IOS-XR에서 BGP 경로 선택 구성 및 확인

목차

소개

이 문서에서는 Cisco IOS®-XR 내 BGP(Border Gateway Protocol)에 대한 경로 정책의 **set path-selection** 문에 대해 설명합니다.

배경 정보

많은 설계에서는 하나의 접두사에 대해 BGP를 선택하고 여러 경로를 광고하는 것을 목표로 합니다.

기본적으로 하나의 BGP 경로만 최적 경로로 선택되며 이 최상의 경로만 광고됩니다. BGP Best Path Selection Algorithm은 다음 사항을 결정합니다.

BGP 최적 경로 선택 알고리즘

최상의 경로 외에도 두 번째로 좋은 경로를 백업 경로로 선택할 수 있습니다. 이 백업 경로는 BGP PIC(Prefix Independent Convergence)가 있는 설계에 사용할 수 있습니다.

BGP는 로드 밸런싱을 위해 여러 경로를 설치할 수 있습니다. 이는 ECMP(Equal Cost Multipath) 로드 밸런싱 또는 UCMP(Unequal Cost Multipath)일 수 있습니다. 이러한 다중 경로는 로드 밸런싱을 달성하기 위해 RIB(Routing Table) 및 데이터 평면 또는 FIB(Forwarding Instance Base) 테이블에 설치됩니다. FIB 테이블은 CEF(Cisco Express Forwarding) 테이블이라고도 합니다.

이 문서에서는 두 가지 목표에 대해 중점적으로 설명합니다.

- 설치할 여러 경로를 선택하기 위해 BGP를 가져오는 방법
- BGP를 통해 여러 경로를 광고하는 방법

BGP에서 사용하는 또 다른 기능은 추가 경로(ADD-Paths)입니다. 이 기능을 통해 BGP는 하나의 BGP 세션을 통해 둘 이상의 경로를 알릴 수 있습니다.

요약

- 최상의 경로는 항상 BGP에서 선택됩니다. 그렇지 않다면, 뭔가 문제가 있다. 이 기사에는 이러한 시나리오는 다루지 않습니다.
- 특정 기능이 구성된 경우(예: BGP PIC) 백업 경로를 선택할 수 있습니다.
- BGP에 대해 경로 정책을 특정 주소 패밀리에 구성하여 설치 및/또는 알릴 경로를 선택할 수 있습니다.
- Cisco IOS®-XR 7.3.1 이전에는 특정 접두사에 대한 경로를 선택하기 위해 route-policy에서 **set path-selection** 문을 하나만 지원합니다.
- Cisco IOS®-XR 7.3.1부터 특정 접두사에 대한 경로를 선택하기 위해 route-policy에서 여러 **set path-selection** 문을 지원합니다.
- Cisco IOS®-XR 7.3.1부터 BGP 접두사에 대한 특정 경로를 하나의 BGP 인접 디바이스에 광고하는 데 route-policy를 사용할 수 있는 기능이 추가되었습니다.

BGP에 의한 다중 경로 경로 선택은 경로를 수신하는 순서대로 수행됩니다. 그러나 **show bgp** 명령은 BGP 경로를 사전적 순서로 표시합니다.

Cisco IOS®-XR 7.3.1-에 도입된 새로운 명령을 사용하여 BGP 경로를 수신한 순서대로 확인할 수 있습니다.

```
show bgp <afi> rd <rd> <path_details>
```

이를 통해 다중 경로를 확인하고 문제를 해결할 수 있습니다. 이 솔루션은 경로가 다른 경로가 아닌 다중 경로로 선택된 이유에 대한 주요 질문을 해결합니다.

다중 경로 보호 경로는 다중 경로 경로가 아니라 다른 모든 다중 경로 경로를 보호하는 백업 경로입니다.

Cisco IOS®-XR 7.3.1부터 set path-selection 문에 **대한** 이 새로운 키워드가 **있습니다**. **백업 경로** 또는 다중 경로 경로와 함께 다중 경로 보호 경로**를** 광고하**는** 데 사용할 수 있습니다. route-policy에서 사용할 전체 명령은 다음과 같습니다.

```
set path-selection backup 1 install multipath-protect advertise multipath-protect-advertise

set path-selection multipath advertise multipath-protect multipath-protect-advertise
```

모든 키워드 조합과 함께 set path-selection 명령의 개요입니다. 자세한 설명과 예는 다음 섹션에서 확인할 수 있습니다.

아래의 모든 경우 최상의 경로가 설치됩니다. 그렇지 않은 경우 문제가 발생하지만(예: next hop이 유효하지 않음) set path-selection 명령과 관련이 없습니다.

백업 경로를 선택하려면 BGP 백업 경로를 선택할 수 있는 BGP에 대해 기능을 활성화해야 합니다. 예: BGP PIC.

BGP에서 address family 명령 **maximum-paths**에 의해 다중 경로 경로**가 활성화됩니다**.

```
mamximum-paths {ebgp | eibgp | ibgp} <2-32> (unequal-cost)
```
즉, 최상의 경로는 다중 경로 경로입니다. 최상의 경로는 BGP에 대한 다중 경로가 활성화되지 않은 경우 라우팅 테이블에 설치된 유일한 경로입니다. 명령 **최대 경로 {ebgp**를 사용하여 라우팅 테이블에 설치된 BGP 경로 수를 제어할 수 있습니다. **| eibgp | ibgp} <2-32> (같지 않음)**.
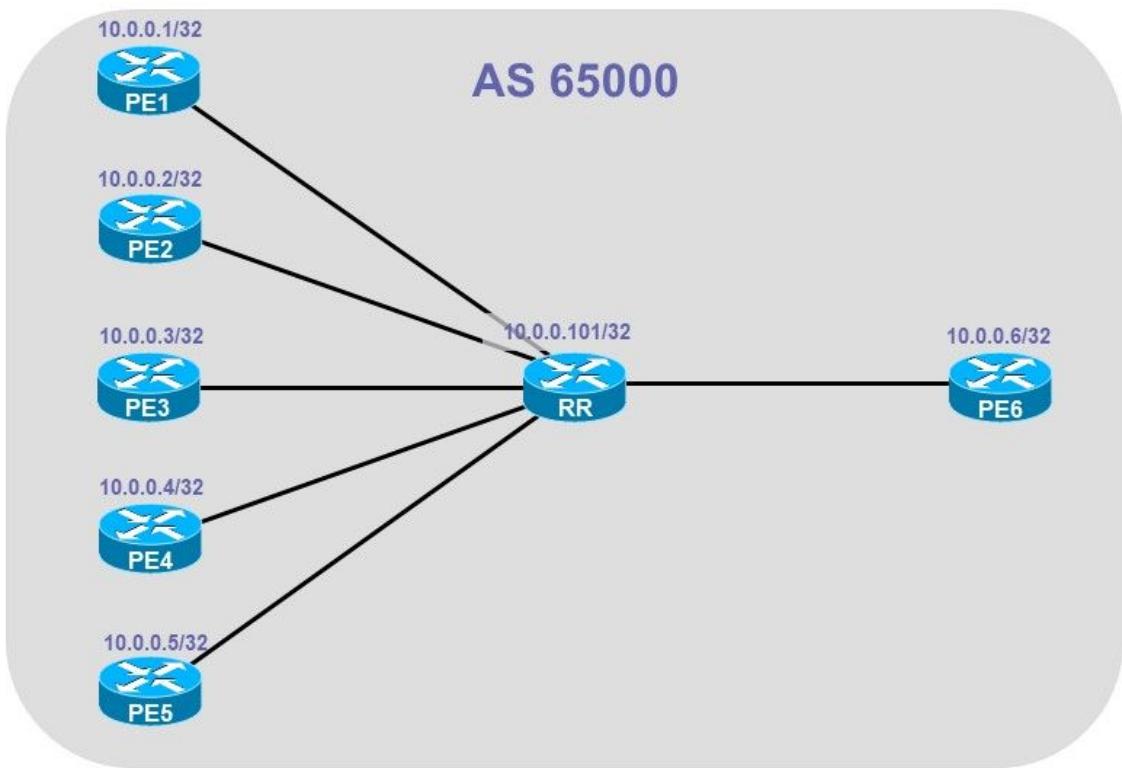
이 표에서는 set path-selection 명령을 사용하여 모든 옵션**의** 개요를 제공합니다. 자세한 내용과 예는 여기에 제시된 각 케이스의 다음 섹션을 참조하십시오.

사례	명령을 사용합니다	설치	광고
1	경로 선택 백업 1 설치 설정	백업 경로 1개가 설치되어 있습니다.	최상의 경로만 알려집
2	경로 선택 백업 1 알림 설정	백업 경로가 설치되지 않았습니다.	백업 경로가 광고됩니
3	경로 선택 백업 1 설치 알림 설정	백업 경로가 설치됩니다.	백업 경로가 광고됩니
4	경로 선택 모든 알림 설정	백업 경로가 설치되지 않았습니다. 다중 경로 경로가 설치됩니다.	모든 경로가 광고됩니 상의 경로, 백업 경로, 경로, 비다중 경로 경로
5	경로 선택 최적 경로 설정	다중 경로 경로가 설치됩니다.	최상의 경로만 알려집
6	경로 선택 다중 경로 알림 설정	다중 경로 경로가 설치됩니다.	다중 경로 경로가 광고다.
7	set path-selection backup 1 install multipath-protect	다중 경로 경로가 설치됩니다. 다른 경로는 백업 경로(다중 경로 경로 옆에 아직 경로가 있는 경우 'backup(protect multipath)' 경로로 설치됩니다.	최상의 경로만 알려집

8	set path-selection backup 1 install multipath-protect advertise	다중 경로 경로가 설치됩니다. 다른 경로는 백업 경로(다중 경로 경로 옆에 아직 경로가 있는 경우 'backup(protect multipath)' 경로로 설치됩니다.	최적의 경로 및 백업 경가 광고됩니다. backup(protect multip경로는 알려지지 않습
9	path-selection group-best advertise 설정	Group-Best 선택은 AS별 및 next-hop별 최상의 경로입니다. 다중 경로 경로가 설치됩니다.	모든 그룹 최상의 경로광고됩니다.
10	set path-selection backup 1 install multipath-protect multipath-protect-advertise	다중 경로 경로가 설치됩니다. 다른 경로는 백업 경로(다중 경로 경로 옆에 아직 경로가 있는 경우 'backup(protect multipath)' 경로로 설치됩니다.	최상의 경로, 백업 경백업(보호 다중 경로)가 광고됩니다.
11	set path-selection multipath advertise multipath-protect	다중 경로 경로가 설치됩니다.	다중 경로 경로가 광고다. backup(protect multip경로는 알려지지 않습
12	set path-selection multipath advertise-protect multipath-protect-advertise	다중 경로 경로가 설치됩니다. 다른 경로는 백업 경로(다중 경로 경로 옆에 아직 경로가 있는 경우 'backup(protect multipath)' 경로로 설치됩니다.	다중 경로 경로가 광고다. backup(protect multip경로가 광고됩니다.

이 문서에서 사용되는 토폴로지입니다.

모든 경우 RR(Route-Reflector)과 PE6 간에 ADD-PATH가 활성화됩니다.

PE1, PE2, PE3, PE4, PE5 및 PE6는 모두 vpnv4 유니캐스트 경로와 동일한 접두사를 RR에 알립니다.

PE6은 RR에서 이 접두사를 수신하는 인그레스 PE입니다.

달리 언급되지 않는 한, ADD-PATH는 모든 BGP 세션에서 활성화되고 RR에서 주소군 vpnv4 유니캐스트에 대해 최대 경로 ibgp 3이 구성됩니다.

> **참고:** RIB 및 CEF 테이블에 최대 하나의 백업 경로가 설치됩니다. 두 개 이상의 항목이 가능하지 않거나 지원되지 않습니다. 경로는 BGP 테이블, RIB 테이블 및 CEF 테이블에서 백업으로 표시됩니다.

백업 경로는 항상 이 문서에서 BGP에 의해 선택됩니다. 백업 경로는 다른 기능에서 선택할 수 있지만, 여기서는 항상 BGP입니다.

BGP에 대해 다중 경로가 구성된 경우 BGP 테이블에 다중 경로(ECMP 또는 UCMP) 경로가 설치될 수 있습니다. 이러한 경로는 **다중 경로로** 표시됩니다. 백업 경로는 두 번째로 좋은 경로이므로, 경로가 있는 경우 다중 경로 중 하나여야 합니다. 즉, 이 기능이 구성된 경우 BGP에서 백업(보호 다중 경로)을 선택할 수 있습니다(**set path-selection route-policy** 문의 multipath-**protect** 키워드). 이 경우 이 **백업(보호 다중 경로)** 경로는 RIB 및 CEF 테이블의 백업 경로입니다. BGP에서 선택되고 BGP로 표시된 백업 경로는 백업 경로가 아니라 다중 경로 경로입니다.

RR에 RR의 역할만 있는 경우 RR의 백업 경로는 큰 의미가 없습니다.

이 문서에서는 RR이 PE 라우터라고 가정합니다. 이 경우 백업 경로를 선택하고 설치하는 것이 적절합니다. 백업 경로를 BGP PIC에 사용할 수 있습니다.

백업 경로는 특정 접두사를 지정할 때 RIB에서 **백업**으로 표시되고 접두사를 지정하지 않을 경우 "!"로 표시됩니다.

```
RP/0/RP0/CPU0:RR#show route vrf one 10.1.1.1/32
Routing entry for 10.1.1.1/32
 Known via "bgp 65000", distance 200, metric 0
 Number of pic paths 1 , type internal
 Installed Sep 17 13:25:25.064 for 00:03:27
 Routing Descriptor Blocks
    10.0.0.1, from 10.0.0.1, BGP multi path
      Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
      Route metric is 0
    10.0.0.2, from 10.0.0.2, BGP backup path
      Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
      Route metric is 0
    10.0.0.3, from 10.0.0.3, BGP multi path
      Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
      Route metric is 0
    10.0.0.4, from 10.0.0.4, BGP multi path
      Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
      Route metric is 0
 No advertising protos.


RP/0/RP0/CPU0:RR#show route vrf one

Codes: C - connected, S - static, R - RIP, B - BGP, (>) - Diversion path
       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, E - EGP
       i - ISIS, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, su - IS-IS summary null, * - candidate default
       U - per-user static route, o - ODR, L - local, G  - DAGR, l - LISP
       A - access/subscriber, a - Application route
       M - mobile route, r - RPL, t - Traffic Engineering, (!) - FRR Backup path

Gateway of last resort is not set

B    10.1.1.1/32 [200/0] via 10.0.0.1 (nexthop in vrf default), 00:02:16
                 [200/0] via 10.0.0.2 (nexthop in vrf default), 00:02:16 (!)
                 [200/0] via 10.0.0.3 (nexthop in vrf default), 00:02:16
                 [200/0] via 10.0.0.4 (nexthop in vrf default), 00:02:16
```

경로 정책에서 경로 선택 명령 설정

이 섹션에서는 라우터 BGP에서 특정 주소 패밀리의 route-policy에서 사용되는 모든 **set path-selection** 문에 대해 설명합니다.

이는 Cisco IOS®-XR 버전이 Pre-Cisco IOS®-XR 7.3.1 버전이든 관계없이 가능합니다.

구성:


```
router bgp 65000
 address-family ipv4 unicast
 !
 address-family vpnv4 unicast
 additional-paths receive
 additional-paths send
 additional-paths selection route-policy BGP-Path-Selection
 !
 neighbor 10.0.0.1
 remote-as 65000
 update-source Loopback0
```

```
address-family ipv4 unicast
 route-reflector-client
!
address-family vpnv4 unicast
 route-reflector-client
!
!
neighbor 10.0.0.2
remote-as 65000
update-source Loopback0
address-family ipv4 unicast
 route-reflector-client
!
address-family vpnv4 unicast
 route-reflector-client
!
!
neighbor 10.0.0.3
remote-as 65000
update-source Loopback0
address-family ipv4 unicast
 route-reflector-client
!
address-family vpnv4 unicast
 route-reflector-client
!
!
neighbor 10.0.0.4
remote-as 65000
update-source Loopback0
address-family ipv4 unicast
 route-reflector-client
!
address-family vpnv4 unicast
 route-reflector-client
!
!
neighbor 10.0.0.5
remote-as 65000
update-source Loopback0
address-family ipv4 unicast
 route-reflector-client
!
address-family vpnv4 unicast
 route-reflector-client
!
!
neighbor 10.0.0.6
remote-as 65000
update-source Loopback0
address-family ipv4 unicast
 route-reflector-client
!
address-family vpnv4 unicast
 route-reflector-client
!
!
vrf one
rd 1:1
address-family ipv4 unicast
 maximum-paths ibgp 3
 additional-paths selection route-policy BGP-Path-Selection
 redistribute connected
!
```

```
  !
!
```

set path-selection 문이 있는 route-policy는 address-family vpnv4 유니캐스트 아래에 적용됩니다.

set path-selection 문이 있는 route-policy도 VRF에 적용됩니다. 이는 VRF RIB/CEF 테이블에 백업 경로를 설치하거나 PE-CE 링크를 통해 BGP 세션을 통해 광고해야 하는 경우에 필요합니다.

여기서는 두 경로 정책이 모두 동일하지만 VRF와 달리 주소군 아래에 서로 다른 정책을 적용할 수 있습니다.

