

Site-to-Site VPN over Secure Firewall을 위한 SD-WAN 구성

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소개

이 문서에서는 보안 방화벽에서 SD-WAN 기능을 사용하는 BGP 오버레이 라우팅을 사용하는 경로 기반 VPN 구축 시나리오에 대해 설명합니다.

사전 요구 사항

모든 허브와 스포크는 FTD 7.6 이상 소프트웨어를 실행 중이며 동일한 FMC를 통해 관리됩니다. 또한 7.6 이상 소프트웨어를 실행 중입니다.

요구 사항

다음 주제에 대한 지식을 보유하고 있으면 유용합니다.

- IKEv2
- 경로 기반 VPN
- VTI(Virtual Tunnel Interface)
- IPSec
- BGP

사용되는 구성 요소

이 문서의 정보는 다음을 기반으로 합니다.

- Cisco Secure Firewall Threat Defense 7.7.10
- Cisco Secure Firewall Management Center 7.7.10

이 문서의 정보는 특정 랩 환경의 디바이스를 토대로 작성되었습니다. 이 문서에 사용된 모든 디바이스는 초기화된(기본) 컨피그레이션으로 시작되었습니다. 현재 네트워크가 작동 중인 경우 모든 명령의 잠재적인 영향을 미리 숙지하시기 바랍니다.

기능 정보

Management Center는 새로운 SD-WAN 마법사를 사용하여 VPN 터널 컨피그레이션 및 중앙 본부(허브)와 원격 브랜치 사이트(스포크) 간 라우팅을 간소화합니다.

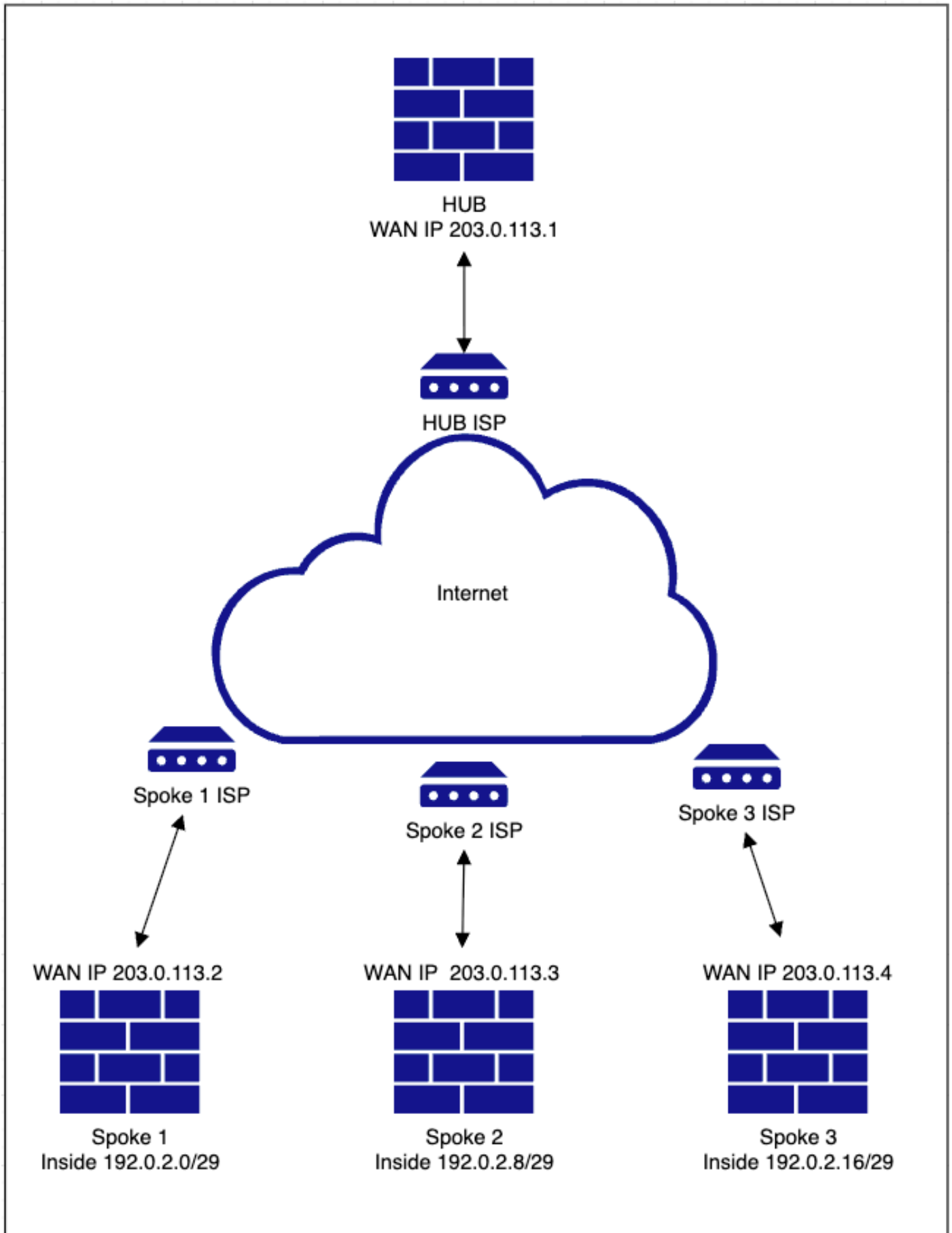
- BGP를 통해 오버레이 라우팅이 활성화된 허브의 DVTI(Dynamic Virtual Tunnel Interface) 및 스포크의 SVTI(Static Virtual Tunnel Interface)를 활용하여 VPN 컨피그레이션을 자동화합니다.
- 스포크에 대한 SVTI IP 주소를 자동으로 할당하고 암호화 매개변수를 비롯한 전체 VTI 컨피그레이션을 푸시합니다.
- 동일한 마법사 내에서 손쉬운 1단계 라우팅 컨피그레이션을 제공하여 오버레이 라우팅을 위한 BGP를 활성화합니다.
- BGP에 대한 경로 리플렉터 특성을 활용하여 확장 가능하고 최적화된 라우팅을 활성화합니다.
- 사용자의 개입을 최소화하면서 여러 스포크를 동시에 추가할 수 있습니다.

지원되는 토폴로지

이 문서에서는 사용자가 다양한 구축 시나리오를 파악할 수 있도록 여러 토폴로지에 대해 설명합니다.

허브 및 스포크(단일 ISP)

네트워크 다이어그램



설정

- Devices(디바이스) > VPN > Site to Site(사이트 대 사이트) > Add(추가) > SD-WAN

Topology(SD-WAN 토폴로지) > > Create(생성)로 이동합니다.

The screenshot shows the 'Create VPN Topology' dialog in the FMC (Fortinet Management Console) interface. The 'Topology Name' field is populated with 'HUB-Spoke-VPN-Single-ISP'. Under the 'VPN Type' section, 'SD-WAN Topology' is selected, and 'Hub and Spoke' is chosen under 'Select VPN Topology'. A warning message for 'SASE Topology' is visible, stating it cannot be selected because the Cisco Umbrella Connection is not configured. Buttons for 'Cancel' and 'Create' are at the bottom.

· 허브를 추가하고 허브 끝에 DVTI를 만듭니다. DVTI 컨피그레이션의 일부로 토폴로지에 따라 올바른 터널 소스 인터페이스를 선택해야 합니다.

FMC Site To Site Overview Analysis Policies **Devices** Objects Integration Deploy admin

HUB-Spoke-VPN-Single-ISP

Hub and Spoke Route-Based (VTI) VPN Topology

1 Hubs

2 Spokes

3 Authentication

4 SD-WAN Settings

Next

Add Hub

Device * ftd1

Dynamic Virtual Tunnel Interface (DVTI) * VPN-OUT-1_dynamic_vti_1
Tunnel Source: VPN-OUT-1 (IP Address: 203.0.113.1)

Hub Gateway IP Address 203.0.113.1

Spoke Tunnel IP Address Pool * Select...

Cancel Add

Edit Virtual Tunnel Interface

General

Tunnel Type
☐ Static ☒ Dynamic

Name: * VPN-OUT-1_dynamic_vti_1

☒ Enabled

Description:

Security Zone: VPN-OUT-1

Virtual Tunnel Interface Details
An interface named Tunnel<ID> is configured. Tunnel Source is a physical interface where VPN tunnel terminates for the VTI.

Template ID: * 1 (1 - 10413)

Tunnel Source: GigabitEthernet0/0 (VPN-OUT-1) 203.0.113.1

IPsec Tunnel Details
IPsec Tunnel mode is decided by VPN traffic IP type. Configure IPv4 and IPv6 addresses accordingly.

