

Configuratie en controleer de selectie van het BGP Pad in IOS-XR

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Inleiding

Dit document beschrijft de **ingestelde pad-selectie** verklaring in een routebeleid voor Border Gateway Protocol (BGP) binnen Cisco IOS®-XR.

Achtergrondinformatie

Veel ontwerpen zijn erop gericht om BGP meerdere paden te laten selecteren en bekendmaken voor één prefix.

Standaard wordt slechts één BGP-pad als het beste pad geselecteerd en wordt alleen dit beste pad geadverteerd. Het BGP-algoritme voor selectie van beste pad beslist hierover:

[BGP-algoritme voor selectie van het beste pad](#)

Naast het beste pad kan een tweede-best pad worden gekozen als back-uppad. Dit reservepad kan in ontwerpen met BGP PIC (Prefix Onafhankelijke Convergentie) worden gebruikt.

BGP kan meerdere paden installeren om taakverdeling te bereiken. Dit kan zijn: Edge Multipath-belasting (ECMP) of ongelijke kosten-multipath (UCMP). Deze multipath wordt geïnstalleerd in de routingtabel (RIB) en in de tabel Data plane of FIB (Forwarding Instance Base) om een taakverdeling te bereiken. De FIB-tabel is ook bekend als de CEF-tabel (Cisco Express Forwarding).

Dit artikel richt zich op twee doelen:

- Hoe zorgt u ervoor dat BGP meerdere paden kiest die moeten worden geïnstalleerd?
- Hoe krijgen we BGP om meerdere paden aan te geven?

Een andere functie die wordt gebruikt door BGP is Aanvullende paden (ADD-paden). Met deze functie kan BGP meerdere paden per BGP-sessie adverteren.

Samenvatting

- Het beste pad wordt altijd door BGP gekozen. Zo niet, dan is er iets mis. Dit artikel heeft geen betrekking op deze scenario's.
- Er kan een reservepad worden gekozen als de specifieke optie is ingesteld (bijvoorbeeld BGP PIC).
- Een route-beleid kan onder een specifieke adresfamilie voor BGP worden ingesteld om de te installeren en/of geadverteerde paden te selecteren.
- Vóór Cisco IOS®-XR 7.3.1 is er ondersteuning voor slechts één **set pad-selectie** verklaring in het route-beleid voor het selecteren van paden voor een specifiek voorvoegsel.
- Om met Cisco IOS®-XR 7.3.1 te beginnen, is er steun voor meerdere **set pad-selectie** verklaringen in het route-beleid voor het selecteren van paden voor een specifiek voorvoegsel.
- Om met Cisco IOS®-XR 7.3.1 te beginnen, werd een eigenschap toegevoegd waar een route-beleid kan worden gebruikt om specifieke paden voor een BGP prefix aan één BGP buurman te adverteren.

De selectie van multipath paden door BGP wordt uitgevoerd in volgorde van ontvangst van de paden. De opdrachten **bgp** van de **show** tonen echter de BGP-paden in lexicografische volgorde.

Een nieuwe opdracht - geïntroduceerd in Cisco IOS®-XR 7.3.1 - kan worden gebruikt om de BGP paden te zien in de volgorde waarin ze werden ontvangen:

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

Dit helpt de verificatie en probleemoplossing van multipath. Hiermee wordt de belangrijkste vraag opgelost waarom een pad is gekozen als een multipath en niet als een ander.

Een pad dat meerdere pad beschermt is een reservepad dat geen multipath is maar alle andere multipath paden beschermt.

Om te beginnen met Cisco IOS®-XR 7.3.1, is er deze nieuwe sleutelwoord **multipath-protection-advertentie** voor de **ingestelde pad-selectie** verklaring. Het kan worden gebruikt om het multi-path-security pad **naast het back-uppad** of **langs de multipath paden** aan te geven. De volledige opdrachten die in het routebeleid moeten worden gebruikt zijn:

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

Dit is een overzicht van de **set pad-selectie** opdracht met al zijn sleutelwoordcombinaties. Een gedetailleerdere uitleg en voorbeelden worden gevonden in de volgende sectie.

In alle onderstaande gevallen is het beste pad geïnstalleerd. Als dit niet het geval is, is er iets mis (de volgende hop is bijvoorbeeld ongeldig), maar dit heeft niets te maken met de opdracht **pad-selectie**.

Om het reservepad te kunnen selecteren moet een optie voor BGP worden ingeschakeld waarmee een BGP back-uppad kan worden geselecteerd: Bijvoorbeeld BGP PIC.

Multipath paden zijn in BGP ingeschakeld door **maximum-paden** van de adresfamilie:

```
maximum-paths {ebgp | eibgp | ibgp} <2-32> (unequal-cost)
```