VRF1에서 **최대 경로** *ibgp 3*이 사용되므로 RIB/CEF 테이블에 최대 3개의 ECMP 경로가 있을 수 있습니다.

이러한 경우에는 경로 선택 **설정**으로 경로 정책에 대한 모든 가능성**을 보여줍니다**.

1. 경로 선택 백업 1 설치 설정

```
route-policy BGP-Path-Selection
 set path-selection backup 1 install
end-policy
!

RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
 Process             bRIB/RIB  SendTblVer
 Speaker                    5           5
Last Modified: Sep 17 13:14:35.907 for 00:04:41
Paths: (5 available, best #1)
 Advertised to update-groups (with more than one peer):
   0.2 0.3
 Path #1: Received by speaker 0
 Advertised to update-groups (with more than one peer):
   0.2 0.3
 Local, (Received from a RR-client)
   10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, multipath,
import-candidate, imported
     Received Path ID 0, Local Path ID 1, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #2: Received by speaker 0
 Not advertised to any peer
 Local, (Received from a RR-client)
   10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, multipath, backup, add-path,
import-candidate, imported
     Received Path ID 0, Local Path ID 2, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #3: Received by speaker 0
 Not advertised to any peer
 Local, (Received from a RR-client)
   10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
```

```
      Received Path ID 0, Local Path ID 0, version 0
      Extended community: RT:65000:1
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #4: Received by speaker 0
 Not advertised to any peer
 Local, (Received from a RR-client)
    10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4)
      Received Label 24013
      Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
      Received Path ID 0, Local Path ID 0, version 0
      Extended community: RT:65000:1
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #5: Received by speaker 0
 Not advertised to any peer
 Local, (Received from a RR-client)
    10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5)
      Received Label 24014
      Origin incomplete, metric 0, localpref 100, valid, internal, **multipath**, import-candidate,
imported
      Received Path ID 1, Local Path ID 0, version 0
      Extended community: RT:65000:1
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:


RP/0/RP0/CPU0:RR#**show route vrf one 10.1.1.1/32**
Routing entry for 10.1.1.1/32
 Known via "bgp 65000", distance 200, metric 0
 Number of pic paths 1 , type internal
 Installed Sep 17 13:25:25.064 for 00:03:27
 Routing Descriptor Blocks
    10.0.0.1, from 10.0.0.1, **BGP multi path**
      Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
      Route metric is 0
    10.0.0.2, from 10.0.0.2, **BGP backup path**
      Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
      Route metric is 0
    10.0.0.3, from 10.0.0.3, **BGP multi path**
      Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
      Route metric is 0
    10.0.0.4, from 10.0.0.4, **BGP multi path**
      Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
      Route metric is 0
 No advertising protos.


RP/0/RP0/CPU0:RR#**show cef vrf one 10.1.1.1/32**
10.1.1.1/32, version 119, internal 0x5000001 0x30 (ptr 0xd96a770) [1], 0x0 (0xe3662a8), 0xa08
(0xf4e10a8)
 Updated Sep 17 13:25:25.068
 Prefix Len 32, traffic index 0, precedence n/a, priority 3
  via 10.0.0.1/32, 3 dependencies, recursive, **bgp-multipath** [flags 0x6080]
    path-idx 0 NHID 0x0 [0xdab2bc0 0x0], Internal 0xd6a2730
    recursion-via-/32
    next hop VRF - 'default', table - 0xe0000000
    next hop 10.0.0.1/32 via 24003/0/21
     next hop 10.1.101.1/32 Gi0/0/0/0    labels imposed {ImplNull 24012}
  via 10.0.0.2/32, 2 dependencies, recursive, **backup** [flags 0x6100]
    path-idx 1 NHID 0x0 [0xdab2e48 0x0]
    recursion-via-/32
    next hop VRF - 'default', table - 0xe0000000
    next hop 10.0.0.2/32 via 24001/0/21
     next hop 10.2.101.2/32 Gi0/0/0/4    labels imposed {ImplNull 24012}
  via 10.0.0.3/32, 3 dependencies, recursive, **bgp-multipath** [flags 0x6080]
    path-idx 2 NHID 0x0 [0xdab2060 0x0], Internal 0xd6a2550
    recursion-via-/32
```

```
       next hop VRF - 'default', table - 0xe0000000
       next hop 10.0.0.3/32 via 24007/0/21
        next hop 10.3.101.3/32 Gi0/0/0/6    labels imposed {ImplNull 24012}
     via 10.0.0.4/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
       path-idx 3 NHID 0x0 [0xdab2c98 0x0], Internal 0xd6a2190
       recursion-via-/32
       next hop VRF - 'default', table - 0xe0000000
       next hop 10.0.0.4/32 via 24000/0/21
        next hop 10.4.101.4/32 Gi0/0/0/7    labels imposed {ImplNull 24013}
```

알려진 경로를 확인합니다.

```
RP/0/RP0/CPU0:PE6#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32
BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
 Process            bRIB/RIB  SendTblVer
 Speaker                 87          87
Last Modified: Sep 17 13:50:32.649 for 00:00:42
Paths: (1 available, best #1)
 Not advertised to any peer
 Path #1: Received by speaker 0
 Not advertised to any peer
 Local
   10.0.0.1 (metric 3) from 10.0.0.101 (10.0.0.1)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, import-
candidate, imported
     Received Path ID 1, Local Path ID 1, version 87
     Extended community: RT:65000:1
     Originator: 10.0.0.1, Cluster list: 10.0.0.101
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

결론: VRF의 RR에 1개의 백업 경로가 설치되어 있습니다. 최상의 경로만 알려집니다.

2. 경로 선택 백업 1 알림 설정

```
route-policy BGP-Path-Selection
 set path-selection backup 1 advertise
end-policy
!

RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32
BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
 Process            bRIB/RIB  SendTblVer
 Speaker                  5           5
Last Modified: Sep 17 13:38:03.907 for 00:02:04
Paths: (5 available, best #1)
 Advertised to update-groups (with more than one peer):
   0.2 0.3
 Path #1: Received by speaker 0
 Advertised to update-groups (with more than one peer):
   0.2 0.3
 Local, (Received from a RR-client)
   10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, multipath,
import-candidate, imported
     Received Path ID 0, Local Path ID 1, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

```
 Path #2: Received by speaker 0
 Advertised to update-groups (with more than one peer):
   0.3
 Local, (Received from a RR-client)
   10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, multipath, backup, add-path,
import-candidate, imported
     Received Path ID 0, Local Path ID 2, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #3: Received by speaker 0
 Not advertised to any peer
 Local, (Received from a RR-client)
   10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
     Received Path ID 0, Local Path ID 0, version 0
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #4: Received by speaker 0
 Not advertised to any peer
 Local, (Received from a RR-client)
   10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4)
     Received Label 24013
     Origin incomplete, metric 0, localpref 100, valid, internal, multipath, import-candidate,
imported
     Received Path ID 0, Local Path ID 0, version 0
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #5: Received by speaker 0
 Not advertised to any peer
 Local, (Received from a RR-client)
   10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5)
     Received Label 24014
     Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
     Received Path ID 1, Local Path ID 0, version 0
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1


RP/0/RP0/CPU0:RR#show route vrf one 10.1.1.1/32
Routing entry for 10.1.1.1/32
 Known via "bgp 65000", distance 200, metric 0, type internal
 Installed Sep 17 13:38:04.233 for 00:04:26
 Routing Descriptor Blocks
   10.0.0.1, from 10.0.0.1, BGP multi path
     Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
     Route metric is 0
   10.0.0.2, from 10.0.0.2, BGP multi path
     Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
     Route metric is 0
   10.0.0.4, from 10.0.0.4, BGP multi path
     Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
     Route metric is 0
 No advertising protos.


RP/0/RP0/CPU0:RR#show cef vrf one 10.1.1.1/32
10.1.1.1/32, version 135, internal 0x5000001 0x30 (ptr 0xd96a770) [1], 0x0 (0xe3662a8), 0xa08
(0xf696158)
 Updated Sep 17 13:38:04.236
 Prefix Len 32, traffic index 0, precedence n/a, priority 3
  via 10.0.0.1/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
   path-idx 0 NHID 0x0 [0xdab2bc0 0x0]
```

```
  recursion-via-/32
  next hop VRF - 'default', table - 0xe0000000
  next hop 10.0.0.1/32 via 24003/0/21
   next hop 10.1.101.1/32 Gi0/0/0/0    labels imposed {ImplNull 24012}
 via 10.0.0.2/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
  path-idx 1 NHID 0x0 [0xdab2e48 0x0]
   recursion-via-/32
   next hop VRF - 'default', table - 0xe0000000
   next hop 10.0.0.2/32 via 24001/0/21
    next hop 10.2.101.2/32 Gi0/0/0/4    labels imposed {ImplNull 24012}
 via 10.0.0.4/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
  path-idx 2 NHID 0x0 [0xdab2c98 0x0]
   recursion-via-/32
   next hop VRF - 'default', table - 0xe0000000
   next hop 10.0.0.4/32 via 24000/0/21
    next hop 10.4.101.4/32 Gi0/0/0/7    labels imposed {ImplNull 24013}
```

알려진 경로를 확인합니다.

```
RP/0/RP0/CPU0:PE6#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
 Process           bRIB/RIB  SendTblVer
 Speaker                 73          73
Last Modified: Sep 17 13:38:05.649 for 00:02:47
Paths: (2 available, best #1)
 Not advertised to any peer
 Path #1: Received by speaker 0
 Not advertised to any peer
 Local
   10.0.0.1 (metric 3) from 10.0.0.101 (10.0.0.1)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, import-
candidate, imported
     Received Path ID 1, Local Path ID 1, version 73
     Extended community: RT:65000:1
     Originator: 10.0.0.1, Cluster list: 10.0.0.101
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #2: Received by speaker 0
  Not advertised to any peer
 Local
   10.0.0.2 (metric 3) from 10.0.0.101 (10.0.0.2)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
     Received Path ID 2, Local Path ID 0, version 0
     Extended community: RT:65000:1
     Originator: 10.0.0.2, Cluster list: 10.0.0.101
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

결론: 백업 경로가 설치되지 않았습니다. 백업 경로가 광고됩니다.

3 . 경로 선택 백업 1 설치 알림 설정

```
route-policy BGP-Path-Selection
 set path-selection backup 1 advertise install
end-policy
!

RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32
```

```
BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
 Process            bRIB/RIB  SendTblVer
 Speaker                  5           5
Last Modified: Sep 17 14:20:36.907 for 00:01:55
Paths: (5 available, best #1)
 Advertised to update-groups (with more than one peer):
   0.2 0.3
 Path #1: Received by speaker 0
 Advertised to update-groups (with more than one peer):
   0.2 0.3
 Local, (Received from a RR-client)
   10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, multipath,
import-candidate, imported
     Received Path ID 0, Local Path ID 1, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #2: Received by speaker 0
 Advertised to update-groups (with more than one peer):
   0.3
 Local, (Received from a RR-client)
   10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, multipath, backup, add-path,
import-candidate, imported
     Received Path ID 0, Local Path ID 2, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #3: Received by speaker 0
 Not advertised to any peer
 Local, (Received from a RR-client)
   10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
     Received Path ID 0, Local Path ID 0, version 0
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #4: Received by speaker 0
 Not advertised to any peer
 Local, (Received from a RR-client)
   10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4)
     Received Label 24013
     Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
     Received Path ID 0, Local Path ID 0, version 0
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #5: Received by speaker 0
 Not advertised to any peer
 Local, (Received from a RR-client)
   10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5)
     Received Label 24014
     Origin incomplete, metric 0, localpref 100, valid, internal, multipath, import-candidate,
imported
     Received Path ID 1, Local Path ID 0, version 0
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1


RP/0/RP0/CPU0:RR#show route vrf one 10.1.1.1/32
Routing entry for 10.1.1.1/32
 Known via "bgp 65000", distance 200, metric 0
 Number of pic paths 1 , type internal
```

```
   Installed Sep 17 14:23:42.997 for 00:00:59
   Routing Descriptor Blocks
     10.0.0.1, from 10.0.0.1, BGP multi path
       Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
       Route metric is 0
     10.0.0.2, from 10.0.0.2, BGP backup path
       Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
       Route metric is 0
     10.0.0.3, from 10.0.0.3, BGP multi path
       Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
       Route metric is 0
     10.0.0.5, from 10.0.0.5, BGP multi path
       Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
       Route metric is 0
   No advertising protos.


RP/0/RP0/CPU0:RR#show cef vrf one 10.1.1.1/32
10.1.1.1/32, version 185, internal 0x5000001 0x30 (ptr 0xd96a770) [1], 0x0 (0xe3662a8), 0xa08
(0xf4e10a8)
 Updated Sep 17 14:23:42.999
 Prefix Len 32, traffic index 0, precedence n/a, priority 3
  via 10.0.0.1/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
   path-idx 0 NHID 0x0 [0xdab2bc0 0x0], Internal 0xd6a2730
   recursion-via-/32
   next hop VRF - 'default', table - 0xe0000000
   next hop 10.0.0.1/32 via 24003/0/21
    next hop 10.1.101.1/32 Gi0/0/0/0    labels imposed {ImplNull 24012}
  via 10.0.0.2/32, 2 dependencies, recursive, backup [flags 0x6100]
   path-idx 1 NHID 0x0 [0xdab2e48 0x0]
   recursion-via-/32
   next hop VRF - 'default', table - 0xe0000000
   next hop 10.0.0.2/32 via 24001/0/21
    next hop 10.2.101.2/32 Gi0/0/0/4    labels imposed {ImplNull 24012}
  via 10.0.0.3/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
   path-idx 2 NHID 0x0 [0xdab2060 0x0], Internal 0xd6a2550
   recursion-via-/32
   next hop VRF - 'default', table - 0xe0000000
   next hop 10.0.0.3/32 via 24007/0/21
    next hop 10.3.101.3/32 Gi0/0/0/6    labels imposed {ImplNull 24012}
  via 10.0.0.5/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
   path-idx 3 NHID 0x0 [0xdab2368 0x0], Internal 0xd6a2190
   recursion-via-/32
   next hop VRF - 'default', table - 0xe0000000
   next hop 10.0.0.5/32 via 24005/0/21
    next hop 10.5.101.5/32 Gi0/0/0/1    labels imposed {ImplNull 24014}
```
알려진 경로를 확인합니다.


```
RP/0/RP0/CPU0:PE6#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
 Process           bRIB/RIB  SendTblVer
 Speaker               105         105
Last Modified: Sep 17 14:23:43.649 for 00:02:16
Paths: (2 available, best #1)
 Not advertised to any peer
 Path #1: Received by speaker 0
 Not advertised to any peer
 Local
   10.0.0.1 (metric 3) from 10.0.0.101 (10.0.0.1)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, import-
```

```
candidate, imported
      Received Path ID 1, Local Path ID 1, version 105
      Extended community: RT:65000:1
      Originator: 10.0.0.1, Cluster list: 10.0.0.101
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #2: Received by speaker 0
 Not advertised to any peer
 Local
    10.0.0.2 (metric 3) from 10.0.0.101 (10.0.0.2)
      Received Label 24012
      Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
      Received Path ID 2, Local Path ID 0, version 0
      Extended community: RT:65000:1
      Originator: 10.0.0.2, Cluster list: 10.0.0.101
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

결론: 백업 경로가 설치됩니다. 백업 경로가 광고됩니다. 이것은 1.2입니다.