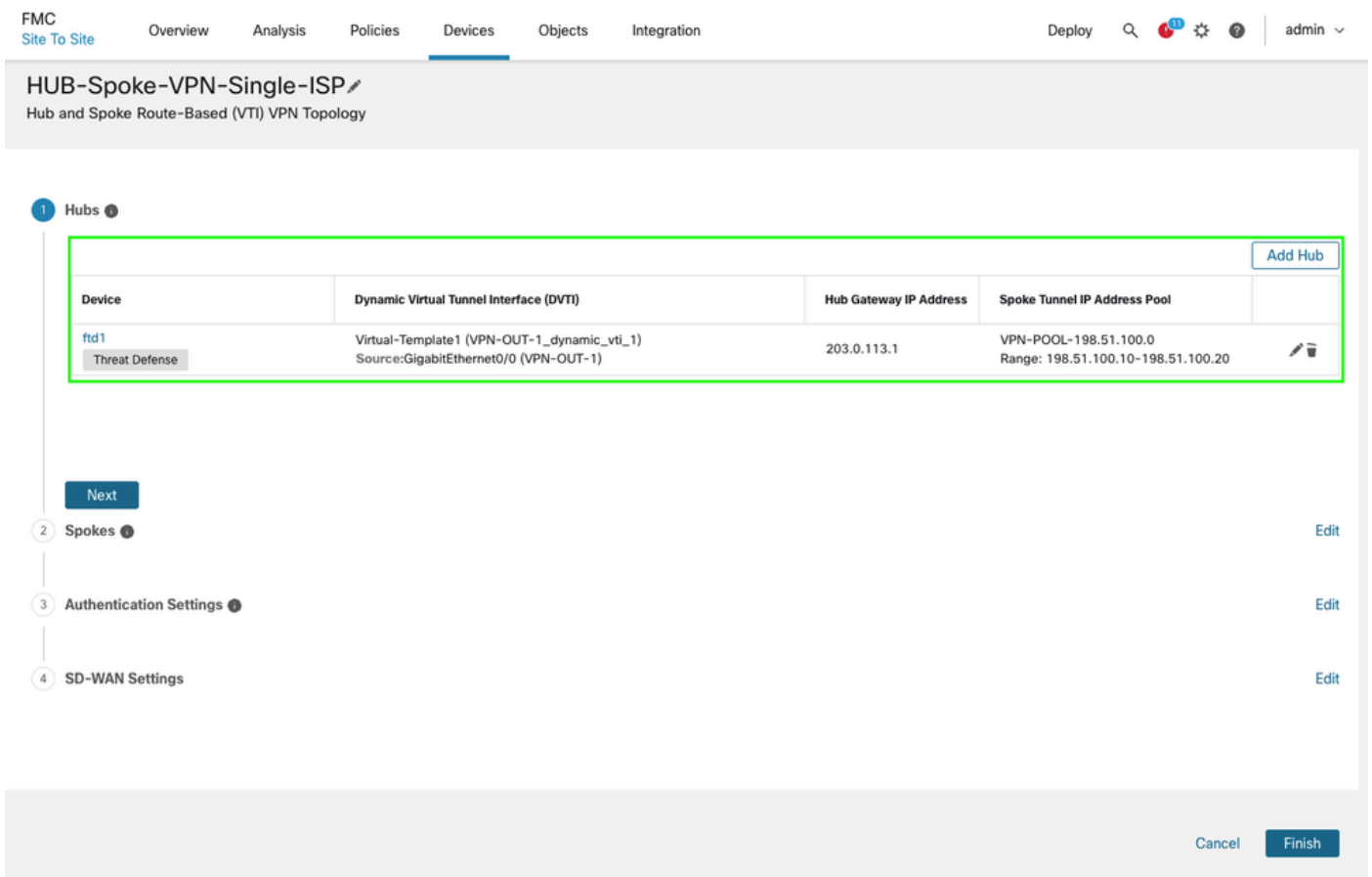
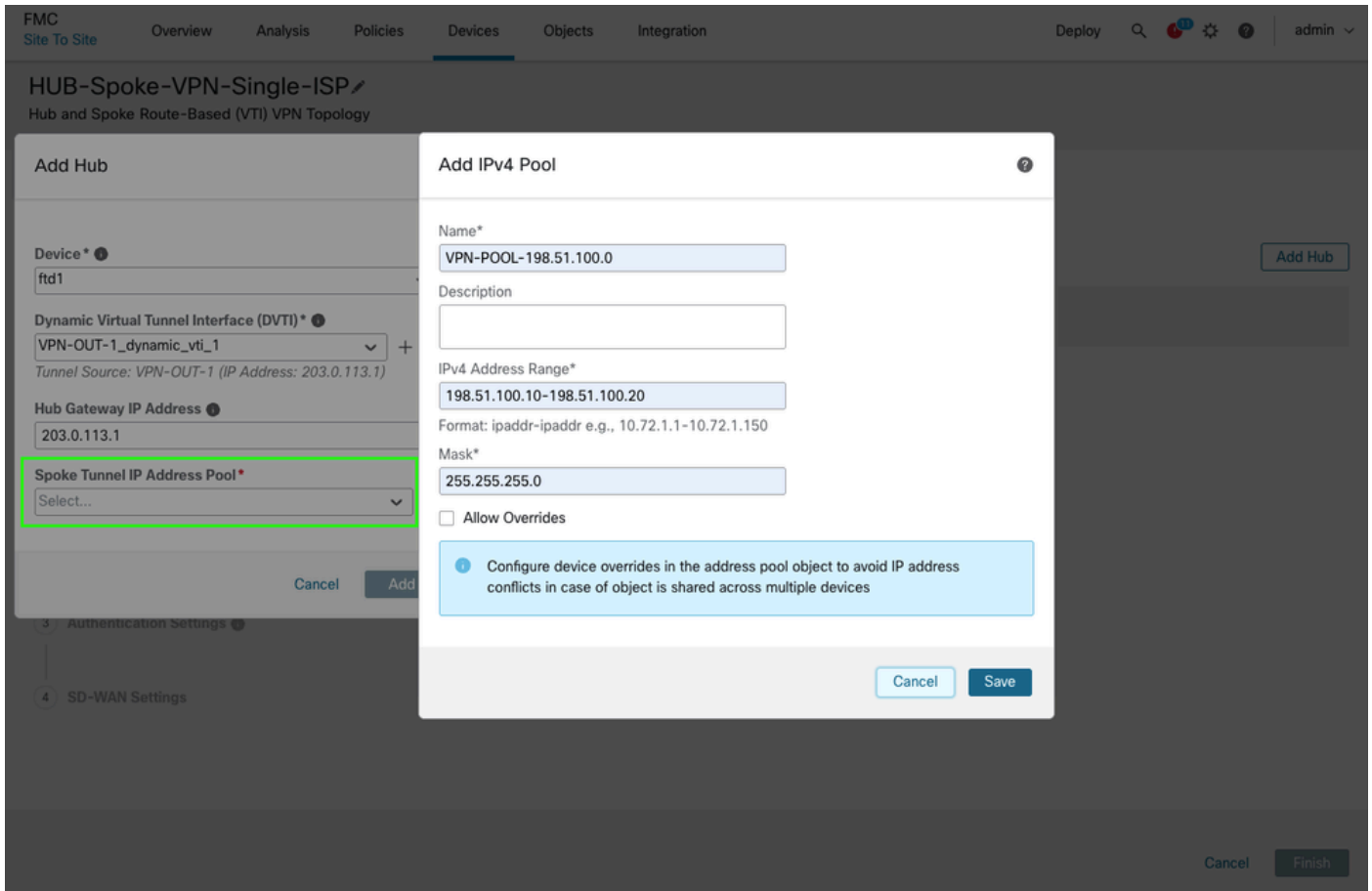
IPsec Tunnel Mode: *
☒ IPv4 ☐ IPv6

IP Address: *
☐ Configure IP
☒ Borrow IP (IP unnumbered) Loopback1 (VPN-Loopback-IB... +

VPN Topology Usage

Cancel OK

- 스포크 터널 IP 주소 풀을 생성하고 Save(저장)를 클릭한 다음 Add(추가)를 클릭합니다. IP 주소 풀은 스포크에 VTI 터널 IP 주소를 할당하는 데 사용됩니다.



- 다음을 클릭하여 계속하고 스포크를 추가합니다. 공통 인터페이스/영역 이름이 있거나 개별적으로 스포크를 추가할 경우 대량 추가 옵션을 활용할 수 있습니다.

HUB-Spoke-VPN-Single-ISP

Hub and Spoke Route-Based (VTI) VPN Topology

1 Hubs

Edit

Device ftd1 DVTI VPN-OUT-1_dynamic_vti_1 Gateway IP Address 203.0.113.1 Spoke Tunnel IP Address Pool VPN-POOL-198.51.100.0

2 Spokes

View Generated Tunnel Interfaces

Add Spokes (Bulk Addition)

Add Spoke

No spokes are configured. Add a spoke.

Next

3 Authentication Settings

Edit

4 SD-WAN Settings

Edit

Cancel

Finish

- 디바이스를 선택하고 WAN/외부 인터페이스의 이름 지정 패턴을 지정합니다. 디바이스가 동일한 인터페이스 이름을 공유하는 경우 이니셜을 사용하면 됩니다. Next(다음)를 클릭하고 검증에 성공하면 Add(추가)를 클릭합니다. 대량 추가에 대해서도 동일한 방법으로 영역 이름을 사용할 수 있습니다.

FMC
Site To Site

OverviewAnalysisPolicies**Devices**ObjectsIntegration

Deploy 🔍 11 ⚙️ ? admin ▾

HUB-Spoke-VPN-Single-ISP

Hub and Spoke Route-Based (VTI) VPN Topology

1 Hubs

Device ftd1 DVTI VPN-OUT-1_dynamic_vti_1 Gateway IP Address 203.0.113.1 Spoke Tunnel IP Address Pool VPN-POOL-198.51.100.0

2 Spokes

Next

3 Authentication Settings

4 SD-WAN Settings

Spokes (Bulk Addition)

