
 tunnel source Ethernet0/0
 tunnel destination 172.16.0.1
 tunnel protection ipsec profile default
!
interface Tunnel1
 ip address negotiated
 ip nhrp network-id 1
 ip nhrp shortcut virtual-template 2
 tunnel source Ethernet0/0
 tunnel destination 172.16.0.2
 tunnel protection ipsec profile default
!
interface Ethernet0/0
 ip address 172.16.0.4 255.255.255.0
!
interface Ethernet0/1
 ip address 192.168.4.4 255.255.255.0
!
interface Virtual-Template2 type tunnel
 ip unnumbered Ethernet0/1
 ip nhrp network-id 1
 ip nhrp shortcut virtual-template 2
 tunnel protection ipsec profile default
!
router bgp 1
 bgp log-neighbor-changes
 timers bgp 15 30
 neighbor 10.0.1.1 remote-as 1
 neighbor 10.0.2.1 remote-as 1
 !
 address-family ipv4
 network 192.168.4.0
 neighbor 10.0.1.1 activate
 neighbor 10.0.2.1 activate
 exit-address-family
!
```

R5-AGGR1配置

```
hostname R5-LAN1
!
no aaa new-model
!
!
interface Loopback0
 ip address 10.0.5.1 255.255.255.255
!
interface Ethernet0/0
 ip address 192.168.0.5 255.255.255.0
 bfd interval 50 min_rx 50 multiplier 5
!
! HSRP configuration on the LAN side
!
interface Ethernet0/1
 ip address 192.168.1.5 255.255.255.0
 standby 1 ip 192.168.1.254
!
router bgp 1
 bgp log-neighbor-changes
 neighbor 192.168.0.1 remote-as 1
 neighbor 192.168.0.1 fall-over bfd
 neighbor 192.168.0.2 remote-as 1
 neighbor 192.168.0.2 fall-over bfd
 !
 address-family ipv4
 redistribute connected
 redistribute static
 neighbor 192.168.0.1 activate
 neighbor 192.168.0.2 activate
 exit-address-family
```

R6-AGGR2配置

```
hostname R6-LAN2
!
interface Loopback0
 ip address 10.0.6.1 255.255.255.255
!
interface Ethernet0/0
 ip address 192.168.0.6 255.255.255.0
 bfd interval 50 min_rx 50 multiplier 5
!
interface Ethernet0/1
 ip address 192.168.1.6 255.255.255.0
 standby 1 ip 192.168.1.254
 standby 1 priority 200
!
router bgp 1
 bgp log-neighbor-changes
 neighbor 192.168.0.1 remote-as 1
 neighbor 192.168.0.1 fall-over bfd
 neighbor 192.168.0.2 remote-as 1
 neighbor 192.168.0.2 fall-over bfd
 !
 address-family ipv4
 redistribute connected
 redistribute static
 neighbor 192.168.0.1 activate
 neighbor 192.168.0.2 activate
 exit-address-family
```

```
!
```

R7-HOST配置（模拟该网络中的HOST）

```
hostname R7-HOST
!
no aaa new-model
!
interface Ethernet0/0
 ip address 192.168.1.7 255.255.255.0
!
ip route 0.0.0.0 0.0.0.0 192.168.1.254
```

重要配置说明

以下是前面部分介绍的有关配置的一些重要说明：

- 两个集线器之间的点对点GRE隧道是辐射到辐射型连接在所有场景中都正常工作所必需的，特别是包括某些辐射只连接到其中一个集线器而其他集线器连接到另一个集线器的场景。
- 为避免从另一个集线器发送的流量指示，需要在两个集线器之间的GRE隧道接口中进行**no bfd echo配置。**BFD回显具有相同的源IP地址和目的IP地址，与发送BFD回显的路由器的IP地址相同。由于这些数据包由响应的路由器路由回，因此会生成NHRP流量指示。
- 在BGP配置中，不需要向分支通告网络的路由映射过滤，但是，它使配置更加优化，因为只通告聚合/汇总路由：

```
neighbor SPOKES route-map AGGR out
```

- 在集线器上，要设置正确的BGP本地首选项，需要**route-map LOCALPREF**配置，并且它仅将重分发的静态路由过滤为汇总路由和IKEv2配置模式路由。
- 此设计不解决远程办公室位置（分支）的冗余问题。 如果分支上的WAN链路断开，VPN也不工作。为解决此问题，向分支路由器添加第二条链路或在同一位置添加第二条分支路由器。

总之，本文档中介绍的冗余设计可作为状态化切换(SSO)/状态化功能的现代替代方案。它非常灵活，可进行微调以满足您的特定部署需求。

验证

当前没有可用于此配置的验证过程。

故障排除

目前没有针对此配置的故障排除信息。

相关信息

- Cisco IOS FlexVPN产品手册
- 配置FlexVPN分支到分支

- 技术支持和文档 - Cisco Systems