4. 경로 선택 모든 알림 설정

```
route-policy BGP-Path-Selection
 set path-selection all advertise
end-policy
!

RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
 Process           bRIB/RIB  SendTblVer
 Speaker                  5           5
Last Modified: Sep 17 14:28:58.907 for 00:04:04
Paths: (5 available, best #1)
 Advertised to update-groups (with more than one peer):
   0.2 0.3
 Path #1: Received by speaker 0
 Advertised to update-groups (with more than one peer):
   0.2 0.3
 Local, (Received from a RR-client)
    10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1)
      Received Label 24012
      Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, multipath,
import-candidate, imported
      Received Path ID 0, Local Path ID 1, version 5
      Extended community: RT:65000:1
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #2: Received by speaker 0
 Advertised to update-groups (with more than one peer):
   0.2
 Local, (Received from a RR-client)
    10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2)
      Received Label 24012
      Origin incomplete, metric 0, localpref 100, valid, internal, multipath, add-path, import-
candidate, imported
      Received Path ID 0, Local Path ID 4, version 5
      Extended community: RT:65000:1
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #3: Received by speaker 0
 Advertised to update-groups (with more than one peer):
   0.2
 Local, (Received from a RR-client)
    10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3)
```

```
      Received Label 24012
      Origin incomplete, metric 0, localpref 100, valid, internal, add-path, import-candidate,
imported
      Received Path ID 0, Local Path ID 2, version 5
      Extended community: RT:65000:1
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #4: Received by speaker 0
 Advertised to update-groups (with more than one peer):
   0.2
 Local, (Received from a RR-client)
   10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4)
      Received Label 24013
      Origin incomplete, metric 0, localpref 100, valid, internal, add-path, import-candidate,
imported
      Received Path ID 0, Local Path ID 3, version 5
      Extended community: RT:65000:1
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #5: Received by speaker 0
 Advertised to update-groups (with more than one peer):
   0.2
 Local, (Received from a RR-client)
   10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5)
      Received Label 24014
      Origin incomplete, metric 0, localpref 100, valid, internal, **multipath**, add-path, import-
candidate, imported
      Received Path ID 1, Local Path ID 5, version 5
      Extended community: RT:65000:1
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1


RP/0/RP0/CPU0:RR#**show route vrf one 10.1.1.1/32**
Routing entry for 10.1.1.1/32
 Known via "bgp 65000", distance 200, metric 0, type internal
 Installed Sep 17 14:28:59.169 for 00:04:52
 Routing Descriptor Blocks
   10.0.0.1, from 10.0.0.1, **BGP multi path**
     Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
     Route metric is 0
   10.0.0.2, from 10.0.0.2, **BGP multi path**
     Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
     Route metric is 0
   10.0.0.5, from 10.0.0.5, **BGP multi path**
     Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
     Route metric is 0
 No advertising protos.


RP/0/RP0/CPU0:RR#**show cef vrf one 10.1.1.1/32**
10.1.1.1/32, version 201, internal 0x5000001 0x30 (ptr 0xd96a770) [1], 0x0 (0xe3662a8), 0xa08
(0xf696158)
 Updated Sep 17 14:28:59.175
 Prefix Len 32, traffic index 0, precedence n/a, priority 3
  via 10.0.0.1/32, 3 dependencies, recursive, **bgp-multipath** [flags 0x6080]
   path-idx 0 NHID 0x0 [0xdab2bc0 0x0]
   recursion-via-/32
   next hop VRF - 'default', table - 0xe0000000
   next hop 10.0.0.1/32 via 24003/0/21
    next hop 10.1.101.1/32 Gi0/0/0/0    labels imposed {ImplNull 24012}
  via 10.0.0.2/32, 3 dependencies, recursive, **bgp-multipath** [flags 0x6080]
   path-idx 1 NHID 0x0 [0xdab2e48 0x0]
   recursion-via-/32
   next hop VRF - 'default', table - 0xe0000000
   next hop 10.0.0.2/32 via 24001/0/21
    next hop 10.2.101.2/32 Gi0/0/0/4    labels imposed {ImplNull 24012}
  via 10.0.0.5/32, 3 dependencies, recursive, **bgp-multipath** [flags 0x6080]
```

```
      path-idx 2 NHID 0x0 [0xdab2368 0x0]
      recursion-via-/32
      next hop VRF - 'default', table - 0xe0000000
      next hop 10.0.0.5/32 via 24005/0/21
       next hop 10.5.101.5/32 Gi0/0/0/1    labels imposed {ImplNull 24014}
```

알려진 경로를 확인합니다.


```
RP/0/RP0/CPU0:PE6#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
 Process           bRIB/RIB  SendTblVer
 Speaker              125         125
Last Modified: Sep 17 14:29:00.649 for 00:02:21
Paths: (5 available, best #1)
 Not advertised to any peer
 Path #1: Received by speaker 0
 Not advertised to any peer
 Local
   10.0.0.1 (metric 3) from 10.0.0.101 (10.0.0.1)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, import-
candidate, imported
     Received Path ID 1, Local Path ID 1, version 125
     Extended community: RT:65000:1
     Originator: 10.0.0.1, Cluster list: 10.0.0.101
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #2: Received by speaker 0
 Not advertised to any peer
 Local
   10.0.0.3 (metric 3) from 10.0.0.101 (10.0.0.3)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
     Received Path ID 2, Local Path ID 0, version 0
     Extended community: RT:65000:1
     Originator: 10.0.0.3, Cluster list: 10.0.0.101
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #3: Received by speaker 0
 Not advertised to any peer
 Local
   10.0.0.4 (metric 3) from 10.0.0.101 (10.0.0.4)
     Received Label 24013
     Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
     Received Path ID 3, Local Path ID 0, version 0
     Extended community: RT:65000:1
     Originator: 10.0.0.4, Cluster list: 10.0.0.101
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #4: Received by speaker 0
 Not advertised to any peer
 Local
   10.0.0.2 (metric 3) from 10.0.0.101 (10.0.0.2)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
     Received Path ID 4, Local Path ID 0, version 0
     Extended community: RT:65000:1
     Originator: 10.0.0.2, Cluster list: 10.0.0.101
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #5: Received by speaker 0
 Not advertised to any peer
 Local
   10.0.0.5 (metric 3) from 10.0.0.101 (10.0.0.5)
     Received Label 24014
```

```
      Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
      Received Path ID 5, Local Path ID 0, version 0
      Extended community: RT:65000:1
      Originator: 10.0.0.5, Cluster list: 10.0.0.101
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```
결론: 백업 경로가 설치되지 않았습니다. 모든 (5) 경로가 광고됩니다.

5. 경로 선택 최적 경로 설정

```
route-policy BGP-Path-Selection
 set path-selection best-path
end-policy
!

RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:  Process           bRIB/RIB  SendTblVer
 Speaker                   5             5
Last Modified: Sep 17 15:34:15.907 for 00:00:09
Paths: (5 available, best #1)
 Advertised to update-groups (with more than one peer):
   0.2 0.3
 Path #1: Received by speaker 0
 Advertised to update-groups (with more than one peer):
   0.2 0.3
 Local, (Received from a RR-client)
   10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, multipath,
import-candidate, imported
     Received Path ID 0, Local Path ID 1, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #2: Received by speaker 0
 Not advertised to any peer
 Local, (Received from a RR-client)
   10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, multipath, import-candidate,
imported
     Received Path ID 0, Local Path ID 0, version 0
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #3: Received by speaker 0
 Not advertised to any peer
 Local, (Received from a RR-client)
   10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, multipath, import-candidate,
imported
     Received Path ID 0, Local Path ID 0, version 0
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #4: Received by speaker 0
 Not advertised to any peer
 Local, (Received from a RR-client)
   10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4)
     Received Label 24013
     Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
     Received Path ID 0, Local Path ID 0, version 0
```

```
      Extended community: RT:65000:1
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #5: Received by speaker 0
 Not advertised to any peer
 Local, (Received from a RR-client)
   10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5)
      Received Label 24014
      Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
      Received Path ID 1, Local Path ID 0, version 0
      Extended community: RT:65000:1
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1


RP/0/RP0/CPU0:RR#show route vrf one 10.1.1.1/32
Routing entry for 10.1.1.1/32
 Known via "bgp 65000", distance 200, metric 0, type internal
 Installed Sep 17 15:34:16.311 for 00:00:28
 Routing Descriptor Blocks
   10.0.0.1, from 10.0.0.1, BGP multi path
     Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
     Route metric is 0
   10.0.0.2, from 10.0.0.2, BGP multi path
     Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
     Route metric is 0
   10.0.0.3, from 10.0.0.3, BGP multi path
     Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
     Route metric is 0
 No advertising protos.


RP/0/RP0/CPU0:RR#show cef vrf one 10.1.1.1/32
10.1.1.1/32, version 215, internal 0x5000001 0x30 (ptr 0xd96a770) [1], 0x0 (0xe3662a8), 0xa08
(0xf696100)
 Updated Sep 17 15:34:16.313
 Prefix Len 32, traffic index 0, precedence n/a, priority 3
  via 10.0.0.1/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
   path-idx 0 NHID 0x0 [0xdab2bc0 0x0]
   recursion-via-/32
   next hop VRF - 'default', table - 0xe0000000
   next hop 10.0.0.1/32 via 24003/0/21
    next hop 10.1.101.1/32 Gi0/0/0/0    labels imposed {ImplNull 24012}
  via 10.0.0.2/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
   path-idx 1 NHID 0x0 [0xdab2e48 0x0]
   recursion-via-/32
   next hop VRF - 'default', table - 0xe0000000
   next hop 10.0.0.2/32 via 24001/0/21
    next hop 10.2.101.2/32 Gi0/0/0/4    labels imposed {ImplNull 24012}
  via 10.0.0.3/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
   path-idx 2 NHID 0x0 [0xdab2060 0x0]
   recursion-via-/32
   next hop VRF - 'default', table - 0xe0000000
   next hop 10.0.0.3/32 via 24007/0/21
    next hop 10.3.101.3/32 Gi0/0/0/6    labels imposed {ImplNull 24012}
```

결론: 최상의 경로 및 다중 경로 경로만 설치됩니다. 최상의 경로만 알려집니다. 선택, 설치 또는 광고된 백업 경로가 없습니다.

6. 경로 선택 다중 경로 알림 설정

Advertise는 필수 키워드입니다.


```
route-policy BGP-Path-Selection
 set path-selection multipath advertise
```

```
end-policy
```
이 작업을 수행하려면 특정 주소군에 대한 BGP에 대해 다중 경로가 활성화되어 있어야 합니다.

여기서 VRF one의 ipv4 유니캐스트에 대한 다중 경로가 활성화됩니다.

```
router bgp 65000
 vrf one
 rd 1:1
 address-family ipv4 unicast
   maximum-paths ibgp 3
  additional-paths selection route-policy BGP-Path-Selection
  redistribute connected


RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
 Process           bRIB/RIB   SendTblVer
 Speaker                 5           5
Last Modified: Sep 17 15:40:15.907 for 00:00:28
Paths: (5 available, best #1)
 Advertised to update-groups (with more than one peer):
   0.2 0.3
 Path #1: Received by speaker 0
 Advertised to update-groups (with more than one peer):
   0.2 0.3
 Local, (Received from a RR-client)
   10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, multipath,
import-candidate, imported
     Received Path ID 0, Local Path ID 1, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #2: Received by speaker 0
 Advertised to update-groups (with more than one peer):
   0.3
 Local, (Received from a RR-client)
   10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, multipath, add-path, import-
candidate, imported
     Received Path ID 0, Local Path ID 3, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #3: Received by speaker 0
 Not advertised to any peer
 Local, (Received from a RR-client)
   10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
     Received Path ID 0, Local Path ID 0, version 0
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #4: Received by speaker 0
 Advertised to update-groups (with more than one peer):
   0.3
 Local, (Received from a RR-client)
   10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4)
     Received Label 24013
     Origin incomplete, metric 0, localpref 100, valid, internal, multipath, add-path, import-
```

```
candidate, imported
      Received Path ID 0, Local Path ID 2, version 5
      Extended community: RT:65000:1
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #5: Received by speaker 0
 Not advertised to any peer
 Local, (Received from a RR-client)
    10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5)
      Received Label 24014
      Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
      Received Path ID 1, Local Path ID 0, version 0
      Extended community: RT:65000:1
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1


RP/0/RP0/CPU0:RR#show route vrf one 10.1.1.1/32
Routing entry for 10.1.1.1/32
 Known via "bgp 65000", distance 200, metric 0, type internal
 Installed Sep 17 15:40:16.152 for 00:01:11
 Routing Descriptor Blocks
    10.0.0.1, from 10.0.0.1, BGP multi path
      Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
      Route metric is 0
    10.0.0.2, from 10.0.0.2, BGP multi path
      Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
      Route metric is 0
    10.0.0.4, from 10.0.0.4, BGP multi path
      Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
      Route metric is 0
 No advertising protos.


RP/0/RP0/CPU0:RR#show cef vrf one 10.1.1.1/32
10.1.1.1/32, version 229, internal 0x5000001 0x30 (ptr 0xd96a770) [1], 0x0 (0xe3662a8), 0xa08
(0xf6961b0)
 Updated Sep 17 15:40:16.156
 Prefix Len 32, traffic index 0, precedence n/a, priority 3
  via 10.0.0.1/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
   path-idx 0 NHID 0x0 [0xdab2bc0 0x0]
   recursion-via-/32
   next hop VRF - 'default', table - 0xe0000000
   next hop 10.0.0.1/32 via 24003/0/21
    next hop 10.1.101.1/32 Gi0/0/0/0    labels imposed {ImplNull 24012}
  via 10.0.0.2/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
   path-idx 1 NHID 0x0 [0xdab2e48 0x0]
   recursion-via-/32
   next hop VRF - 'default', table - 0xe0000000
   next hop 10.0.0.2/32 via 24001/0/21
    next hop 10.2.101.2/32 Gi0/0/0/4    labels imposed {ImplNull 24012}
  via 10.0.0.4/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
   path-idx 2 NHID 0x0 [0xdab2c98 0x0]
   recursion-via-/32
   next hop VRF - 'default', table - 0xe0000000
   next hop 10.0.0.4/32 via 24000/0/21
    next hop 10.4.101.4/32 Gi0/0/0/7    labels imposed {ImplNull 24013}
```
알려진 경로를 확인합니다.

```
RP/0/RP0/CPU0:PE6#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
 Process           bRIB/RIB  SendTblVer
 Speaker                153         153
Last Modified: Sep 17 15:40:17.649 for 00:02:08
```

```
Paths: (3 available, best #1)
 Not advertised to any peer
 Path #1: Received by speaker 0
 Not advertised to any peer
 Local
   10.0.0.1 (metric 3) from 10.0.0.101 (10.0.0.1)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, import-
candidate, imported
     Received Path ID 1, Local Path ID 1, version 153
     Extended community: RT:65000:1
     Originator: 10.0.0.1, Cluster list: 10.0.0.101
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #2: Received by speaker 0
 Not advertised to any peer
 Local
   10.0.0.4 (metric 3) from 10.0.0.101 (10.0.0.4)
     Received Label 24013
     Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
     Received Path ID 2, Local Path ID 0, version 0
     Extended community: RT:65000:1
     Originator: 10.0.0.4, Cluster list: 10.0.0.101
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #3: Received by speaker 0
 Not advertised to any peer
 Local
   10.0.0.2 (metric 3) from 10.0.0.101 (10.0.0.2)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
     Received Path ID 3, Local Path ID 0, version 0
     Extended community: RT:65000:1
     Originator: 10.0.0.2, Cluster list: 10.0.0.101
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

- vpnv4 경로는 다중 경로로 표시됩니다.
- 3개의 다중 경로 경로가 RIB에 설치됩니다.
- 3개의 다중 경로 경로가 광고됩니다.
- 백업 경로가 없습니다.

결론: 다중 경로 경로는 RIB에 설치되고 광고됩니다. 선택, 설치 또는 광고된 백업이 없습니다.

7 . set path-selection backup 1 install multipath-protect

```
route-policy BGP-Path-Selection
  set path-selection backup 1 install multipath-protect
end-policy


RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
 Process            bRIB/RIB  SendTblVer
 Speaker                   5           5
Last Modified: Sep 17 15:46:17.907 for 00:04:59
Paths: (5 available, best #1)
 Advertised to update-groups (with more than one peer):
   0.2 0.3
 Path #1: Received by speaker 0
 Advertised to update-groups (with more than one peer):
   0.2 0.3
 Local, (Received from a RR-client)
```

```
   10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1)
      Received Label 24012
      Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, multipath,
import-candidate, imported
      Received Path ID 0, Local Path ID 1, version 5
      Extended community: RT:65000:1
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #2: Received by speaker 0
 Not advertised to any peer
 Local, (Received from a RR-client)
   10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2)
      Received Label 24012
      Origin incomplete, metric 0, localpref 100, valid, internal, multipath, backup, add-path,
import-candidate, imported
      Received Path ID 0, Local Path ID 2, version 5
      Extended community: RT:65000:1
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #3: Received by speaker 0
 Not advertised to any peer
 Local, (Received from a RR-client)
   10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3)
      Received Label 24012
      Origin incomplete, metric 0, localpref 100, valid, internal, backup(protect multipath),
add-path, import-candidate, imported
      Received Path ID 0, Local Path ID 3, version 5
      Extended community: RT:65000:1
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #4: Received by speaker 0
 Not advertised to any peer
 Local, (Received from a RR-client)
   10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4)
      Received Label 24013
      Origin incomplete, metric 0, localpref 100, valid, internal, multipath, import-candidate,
imported
      Received Path ID 0, Local Path ID 0, version 0
      Extended community: RT:65000:1
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #5: Received by speaker 0
 Not advertised to any peer
 Local, (Received from a RR-client)
   10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5)
      Received Label 24014
      Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
      Received Path ID 1, Local Path ID 0, version 0
      Extended community: RT:65000:1
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

RP/0/RP0/CPU0:RR#show route vrf one 10.1.1.1/32
Routing entry for 10.1.1.1/32
 Known via "bgp 65000", distance 200, metric 0
 Number of pic paths 1 , type internal
 Installed Sep 17 15:46:17.904 for 00:05:14
 Routing Descriptor Blocks
   10.0.0.1, from 10.0.0.1, BGP multi path
      Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
      Route metric is 0
   10.0.0.2, from 10.0.0.2, BGP multi path
      Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
      Route metric is 0
   10.0.0.3, from 10.0.0.3, BGP backup path
      Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
      Route metric is 0
   10.0.0.4, from 10.0.0.4, BGP multi path
```

```
      Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
      Route metric is 0
 No advertising protos.


RP/0/RP0/CPU0:RR#show cef vrf one 10.1.1.1/32
10.1.1.1/32, version 249, internal 0x5000001 0x30 (ptr 0xd96a770) [1], 0x0 (0xe3662a8), 0xa08
(0xf4e10a8)
 Updated Sep 17 15:46:17.907
 Prefix Len 32, traffic index 0, precedence n/a, priority 3
  via 10.0.0.1/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
   path-idx 0 NHID 0x0 [0xdab2bc0 0x0], Internal 0xd6a2190
   recursion-via-/32
   next hop VRF - 'default', table - 0xe0000000
   next hop 10.0.0.1/32 via 24003/0/21
    next hop 10.1.101.1/32 Gi0/0/0/0    labels imposed {ImplNull 24012}
  via 10.0.0.2/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
   path-idx 1 NHID 0x0 [0xdab2e48 0x0], Internal 0xd6a2550
   recursion-via-/32
   next hop VRF - 'default', table - 0xe0000000
   next hop 10.0.0.2/32 via 24001/0/21
    next hop 10.2.101.2/32 Gi0/0/0/4    labels imposed {ImplNull 24012}
  via 10.0.0.3/32, 2 dependencies, recursive, backup [flags 0x6100]
   path-idx 2 NHID 0x0 [0xdab2060 0x0]
   recursion-via-/32
   next hop VRF - 'default', table - 0xe0000000
   next hop 10.0.0.3/32 via 24007/0/21
    next hop 10.3.101.3/32 Gi0/0/0/6    labels imposed {ImplNull 24012}
  via 10.0.0.4/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
   path-idx 3 NHID 0x0 [0xdab2c98 0x0], Internal 0xd6a2730
   recursion-via-/32
   next hop VRF - 'default', table - 0xe0000000
   next hop 10.0.0.4/32 via 24000/0/21
    next hop 10.4.101.4/32 Gi0/0/0/7    labels imposed {ImplNull 24013}
```
알려진 경로를 확인합니다.


```
RP/0/RP0/CPU0:PE6#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
 Process           bRIB/RIB  SendTblVer
 Speaker               163        163
Last Modified: Sep 17 15:46:18.649 for 00:07:36
Paths: (1 available, best #1)
 Not advertised to any peer
 Path #1: Received by speaker 0
 Not advertised to any peer
 Local
   10.0.0.1 (metric 3) from 10.0.0.101 (10.0.0.1)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, import-
candidate, imported
     Received Path ID 1, Local Path ID 1, version 163
     Extended community: RT:65000:1
     Originator: 10.0.0.1, Cluster list: 10.0.0.101
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```
backup(protect multipath) 경로가 없을 수 있습니다. 예를 들어, BGP **최대 경로 2**가 구성되어 있고
2개의 경로만 수신되는 경우, 2개의 경로는 다중 경로이며 backup(protect multipath) 경로가 없습니
다.

결론: 모든 다중 경로 경로는 RIB에 설치됩니다. 다른 경로가 백업 경로(backup(protect multipath)

경로)로 설치됩니다. 최상의 경로만 알려집니다.

8. set path-selection backup 1 install multipath-protect advertise