Add Spoke

Edit

Edit

Cancel

Finish

Add Bulk Spokes

1 Add Devices

2 Validate Devices

Available Devices *

🔍 Search

Add

Remove

Selected Devices *

ftd2

ftd3

ftd4

Select VPN Interface Using *

Interface Name Pattern

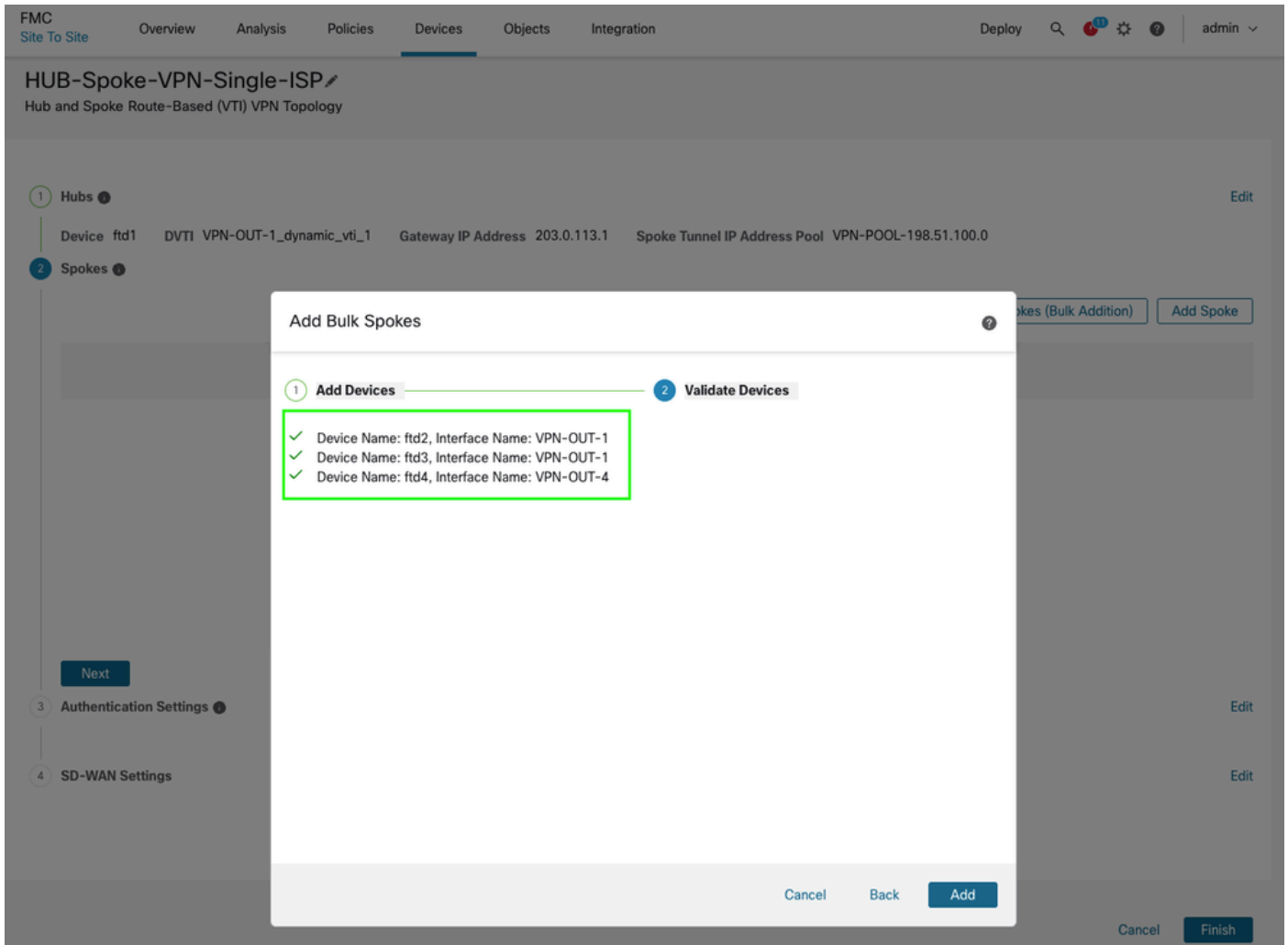
out

Security Zone

Select... +

Cancel

Next



- 스포크 및 오버레이 인터페이스 세부사항을 확인하여 올바른 인터페이스가 선택되었는지 확인한 후 Next(다음)를 클릭합니다.

HUB-Spoke-VPN-Single-ISP

Hub and Spoke Route-Based (VTI) VPN Topology

1 Hubs

Edit

Device ftd1 DVTI VPN-OUT-1_dynamic_vti_1 Gateway IP Address 203.0.113.1 Spoke Tunnel IP Address Pool VPN-POOL-198.51.100.0

2 Spokes

View Generated Tunnel Interfaces

Add Spokes (Bulk Addition)

Add Spoke

Device	VPN Interface	Local Tunnel (IKE) Identity	
ftd2 Threat Defense	VPN-OUT-1 (GigabitEthernet0/0) IP Address:203.0.113.2	Type: Key ID Value: HUB-Spoke-VPN-Single-ISP_ftd2	 
ftd3 Threat Defense	VPN-OUT-1 (GigabitEthernet0/0) IP Address:203.0.113.3	Type: Key ID Value: HUB-Spoke-VPN-Single-ISP_ftd3	 
ftd4 Threat Defense	VPN-OUT-4 (GigabitEthernet0/0) IP Address:203.0.113.4	Type: Key ID Value: HUB-Spoke-VPN-Single-ISP_ftd4	 

Next

<<

Viewing 1-3 of 3

>>

3 Authentication Settings

Edit

4 SD-WAN Settings

Edit

Cancel

Finish

- 필요에 따라 IPsec 컨피그레이션의 기본 매개변수를 유지하거나 사용자 지정 암호를 지정할 수 있습니다. Next(다음)를 클릭하여 계속 진행합니다. 이 문서에서는 기본 매개변수를 사용합니다.

HUB-Spoke-VPN-Single-ISP

Hub and Spoke Route-Based (VTI) VPN Topology

1 Hubs

[Edit](#)

Device	ftd1	DVTI	VPN-OUT-1_dynamic_vti_1	Gateway IP Address	203.0.113.1	Spoke Tunnel IP Address Pool	VPN-POOL-198.51.100.0
--------	------	------	-------------------------	--------------------	-------------	------------------------------	-----------------------

2 Spokes

[Edit](#)

Device	ftd2	VPN Interface	VPN-OUT-1	Local Tunnel (IKE) Identity	Key ID: HUB-Spoke-VPN-Single-ISP_ftd2
	ftd3		VPN-OUT-1		Key ID: HUB-Spoke-VPN-Single-ISP_ftd3
	ftd4		VPN-OUT-4		Key ID: HUB-Spoke-VPN-Single-ISP_ftd4

3 Authentication Settings

Authentication Type*

Pre-shared Automatic Key

Transform Sets (IPsec Proposals)*

AES-GCM x

[Show Details](#)

IKEv2 Policies*

AES-GCM-NUL-SSH-LATEST x

[Show Details](#)

Pre-shared Key Length*

24 The range is 1 to 127.

Next

4 SD-WAN Settings

[Edit](#)

Cancel

Finish

- 마지막으로, AS 번호, 내부 인터페이스 광고, 접두사 필터링을 위한 커뮤니티 태그와 같은 적절한 BGP 매개변수를 지정하여 이 토폴로지에 대해 동일한 마법사 내에서 오버레이 라우팅을 구성할 수 있습니다. 보안 영역은 액세스 제어 정책을 통해 트래픽 필터링을 지원할 수 있으며, 이름이 내부와 다르거나 토폴로지의 디바이스 간에 대칭적이지 않은 경우 인터페이스에 대한 객체를 생성하여 연결된 인터페이스 재배포에 사용할 수도 있습니다.

HUB-Spoke-VPN-Single-ISP

Hub and Spoke Route-Based (VTI) VPN Topology

1 Hubs

Device ftd1 DVTI VPN-OUT-1_dynamic_vti_1 Gateway IP Address 203.0.113.1 Spoke Tunnel IP Address Pool VPN-POOL-198.51.100.32

Edit

2 Spokes

ftd2 VPN-OUT-1

ftd3 VPN-OUT-1

ftd4 VPN-OUT-4

Key ID: HUB-Spoke-VPN-Single-ISP_ftd2

Key ID: HUB-Spoke-VPN-Single-ISP_ftd3

Key ID: HUB-Spoke-VPN-Single-ISP_ftd4

Edit

3 Authentication Settings

Authentication Pre-shared Automatic Key Pre-shared Key Length 24

Edit

4 SD-WAN Settings

Spoke Tunnel Interface Auto Generation

Static Virtual Tunnel Interfaces (SVTIs) are auto generated on each spoke using the spoke's VPN interface as tunnel source to establish a VPN to the DVTI on each of the hubs. [View more](#)

Spoke Tunnel Interface Security Zone

VPN-OUT-1 +

Overlay Routing Configuration

BGP can be enabled on the VPN overlay topology for seamless VPN connectivity from the spokes to the hub, and for spoke-to-spoke connectivity via the hub. [View more](#)

☒ Enable BGP on the VPN Overlay Topology

Autonomous System Number *

65500

Community Tag for Local Routes *

101010

☒ Redistribute Connected Interfaces

Default inside*

+

☒ Enable Multiple Paths for BGP

Allows multiple BGP routes to be used at the same time to reach the same destination. Enables BGP to load-balance traffic across multiple links.

Next

You have unsaved changes

Cancel

Finish

- Next(다음), Finish(마침), 마지막으로 Deploy(구축)를 차례로 클릭하여 프로세스를 완료합니다.

확인

- Devices(디바이스) > VPN(VPN) > Site to Site(사이트 대 사이트)로 이동하여 터널 상태를 확인할 수 있습니다.

Firewall Management Center Devices / VPN / Site To Site Overview Analysis Policies **Devices** Objects Integration Deploy 🔍 ⚙️ ? admin ▾

Last Updated: 12:06 PM Refresh NAT Exemptions Add

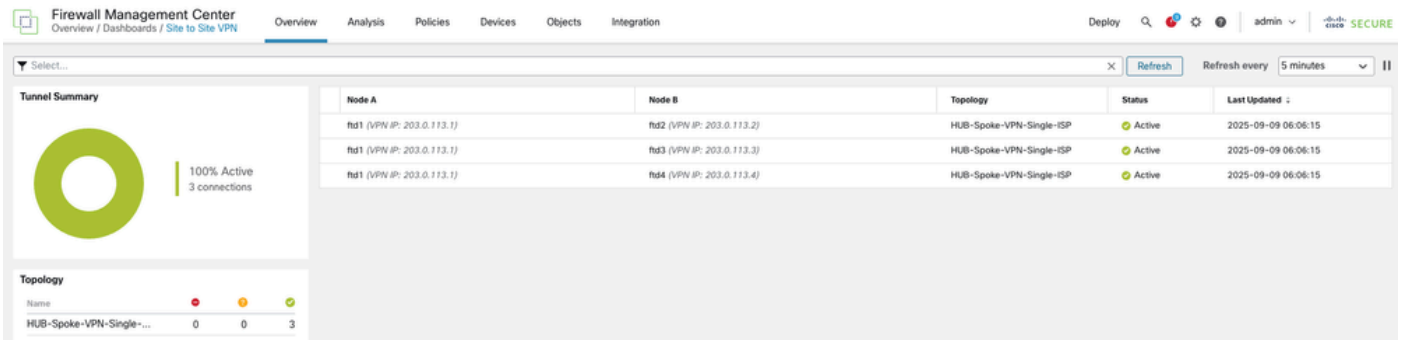
Select...