```
route-policy BGP-Path-Selection
 set path-selection backup 1 install multipath-protect advertise
end-policy
```

RP/0/RP0/CPU0:RR#**show bgp vpnv4 unicast rd 1:1 10.1.1.1/32**

```
BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
 Process            bRIB/RIB  SendTblVer
 Speaker                   5           5
Last Modified: Sep 17 16:03:00.907 for 00:01:19
Paths: (5 available, best #1)
 Advertised to update-groups (with more than one peer):
   0.2 0.3
 Path #1: Received by speaker 0
 Advertised to update-groups (with more than one peer):
   0.2 0.3
 Local, (Received from a RR-client)
   10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, multipath,
import-candidate, imported
     Received Path ID 0, Local Path ID 1, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #2: Received by speaker 0
 Advertised to update-groups (with more than one peer):
   0.3
 Local, (Received from a RR-client)
   10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, multipath, backup, add-path,
import-candidate, imported
     Received Path ID 0, Local Path ID 2, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #3: Received by speaker 0
 Not advertised to any peer
 Local, (Received from a RR-client)
   10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, multipath, import-candidate,
imported
     Received Path ID 0, Local Path ID 0, version 0
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #4: Received by speaker 0
 Not advertised to any peer
 Local, (Received from a RR-client)
   10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4)
     Received Label 24013
     Origin incomplete, metric 0, localpref 100, valid, internal, backup(protect multipath),
add-path, import-candidate, imported
     Received Path ID 0, Local Path ID 3, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #5: Received by speaker 0
```

```
 Not advertised to any peer
 Local, (Received from a RR-client)
    10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5)
      Received Label 24014
      Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
      Received Path ID 1, Local Path ID 0, version 0
      Extended community: RT:65000:1
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1


RP/0/RP0/CPU0:RR#show route vrf one 10.1.1.1/32
Routing entry for 10.1.1.1/32
 Known via "bgp 65000", distance 200, metric 0
 Number of pic paths 1 , type internal
 Installed Sep 17 16:03:01.199 for 00:05:13
 Routing Descriptor Blocks
    10.0.0.1, from 10.0.0.1, BGP multi path
      Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
      Route metric is 0
    10.0.0.2, from 10.0.0.2, BGP multi path
      Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
      Route metric is 0
    10.0.0.3, from 10.0.0.3, BGP multi path
      Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
      Route metric is 0
    10.0.0.4, from 10.0.0.4, BGP backup path
      Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
      Route metric is 0
 No advertising protos.


RP/0/RP0/CPU0:RR#show cef vrf one 10.1.1.1/32
10.1.1.1/32, version 281, internal 0x5000001 0x30 (ptr 0xd96a770) [1], 0x0 (0xe3662a8), 0xa08
(0xf4e1108)
 Updated Sep 17 16:03:01.206
 Prefix Len 32, traffic index 0, precedence n/a, priority 3
  via 10.0.0.1/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
   path-idx 0 NHID 0x0 [0xdab2bc0 0x0], Internal 0xd6a2190
   recursion-via-/32
   next hop VRF - 'default', table - 0xe0000000
   next hop 10.0.0.1/32 via 24003/0/21
    next hop 10.1.101.1/32 Gi0/0/0/0    labels imposed {ImplNull 24012}
  via 10.0.0.2/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
   path-idx 1 NHID 0x0 [0xdab2e48 0x0], Internal 0xd6a2550
   recursion-via-/32
   next hop VRF - 'default', table - 0xe0000000
   next hop 10.0.0.2/32 via 24001/0/21
    next hop 10.2.101.2/32 Gi0/0/0/4    labels imposed {ImplNull 24012}
  via 10.0.0.3/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
   path-idx 2 NHID 0x0 [0xdab2060 0x0], Internal 0xd6a2910
   recursion-via-/32
   next hop VRF - 'default', table - 0xe0000000
   next hop 10.0.0.3/32 via 24007/0/21
    next hop 10.3.101.3/32 Gi0/0/0/6    labels imposed {ImplNull 24012}
  via 10.0.0.4/32, 2 dependencies, recursive, backup [flags 0x6100]
   path-idx 3 NHID 0x0 [0xdab2c98 0x0]
   recursion-via-/32
   next hop VRF - 'default', table - 0xe0000000
   next hop 10.0.0.4/32 via 24000/0/21
    next hop 10.4.101.4/32 Gi0/0/0/7    labels imposed {ImplNull 24013}
```

알려진 경로를 확인합니다.


```
RP/0/RP0/CPU0:PE6#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32
```

```
BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
 Process           bRIB/RIB  SendTblVer
 Speaker              181        181
Last Modified: Sep 17 16:03:02.649 for 00:07:39
Paths: (2 available, best #1)
 Not advertised to any peer
 Path #1: Received by speaker 0
 Not advertised to any peer
 Local
   10.0.0.1 (metric 3) from 10.0.0.101 (10.0.0.1)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, import-
candidate, imported
     Received Path ID 1, Local Path ID 1, version 181
     Extended community: RT:65000:1
     Originator: 10.0.0.1, Cluster list: 10.0.0.101
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #2: Received by speaker 0
 Not advertised to any peer
 Local
   10.0.0.2 (metric 3) from 10.0.0.101 (10.0.0.2)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
     Received Path ID 2, Local Path ID 0, version 0
     Extended community: RT:65000:1
     Originator: 10.0.0.2, Cluster list: 10.0.0.101
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

- 3개의 다중 경로 경로가 있습니다.
- 하나의 'backup(protect multipath)' 경로가 있습니다. RIB/CEF 테이블에 설치된 백업 경로입니다.
- 다섯 번째 경로는 표시 해제되어 있습니다.
- 최적의 경로 및 백업 경로가 광고됩니다.

backup(protect multipath) 경로가 없을 수 있습니다. 예를 들어 BGP **최대 경로** *2*가 구성되어 있고 2개의 경로만 수신되는 경우 2개의 경로는 다중 경로이며 **backup(protect multipath)** 경로가 없는 **것입니다.**

이 알려진 백업 경로는 다중 경로 경로(BGP 테이블에서 백업으로 표시됨) 중 하나입니다.

이는 **최대 경로 ibgp 1로 구성됩니다.**

```
RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
 Process           bRIB/RIB  SendTblVer
 Speaker                5          5
Last Modified: Sep 17 16:15:48.907 for 00:00:44
Paths: (5 available, best #1)
 Advertised to update-groups (with more than one peer):
   0.2 0.3
 Path #1: Received by speaker 0
 Advertised to update-groups (with more than one peer):
   0.2 0.3
 Local, (Received from a RR-client)
   10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, import-
candidate, imported
```

```
      Received Path ID 0, Local Path ID 1, version 5
      Extended community: RT:65000:1
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #2: Received by speaker 0
 Advertised to update-groups (with more than one peer):
   0.2
 Local, (Received from a RR-client)
   10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2)
      Received Label 24012
      Origin incomplete, metric 0, localpref 100, valid, internal, **backup**, add-path, import-
candidate, imported
      Received Path ID 0, Local Path ID 2, version 5
      Extended community: RT:65000:1
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #3: Received by speaker 0
 Not advertised to any peer
 Local, (Received from a RR-client)
   10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3)
      Received Label 24012
      Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
      Received Path ID 0, Local Path ID 0, version 0
      Extended community: RT:65000:1
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #4: Received by speaker 0
 Not advertised to any peer
 Local, (Received from a RR-client)
   10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4)
      Received Label 24013
      Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
      Received Path ID 0, Local Path ID 0, version 0
      Extended community: RT:65000:1
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #5: Received by speaker 0
 Not advertised to any peer
 Local, (Received from a RR-client)
   10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5)
      Received Label 24014
      Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
      Received Path ID 1, Local Path ID 0, version 0
      Extended community: RT:65000:1
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1


RP/0/RP0/CPU0:RR#**show route vrf one 10.1.1.1/32**
Routing entry for 10.1.1.1/32
 Known via "bgp 65000", distance 200, metric 0
 Number of pic paths 1 , type internal
 Installed Sep 17 16:15:48.900 for 00:01:28
 Routing Descriptor Blocks
   10.0.0.1, from 10.0.0.1
      Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
      Route metric is 0
   10.0.0.2, from 10.0.0.2, **BGP backup path**
      Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
      Route metric is 0
 No advertising protos.


RP/0/RP0/CPU0:RR#**show cef vrf one 10.1.1.1/32**
10.1.1.1/32, version 297, internal 0x5000001 0x30 (ptr 0xd96a770) [1], 0x0 (0xe3662a8), 0xa08
(0xf6960a8)
 Updated Sep 17 16:15:48.903
 Prefix Len 32, traffic index 0, precedence n/a, priority 3
  via 10.0.0.1/32, 3 dependencies, recursive [flags 0x6000]
   path-idx 0 NHID 0x0 [0xdab2bc0 0x0], Internal 0xd6a2190
```

```
    recursion-via-/32
    next hop VRF - 'default', table - 0xe0000000
    next hop 10.0.0.1/32 via 24003/0/21
      next hop 10.1.101.1/32 Gi0/0/0/0    labels imposed {ImplNull 24012}
  via 10.0.0.2/32, 2 dependencies, recursive, backup [flags 0x6100]
    path-idx 1 NHID 0x0 [0xdab2e48 0x0]
    recursion-via-/32
    next hop VRF - 'default', table - 0xe0000000
    next hop 10.0.0.2/32 via 24001/0/21
      next hop 10.2.101.2/32 Gi0/0/0/4    labels imposed {ImplNull 24012}
```

알려진 경로를 확인합니다.

```
RP/0/RP0/CPU0:PE6#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
 Process            bRIB/RIB  SendTblVer
 Speaker               189        189
Last Modified: Sep 17 16:15:50.649 for 00:02:10
Paths: (2 available, best #1)
 Not advertised to any peer
 Path #1: Received by speaker 0
 Not advertised to any peer
 Local
   10.0.0.1 (metric 3) from 10.0.0.101 (10.0.0.1)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, import-
candidate, imported
     Received Path ID 1, Local Path ID 1, version 189
     Extended community: RT:65000:1
     Originator: 10.0.0.1, Cluster list: 10.0.0.101
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #2: Received by speaker 0
 Not advertised to any peer
 Local
   10.0.0.2 (metric 3) from 10.0.0.101 (10.0.0.2)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
     Received Path ID 2, Local Path ID 0, version 0
     Extended community: RT:65000:1
     Originator: 10.0.0.2, Cluster list: 10.0.0.101
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```
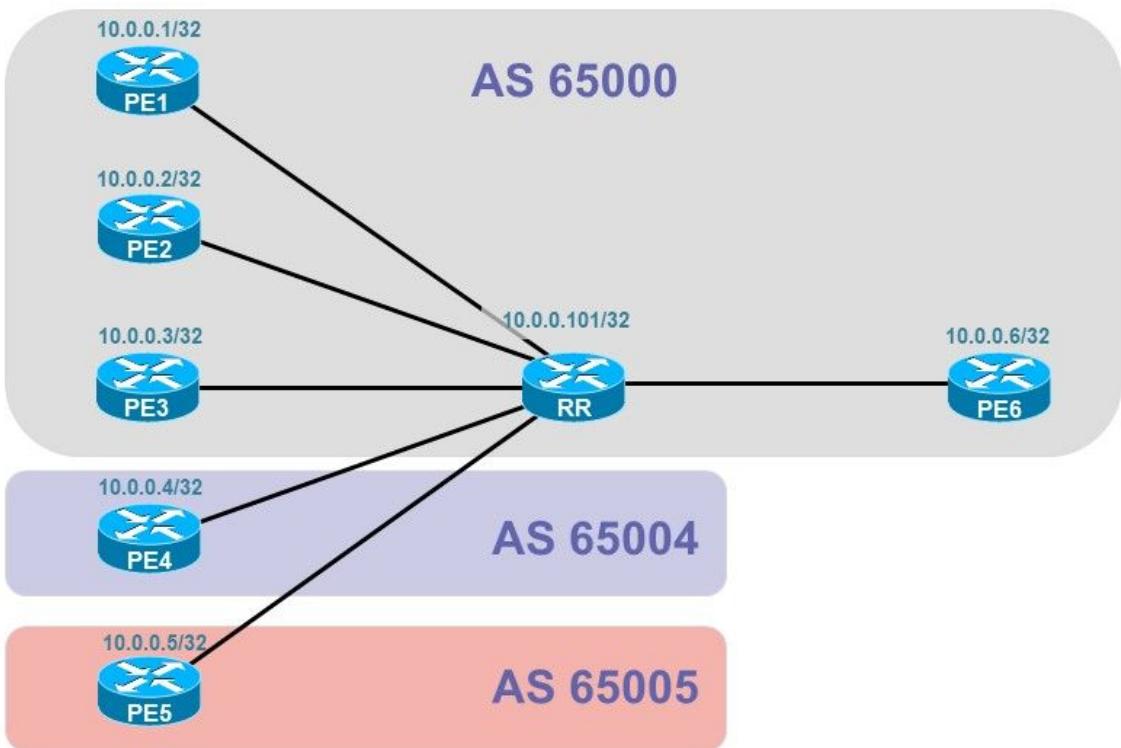
- RR에 ECMP가 없습니다.
- 두 번째로 좋은 경로는 백업 경로입니다. RIB/CEF 테이블에 설치됩니다.
- 최적의 경로 및 백업 경로를 알려드립니다.
- backup(protect multipath) 경로가 없습니다.

결론: 모든 다중 경로 경로는 RIB에 설치됩니다. 다른 경로가 백업 경로로 설치됩니다. 최적의 경로 및 백업 경로가 광고됩니다.

9 . path-selection group-best advertise 설정

- group-best는 advertise에서만 사용할 수 있습니다.
- Group-Best Selection은 AS(Autonomous System)별, 그리고 next-hop별 최적의 경로입니다.
- 접두사는 다른 자동 시스템에서 시작합니다.

이 경우에는 다른 토폴로지가 사용됩니다. 라우터는 이미지 1과 동일하지만 PE4는 현재 AS 65004에 있고 PE5는 AS 65005에 있습니다. 다른 모든 라우터는 여전히 AS 65000에 있습니다.

이미지 2

즉, 이제 RR과 PE4 간에 그리고 RR과 PE5 간에 eBGP 세션이 있습니다.