Topology Name	VPN Type	Network Topology	Tunnel Status Distribution	IKv1	IKv2
▼ HUB-Spoke-VPN-Single-ISP	Route Based (VTI)	SD-WAN Topology	3 Tunnels	✓	

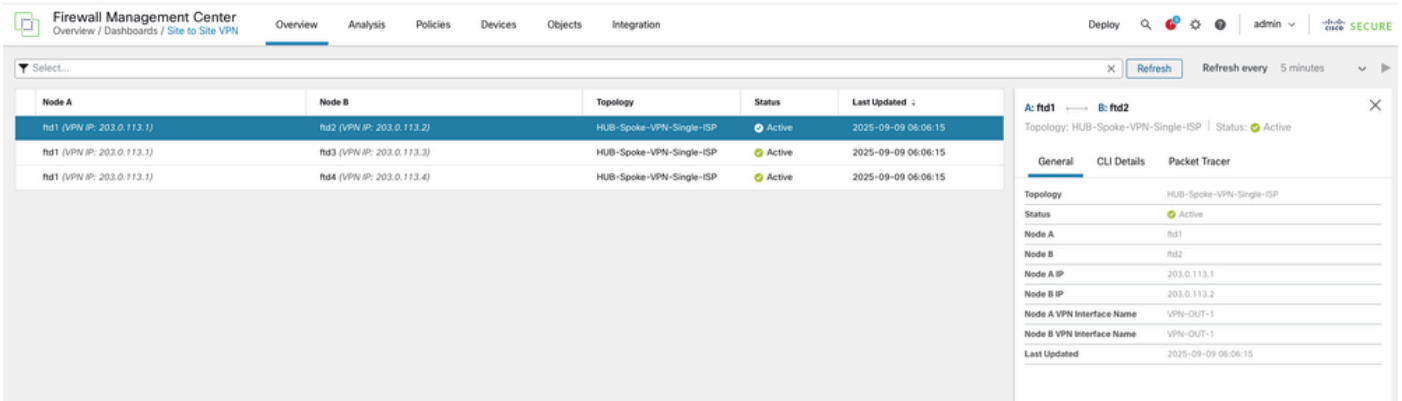
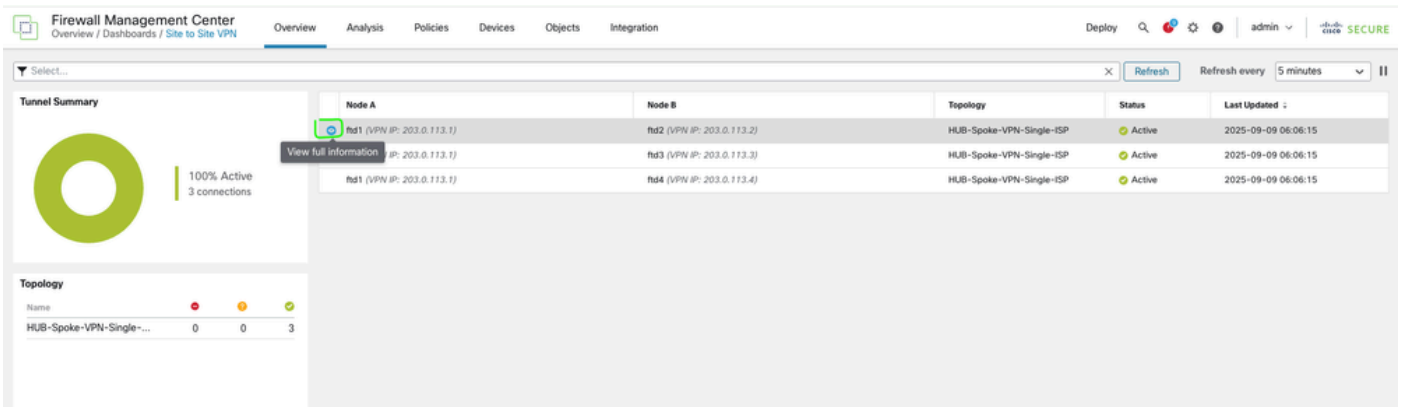
Hub			Spoke		
Device	VPN Interface	VTI Interface	Device	VPN Interface	VTI Interface
ftd1	VPN-OUT-1 (203.0.113.1)	VPN-OUT-1_dynamic_... (10.18.89.254)	ftd2	VPN-OUT-1 (203.0.113.2)	VPN-OUT-1_static_... (198.51.100.10)
ftd1	VPN-OUT-1 (203.0.113.1)	VPN-OUT-1_dynamic_... (10.18.89.254)	ftd3	VPN-OUT-1 (203.0.113.3)	VPN-OUT-1_static_... (198.51.100.11)
ftd1	VPN-OUT-1 (203.0.113.1)	VPN-OUT-1_dynamic_... (10.18.89.254)	ftd4	VPN-OUT-4 (203.0.113.4)	VPN-OUT-4_static_... (198.51.100.12)

Viewing 1-3 of 3

- 추가 세부 정보는 Overview(개요) > Dashboards(대시보드) > Site to Site VPN(사이트 대 사이트 VPN)으로 이동하여 확인할 수 있습니다.



- 자세히 알아보려면 터널을 선택하고 전체 정보 보기를 클릭합니다.



Firewall Management Center
Overview / Dashboards / Site to Site VPN

Overview Analysis Policies Devices Objects Integration

Deploy 🔍 ⚙️ 👤 admin 🔒 **SECURE**

Select...

Node A	Node B	Topology	Status	Last Updated
ftd1 (VPN IP: 203.0.113.1)	ftd2 (VPN IP: 203.0.113.2)	HUB-Spoke-VPN-Singl...	Active	2025-09-09 06:06:15
ftd1 (VPN IP: 203.0.113.1)	ftd3 (VPN IP: 203.0.113.3)	HUB-Spoke-VPN-Singl...	Active	2025-09-09 06:06:15
ftd1 (VPN IP: 203.0.113.1)	ftd4 (VPN IP: 203.0.113.4)	HUB-Spoke-VPN-Singl...	Active	2025-09-09 06:06:15

Refresh Refresh every 5 minutes

A: ftd1 ↔ B: ftd2
Topology: HUB-Spoke-VPN-Single-ISP | Status: Active

General CLI Details Packet Tracer

Refresh Maximize view

Summary

Node A (203.0.113.1/500)	Node B (203.0.113.2/500)
Transmitted: 9.52 KB (9744 B)	Transmitted: 9.26 KB (9481 B)
Received: 12.33 KB (12628 B)	Received: 12.61 KB (12912 B)

IPsec Security Associations (1)

0.0.0.0/0.0.0.0/0 0.0.0.0/0.0.0.0/0

```

ftd1 (VPN Interface IP: 203.0.113.1)
show crypto ipsec sa peer 203.0.113.2
peer address: 203.0.113.2
interface: VPN-OUT-1_dynamic_vti_1_va9
Crypto map tag: VPN-OUT-1_dynamic_vti_1_vtemplate_dyn_map, seq num: 1, local addr: 203.0.113.1

Protected vrf (jvrf): Global
local ident (addr/mask/prot/port): (0.0.0.0/0.0.0.0/0/0)
remote ident (addr/mask/prot/port): (0.0.0.0/0.0.0.0/0/0)
current_peer: 203.0.113.2

#pkts encaps: 155, #pkts encrypt: 155, #pkts digest: 155
#pkts decaps: 154, #pkts decrypt: 154, #pkts verify: 154
#pkts compressed: 0, #pkts decompressed: 0
#pkts not compressed: 155, #pkts comp failed: 0, #pkts decomp failed: 0
#pre-frag successes: 0, #pre-frag failures: 0, #fragments created: 0
#PMTUs sent: 0, #PMTUs rcvd: 0, #decapsulated frgs needing reassembly: 0
#TFC rcvd: 0, #TFC sent: 0
#Valid ICMP Errors rcvd: 0, #Invalid ICMP Errors rcvd: 0
#pkts not offload decrypted: 154

ftd2 (VPN Interface IP: 203.0.113.2)
show crypto ipsec sa peer 203.0.113.1
peer address: 203.0.113.1
interface: VPN-OUT-1_static_vti_1
Crypto map tag: __vti-crypto-map-Tunnel1-0-1, seq num: 65280, local addr: 203.0.113.2

Protected vrf (jvrf): Global
local ident (addr/mask/prot/port): (0.0.0.0/0.0.0.0/0/0)
remote ident (addr/mask/prot/port): (0.0.0.0/0.0.0.0/0/0)
current_peer: 203.0.113.1

```

Viewing 1-3 of 3

- 출력은 FTD CLI에서 직접 표시되며 업데이트된 카운터 및 중요 정보(예: SPI(Security Parameter Index) 세부사항)를 표시하도록 새로 고칠 수 있습니다.

Tunnel Details	
Summary	
Node A (203.0.113.1/500) ⓘ	Node B (203.0.113.2/500) ⓘ
Transmitted: 9.52 KB (9744 B)	Transmitted: 9.26 KB (9481 B)
Received: 12.33 KB (12628 B)	Received: 12.61 KB (12912 B)
IPsec Security Associations (1)	
0.0.0.0/0.0.0.0/0/0	0.0.0.0/0.0.0.0/0/0
ftd1 (VPN Interface IP: 203.0.113.1)	ftd2 (VPN Interface IP: 203.0.113.2)
show crypto ipsec sa peer 203.0.113.2 ⓘ peer address: 203.0.113.2 interface: VPN-OUT-1_dynamic_vti_1_va9 Crypto map tag: VPN-OUT-1_dynamic_vti_1_vtemplate_dyn_map, seq num: 100	show crypto ipsec sa peer 203.0.113.1 ⓘ peer address: 203.0.113.1 interface: VPN-OUT-1_static_vti_1 Crypto map tag: __vti-crypto-map-Tunnel1-0-1, seq num: 65280, loc
Protected vrf (ivrf): Global	Protected vrf (ivrf): Global
local ident (addr/mask/prot/port): (0.0.0.0/0.0.0.0/0/0)	local ident (addr/mask/prot/port): (0.0.0.0/0.0.0.0/0/0)
remote ident (addr/mask/prot/port): (0.0.0.0/0.0.0.0/0/0)	remote ident (addr/mask/prot/port): (0.0.0.0/0.0.0.0/0/0)
current_peer: 203.0.113.2	current_peer: 203.0.113.1
#pkts encaps: 155, #pkts encrypt: 155, #pkts digest: 155	#pkts encaps: 154, #pkts encrypt: 154, #pkts digest: 154
#pkts decaps: 154, #pkts decrypt: 154, #pkts verify: 154	#pkts decaps: 155, #pkts decrypt: 155, #pkts verify: 155
#pkts compressed: 0, #pkts decompressed: 0	#pkts compressed: 0, #pkts decompressed: 0
#pkts not compressed: 155, #pkts comp failed: 0, #pkts decomp t	#pkts not compressed: 154, #pkts comp failed: 0, #pkts decomp f
#pre-frag successes: 0, #pre-frag failures: 0, #fragments creat	#pre-frag successes: 0, #pre-frag failures: 0, #fragments creat
#PMTUs sent: 0, #PMTUs rcvd: 0, #decapsulated frgs needing reas	#PMTUs sent: 0, #PMTUs rcvd: 0, #decapsulated frgs needing reas
#TFC rcvd: 0, #TFC sent: 0	#TFC rcvd: 0, #TFC sent: 0
#Valid ICMP Errors rcvd: 0, #Invalid ICMP Errors rcvd: 0	#Valid ICMP Errors rcvd: 0, #Invalid ICMP Errors rcvd: 0
#pkts not offload decrypted: 154	#pkts not offload decrypted: 155
#send errors: 0, #recv errors: 0	#send errors: 0, #recv errors: 0
local crypto endpt.: 203.0.113.1/500, remote crypto endpt.: 203	local crypto endpt.: 203.0.113.2/500, remote crypto endpt.: 203
path mtu 1500, ipsec overhead 55(36), media mtu 1500	path mtu 1500, ipsec overhead 55(36), media mtu 1500
PMTU time remaining (sec): 0, DF policy: copy-df	PMTU time remaining (sec): 0, DF policy: copy-df
ICMP error validation: disabled, TFC packets: disabled	ICMP error validation: disabled, TFC packets: disabled
current outbound spi: 3EE69843	current outbound spi: D113FBF4
current inbound spi : D113FBF4	current inbound spi : 3EE69843
inbound esp sas:	inbound esp sas:
spi: 0xD113FBF4 (3507747828)	spi: 0x3EE69843 (1055299651)
SA State: active	SA State: active
transform: esp-aes-gcm-256 esp-null-hmac no compression	transform: esp-aes-gcm-256 esp-null-hmac no compression
in use settings =(L2L, Tunnel, IKEv2, VTI,)	in use settings =(L2L, Tunnel, IKEv2, VTI,)
slot: 0, conn_id: 9, crypto-map: VPN-OUT-1_dynamic_vti_1_vt	slot: 0, conn_id: 4, crypto-map: __vti-crypto-map-Tunnel1-0-
sa timing: remaining key lifetime (sec): 24309	sa timing: remaining key lifetime (sec): 24308

Close Refresh

- FTD CLI를 사용하여 라우팅 정보 및 BGP 피어링 상태를 확인할 수도 있습니다.

HUB 측

<#root>

HUB1# show bgp summary

```
BGP router identifier 198.51.100.3, local AS number 65500
BGP table version is 7, main routing table version 7
2 network entries using 400 bytes of memory
2 path entries using 160 bytes of memory
1/1 BGP path/bestpath attribute entries using 208 bytes of memory
```

1 BGP community entries using 24 bytes of memory
1 BGP route-map cache entries using 64 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 856 total bytes of memory
BGP activity 2/0 prefixes, 4/2 paths, scan interval 60 secs

Neighbor	V	AS	MsgRcvd	MsgSent	TblVer	InQ	OutQ	Up/Down	State/PfxRcd
198.51.100.10	4	65500	4	6	7	0	0	00:00:45	0

<<<<< spoke 1 bgp peering

198.51.100.11	4	65500	5	5	7	0	0	00:00:44	1
---------------	---	-------	---	---	---	---	---	----------	---

<<<<< spoke 2 bgp peering

198.51.100.12	4	65500	5	5	7	0	0	00:00:52	1
---------------	---	-------	---	---	---	---	---	----------	---

<<<<< spoke 3 bgp peering

<#root>

HUB1# show route bgp

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, V - VPN
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, + - replicated route
SI - Static InterVRF, BI - BGP InterVRF

Gateway of last resort is not set

B 192.0.2.0 255.255.255.248 [200/1] via 198.51.100.10, 00:00:18

<<<<<<< spoke 1 inside network

B 192.0.2.8 255.255.255.248 [200/1] via 198.51.100.11, 00:08:08

<<<<<<< spoke 2 inside network

B 192.0.2.16 255.255.255.248 [200/1] via 198.51.100.12, 00:08:16

<<<<<<< spoke 3 inside network

<#root>

HUB1#show bgp ipv4 unicast neighbors 198.51.100.10 routes

<<<<< to check only prefix received from specific peer

BGP table version is 14, local router ID is 198.51.100.3
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
r RIB-failure, S Stale, m multipath
Origin codes: i - IGP, e - EGP, ? - incomplete

Network	Next Hop	Metric	LocPrf	Weight	Path
*>i192.0.2.0/29	198.51.100.10	1	100	0	?

<<<<<<<<< routes received from spoke 1

Total number of prefixes 1

<#root>

HUB1#show bgp ipv4 unicast neighbors 198.51.100.11 routes

<<<<< to check only prefix receieved from specific peer

BGP table version is 14, local router ID is 198.51.100.3
 Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
 r RIB-failure, S Stale, m multipath
 Origin codes: i - IGP, e - EGP, ? - incomplete

Network	Next Hop	Metric	LocPrf	Weight	Path
*>i192.0.2.8/29	198.51.100.11	1	100	0	?

<<<<<<<<< routes received from spoke 2

Total number of prefixes 1

<#root>

HUB1#show bgp ipv4 unicast neighbors 198.51.100.12 routes

<<<<< to check only prefix receieved from specific peer

BGP table version is 14, local router ID is 198.51.100.3
 Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
 r RIB-failure, S Stale, m multipath
 Origin codes: i - IGP, e - EGP, ? - incomplete

Network	Next Hop	Metric	LocPrf	Weight	Path
*>i192.0.2.16/29	198.51.100.12	1	100	0	?

<<<<<<<<< routes received from spoke 3

Total number of prefixes 1

스포크 사이드

스포크 디바이스에서도 동일한 확인을 수행할 수 있습니다. 여기 이 바퀴살 중 하나의 예가 있습니다.

<#root>

Spoke1# show bgp summary

BGP router identifier 198.51.100.4, local AS number 65500
BGP table version is 12, main routing table version 12
3 network entries using 600 bytes of memory
3 path entries using 240 bytes of memory
2/2 BGP path/bestpath attribute entries using 416 bytes of memory
2 BGP rrinfo entries using 80 bytes of memory
1 BGP community entries using 24 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 1360 total bytes of memory
BGP activity 5/2 prefixes, 7/4 paths, scan interval 60 secs

Neighbor	V	AS	MsgRcvd	MsgSent	TblVer	InQ	OutQ	Up/Down	State/PfxRcd
198.51.100.1	4	65500	12	11	12	0	0	00:07:11	2

<<<<<<<< BGP peering with HUB

<#root>

Spoke1# show bgp ipv4 unicast neighbors 198.51.100.1 routes

BGP table version is 12, local router ID is 198.51.100.4
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
r RIB-failure, S Stale, m multipath
Origin codes: i - IGP, e - EGP, ? - incomplete

Network	Next Hop	Metric	LocPrf	Weight	Path
*>i192.0.2.8/29	198.51.100.1	1	100	0	?

<<<<<<< route received from HUB for spoke 2

*>i192.0.2.16/29	198.51.100.1	1	100	0	?
------------------	--------------	---	-----	---	---

<<<<<<< route received from HUB for spoke 3

Total number of prefixes 2

<#root>

Spoke1# show bgp ipv4 unicast neighbors 198.51.100.1 advertised-routes

BGP table version is 12, local router ID is 198.51.100.4
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
r RIB-failure, S Stale, m multipath

Origin codes: i - IGP, e - EGP, ? - incomplete

Network	Next Hop	Metric	LocPrf	Weight	Path
*> 192.0.2.0/29	0.0.0.0	0		32768	?

<<<<<<< route advertised by this spoke into BGP

Total number of prefixes 1

<#root>

Spoke1# show route bgp

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, V - VPN
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, + - replicated route
SI - Static InterVRF, BI - BGP InterVRF

Gateway of last resort is not set

B 192.0.2.8 255.255.255.248 [200/1] via 198.51.100.1, 00:13:42

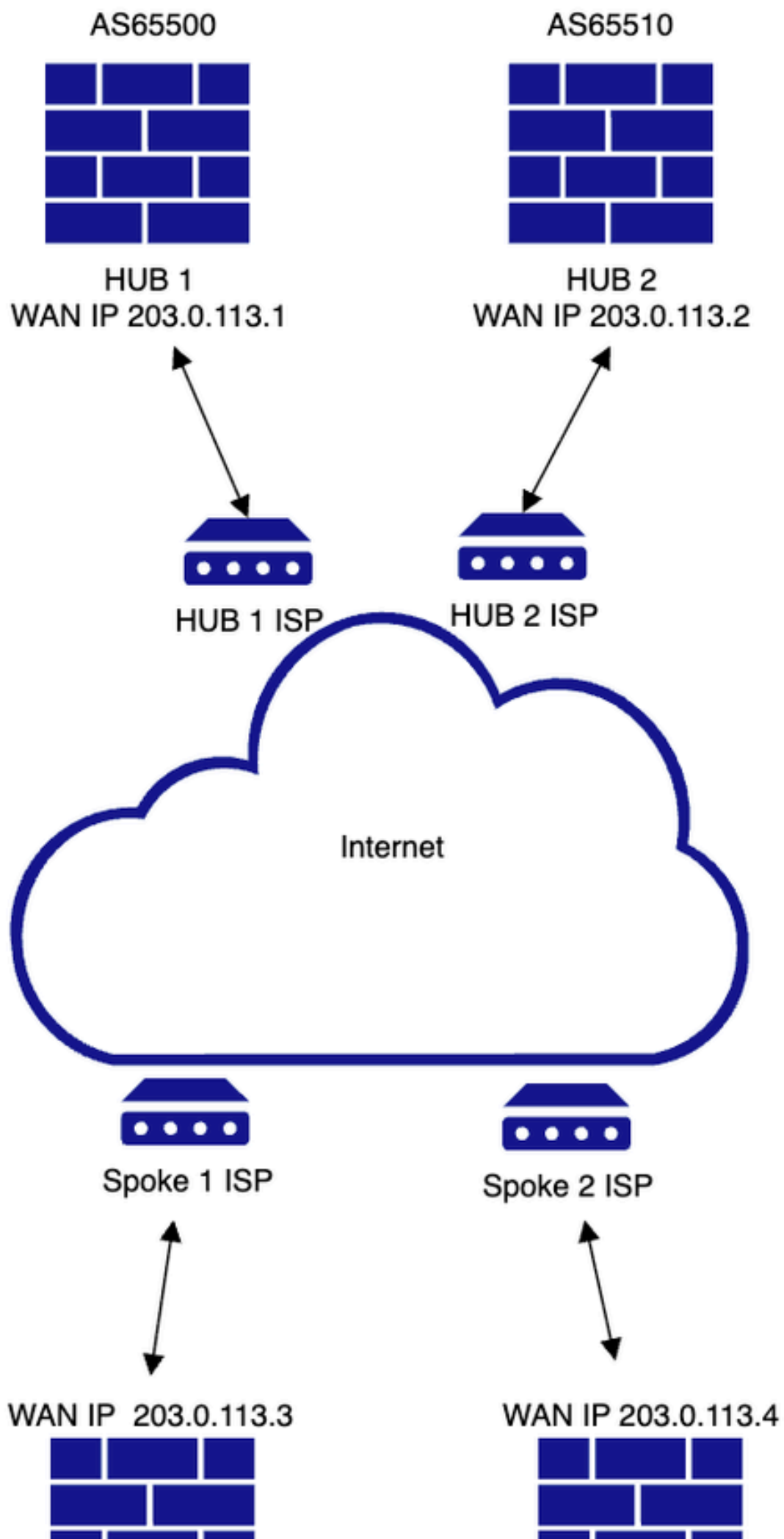
<<<<<< spoke 2 inside network

B 192.0.2.16 255.255.255.248 [200/1] via 198.51.100.1, 00:13:42

<<<<<< spoke 3 inside network

듀얼 허브 & 스포크(보조 허브와 스포크 사이의 EBGP를 통한 이중화 허브용 단일 ISP)

네트워크 다이어그램



허브 추가) 창에서 약간 수정하면서 동일한 마법사가 필요합니다. 필요한 변경 사항에만 집중하여 프로세스를 빠르게 진행할 수 있습니다.