```
route-policy BGP-Path-Selection
 set path-selection group-best advertise
end-policy

RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
 Process           bRIB/RIB  SendTblVer
 Speaker                  5           5
   Local Label: 24010
Last Modified: Sep 21 06:06:29.117 for 00:02:18
Paths: (5 available, best #1)
 Advertised to update-groups (with more than one peer):
   0.3 0.4
 Path #1: Received by speaker 0
 Advertised to update-groups (with more than one peer):
   0.3 0.4
 Local, (Received from a RR-client)
   10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1)
     Received Label 24014
     Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, multipath,
import-candidate, imported
     Received Path ID 1, Local Path ID 1, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #2: Received by speaker 0
 Not advertised to any peer
 Local, (Received from a RR-client)
   10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2)
     Received Label 24014
     Origin incomplete, metric 0, localpref 100, valid, internal, multipath, import-candidate,
```

```
imported
      Received Path ID 1, Local Path ID 0, version 0
      Extended community: RT:65000:1
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #3: Received by speaker 0
 Not advertised to any peer
 Local, (Received from a RR-client)
    10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3)
      Received Label 24014
      Origin incomplete, metric 0, localpref 100, valid, internal, multipath, import-candidate,
imported
      Received Path ID 1, Local Path ID 0, version 0
      Extended community: RT:65000:1
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #4: Received by speaker 0
 Advertised to update-groups (with more than one peer):
    0.4
 65004
    10.4.101.4 from 10.4.101.4 (10.0.0.4)
      Received Label 24015
      Origin incomplete, metric 0, localpref 100, valid, external, group-best, add-path, import-
candidate, imported
      Received Path ID 0, Local Path ID 2, version 5
      Extended community: RT:65000:1
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #5: Received by speaker 0
 Advertised to update-groups (with more than one peer):
    0.4
 65005
    10.5.101.5 from 10.5.101.5 (10.0.0.5)
      Received Label 24014
      Origin incomplete, metric 0, localpref 100, valid, external, group-best, add-path, import-
candidate, imported
      Received Path ID 0, Local Path ID 3, version 5
      Extended community: RT:65000:1
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1


RP/0/RP0/CPU0:RR#show route vrf one 10.1.1.1/32
Routing entry for 10.1.1.1/32
 Known via "bgp 65000", distance 200, metric 0, type internal
 Installed Sep 20 19:59:07.762 for 10:00:40
 Routing Descriptor Blocks
    10.0.0.1, from 10.0.0.1, BGP multi path
      Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
      Route metric is 0
    10.0.0.2, from 10.0.0.2, BGP multi path
      Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
      Route metric is 0
    10.0.0.3, from 10.0.0.3, BGP multi path
      Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
      Route metric is 0
 No advertising protos.


RP/0/RP0/CPU0:RR#show cef vrf one 10.1.1.1/32
10.1.1.1/32, version 114, internal 0x1000001 0x30 (ptr 0xd96a338) [1], 0x0 (0xe366530), 0xa08
(0xf69e0a8)
 Updated Sep 20 19:59:07.765
 Prefix Len 32, traffic index 0, precedence n/a, priority 3
  via 10.0.0.1/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
   path-idx 0 NHID 0x0 [0xdab1b98 0x0]
   recursion-via-/32
   next hop VRF - 'default', table - 0xe0000000
   next hop 10.0.0.1/32 via 24008/0/21
```

```
      local label 24010
        next hop 10.1.101.1/32 Gi0/0/0/0    labels imposed {ImplNull 24014}
      via 10.0.0.2/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
        path-idx 1 NHID 0x0 [0xdab30d0 0x0]
        recursion-via-/32
        next hop VRF - 'default', table - 0xe0000000
        next hop 10.0.0.2/32 via 24000/0/21
         local label 24010
          next hop 10.2.101.2/32 Gi0/0/0/4    labels imposed {ImplNull 24014}
      via 10.0.0.3/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
        path-idx 2 NHID 0x0 [0xdab2918 0x0]
        recursion-via-/32
        next hop VRF - 'default', table - 0xe0000000
        next hop 10.0.0.3/32 via 24002/0/21
         local label 24010
          next hop 10.3.101.3/32 Gi0/0/0/6    labels imposed {ImplNull 24014}
```

RR에는 RIB 및 CEF 테이블에 세 개의 ECMP 경로가 여전히 설치되어 있습니다.

```
RP/0/RP0/CPU0:PE6#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
 Process           bRIB/RIB  SendTblVer
 Speaker                 47          47
Last Modified: Sep 20 19:59:07.588 for 09:59:44
Paths: (3 available, best #1)
 Not advertised to any peer
 Path #1: Received by speaker 0
 Not advertised to any peer
 Local
   10.0.0.3 (metric 5) from 10.0.0.101 (10.0.0.3)
     Received Label 24014
     Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, import-
candidate, imported
     Received Path ID 1, Local Path ID 1, version 47
     Extended community: RT:65000:1
     Originator: 10.0.0.3, Cluster list: 10.0.0.101
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #2: Received by speaker 0
 Not advertised to any peer
 65004
   10.4.101.4 (metric 3) from 10.0.0.101 (10.0.0.101)
     Received Label 24010
     Origin incomplete, metric 0, localpref 100, valid, internal, group-best, import-candidate,
imported
     Received Path ID 2, Local Path ID 0, version 0
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #3: Received by speaker 0
 Not advertised to any peer
 65005
   10.5.101.5 (metric 2) from 10.0.0.101 (10.0.0.101)
     Received Label 24010
     Origin incomplete, metric 0, localpref 100, valid, internal, group-best, import-candidate,
imported
     Received Path ID 3, Local Path ID 0, version 0
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

RR은 AS 65000에서 수신된 세 경로에서 그룹 최상의 경로를 광고합니다. 이 경로 외에 RR은 AS 65004에서 수신된 그룹 최적 경로와 AS 65005에서 수신된 경로를 광고합니다.

세 개의 경로에 서로 다른 인접 디바이스 AS가 있기 때문에 세 개의 그룹 최적 경로가 있습니다. 이러한 모든 경로가 광고됩니다. 다중 경로 경로는 알려지지 않습니다.

결론: 모든 그룹 최상의 경로가 광고됩니다.

10. set path-selection backup 1 install multipath-protect advert-protect multipath-protect-advertise

이 옵션은 Cisco IOS®-XR 7.3.1부터 사용할 수 있습니다.

Cisco IOS®-XR 7.3.1부터 새로운 키워드 **multipath-protect-advertise가 있습니다**.

이렇게 하면 **다중 경로 보호** 경로를 백업 경로와 함께 알릴 수 있습니다. Cisco IOS®-XR 7.3.1 전에 **다중 경로 보호** 경로가 설치되었지만 알려지지 않았습니다. (케이스 8 참조)

```
route-policy BGP-Path-Selection
 set path-selection backup 1 install multipath-protect advertise multipath-protect-advertise
end-policy
!

RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
 Process           bRIB/RIB  SendTblVer
 Speaker                  5           5
Last Modified: Sep 17 16:43:05.907 for 00:01:14
Paths: (5 available, best #1)
 Advertised to update-groups (with more than one peer):
  0.2 0.3
 Path #1: Received by speaker 0
 Advertised to update-groups (with more than one peer):
  0.2 0.3
 Local, (Received from a RR-client)
   10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, multipath,
import-candidate, imported
     Received Path ID 0, Local Path ID 1, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #2: Received by speaker 0
 Advertised to update-groups (with more than one peer):
  0.3
 Local, (Received from a RR-client)
   10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, multipath, backup, add-path,
import-candidate, imported
     Received Path ID 0, Local Path ID 2, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #3: Received by speaker 0
 Not advertised to any peer
 Local, (Received from a RR-client)
   10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, multipath, import-candidate,
```

```
imported
      Received Path ID 0, Local Path ID 0, version 0
      Extended community: RT:65000:1
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #4: Received by speaker 0
 Advertised to update-groups (with more than one peer):
   0.3
 Local, (Received from a RR-client)
   10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4)
     Received Label 24013
     Origin incomplete, metric 0, localpref 100, valid, internal, **backup(protect multipath)**,
add-path, import-candidate, imported
     Received Path ID 0, Local Path ID 3, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #5: Received by speaker 0
 Not advertised to any peer
 Local, (Received from a RR-client)
   10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5)
     Received Label 24014
     Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
     Received Path ID 1, Local Path ID 0, version 0
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1


RP/0/RP0/CPU0:RR#**show route vrf one 10.1.1.1**
Routing entry for 10.1.1.1/32
 Known via "bgp 65000", distance 200, metric 0
 Number of pic paths 1 , type internal
 Installed Sep 17 16:43:05.562 for 00:01:45
 Routing Descriptor Blocks
   10.0.0.1, from 10.0.0.1, **BGP multi path**
     Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
     Route metric is 0
   10.0.0.2, from 10.0.0.2, **BGP multi path**
     Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
     Route metric is 0
   10.0.0.3, from 10.0.0.3, **BGP multi path**
     Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
     Route metric is 0
   10.0.0.4, from 10.0.0.4, **BGP backup path**
     Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
     Route metric is 0
 No advertising protos.


RP/0/RP0/CPU0:RR#**show cef vrf one 10.1.1.1**
10.1.1.1/32, version 323, internal 0x5000001 0x30 (ptr 0xd96a770) [1], 0x0 (0xe3662a8), 0xa08
(0xf4e1168)
 Updated Sep 17 16:43:05.567
 Prefix Len 32, traffic index 0, precedence n/a, priority 3
  via 10.0.0.1/32, 3 dependencies, recursive, **bgp-multipath** [flags 0x6080]
   path-idx 0 NHID 0x0 [0xdab2bc0 0x0], Internal 0xd6a2190
   recursion-via-/32
   next hop VRF - 'default', table - 0xe0000000
   next hop 10.0.0.1/32 via 24003/0/21
    next hop 10.1.101.1/32 Gi0/0/0/0    labels imposed {ImplNull 24012}
  via 10.0.0.2/32, 3 dependencies, recursive, **bgp-multipath** [flags 0x6080]
   path-idx 1 NHID 0x0 [0xdab2e48 0x0], Internal 0xd6a2730
   recursion-via-/32
   next hop VRF - 'default', table - 0xe0000000
   next hop 10.0.0.2/32 via 24001/0/21
    next hop 10.2.101.2/32 Gi0/0/0/4    labels imposed {ImplNull 24012}
  via 10.0.0.3/32, 3 dependencies, recursive, **bgp-multipath** [flags 0x6080]
```

```
  path-idx 2 NHID 0x0 [0xdab2060 0x0], Internal 0xd6a2910
  recursion-via-/32
  next hop VRF - 'default', table - 0xe0000000
  next hop 10.0.0.3/32 via 24007/0/21
   next hop 10.3.101.3/32 Gi0/0/0/6    labels imposed {ImplNull 24012}
 via 10.0.0.4/32, 2 dependencies, recursive, backup [flags 0x6100]
  path-idx 3 NHID 0x0 [0xdab2c98 0x0]
  recursion-via-/32
  next hop VRF - 'default', table - 0xe0000000
  next hop 10.0.0.4/32 via 24000/0/21
   next hop 10.4.101.4/32 Gi0/0/0/7    labels imposed {ImplNull 24013}
```

알려진 경로를 확인합니다.

```
RP/0/RP0/CPU0:PE6#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
 Process           bRIB/RIB  SendTblVer
 Speaker              207        207
Last Modified: Sep 17 16:43:06.649 for 00:02:31
Paths: (3 available, best #1)
 Not advertised to any peer
 Path #1: Received by speaker 0
 Not advertised to any peer
 Local
   10.0.0.1 (metric 3) from 10.0.0.101 (10.0.0.1)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, import-
candidate, imported
     Received Path ID 1, Local Path ID 1, version 207
     Extended community: RT:65000:1
     Originator: 10.0.0.1, Cluster list: 10.0.0.101
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #2: Received by speaker 0
 Not advertised to any peer
 Local
   10.0.0.2 (metric 3) from 10.0.0.101 (10.0.0.2)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
     Received Path ID 2, Local Path ID 0, version 0
     Extended community: RT:65000:1
     Originator: 10.0.0.2, Cluster list: 10.0.0.101
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #3: Received by speaker 0
 Not advertised to any peer
 Local
   10.0.0.4 (metric 3) from 10.0.0.101 (10.0.0.4)
     Received Label 24013
     Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
     Received Path ID 3, Local Path ID 0, version 0
     Extended community: RT:65000:1
     Originator: 10.0.0.4, Cluster list: 10.0.0.101
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

결론: 모든 다중 경로 경로는 RIB에 설치됩니다. 다른 경로 -backup(protect multipath) path-가 백업 경로로 설치됩니다. 최상의 경로, 백업 경로 및 **백업(보호 다중 경로)** 경로가 광고됩니다.

11. set path-selection multipath advertise multipath-protect

이 옵션은 Cisco IOS®-XR 7.3.1부터 사용할 수 있습니다.

```
route-policy BGP-Path-Selection
 set path-selection multipath advertise multipath-protect
end-policy
!


RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
 Process           bRIB/RIB  SendTblVer
 Speaker                  5           5
Last Modified: Sep 18 06:12:25.907 for 00:00:12
Paths: (5 available, best #1)
 Advertised to update-groups (with more than one peer):
   0.2 0.3
 Path #1: Received by speaker 0
 Advertised to update-groups (with more than one peer):
   0.2 0.3
 Local, (Received from a RR-client)
   10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, multipath,
import-candidate, imported
     Received Path ID 0, Local Path ID 1, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #2: Received by speaker 0
 Advertised to update-groups (with more than one peer):
   0.3
 Local, (Received from a RR-client)
   10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, multipath, add-path, import-
candidate, imported
     Received Path ID 0, Local Path ID 3, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #3: Received by speaker 0
 Not advertised to any peer
 Local, (Received from a RR-client)
   10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, backup(protect multipath),
add-path, import-candidate, imported
     Received Path ID 0, Local Path ID 4, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #4: Received by speaker 0
 Advertised to update-groups (with more than one peer):
   0.3
 Local, (Received from a RR-client)
   10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4)
     Received Label 24013
     Origin incomplete, metric 0, localpref 100, valid, internal, multipath, add-path, import-
candidate, imported
     Received Path ID 0, Local Path ID 2, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #5: Received by speaker 0
 Not advertised to any peer
 Local, (Received from a RR-client)
   10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5)
```

```
     Received Label 24014
     Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
     Received Path ID 1, Local Path ID 0, version 0
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1


RP/0/RP0/CPU0:RR#show route vrf one 10.1.1.1/32
Routing entry for 10.1.1.1/32
 Known via "bgp 65000", distance 200, metric 0
 Number of pic paths 1 , type internal
 Installed Sep 18 06:12:26.137 for 00:05:23
 Routing Descriptor Blocks
   10.0.0.1, from 10.0.0.1, BGP multi path
     Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
     Route metric is 0
   10.0.0.2, from 10.0.0.2, BGP multi path
     Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
     Route metric is 0
   10.0.0.3, from 10.0.0.3, BGP backup path
     Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
     Route metric is 0
   10.0.0.4, from 10.0.0.4, BGP multi path
     Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
     Route metric is 0
 No advertising protos.


RP/0/RP0/CPU0:RR#show cef vrf one 10.1.1.1/32
10.1.1.1/32, version 345, internal 0x5000001 0x30 (ptr 0xd96a770) [1], 0x0 (0xe3662a8), 0xa08
(0xf4e1108)
 Updated Sep 18 06:12:26.140
 Prefix Len 32, traffic index 0, precedence n/a, priority 3
  via 10.0.0.1/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
   path-idx 0 NHID 0x0 [0xdab2bc0 0x0], Internal 0xd6a2190
   recursion-via-/32
   next hop VRF - 'default', table - 0xe0000000
   next hop 10.0.0.1/32 via 24003/0/21
    next hop 10.1.101.1/32 Gi0/0/0/0    labels imposed {ImplNull 24012}
  via 10.0.0.2/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
   path-idx 1 NHID 0x0 [0xdab2e48 0x0], Internal 0xd6a2730
   recursion-via-/32
   next hop VRF - 'default', table - 0xe0000000
   next hop 10.0.0.2/32 via 24001/0/21
    next hop 10.2.101.2/32 Gi0/0/0/4    labels imposed {ImplNull 24012}
  via 10.0.0.3/32, 2 dependencies, recursive, backup [flags 0x6100]
   path-idx 2 NHID 0x0 [0xdab2060 0x0]
   recursion-via-/32
   next hop VRF - 'default', table - 0xe0000000
   next hop 10.0.0.3/32 via 24007/0/21
    next hop 10.3.101.3/32 Gi0/0/0/6    labels imposed {ImplNull 24012}
  via 10.0.0.4/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
   path-idx 3 NHID 0x0 [0xdab2c98 0x0], Internal 0xd6a2550
   recursion-via-/32
   next hop VRF - 'default', table - 0xe0000000
   next hop 10.0.0.4/32 via 24000/0/21
    next hop 10.4.101.4/32 Gi0/0/0/7    labels imposed {ImplNull 24013}
```
알려진 경로를 확인합니다.


```
RP/0/RP0/CPU0:PE6#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
 Process           bRIB/RIB   SendTblVer
```

```
  Speaker                    221            221
Last Modified: Sep 18 06:12:27.649 for 00:01:38
Paths: (3 available, best #1)
 Not advertised to any peer
 Path #1: Received by speaker 0
 Not advertised to any peer
 Local
    10.0.0.1 (metric 3) from 10.0.0.101 (10.0.0.1)
      Received Label 24012
      Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, import-
candidate, imported
      Received Path ID 1, Local Path ID 1, version 221
      Extended community: RT:65000:1
      Originator: 10.0.0.1, Cluster list: 10.0.0.101
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #2: Received by speaker 0
 Not advertised to any peer
 Local
    10.0.0.4 (metric 3) from 10.0.0.101 (10.0.0.4)
      Received Label 24013
      Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
      Received Path ID 2, Local Path ID 0, version 0
      Extended community: RT:65000:1
      Originator: 10.0.0.4, Cluster list: 10.0.0.101
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #3: Received by speaker 0
 Not advertised to any peer
 Local
    10.0.0.2 (metric 3) from 10.0.0.101 (10.0.0.2)
      Received Label 24012
      Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
      Received Path ID 3, Local Path ID 0, version 0
      Extended community: RT:65000:1
      Originator: 10.0.0.2, Cluster list: 10.0.0.101
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

- 세 번째 경로는 백업 경로입니다. BGP에서 백업(보호 다중 경로)으로 표시되고 RIB에서 백업 경로로 설치됩니다.
- 최상의 경로 및 다중 경로 경로가 광고됩니다.
- 'backup(protect multipath)' 경로는 알려지지 않습니다.