· 첫 번째 HUB를 추가한 후 이전에 HUB1에 사용했던 것과 동일한 단계를 사용하여 두 번째 HUB를 추가합니다.

FMC Site To Site Overview Analysis Policies **Devices** Objects Integration Deploy 🔍 ⚙️ ? admin ▾

Dual-HUB-Spoke-VPN-Single-ISP

Hub and Spoke Route-Based (VTI) VPN Topology

1 Hubs ⓘ

Device	Dynamic Virtual Tunnel Interface (DVTI)	Hub Gateway IP Address	Spoke Tunnel IP Address Pool
ftd1 Threat Defense	Virtual-Template1 (VPN-OUT-1_dynamic_vti_1) Source:GigabitEthernet0/0 (VPN-OUT-1)	203.0.113.1	VPN-POOL-198.51.100.0 Range: 198.51.100.10-198.51.100.11

Next

Add Hub

· DVTI(Dynamic Virtual Tunnel Interface)를 생성합니다.

Firewall Management Center Overview Analysis Policies **Devices** Objects Integration Deploy 🔍 ⚙️ ? admin ▾

Dual-HUB-Spoke-VPN-Single-ISP

Hub and Spoke Route-Based (VTI) VPN Topology

1 Hubs ⓘ

Add Virtual Tunnel Interface

General Path Monitoring

Tunnel Type
☐ Static ☒ Dynamic
 Name:* VPN-OUT-1_dynamic_vti_1
☒ Enabled
 Description:
 Security Zone:
 Priority: 0 (0 - 65535)
 Virtual Tunnel Interface Details
 An interface named TunnelID* is configured. Tunnel Source is a physical interface where VPN tunnel terminates for the VTI.
 Template ID:* 1 (1 - 10413)
 Tunnel Source:
 GigabitEthernet0/0 (VPN-OUT-1) 203.0.113.2
 IPsec Tunnel Details
 IPsec Tunnel mode is decided by VPN traffic IP type. Configure IPv4 and IPv6 addresses accordingly.
 IPsec Tunnel Mode:*
☒ IPv4 ☐ IPv6
 IP Address:*
☐ Configure IP 169.254.2.1/30
☒ Borrow IP (IP unnumbered) Select Interface +
 Cancel OK

Add Loopback Interface

General IPv4 IPv6

Name:
 VPN-OUT-LOOPBACK
☒ Enabled
 Loopback ID:* 1 (1-1024)
 Description
 Cancel OK

Add Hub

Device * ftd2
 Dynamic Virtual Tunnel Interface (DVTI) *
 Select... +
 Hub Gateway IP Address
 Cancel Add

· 스포크 측의 HUB 2 VTI 터널에 새 IP 주소 풀이 필요합니다. 새 풀을 생성 및 구성한 다음 번

경 사항을 저장합니다.

Firewall Management Center
Devices / VPN / Site To Site

Overview Analysis Policies **Devices** Objects Integration

Deploy 🔍 ⚙️ 👤 admin 🔒 **SECURE**

Dual-HUB-Spoke-VPN-Single-ISP

Hub and Spoke Route-Based (VTI) VPN Topology

1 Hubs

Next

2 Spokes

3 Authentication Settings

4 SD-WAN Settings

BGP on Overlay Enabled
Hubs and spokes are configured with internal BGP and AS number

Add Hub

Device *
ftd2

Dynamic Virtual Tunnel Interface (DVTI) *
VPN-OUT-1_dynamic_vti_1
Tunnel Source: VPN-OUT-1 (IP Address: 203.0.113.2)

Hub Gateway IP Address
203.0.113.2

Spoke Tunnel IP Address Pool *
VPN-POOL-198.51.100.32

Cancel Add

Device	Dynamic Virtual Tunnel Interface (DVTI)	Hub Gateway IP Address	Spoke Tunnel IP Address Pool
ftd1 Threat Defense	Virtual-Template1 (VPN-OUT-1_dynamic_vti_1) Source:GigabitEthernet0/0 (VPN-OUT-1)	203.0.113.1	VPN-POOL-198.51.100.0 Range: 198.51.100.10-198.51.100.20

Firewall Management Center
Devices / VPN / Site To Site

Overview Analysis Policies **Devices** Objects Integration

Deploy 🔍 ⚙️ 👤 admin 🔒 **SECURE**

Dual-HUB-Spoke-VPN-Single-ISP

Hub and Spoke Route-Based (VTI) VPN Topology

1 Hubs

Next

2 Spokes

3 Authentication Settings

4 SD-WAN Settings

BGP on Overlay Enabled
Hubs and spokes are configured with internal BGP and AS number 65500.

Device	Dynamic Virtual Tunnel Interface (DVTI)	Hub Gateway IP Address	Spoke Tunnel IP Address Pool
ftd1 Threat Defense	Virtual-Template1 (VPN-OUT-1_dynamic_vti_1) Source:GigabitEthernet0/0 (VPN-OUT-1)	203.0.113.1	VPN-POOL-198.51.100.0 Range: 198.51.100.10-198.51.100.20
ftd2 Threat Defense	Virtual-Template1 (VPN-OUT-1_dynamic_vti_1) Source:GigabitEthernet0/0 (VPN-OUT-1)	203.0.113.2	VPN-POOL-198.51.100.32 Range: 198.51.100.40-198.51.100.50

Cancel Finish

- 두 번째 HUB와 스포크 간의 eBGP 피어링을 구성하려면 마지막 단계에서 SD-WAN 설정을 수정합니다. Secondary HUB is in a different Autonomous System(보조 허브가 다른 자동 시스템에 있음) 옵션을 활성화하고 보조 허브의 AS(자동 시스템) 번호를 지정합니다. IBGP는 Secondary HUB is in different Autonomous System(보조 허브가 다른 자동 시스템에 있음) 옵션을 선택하지 않은 상태로 두어 사용자 환경에서 다른 AS 번호를 사용하는 데 제한이 없는 경우에도 사용할 수 있습니다. 이렇게 하면 보조 HUB에 대해서도 동일한 커뮤니티 태그 및

AS 번호가 푸시됩니다. 이 문서에서는 현재 설정을 위한 eBGP에 대해 중점적으로 다룹니다.

Firewall Management Center
Devices / VPN / Site To Site

Overview Analysis Policies **Devices** Objects Integration

Deploy 🔍 ⚙️ 👤 admin cisco SECURE

Dual-HUB-Spoke-VPN-Single-ISP

Hub and Spoke Route-Based (VTI) VPN Topology

1 Hubs

Device ftd1 ftd2 DVTI VPN-OUT-1_dynamic_vti_1 VPN-OUT-1_dynamic_vti_1 Gateway IP Address 203.0.113.1 203.0.113.2 Spoke Tunnel IP Address Pool VPN-POOL-198.51.100.0 VPN-POOL-198.51.100.32

Edit

2 Spokes

Device ftd3 ftd4 VPN Interface VPN-OUT-1 VPN-OUT-4 Local Tunnel (IKE) Identity Key ID: HUB-Spoke-VPN-Single-ISP_ftd3 Key ID: HUB-Spoke-VPN-Single-ISP_ftd4

Edit

3 Authentication Settings

Authentication Pre-shared Automatic Key Pre-shared Key Length 24

Edit

4 SD-WAN Settings

Spoke Tunnel Interface Auto Generation

Static Virtual Tunnel Interfaces (SVTIs) are auto generated on each spoke using the spoke's VPN interface as tunnel source to establish a VPN to the DVTI on each of the hubs. [View more](#)

Spoke Tunnel Interface Security Zone

VPN-OUT-1 X +

Overlay Routing Configuration

BGP can be enabled on the VPN overlay topology for seamless VPN connectivity from the spokes to the hub, and for spoke-to-spoke connectivity via the hub. [View more](#)

☒ Enable BGP on the VPN Overlay Topology

Autonomous System Number * 65500 Community Tag for Local Routes * 101010

☒ Redistribute Connected Interfaces

Default Inside* +

☒ Secondary Hub is in different Autonomous System

Autonomous System Number * 65510 Community Tag for Learned Routes * 010101

☒ Enable Multiple Paths for BGP

Allows multiple BGP routes to be used at the same time to reach the same destination. Enables BGP to load-balance traffic across multiple links.