12. set path-selection multipath advertise multipath-protect multipath-protect-advert

이렇게 하면 다중 경로 보호 경로를 설치하여 다중 경로 경로와 함께 알릴 수 있습니다.

```
route-policy BGP-Path-Selection
 set path-selection multipath advertise multipath-protect multipath-protect-advertise
end-policy

RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
 Process           bRIB/RIB  SendTblVer
 Speaker                  5           5
Last Modified: Sep 18 06:22:22.907 for 00:03:12
Paths: (5 available, best #1)
 Advertised to update-groups (with more than one peer):
   0.2 0.3
 Path #1: Received by speaker 0
```

```
 Advertised to update-groups (with more than one peer):
   0.2 0.3
 Local, (Received from a RR-client)
   10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, **best**, group-best, **multipath**,
import-candidate, imported
     Received Path ID 0, Local Path ID 1, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #2: Received by speaker 0
 Advertised to update-groups (with more than one peer):
   0.2
 Local, (Received from a RR-client)
   10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, **backup(protect multipath)**,
add-path, import-candidate, imported
     Received Path ID 0, Local Path ID 4, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #3: Received by speaker 0
 Not advertised to any peer
 Local, (Received from a RR-client)
   10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
     Received Path ID 0, Local Path ID 0, version 0
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #4: Received by speaker 0
 Advertised to update-groups (with more than one peer):
   0.2
 Local, (Received from a RR-client)
   10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4)
     Received Label 24013
     Origin incomplete, metric 0, localpref 100, valid, internal, **multipath**, add-path, import-
candidate, imported
     Received Path ID 0, Local Path ID 2, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #5: Received by speaker 0
 Advertised to update-groups (with more than one peer):
   0.2
 Local, (Received from a RR-client)
   10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5)
     Received Label 24014
     Origin incomplete, metric 0, localpref 100, valid, internal, **multipath**, add-path, import-
candidate, imported
     Received Path ID 1, Local Path ID 3, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1


RP/0/RP0/CPU0:RR#**show route vrf one 10.1.1.1/32**
Routing entry for 10.1.1.1/32
 Known via "bgp 65000", distance 200, metric 0
 Number of pic paths 1 , type internal
 Installed Sep 18 06:22:23.059 for 00:03:34
 Routing Descriptor Blocks
   10.0.0.1, from 10.0.0.1, **BGP multi path**
     Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
     Route metric is 0
   10.0.0.2, from 10.0.0.2, **BGP backup path**
```

```
      Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
      Route metric is 0
    10.0.0.4, from 10.0.0.4, BGP multi path
      Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
      Route metric is 0
    10.0.0.5, from 10.0.0.5, BGP multi path
      Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
      Route metric is 0
  No advertising protos.


RP/0/RP0/CPU0:RR#show cef vrf one 10.1.1.1/32
10.1.1.1/32, version 367, internal 0x5000001 0x30 (ptr 0xd96a770) [1], 0x0 (0xe3662a8), 0xa08
(0xf4e11c8)
 Updated Sep 18 06:22:23.062
 Prefix Len 32, traffic index 0, precedence n/a, priority 3
  via 10.0.0.1/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
   path-idx 0 NHID 0x0 [0xdab2bc0 0x0], Internal 0xd6a2190
   recursion-via-/32
   next hop VRF - 'default', table - 0xe0000000
   next hop 10.0.0.1/32 via 24003/0/21
    next hop 10.1.101.1/32 Gi0/0/0/0    labels imposed {ImplNull 24012}
  via 10.0.0.2/32, 2 dependencies, recursive, backup [flags 0x6100]
   path-idx 1 NHID 0x0 [0xdab2e48 0x0]
   recursion-via-/32
   next hop VRF - 'default', table - 0xe0000000
   next hop 10.0.0.2/32 via 24001/0/21
    next hop 10.2.101.2/32 Gi0/0/0/4    labels imposed {ImplNull 24012}
  via 10.0.0.4/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
   path-idx 2 NHID 0x0 [0xdab2c98 0x0], Internal 0xd6a2550
   recursion-via-/32
   next hop VRF - 'default', table - 0xe0000000
   next hop 10.0.0.4/32 via 24000/0/21
    next hop 10.4.101.4/32 Gi0/0/0/7    labels imposed {ImplNull 24013}
  via 10.0.0.5/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
   path-idx 3 NHID 0x0 [0xdab2368 0x0], Internal 0xd6a2910
   recursion-via-/32
   next hop VRF - 'default', table - 0xe0000000
   next hop 10.0.0.5/32 via 24005/0/21
    next hop 10.5.101.5/32 Gi0/0/0/1    labels imposed {ImplNull 24014}
```

알려진 경로를 확인합니다.


```
RP/0/RP0/CPU0:PE6#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
 Process           bRIB/RIB  SendTblVer
 Speaker                235         235
Last Modified: Sep 18 06:22:24.649 for 00:03:59
Paths: (4 available, best #1)
 Not advertised to any peer
 Path #1: Received by speaker 0
 Not advertised to any peer
 Local
   10.0.0.1 (metric 3) from 10.0.0.101 (10.0.0.1)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, import-
candidate, imported
     Received Path ID 1, Local Path ID 1, version 235
     Extended community: RT:65000:1
     Originator: 10.0.0.1, Cluster list: 10.0.0.101
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #2: Received by speaker 0
 Not advertised to any peer
```

```
Local
   10.0.0.4 (metric 3) from 10.0.0.101 (10.0.0.4)
     Received Label 24013
     Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
     Received Path ID 2, Local Path ID 0, version 0
     Extended community: RT:65000:1
     Originator: 10.0.0.4, Cluster list: 10.0.0.101
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #3: Received by speaker 0
Not advertised to any peer
Local
   10.0.0.5 (metric 3) from 10.0.0.101 (10.0.0.5)
     Received Label 24014
     Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
     Received Path ID 3, Local Path ID 0, version 0
     Extended community: RT:65000:1
     Originator: 10.0.0.5, Cluster list: 10.0.0.101
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #4: Received by speaker 0
Not advertised to any peer
Local
   10.0.0.2 (metric 3) from 10.0.0.101 (10.0.0.2)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
     Received Path ID 4, Local Path ID 0, version 0
     Extended community: RT:65000:1
     Originator: 10.0.0.2, Cluster list: 10.0.0.101
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

결론:

- 3개 경로 모두 BGP에서 다중 경로로 표시됩니다.
- 3 ECMP 경로는 RIB/CEF 테이블에 설치됩니다.
- 두 번째 경로는 백업 경로입니다. BGP에서 백업(보호 다중 경로)으로 표시되고 RIB/CEF 테이블에 백업 경로로 설치됩니다.
- 최상의 경로 및 다중 경로 경로와 'backup(protect multipath)' 경로가 광고됩니다.

Cisco IOS®-XR 7.3.1의 새로운 경로 선택 동작

Cisco IOS®-XR 7.3.1부터 다음과 같이 변경되었습니다.

- 인접 디바이스 경로당 선택할 수 있습니다. Cisco IOS®-XR 7.3.1 이전에는 주소군 하나씩만 있었습니다.
- 하나의 route-policy에서 여러 set path-selection 문이 허용됩니다.
- BGP 경로는 수신된 순서대로 표시될 수 있습니다.

인접 디바이스 경로당 선택 가능

경로 정책에서 사용할 수 있는 경로 선택입니다.

```
RP/0/RP0/CPU0:RR(config-rpl)#set path-selection ?
 all        BGP all paths
 backup     BGP backup path
 best-path  BGP best path
 group-best BGP group best path
 multipath  BGP multipath
```

best-path가 기본값입니다.

주소군 레벨에서 지원됩니다.

컨피그레이션 예시:

```
router bgp 65000
 address-family ipv4 unicast
 !
 address-family vpnv4 unicast
 additional-paths receive
 additional-paths send
  additional-paths selection route-policy BGP-Path-Selection
 !
 neighbor 10.0.0.1
 remote-as 65000
 update-source Loopback0
 address-family ipv4 unicast
  route-reflector-client
 !
 address-family vpnv4 unicast
  route-reflector-client
 !
!
 vrf one
 rd 1:1
 address-family ipv4 unicast
  maximum-paths ibgp 2
   additional-paths selection route-policy BGP-Path-Selection
  redistribute connected
 !
 !
!
```

Cisco IOS®-XR 7.3.1부터 경로 정책의 일부 경로 선택 옵션도 인접 디바이스 레벨에서 지원됩니다. 그러면 어떤 BGP 네이버에 어떤 경로를 알릴지 더 세부적으로 제어할 수 있습니다. 예를 들어, BGP 스피커는 최적의 경로 및 하나의 백업 경로를 하나의 BGP 인접 디바이스에 광고할 수 있지만 다중 경로를 알리고 다른 인접 디바이스에 다중 경로 경로를 보호할 수 있습니다.

네이버 레벨에는 다음이 있습니다.

```
RP/0/RP0/CPU0:RR(config-rpl)#if destination ?
 in                    Member of a set
 is-all                Check for additional paths selected by all path-selection
 is-backup-path        Checks for backup path
 is-best-external      Checks for best external route
 is-best-path          Checks for best path
 is-multi-path         Checks for multiple paths
 is-multipath-protect  Checks for multipath-protect path
 longer-than           Prefix-length greater than the route's prefix length
 or-longer             Prefix-length equal to or greater than the route's prefix length
```

> **경고:** 최상의 경로는 BGP 명령 **maximum-path**가 구성된 경우 **다중** 경로입니다. 그러나 route-policy에 구성된 유일한 조건이 **is-multi-path**인 경우 최적 경로가 아닌 다중 경로 경로만 알려집니다. 이는 BGP 설계에 따라 다르지만 다중 경로 경로를 광고해야 하는 경우 최상의 경로도 광고해야 합니다.

is-all 및 **is-multipath-protect**는 Cisco IOS®-XR 7.3.1과 함께 새로 도입되었습니다.

하나의 Route-Policy에서 여러 set path-selection 명령문이 허용됩니다.

Cisco IOS®-XR 7.3.1부터 하나의 접두사와 관련된 하나의 경로 정책에서 **다중 집합 경로 선택** 문을 가질 수 있습니다. Cisco IOS®-XR 7.3.1 이전에는 이 방법이 허용되지 않았으며 예기치 않은 BGP 경로 동작으로 이어집니다.

하나 이상의 경로를 선택했거나 접두사마다 표시되지 않습니다.

예를 들어 Cisco IOS®-XR 7.3.1 **이전**에 다음 항목이 지원되지 않습니다.

```
route-policy add-path-to-ibgp
 set weight 65000
  set path-selection backup 1 install
 set metric-type type-1
 set extcommunity rt RT BUSINESS additive
  set path-selection all advertise
 set rib-metric 100
end-policy
```

하나의 경로 정책에 동일한 접두사에 적용된 두 개의 **set path-selection** 문이 있습니다.

그러나 **Cisco IOS®-XR 7.3.1 이전**에 다음이 지원됩니다. 이유는 다른 경로 선택 문이 서로 다른 접두사에 대해 사용되기 때문입니다. 선택이 있는 문(destination, community, ...)이 사용된 **경우**

예 1:

```
route-policy ADDPATH
 if destination in TRAFFIC_1 then
   set path-selection backup 1 install
 endif
 if destination in TRAFFIC_2 then
   set path-selection multipath advertise
 endif
end-policy
```

이는 set-path **선택** 문이 서로 다른 접두사와 관련되기 때문에 유용합니다(**if** 문의 경우 두 개에 있음).

예 2:

```
route-policy ADDPATH-2
 if community matches-any COMM_ADD-PATH then
   set path-selection backup 1 install multipath-protect advertise
 else
   set path-selection best-path
 endif
end-policy
```

이는 set path selection 문이 서로 다른 접두사와 관련되기 때문에 유용합니다(**if** 문의 서로 다른 두 부분에 있음).

Cisco IOS®-XR 7.3.1부터 지원됩니다.

다음은 둘 이상의 **set path-selection** 문이 포함된 경로 정책**의** 예입니다.

```
route-policy BGP-Path-Selection
 set path-selection multipath advertise
 set path-selection backup 1 install multipath-protect advertise multipath-protect-advertise
end-policy
!
```

per-neighbor route-policy는 해당 네이버에 광고되는 경로를 지정합니다. 주소군 레벨에서 이미 표시된 경로에서만 경로를 선택할 수 있습니다.

주소군 레벨에서는 경로를 선택할 수 있습니다.

```
RP/0/RP0/CPU0:RR(config-rpl)#set path-selection ?
 all         BGP all paths
 backup      BGP backup path
 best-path   BGP best path
 group-best  BGP group best path
 multipath   BGP multipath
```

네이버 레벨에는 다음이 있습니다.

```
RP/0/RP0/CPU0:RR(config-rpl)#if destination ?
 in                    Member of a set
 is-all                Check for additional paths selected by all path-selection
 is-backup-path        Checks for backup path
 is-best-external      Checks for best external route
 is-best-path          Checks for best path
 is-multi-path         Checks for multiple paths
 is-multipath-protect  Checks for multipath-protect path
 longer-than           Prefix-length greater than the route's prefix length
 or-longer             Prefix-length equal to or greater than the route's prefix length
```

> **경고:** 최상의 경로는 BGP 명령 maximum-path가 구성된 경우 **다중** 경로입니다. 그러나 route-policy에 구성된 유일한 조건이 is-multi-path인 경우 최적 경로가 아닌 다중 경로 경로만 알려집니다. 이는 BGP 설계에 따라 다르지만 다중 경로 경로를 광고해야 하는 경우 최상의 경로도 광고해야 합니다.

is-all 및 is-multipath-protect는 Cisco IOS®-XR 7.3.1과 함께 새로 도입되었습니다.

이 접근 방식을 사용하면 **경로 선택**을 표시하는 데 사용 중인 경로 선택 모드(예: all, backup, multipath, multipath-protect 등)가 혼용될 수 있습니다.

네이버 정책은 경로 선택 표시를 기반으로 **광고**를 제어합니다.

마킹 부품의 경우: 예를 들어 주소 패밀리 레벨의 route-policy에서 백업 및 다중 경로를 함께 구성할 수 있습니다.

```
route-policy BGP-Path-Selection
  set path-selection multipath advertise   (1)
  set path-selection backup 1 install multipath-protect advertise multipath-protect-advertise
 (2)
end-policy
!
```

위의 두 set path-selection 문은 Cisco IOS®-XR 7.3.1부터 새로 지원되는 내용입니다. 이 예시에도 maximum-path ibgp 3이 구성되어 있는 경우 다음과 같은 내용이 제공됩니다.

- 최상의 경로 및 모든 다중 경로 경로를 알릴 수 있습니다.

- 최적의 경로 및 백업(다중 경로 보호) 경로를 알릴 수 있습니다.

Cisco IOS®-XR 7.3.1 이전에는 이 조합을 사용할 수 없었습니다. 즉 (1) 또는 (2) 가 적용됩니다.

결과는 다음과 같습니다.

```
RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
 Process           bRIB/RIB  SendTblVer
 Speaker                  5           5
Last Modified: Sep 18 06:59:27.907 for 00:00:28
Paths: (5 available, best #1)
 Advertised to update-groups (with more than one peer):
   0.2 0.3
 Path #1: Received by speaker 0
 Advertised to update-groups (with more than one peer):
   0.2 0.3
 Local, (Received from a RR-client)
   10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, multipath,
import-candidate, imported
     Received Path ID 0, Local Path ID 1, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #2: Received by speaker 0
 Advertised to update-groups (with more than one peer):
   0.2
 Local, (Received from a RR-client)
   10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, multipath, backup, add-path,
import-candidate, imported
     Received Path ID 0, Local Path ID 2, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #3: Received by speaker 0
 Advertised to update-groups (with more than one peer):
   0.2
 Local, (Received from a RR-client)
   10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, backup(protect multipath),
add-path, import-candidate, imported
     Received Path ID 0, Local Path ID 3, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #4: Received by speaker 0
 Advertised to update-groups (with more than one peer):
   0.2
 Local, (Received from a RR-client)
   10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4)
     Received Label 24013
     Origin incomplete, metric 0, localpref 100, valid, internal, multipath, add-path, import-
candidate, imported
     Received Path ID 0, Local Path ID 4, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #5: Received by speaker 0
 Not advertised to any peer
```

```
 Local, (Received from a RR-client)
    10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5)
      Received Label 24014
      Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
      Received Path ID 1, Local Path ID 0, version 0
      Extended community: RT:65000:1
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1


RP/0/RP0/CPU0:RR#show route vrf one 10.1.1.1/32
Routing entry for 10.1.1.1/32
 Known via "bgp 65000", distance 200, metric 0
 Number of pic paths 1 , type internal
 Installed Sep 18 06:59:27.833 for 00:01:59
 Routing Descriptor Blocks
    10.0.0.1, from 10.0.0.1, BGP multi path
      Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
      Route metric is 0
    10.0.0.2, from 10.0.0.2, BGP multi path
      Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
      Route metric is 0
    10.0.0.3, from 10.0.0.3, BGP backup path
      Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
      Route metric is 0
    10.0.0.4, from 10.0.0.4, BGP multi path
      Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
      Route metric is 0
 No advertising protos.