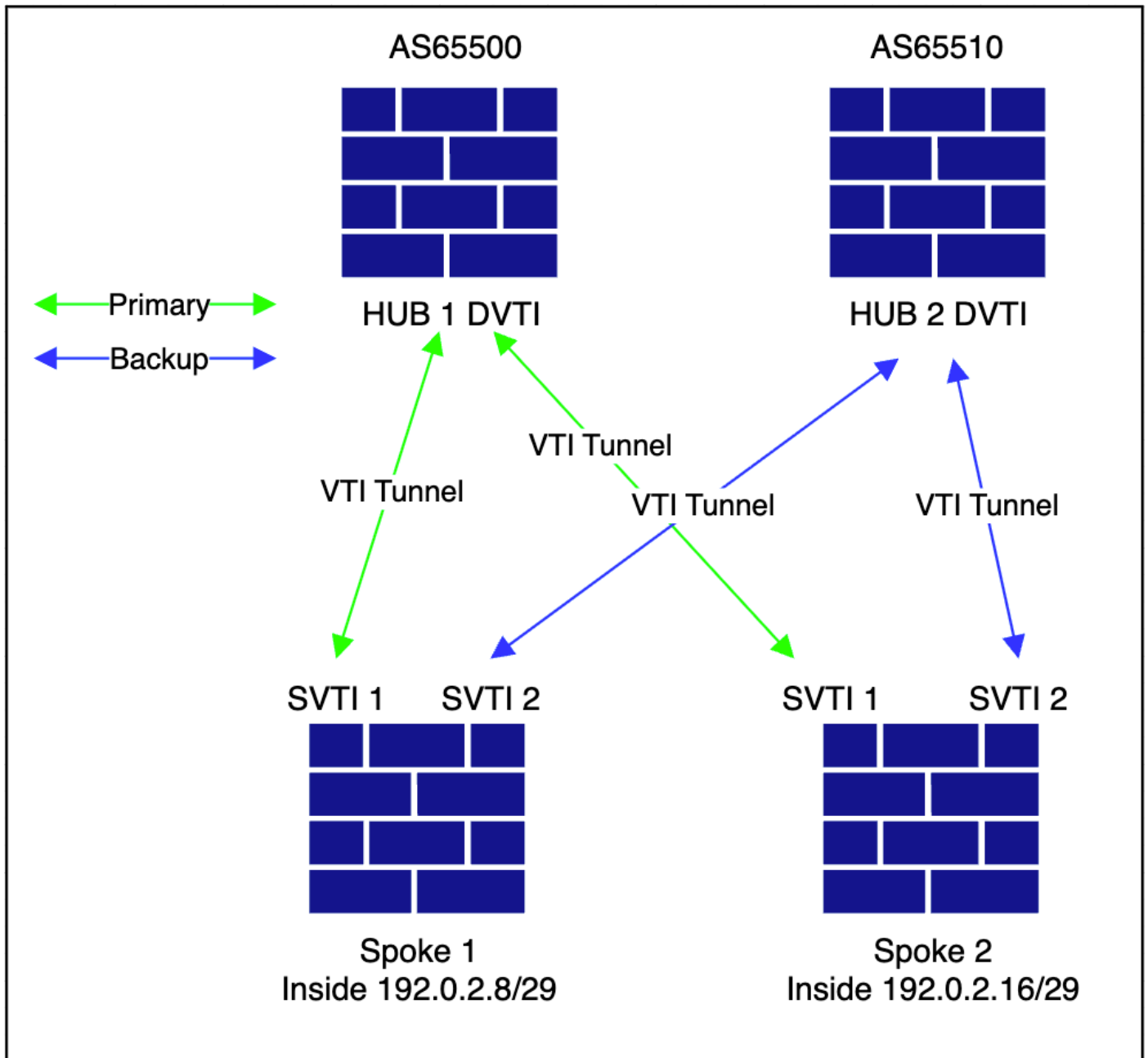
Next You have unsaved changes

Cancel Finish

이 컨피그레이션에서는 AS(Autonomous System) 번호 및 커뮤니티 태그가 모두 고유해야 합니다.

확인

이 다이어그램은 오버레이 토폴로지를 보여줍니다.



- FMC에서 Devices(디바이스) > VPN(VPN) > Site to Site(사이트에서 사이트)로 이동합니다.

Firewall Management Center
Devices / VPN / Site To Site

Overview Analysis Policies **Devices** Objects Integration

Deploy 🔍 ⚙️ ⓘ admin ▾ cloud-circle SECURE

Last Updated: 02:20 PM Refresh NAT Exemptions Add

Select... X Refresh

Topology Name	VPN Type	Network Topology	Tunnel Status Distribution	IKEv1	IKEv2
Dual-HUB-Spoke-VPN-Single-ISP	Route Based (VTI)	SD-WAN Topology	4 Tunnels	✓	

Hub			Spoke		
Device	VPN Interface	VTI Interface	Device	VPN Interface	VTI Interface
FTD ftd1	VPN-OUT-1 (203.0.113.1)	VPN-OUT-1_dynam... (198.51.100.1)	FTD ftd3	VPN-OUT-1 (203.0.113.3)	VPN-OUT-1_static... (198.51.100.10)
FTD ftd1	VPN-OUT-1 (203.0.113.1)	VPN-OUT-1_dynam... (198.51.100.1)	FTD ftd4	VPN-OUT-4 (203.0.113.4)	VPN-OUT-4_static... (198.51.100.11)
FTD ftd2	VPN-OUT-1 (203.0.113.2)	VPN-OUT-1_dynam... (198.51.100.2)	FTD ftd3	VPN-OUT-1 (203.0.113.3)	VPN-OUT-1_static... (198.51.100.40)
FTD ftd2	VPN-OUT-1 (203.0.113.2)	VPN-OUT-1_dynam... (198.51.100.2)	FTD ftd4	VPN-OUT-4 (203.0.113.4)	VPN-OUT-4_static... (198.51.100.41)

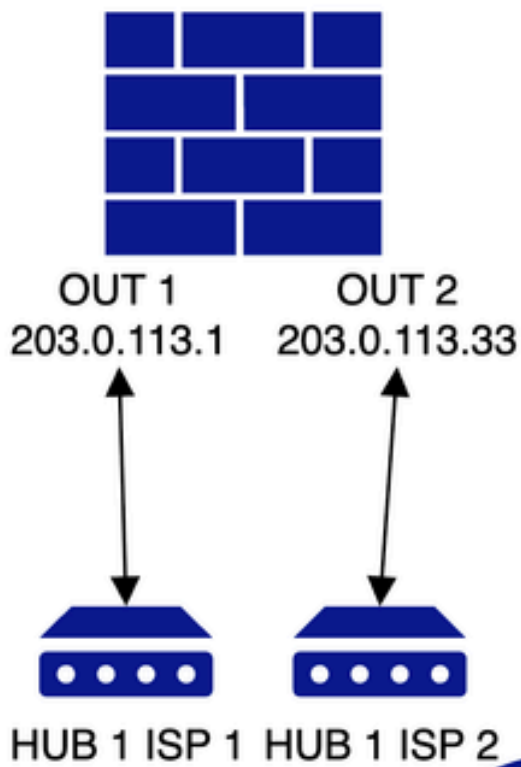
Viewing 1-4 of 4

- 다른 모든 단계는 변경되지 않습니다.

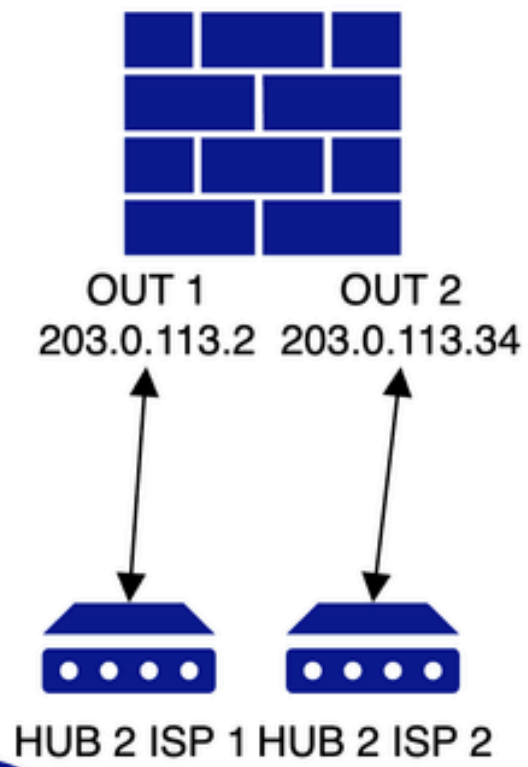
듀얼 허브 및 스포크(보조 허브와 스포크 사이의 EBGP를 통한 이중화 허브 및 ISP용
듀얼 ISP)

네트워크 다이어그램

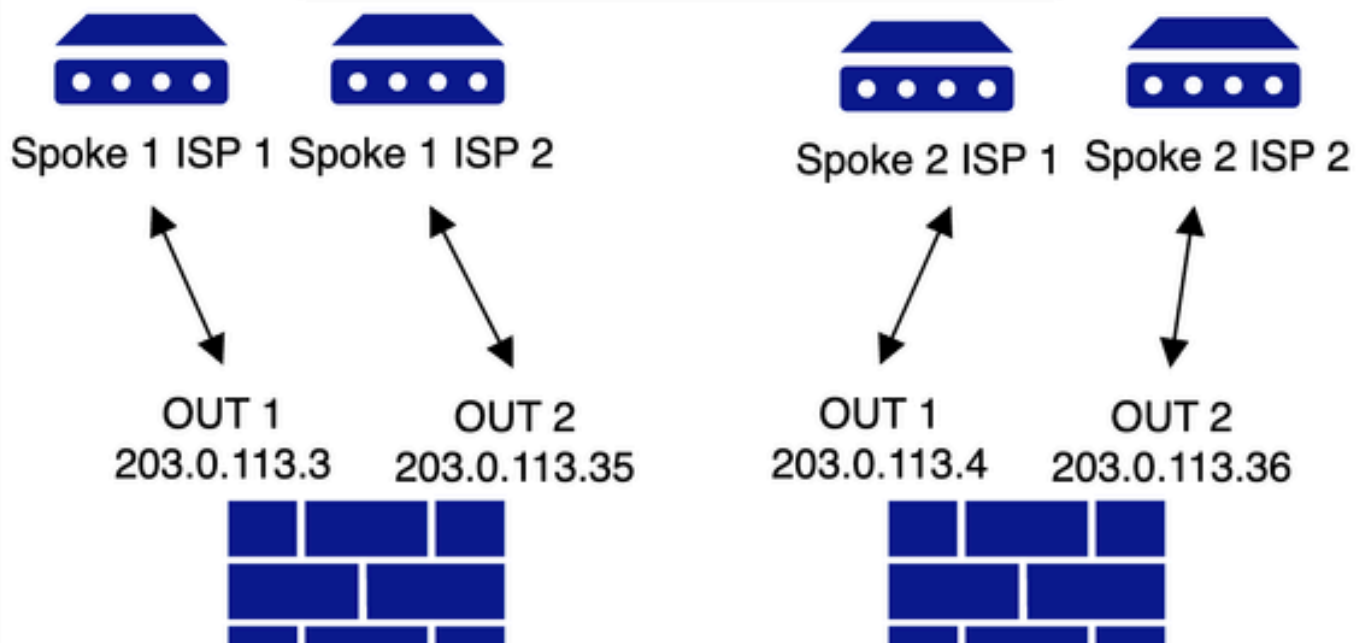
AS65500



AS65510



Internet



토폴로지에서 사용된 것과 일치하는지 확인합니다. 토폴로지는 서로 다른 보안 영역을 사용하지만 기본 및 보조 HUB의 AS 번호와 같은 나머지 컨피그레이션과 커뮤니티 태그가 동일합니다. 이는 UI에서 토폴로지 검증을 완료하는 데 필수입니다.

Firewall Management Center
Devices / VPN / Site To Site

Overview Analysis Policies **Devices** Objects Integration

Deploy 🔍 ⚙️ ⓘ admin ▾

Dual-HUB-Spoke-VPN-Dual-ISP-2

Hub and Spoke Route-Based (VTI) VPN Topology

1 Hubs ⓘ

Device ftd1
ftd2 DVTI VPN-OUT-1_dynamic_vti_2
Gateway IP Address 203.0.113.33
Spoke Tunnel IP Address Pool VPN-POOL-198.51.100.70
VPN-POOL-198.51.100.100

Edit

2 Spokes ⓘ

Device ftd3
ftd4 VPN Interface VPN-OUT-2
Local Tunnel (IKE) Identity Key ID: Dual-HUB-Spoke-VPN-Dual-ISP-2_ftd3
Key ID: Dual-HUB-Spoke-VPN-Dual-ISP-2_ftd4

Edit

3 Authentication Settings ⓘ

Authentication Pre-shared Automatic Key Pre-shared Key Length 24

Edit

4 SD-WAN Settings

Spoke Tunnel Interface Auto Generation

Static Virtual Tunnel Interfaces (SVTIs) are auto generated on each spoke using the spoke's VPN interface as tunnel source to establish a VPN to the DVTI on each of the hubs. [View more](#)

Spoke Tunnel Interface Security Zone ⓘ

VPN-OUT-2 X ▾ +

Overlay Routing Configuration

BGP can be enabled on the VPN overlay topology for seamless VPN connectivity from the spokes to the hub, and for spoke-to-spoke connectivity via the hub. [View more](#)

☒ Enable BGP on the VPN Overlay Topology

Autonomous System Number * ⓘ 65500

Community Tag for Local Routes * ⓘ 101010

☒ Redistribute Connected Interfaces ⓘ

Default inside* ▾ +

☒ Secondary Hub is in different Autonomous System ⓘ

Autonomous System Number * 65510

Community Tag for Learned Routes * ⓘ 010101

☒ Enable Multiple Paths for BGP

Allows multiple BGP routes to be used at the same time to reach the same destination. Enables BGP to load-balance traffic across multiple links.

Next You have unsaved changes

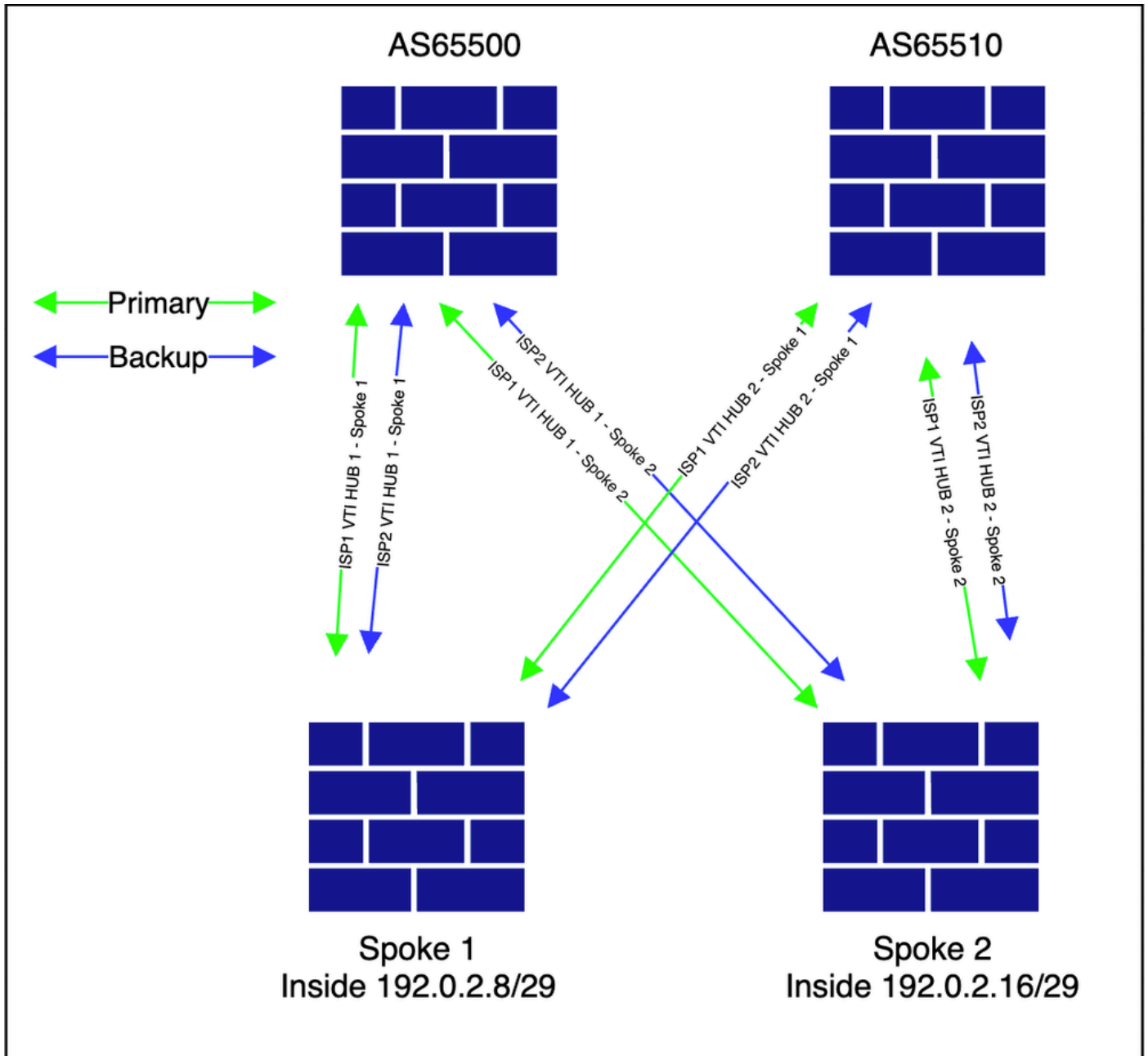
Cancel

Finish

- 다른 모든 설정은 변경되지 않습니다. 마법사를 완료하고 구축을 진행합니다.

확인

- 토폴로지가 표시된 대로 나타납니다.



- Devices(디바이스) > VPN > Site to Site(사이트 대 사이트)로 이동하여 토폴로지를 확인합니다.

198.51.100.4 4 65510 183 183 4 0 0 03:16:30 2

<<<<<<<<< HUB 2 ISP 2 VTI

<#root>

Spoke1#show bgp ipv4 unicast neighbors 198.51.100.1 routes <<<< check for specific prefixes received via

BGP table version is 4, local router ID is 203.0.113.35

Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
r RIB-failure, S Stale, m multipath

Origin codes: i - IGP, e - EGP, ? - incomplete

Network	Next Hop	Metric	LocPrf	Weight	Path
*>i192.0.2.16/29	198.51.100.1	1	100	0	?

<<<<<<<< spoke 2 network received via HUB 1 ISP 1 tunnel

Total number of prefixes 1

<#root>

Spoke1#show bgp ipv4 unicast neighbors 198.51.100.3 routes <<<< check for specific prefixes received via

BGP table version is 4, local router ID is 203.0.113.35

Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
r RIB-failure, S Stale, m multipath

Origin codes: i - IGP, e - EGP, ? - incomplete

Network	Next Hop	Metric	LocPrf	Weight	Path
*mi192.0.2.16/29	198.51.100.3	1	100	0	?

<<<<<<<< spoke 2 network received via HUB 1 ISP 2 tunnel

Total number of prefixes 1

<#root>

Spoke1# show bgp ipv4 unicast neighbors 198.51.100.2 routes <<<< check for specific prefixes received via

BGP table version is 4, local router ID is 203.0.113.35

Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
r RIB-failure, S Stale, m multipath

Origin codes: i - IGP, e - EGP, ? - incomplete

Network	Next Hop	Metric	LocPrf	Weight	Path
* 192.0.2.8/29	198.51.100.2	100		0	65510 65510 ?

<<<<<<< inside network receieved cause we advertised it to HUB 1 from ISP 2 topology

* 192.0.2.16/29	198.51.100.2	100		0	65510 65510 ?
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<<<<<<< spoke 2 network received via HUB 2 ISP 1 tunnel but not preferred

Total number of prefixes 2

<#root>

Spoke1# show bgp ipv4 unicast neighbors 198.51.100.4 routes <<<< check for specific prefixes received via

BGP table version is 4, local router ID is 203.0.113.35

Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
r RIB-failure, S Stale, m multipath

Origin codes: i - IGP, e - EGP, ? - incomplete

Network	Next Hop	Metric	LocPrf	Weight	Path
* 192.0.2.8/29	198.51.100.4	100		0	65510 65510 ?

<<<<<<< inside network received cause we advertised it to HUB 2 from ISP 1 topology

* 192.0.2.16/29	198.51.100.4	100		0	65510 65510 ?
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<<<<<<< spoke 2 network received via HUB 2 ISP 2 tunnel but not preferred

Total number of prefixes 2

표시된 대로 라우팅 테이블이 나타나며, 이는 스포크 측의 두 링크 간에 트래픽이 로드 밸런싱됨을 확인합니다.

<#root>

Spoke1#show route bgp

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, V - VPN

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, + - replicated route

SI - Static InterVRF, BI - BGP InterVRF

Gateway of last resort is not set

B 192.0.2.16 255.255.255.248 [200/1] via 198.51.100.3, 03:23:53

<<<<< multipath for spoke 2 inside network

[200/1] via 198.51.100.1, 03:23:53

<<<<< multipath for spoke 2 inside network

<#root>

Spoke1#show bgp 192.0.2.16

BGP routing table entry for 192.0.2.16/29, version 4
Paths: (4 available, best #4, table default)
Multipath: eBGP iBGP

Advertised to update-groups:

2 4

65510 65510

198.51.100.4 from 198.51.100.4 (198.51.100.4)

<<<< HUB2 ISP2 next-hop

Origin incomplete, metric 100, localpref 100, valid, external

Community: 10101

Local

198.51.100.3 from 198.51.100.3 (198.51.100.3)

<<<< HUB1 ISP2 next-hop

Origin incomplete, metric 1, localpref 100, valid, internal, multipath

Community: 10101

Originator: 203.0.113.36, Cluster list: 198.51.100.3

65510 65510

198.51.100.2 from 198.51.100.2 (198.51.100.4)

<<<< HUB2 ISP1 next-hop

Origin incomplete, metric 100, localpref 100, valid, external

Community: 10101

Local

198.51.100.1 from 198.51.100.1 (198.51.100.3)

<<<< HUB1 ISP1 next-hop

Origin incomplete, metric 1, localpref 100, valid, internal, multipath, best

Community: 10101

Originator: 203.0.113.36, Cluster list: 198.51.100.3

결론

이 문서에서는 단일 설정 마법사를 사용하여 쉽게 구현할 수 있는 다양한 구축 시나리오를 설명합니다.

관련 정보

- 추가 지원이 필요한 경우 TAC에 문의하십시오. 유효한 지원 계약이 필요합니다. [Cisco Worldwide Support 연락처](#).
- [여기서](#) Cisco VPN Community를 방문할 수도 있습니다.

이 번역에 관하여

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