RP/0/RP0/CPU0:RR#show cef vrf one 10.1.1.1/32
10.1.1.1/32, version 409, internal 0x5000001 0x30 (ptr 0xd96a770) [1], 0x0 (0xe3662a8), 0xa08
(0xf4e1168)
 Updated Sep 18 06:59:27.836
 Prefix Len 32, traffic index 0, precedence n/a, priority 3
  via 10.0.0.1/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
   path-idx 0 NHID 0x0 [0xdab2bc0 0x0], Internal 0xd6a2190
   recursion-via-/32
   next hop VRF - 'default', table - 0xe0000000
   next hop 10.0.0.1/32 via 24003/0/21
    next hop 10.1.101.1/32 Gi0/0/0/0    labels imposed {ImplNull 24012}
  via 10.0.0.2/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
   path-idx 1 NHID 0x0 [0xdab2e48 0x0], Internal 0xd6a2550
   recursion-via-/32
   next hop VRF - 'default', table - 0xe0000000
   next hop 10.0.0.2/32 via 24001/0/21
    next hop 10.2.101.2/32 Gi0/0/0/4    labels imposed {ImplNull 24012}
  via 10.0.0.3/32, 2 dependencies, recursive, backup [flags 0x6100]
   path-idx 2 NHID 0x0 [0xdab2060 0x0]
   recursion-via-/32
   next hop VRF - 'default', table - 0xe0000000
   next hop 10.0.0.3/32 via 24007/0/21
    next hop 10.3.101.3/32 Gi0/0/0/6    labels imposed {ImplNull 24012}
  via 10.0.0.4/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
   path-idx 3 NHID 0x0 [0xdab2c98 0x0], Internal 0xd6a2370
   recursion-via-/32
   next hop VRF - 'default', table - 0xe0000000
   next hop 10.0.0.4/32 via 24000/0/21
    next hop 10.4.101.4/32 Gi0/0/0/7    labels imposed {ImplNull 24013}
```

알려진 경로를 확인합니다.

```
RP/0/RP0/CPU0:PE6#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
```

```
Versions:
 Process              bRIB/RIB  SendTblVer
 Speaker                   271        271
Last Modified: Sep 18 06:59:28.649 for 00:01:53
Paths: (4 available, best #1)
 Not advertised to any peer
 Path #1: Received by speaker 0
 Not advertised to any peer
 Local
    10.0.0.1 (metric 3) from 10.0.0.101 (10.0.0.1)
      Received Label 24012
      Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, import-
candidate, imported
      Received Path ID 1, Local Path ID 1, version 271
      Extended community: RT:65000:1
      Originator: 10.0.0.1, Cluster list: 10.0.0.101
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #2: Received by speaker 0
 Not advertised to any peer
 Local
    10.0.0.2 (metric 3) from 10.0.0.101 (10.0.0.2)
      Received Label 24012
      Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
      Received Path ID 2, Local Path ID 0, version 0
      Extended community: RT:65000:1
      Originator: 10.0.0.2, Cluster list: 10.0.0.101
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #3: Received by speaker 0
 Not advertised to any peer
 Local
    10.0.0.3 (metric 3) from 10.0.0.101 (10.0.0.3)
      Received Label 24012
      Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
      Received Path ID 3, Local Path ID 0, version 0
      Extended community: RT:65000:1
      Originator: 10.0.0.3, Cluster list: 10.0.0.101
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #4: Received by speaker 0
 Not advertised to any peer
 Local
    10.0.0.4 (metric 3) from 10.0.0.101 (10.0.0.4)
      Received Label 24013
      Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
      Received Path ID 4, Local Path ID 0, version 0
      Extended community: RT:65000:1
      Originator: 10.0.0.4, Cluster list: 10.0.0.101
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

이제 is-best-path *또는* is-backup-*path*를 기반으로 한 기본(최적 경로) 및 백업 경로를 하나의 인접 디바이스*에 알릴* 수 있습니다.

다른 네이버의 경우 is-multi-path로 다중 경로**를 알릴** 수 있습니다.

인접 디바이스 경로 정책의 예(주소군 레벨에서 route-policy와 함께 사용):

```
route-policy BGP-neighbor-1
 if community matches-any COMM-LIST-1 then
    if destination is-best-path or destination is-backup-path then
      pass
    else
      drop
    endif
```

```
  elseif community matches-any COMM-LIST-2 then
  if destination is-multi-path or destination is-multipath-protect then
      pass
    else
      drop
    endif
  else
    drop
  endif
end-policy
!
```

RR에 다음 BGP 경로가 있는 경우:

```
RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
 Process            bRIB/RIB  SendTblVer
 Speaker                   5           5
Last Modified: Sep 18 07:14:32.907 for 00:06:53
Paths: (5 available, best #1)
 Advertised to update-groups (with more than one peer):
   0.3
 Advertised to peers (in unique update groups):
   10.0.0.6       10.0.0.5
 Path #1: Received by speaker 0
 Advertised to update-groups (with more than one peer):
   0.3
 Advertised to peers (in unique update groups):
   10.0.0.6       10.0.0.5
 Local, (Received from a RR-client)
   10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, multipath,
import-candidate, imported
     Received Path ID 0, Local Path ID 1, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #2: Received by speaker 0
 Advertised to peers (in unique update groups):
   10.0.0.6       10.0.0.5
 Local, (Received from a RR-client)
   10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, multipath, backup, add-path,
import-candidate, imported
     Received Path ID 0, Local Path ID 2, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #3: Received by speaker 0
 Advertised to peers (in unique update groups):
   10.0.0.5
 Local, (Received from a RR-client)
   10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, multipath, add-path, import-
candidate, imported
     Received Path ID 0, Local Path ID 4, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #4: Received by speaker 0
 Advertised to peers (in unique update groups):
```

```
    10.0.0.5
  Local, (Received from a RR-client)
    10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4)
      Received Label 24013
      Origin incomplete, metric 0, localpref 100, valid, internal, backup(protect multipath),
add-path, import-candidate, imported
      Received Path ID 0, Local Path ID 3, version 5
      Extended community: RT:65000:1
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
  Path #5: Received by speaker 0
  Not advertised to any peer
  Local, (Received from a RR-client)
    10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5)
      Received Label 24014
      Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
      Received Path ID 1, Local Path ID 0, version 0
      Extended community: RT:65000:1
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

그런 다음 인접 디바이스 route-policy의 첫 번째 경로에 대해 다음 작업을 수행합니다.

```
    if destination is-best-path or destination is-backup-path then
    pass
```

인접 디바이스 PE6은 다음 경로를 수신합니다.

```
RP/0/RP0/CPU0:PE6#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
 Process           bRIB/RIB   SendTblVer
 Speaker              283          283
Last Modified: Sep 18 07:14:33.649 for 00:07:21
Paths: (2 available, best #1)
  Not advertised to any peer
  Path #1: Received by speaker 0
  Not advertised to any peer
  Local
    10.0.0.1 (metric 3) from 10.0.0.101 (10.0.0.1)
      Received Label 24012
      Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, import-
candidate, imported
      Received Path ID 1, Local Path ID 1, version 283
      Extended community: RT:65000:1
      Originator: 10.0.0.1, Cluster list: 10.0.0.101
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
  Path #2: Received by speaker 0
  Not advertised to any peer
  Local
    10.0.0.2 (metric 3) from 10.0.0.101 (10.0.0.2)
      Received Label 24012
      Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
      Received Path ID 2, Local Path ID 0, version 0
      Extended community: RT:65000:1
      Originator: 10.0.0.2, Cluster list: 10.0.0.101
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

이 두 경로는 RR에서 최적의 경로와 백업 경로입니다.

인접 디바이스 경로 정책의 두 번째 부분(예:

```
   if destination is-multi-path or destination is-multipath-protect
   then
     pass
```

인접 디바이스 PE6은 다음 경로를 수신합니다.

```
RP/0/RP0/CPU0:PE6#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
 Process             bRIB/RIB  SendTblVer
 Speaker               299       299
Last Modified: Sep 18 07:31:09.649 for 00:02:29
Paths: (3 available, best #1)
 Not advertised to any peer
 Path #1: Received by speaker 0
 Not advertised to any peer
 Local
   10.0.0.2 (metric 3) from 10.0.0.101 (10.0.0.2)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, import-
candidate, imported
     Received Path ID 2, Local Path ID 1, version 299
     Extended community: RT:65000:1
     Originator: 10.0.0.2, Cluster list: 10.0.0.101
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #2: Received by speaker 0
 Not advertised to any peer
 Local
   10.0.0.4 (metric 3) from 10.0.0.101 (10.0.0.4)
     Received Label 24013
     Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
     Received Path ID 3, Local Path ID 0, version 0
     Extended community: RT:65000:1
     Originator: 10.0.0.4, Cluster list: 10.0.0.101
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #3: Received by speaker 0
 Not advertised to any peer
 Local
   10.0.0.3 (metric 3) from 10.0.0.101 (10.0.0.3)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
     Received Path ID 4, Local Path ID 0, version 0
     Extended community: RT:65000:1
     Originator: 10.0.0.3, Cluster list: 10.0.0.101
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```
이러한 경로는 다중 경로 경로(그러나 최상의 경로를 포함하지 **않음**) 및 backup(protect multipath) 경로입니다.

수신된 순서대로 BGP 경로 표시

BGP 경로는 사전순으로 표시됩니다.

Cisco IOS®-XR 7.3.1-에 도입된 새로운 명령을 사용하여 BGP 경로를 수신한 순서대로 확인할 수 있습니다.

```
show bgp <afi> rd <rd> <path_details> <age-order>
```
이 명령은 경로가 다중 경로로 표시된 이유를 확인하는 데 유용합니다. 이전에 수신한 경로는 다중

경로로 표시되며 RIB에 최대 경로 경로로 설치됩니다. show **route** 명령은 설치된 경로에 대한 **BGP** multi path 키워드를 표시합니다.

어떤 경로가 다중 경로로 표시되는지 확인하기 위해 새 명령을 사용하여 모든 경로가 수신된 순서를 확인할 수 있습니다. 최신 경로는 출력 맨 위에 있습니다.

예를 들어, 다음 컨피그레이션을 사용합니다.

```
route-policy BGP-Path-Selection
  set path-selection multipath advertise
  set path-selection backup 1 install multipath-protect advertise multipath-protect-advertise
end-policy
!
```

최적 경로 결정 프로세스에는 변경 사항이 없으며, 경로 결정 프로세스에 영향을 주는 속성(예: 로컬 환경 설정)도 없습니다.

RR에는 다음과 같은 BGP 경로 선택이 있습니다.

```
RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
 Process            bRIB/RIB  SendTblVer
 Speaker                 5           5
Last Modified: Sep 18 08:46:11.907 for 00:03:43
Paths: (5 available, best #1)
 Advertised to update-groups (with more than one peer):
   0.3
 Advertised to peers (in unique update groups):
   10.0.0.5
 Path #1: Received by speaker 0
 Advertised to update-groups (with more than one peer):
   0.3
 Advertised to peers (in unique update groups):
   10.0.0.5
 Local, (Received from a RR-client)
   10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, multipath,
import-candidate, imported
     Received Path ID 0, Local Path ID 1, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #2: Received by speaker 0
 Advertised to peers (in unique update groups):
   10.0.0.5
 Local, (Received from a RR-client)
   10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, multipath, backup, add-path,
import-candidate, imported
     Received Path ID 0, Local Path ID 2, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #3: Received by speaker 0
 Advertised to peers (in unique update groups):
   10.0.0.5        10.0.0.6
 Local, (Received from a RR-client)
```

```
      10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3)
        Received Label 24012
        Origin incomplete, metric 0, localpref 100, valid, internal, multipath, add-path, import-
candidate, imported
        Received Path ID 0, Local Path ID 3, version 5
        Extended community: RT:65000:1
        Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #4: Received by speaker 0
 Advertised to peers (in unique update groups):
   10.0.0.5        10.0.0.6
 Local, (Received from a RR-client)
   10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4)
        Received Label 24013
        Origin incomplete, metric 0, localpref 100, valid, internal, backup(protect multipath),
add-path, import-candidate, imported
        Received Path ID 0, Local Path ID 4, version 5
        Extended community: RT:65000:1
        Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #5: Received by speaker 0
 Not advertised to any peer
 Local, (Received from a RR-client)
   10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5)
        Received Label 24014
        Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
        Received Path ID 1, Local Path ID 0, version 0
        Extended community: RT:65000:1
        Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

10.0.0.1의 경로가 가장 좋은 이유는 무엇입니까? 백업 경로10.0.0.2 경로가 있는 이유는 무엇입니까? 10.0.0.3 경로의 경로는 무엇입니까? 백업(보호 다중 경로)에서 10.0.0.4 경로가 시작되는 이유는 무엇입니까? 백업(다중 경로 보호) 경로가 아니라 10.0.0.5의 경로가 최상의 경로가 아닌 이유는 무엇입니까?

끝에 **연령 순서**가 동일한 명령으로 이를 볼 수 있습니다. 최신 경로는 출력 맨 위에 있습니다.

```
RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32 age-order

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
 Process           bRIB/RIB  SendTblVer
 Speaker                5          5
  Flags: 0x240692b2+0x00010000; multipath; backup available;
Last Modified: Sep 18 07:31:07.907 for 00:23:23
Paths: (5 available, best #3)
 Advertised to update-groups (with more than one peer):
   0.3
 Advertised to peers (in unique update groups):
   10.0.0.5
 Path #1: Received by speaker 0
 Flags: 0x2000000084060205, import: 0x96
 Advertised to peers (in unique update groups):
   10.0.0.6        10.0.0.5
 Local, (Received from a RR-client)
   10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4), if-handle 0x00000000
        Received Label 24013
        Origin incomplete, metric 0, localpref 100, valid, internal, backup(protect multipath),
add-path, import-candidate, imported
        Received Path ID 0, Local Path ID 3, version 5
        Extended community: RT:65000:1
        Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #2: Received by speaker 0
 Flags: 0x2000000084020205, import: 0x96
```

```
 Not advertised to any peer
 Local, (Received from a RR-client)
   10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5), if-handle 0x00000000
     Received Label 24014
     Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
     Received Path ID 1, Local Path ID 0, version 0
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #3: Received by speaker 0
 Flags: 0x2000000085070205, import: 0x9f
 Advertised to update-groups (with more than one peer):
   0.3
 Advertised to peers (in unique update groups):
   10.0.0.5
 Local, (Received from a RR-client)
   10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1), if-handle 0x00000000
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, multipath,
import-candidate, imported
     Received Path ID 0, Local Path ID 1, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #4: Received by speaker 0
 Flags: 0x2000000084070205, import: 0x96
 Advertised to peers (in unique update groups):
   10.0.0.6        10.0.0.5
 Local, (Received from a RR-client)
   10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3), if-handle 0x00000000
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, multipath, add-path, import-
candidate, imported
     Received Path ID 0, Local Path ID 4, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #5: Received by speaker 0
 Flags: 0x2000000084070205, import: 0x96
 Advertised to peers (in unique update groups):
   10.0.0.6        10.0.0.5
 Local, (Received from a RR-client)
   10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2), if-handle 0x00000000
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, multipath, backup, add-path,
import-candidate, imported
     Received Path ID 0, Local Path ID 2, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

show bgp 명령을 키워드 bestpath-compare와 함께 사용하여 경로가 최상의 경로가 아닌 이유를 확인할 수 있습니다(경로 기준 이유는 표시).

```
RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32 bestpath-compare

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
 Process           bRIB/RIB  SendTblVer
 Speaker                  5           5
   Flags: 0x240692b2+0x00010000; multipath; backup available;
Last Modified: Sep 18 07:31:07.907 for 00:44:59
Paths: (5 available, best #1)
 Advertised to update-groups (with more than one peer):
   0.3
 Advertised to peers (in unique update groups):
   10.0.0.5
```

```
 Path #1: Received by speaker 0
 Flags: 0x2000000085070205, import: 0x9f
 Advertised to update-groups (with more than one peer):
   0.3
 Advertised to peers (in unique update groups):
   10.0.0.5
 Local, (Received from a RR-client)
   10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1), if-handle 0x00000000
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, **best**, group-best, **multipath**,
import-candidate, imported
     Received Path ID 0, Local Path ID 1, version 5
     Extended community: RT:65000:1
     **best of local AS, Overall best**
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #2: Received by speaker 0
 Flags: 0x2000000084070205, import: 0x96
 Advertised to peers (in unique update groups):
   10.0.0.6        10.0.0.5
 Local, (Received from a RR-client)
   10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2), if-handle 0x00000000
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, **multipath**, **backup**, add-path,
import-candidate, imported
     Received Path ID 0, Local Path ID 2, version 5
     Extended community: RT:65000:1
     **iBGP multi-path**
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #3: Received by speaker 0
 Flags: 0x2000000084070205, import: 0x96
 Advertised to peers (in unique update groups):
   10.0.0.6        10.0.0.5
 Local, (Received from a RR-client)
   10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3), if-handle 0x00000000
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, **multipath**, add-path, import-
candidate, imported
     Received Path ID 0, Local Path ID 4, version 5
     Extended community: RT:65000:1
     **iBGP multi-path**
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #4: Received by speaker 0
 Flags: 0x2000000084060205, import: 0x96
 Advertised to peers (in unique update groups):
   10.0.0.6        10.0.0.5
 Local, (Received from a RR-client)
   10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4), if-handle 0x00000000
     Received Label 24013
     Origin incomplete, metric 0, localpref 100, valid, internal, **backup(protect multipath)**,
add-path, import-candidate, imported
     Received Path ID 0, Local Path ID 3, version 5
     Extended community: RT:65000:1
     **Higher router ID than best path (path #1)**
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #5: Received by speaker 0
 Flags: 0x2000000084020205, import: 0x96
 Not advertised to any peer
 Local, (Received from a RR-client)
   10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5), if-handle 0x00000000
     Received Label 24014
     Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
     Received Path ID 1, Local Path ID 0, version 0
     Extended community: RT:65000:1
     **Higher router ID than best path (path #1)**
```

```
        Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```
BGP 경로의 대부분의 특성이 경로 간에 동일하므로 최적의 경로를 선택하기로 결정한 후 BGP 스 피커의 가장 낮은 라우터 ID로 내려갔습니다. 다음은 BGP 스피커 10.0.0.1입니다. 백업 경로는 두 번째로 좋은 경로이므로 BGP 스피커의 두 번째로 낮은 라우터 ID입니다. 여기 10.0.0.2.

10.0.0.4 및 10.0.0.5의 경로는 10.0.0.1, 10.0.0.2 및 10.0.0.3의 경로보다 나중에 설치되었으므로 다 중 경로가 아닙니다.

백업 대 백업(다중 경로 보호) 경로

```
route-policy BGP-Path-Selection
  set path-selection multipath advertise
  set path-selection backup 1 install multipath-protect advertise multipath-protect-advertise
end-policy
!
```
최대 경로 ibgp 3이 구성되었습니다.

백업은 두 번째로 좋은 경로입니다. 여기서는 백업 경로 전에 다중 경로 경로를 수신했습니다. 세 개 의 다중 경로 경로가 있고 다른 경로는 백업 경로입니다.

```
RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32 age-order

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
 Process              bRIB/RIB  SendTblVer
 Speaker                     5           5
   Flags: 0x240692b2+0x00010000; multipath; backup available;
Last Modified: Sep 18 08:51:17.907 for 00:07:11
Paths: (5 available, best #3)
 Advertised to update-groups (with more than one peer):
   0.3
 Advertised to peers (in unique update groups):
   10.0.0.5
 Path #1: Received by speaker 0
 Flags: 0x2000000084020205, import: 0x96
 Not advertised to any peer
 Local, (Received from a RR-client)
   10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4), if-handle 0x00000000
     Received Label 24013
     Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
     Received Path ID 0, Local Path ID 0, version 0
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #2: Received by speaker 0
 Flags: 0x2000000084060205, import: 0x96
 Advertised to peers (in unique update groups):
   10.0.0.5
 Local, (Received from a RR-client)
   10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2), if-handle 0x00000000
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, backup, add-path, import-
candidate, imported
     Received Path ID 0, Local Path ID 2, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #3: Received by speaker 0
 Flags: 0x2000000085070205, import: 0x9f
 Advertised to update-groups (with more than one peer):
```

```
      0.3
 Advertised to peers (in unique update groups):
   10.0.0.5
 Local, (Received from a RR-client)
   10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1), if-handle 0x00000000
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, multipath,
import-candidate, imported
     Received Path ID 0, Local Path ID 1, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #4: Received by speaker 0
 Flags: 0x2000000084070205, import: 0x96
 Advertised to peers (in unique update groups):
   10.0.0.6
 Local, (Received from a RR-client)
   10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5), if-handle 0x00000000
     Received Label 24014
     Origin incomplete, metric 0, localpref 100, valid, internal, multipath, add-path, import-
candidate, imported
     Received Path ID 1, Local Path ID 3, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #5: Received by speaker 0
 Flags: 0x2000000084070205, import: 0x96
 Advertised to peers (in unique update groups):
   10.0.0.5        10.0.0.6
 Local, (Received from a RR-client)
   10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3), if-handle 0x00000000
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, multipath, add-path, import-
candidate, imported
     Received Path ID 0, Local Path ID 4, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

인접 디바이스 10.0.0.5을 종료합니다. 이제 다음을 수행할 수 있습니다.

```
RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32 age-order

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
 Process           bRIB/RIB  SendTblVer
 Speaker                 7          7
   Flags: 0x2406b2b2+0x00010000; multipath; backup available;
Last Modified: Sep 18 09:05:07.907 for 00:00:23
Paths: (4 available, best #3)
 Advertised to update-groups (with more than one peer):
   0.3
 Path #1: Received by speaker 0
 Flags: 0x2000000084060205, import: 0x96
 Advertised to peers (in unique update groups):
   10.0.0.6
 Local, (Received from a RR-client)
   10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4), if-handle 0x00000000
     Received Label 24013
     Origin incomplete, metric 0, localpref 100, valid, internal, backup(protect multipath),
add-path, import-candidate, imported
     Received Path ID 0, Local Path ID 5, version 7
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #2: Received by speaker 0
 Flags: 0x2000000084070205, import: 0x96
```

```
     Advertised to peers (in unique update groups):
       10.0.0.6
     Local, (Received from a RR-client)
       10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2), if-handle 0x00000000
         Received Label 24012
         Origin incomplete, metric 0, localpref 100, valid, internal, multipath, backup, add-path,
import-candidate, imported
         Received Path ID 0, Local Path ID 2, version 7
         Extended community: RT:65000:1
         Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
     Path #3: Received by speaker 0
     Flags: 0x2000000085070205, import: 0x9f
     Advertised to update-groups (with more than one peer):
       0.3
     Local, (Received from a RR-client)
       10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1), if-handle 0x00000000
         Received Label 24012
         Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, multipath,
import-candidate, imported
         Received Path ID 0, Local Path ID 1, version 5
         Extended community: RT:65000:1
         Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
     Path #4: Received by speaker 0
     Flags: 0x2000000084070205, import: 0x96
     Advertised to peers (in unique update groups):
       10.0.0.6
     Local, (Received from a RR-client)
       10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3), if-handle 0x00000000
         Received Label 24012
         Origin incomplete, metric 0, localpref 100, valid, internal, multipath, add-path, import-
candidate, imported
         Received Path ID 0, Local Path ID 4, version 5
         Extended community: RT:65000:1
         Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

- 10.0.0.5의 길이 사라졌다.
- 10.0.0.2의 경로는 여전히 백업이지만 이제 다중 경로이기도 합니다.
- 백업 경로는 다중 경로 경로이므로 이제 backup(protect multipath) 경로가 있습니다. 10.0.0.4의 경로입니다.

인접 디바이스 10.0.0.5 종료:

```
RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32 age-order

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
 Process           bRIB/RIB  SendTblVer
  Speaker              10          10
    Flags: 0x2406b2b2+0x00010000; multipath; backup available;
Last Modified: Sep 18 09:08:42.907 for 00:00:00
Paths: (5 available, best #4)
 Advertised to update-groups (with more than one peer):
   0.3
 Advertised to peers (in unique update groups):
   10.0.0.5
 Path #1: Received by speaker 0
 Flags: 0x2000000084020205, import: 0x96
 Not advertised to any peer
 Local, (Received from a RR-client)
   10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5), if-handle 0x00000000
     Received Label 24014
     Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
```

```
      Received Path ID 1, Local Path ID 0, version 0
      Extended community: RT:65000:1
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #2: Received by speaker 0
 Flags: 0x200000084060205, import: 0x96
 Advertised to peers (in unique update groups):
   10.0.0.5        10.0.0.6
 Local, (Received from a RR-client)
   10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4), if-handle 0x00000000
      Received Label 24013
      Origin incomplete, metric 0, localpref 100, valid, internal, backup(protect multipath),
add-path, import-candidate, imported
      Received Path ID 0, Local Path ID 5, version 7
      Extended community: RT:65000:1
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #3: Received by speaker 0
 Flags: 0x2000000084070205, import: 0x96
 Advertised to peers (in unique update groups):
   10.0.0.5        10.0.0.6
 Local, (Received from a RR-client)
   10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2), if-handle 0x00000000
      Received Label 24012
      Origin incomplete, metric 0, localpref 100, valid, internal, multipath, backup, add-path,
import-candidate, imported
      Received Path ID 0, Local Path ID 2, version 10
      Extended community: RT:65000:1
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #4: Received by speaker 0
 Flags: 0x2000000085070205, import: 0x9f
 Advertised to update-groups (with more than one peer):
   0.3
 Advertised to peers (in unique update groups):
   10.0.0.5
 Local, (Received from a RR-client)
   10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1), if-handle 0x00000000
      Received Label 24012
      Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, multipath,
import-candidate, imported
      Received Path ID 0, Local Path ID 1, version 5
      Extended community: RT:65000:1
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #5: Received by speaker 0
 Flags: 0x2000000084070205, import: 0x96
 Advertised to peers (in unique update groups):
   10.0.0.5        10.0.0.6
 Local, (Received from a RR-client)
   10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3), if-handle 0x00000000
      Received Label 24012
      Origin incomplete, metric 0, localpref 100, valid, internal, multipath, add-path, import-
candidate, imported
      Received Path ID 0, Local Path ID 4, version 5
      Extended community: RT:65000:1
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```
이전에 설치된 4개 경로로 변경된 것이 없습니다. 10.0.0.5의 경로만 추가되었습니다. 그것은 최신이기 때문에 꼭대기에 있습니다. 이는 다중 경로 또는 백업 경로 유형이 아닙니다.

경로10.0.0.5 상태가 변경된 후 경로가 다중 경로에서 비 다중 경로로 변경되었습니다.

결론:

- 경로가 수신되는 순서는 어떤 경로가 다중 경로인지를 결정하는 데 역할을 합니다.

- 백업(보호 다중 경로) 경로가 있거나 없는 경우 경로를 수신하는 순서가 역할을 합니다.
- 경로를 받는 순서는 경로가 최상의 경로 또는 백업 경로로 선택된 역할을 수행하지 않습니다.

IGP 메트릭별 주문

IGP(Interior Gateway Protocol) 메트릭별로 다중 경로 경로를 주문하는 옵션이 있습니다.

```
RP/0/RP0/CPU0:RR#conf t
RP/0/RP0/CPU0:RR(config)#router bgp 65000
RP/0/RP0/CPU0:RR(config-bgp)#vrf one
RP/0/RP0/CPU0:RR(config-bgp-vrf)#address-family ipv4 unicast
RP/0/RP0/CPU0:RR(config-bgp-vrf-af)#maximum-paths ibgp 3 unequal-cost ?
deterministic Deterministic Multipath selection primarily on IGP metric order
selective Allow multipaths only from marked neighbors
<cr>
RP/0/RP0/CPU0:RR(config-bgp-vrf-af)#maximum-paths ibgp 3 unequal-cost deterministic ?
selective Allow multipaths only from marked neighbors
<cr>
RP/0/RP0/CPU0:RR(config-bgp-vrf-af)#maximum-paths ibgp 3 unequal-cost deterministic
RP/0/RP0/CPU0:RR(config-bgp-vrf-af)#commit
RP/0/RP0/CPU0:RR(config-bgp-vrf-af)#end
RP/0/RP0/CPU0:RR#
```

그렇지 않은 경우 같지 않은 비용이 필요하므로 최상의 경로, 백업 경로만 사용할 수 있습니다. 그러나 다중 경로에는 동일한 IGP 비용이 필요하므로 다중 경로가 없습니다.

토폴로지에서 RR에서 PE 라우터로의 IGP 비용이 변경됩니다. IGP 비용은 다음과 같이 구성됩니다.

- PE1로 RR: 5
- PE2로 RR: 4
- PE3로 RR: 3
- PE4로 RR: 2
- PE5로 RR: 1

여전히 다음과 같습니다.

```
route-policy BGP-Path-Selection
  set path-selection multipath advertise
  set path-selection backup 1 install multipath-protect advertise multipath-protect-advertise
end-policy
!
```

IGP 메트릭(모든 링크에서 비용이 동일함)이 변경되기 전에

```
RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
 Process           bRIB/RIB  SendTblVer
 Speaker                 10          10
Last Modified: Sep 18 09:08:42.907 for 05:26:53
Paths: (5 available, best #1)
 Advertised to update-groups (with more than one peer):
   0.3
 Advertised to peers (in unique update groups):
   10.0.0.5
```

```
  Path #1: Received by speaker 0
 Advertised to update-groups (with more than one peer):
   0.3
 Advertised to peers (in unique update groups):
   10.0.0.5
 Local, (Received from a RR-client)
   10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, multipath,
import-candidate, imported
     Received Path ID 0, Local Path ID 1, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
  Path #2: Received by speaker 0
 Advertised to peers (in unique update groups):
   10.0.0.5         10.0.0.6
 Local, (Received from a RR-client)
   10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, multipath, backup, add-path,
import-candidate, imported
     Received Path ID 0, Local Path ID 2, version 10
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
  Path #3: Received by speaker 0
 Advertised to peers (in unique update groups):
   10.0.0.5         10.0.0.6
 Local, (Received from a RR-client)
   10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, multipath, add-path, import-
candidate, imported
     Received Path ID 0, Local Path ID 4, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
  Path #4: Received by speaker 0
 Advertised to peers (in unique update groups):
   10.0.0.5         10.0.0.6
 Local, (Received from a RR-client)
   10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4)
     Received Label 24013
     Origin incomplete, metric 0, localpref 100, valid, internal, backup(protect multipath),
add-path, import-candidate, imported
     Received Path ID 0, Local Path ID 5, version 7
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
  Path #5: Received by speaker 0
 Not advertised to any peer
 Local, (Received from a RR-client)
   10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5)
     Received Label 24014
     Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
     Received Path ID 1, Local Path ID 0, version 0
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

IGP 메트릭이 변경된 후:

```
RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32 age-order

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
 Process           bRIB/RIB  SendTblVer
```

```
 Speaker                    14          14
    Flags: 0x2486b2b2+0x00010000; multipath; backup available;
Last Modified: Sep 18 16:09:45.907 for 00:01:10
Paths: (5 available, best #2)
 Advertised to update-groups (with more than one peer):
    0.3
 Path #1: Received by speaker 0
 Flags: 0x2000000084020205, import: 0x94
 Not advertised to any peer
 Local, (Received from a RR-client)
    10.0.0.1 (metric 6) from 10.0.0.1 (10.0.0.1), if-handle 0x00000000
      Received Label 24012
      Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
      Received Path ID 1, Local Path ID 0, version 0
      Extended community: RT:65000:1
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #2: Received by speaker 0
 Flags: 0x2000000085070205, import: 0x9f
 Advertised to update-groups (with more than one peer):
    0.3
 Local, (Received from a RR-client)
    10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5), if-handle 0x00000000
      Received Label 24014
      Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, multipath,
import-candidate, imported
      Received Path ID 1, Local Path ID 1, version 11
      Extended community: RT:65000:1
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #3: Received by speaker 0
 Flags: 0x2000000084060205, import: 0x94
 Advertised to update-groups (with more than one peer):
    0.3
 Advertised to peers (in unique update groups):
    10.0.0.6
 Local, (Received from a RR-client)
    10.0.0.2 (metric 5) from 10.0.0.2 (10.0.0.2), if-handle 0x00000000
      Received Label 24012
      Origin incomplete, metric 0, localpref 100, valid, internal, backup(protect multipath),
add-path, import-candidate, imported
      Received Path ID 1, Local Path ID 3, version 10
      Extended community: RT:65000:1
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #4: Received by speaker 0
 Flags: 0x2000000084070205, import: 0xd4
 Advertised to update-groups (with more than one peer):
    0.3
 Advertised to peers (in unique update groups):
    10.0.0.6
 Local, (Received from a RR-client)
    10.0.0.4 (metric 3) from 10.0.0.4 (10.0.0.4), if-handle 0x00000000
      Received Label 24013
      Origin incomplete, metric 0, localpref 100, valid, internal, multipath, backup, add-path,
import-candidate, imported
      Received Path ID 1, Local Path ID 5, version 14
      Extended community: RT:65000:1
      Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #5: Received by speaker 0
 Flags: 0x2000000084070205, import: 0x94
 Advertised to update-groups (with more than one peer):
    0.3
 Advertised to peers (in unique update groups):
    10.0.0.6
 Local, (Received from a RR-client)
    10.0.0.3 (metric 4) from 10.0.0.3 (10.0.0.3), if-handle 0x00000000
```

```
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, multipath, add-path, import-
candidate, imported
     Received Path ID 1, Local Path ID 4, version 10
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

- 이제 가장 좋은 경로는 낮은 IGP 메트릭(메트릭 2)으로 인해 10.0.0.5의 경로입니다.
- 이제 백업 경로는 두 번째로 좋은 IGP 메트릭인 10.0.0.4(메트릭 3)의 경로를 사용하는 경로입니다.
- 최적의 경로 및 백업 경로는 다중 경로이므로 하나의 다중 경로 경로를 선택해야 합니다. 10.0.0.3(메트릭 4)의 경로입니다.
- backup(protect multipath) 경로는 10.0.0.2(metric 5)의 경로입니다.
- 마지막으로 10.0.0.1(메트릭 6)의 경로는 최악의 메트릭을 가지므로 전혀 표시되지 않습니다.