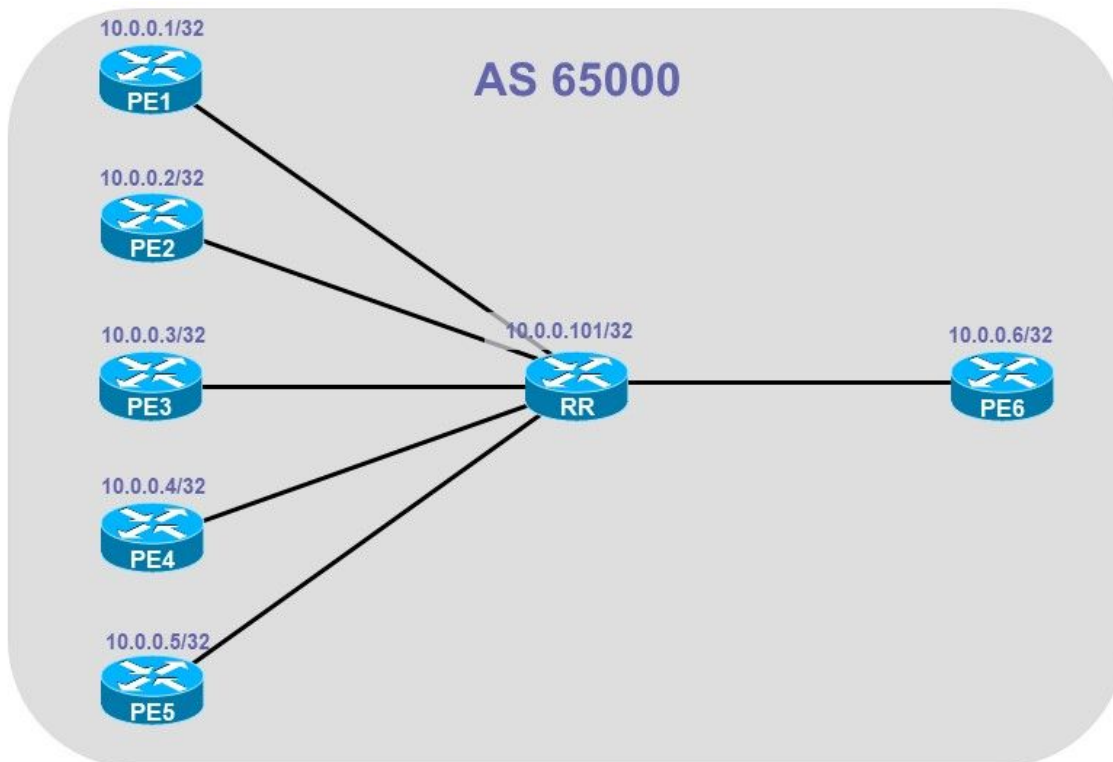
Per definitie is het beste pad een multipath. Het beste pad is het enige pad dat in de routingtabel is geïnstalleerd indien multipath voor BGP niet is ingeschakeld. U kunt controleren hoeveel PHP paden in de routingtabel met de **maximum-paden {ebgp van het bevel geïnstalleerd zijn | eibgp | ibgp} <2-32> (ongelijke kosten)**.

Deze tabel geeft een overzicht van alle opties met de opdracht **pad-selectie**. Voor meer details en voorbeelden, zie de volgende paragraaf voor elk van de hier gepresenteerde gevallen.

Case	Opdracht	Installeren	ADVIEZEN
1	back-up voor maken van pad selecteren 1 installatie	1 back-uppad geïnstalleerd.	Alleen het beste pad geadverteerd.
2	reserve 1-advertenties instellen voor pad-selectie	Het reservepad is niet geïnstalleerd.	Het reservepad wordt geadverteerd.
3	reserve 1-advertenties instellen voor pad-selectie	Het reservepad is geïnstalleerd.	Het reservepad wordt geadverteerd.
4	pad selectie alle advertenties instellen	Het reservepad is niet geïnstalleerd. De multipath-paden zijn geïnstalleerd.	Alle paden worden geadverteerd (beste pad, reservepad, multipath niet-multipath).
5	pad instellen	De multipath-paden zijn geïnstalleerd.	Alleen het beste pad geadverteerd.
6	pad-selectie multipath-advertenties instellen	De multipath-paden zijn geïnstalleerd.	De multipath-paden worden geadverteerd.

7	reserve pad selectie 1 installeren multipath-beveiliging	De multipath-paden zijn geïnstalleerd. Een ander pad is geïnstalleerd als backuppad (het 'reservepad (bescherming multipath)' als er nog paden naast de multipath liggen.	Alleen het beste pad geadverteerd.
8	reserve pad selectie 1 installatie multipath-beschermde advertenties	De multipath-paden zijn geïnstalleerd. Een ander pad is geïnstalleerd als backuppad (het 'reservepad (bescherming multipath)' als er nog paden naast de multipath liggen.	Het beste pad en het reservepad worden geadverteerd. Het backup-pad (sec multipath) wordt niet geadverteerd.
9	Pad-selectie groepsbeste advertenties instellen	Group-best selectie is het beste pad per AS en ook per volgende hop. De multipath-paden zijn geïnstalleerd.	Alle group-best paden worden geadverteerd
10	reserve pad selectie 1 installatie multipath-beschermde advertenties met meerdere pad-beveiliging-advertenties	De multipath-paden zijn geïnstalleerd. Een ander pad is geïnstalleerd als backuppad (het 'reservepad (bescherming multipath)' als er nog paden naast de multipath liggen.	Het beste pad, het backuppad en het backup-pad (bescherm multipath) worden geadverteerd
11	pad-selectie multipath-advertenties instellen met multipath-bescherming	De multipath-paden zijn geïnstalleerd.	De multipath-paden worden geadverteerd Het backup-pad (sec multipath) wordt niet geadverteerd.
12	pad-selectie multipath-advertenties instellen met multipath-bescherming-beschermen advertenties	De multipath-paden zijn geïnstalleerd. Een ander pad is geïnstalleerd als backuppad (het 'reservepad (bescherming multipath)' als er nog paden naast de multipath liggen.	De multipath-paden worden geadverteerd Het backup-pad (sec multipath) wordt geadverteerd.

Dit is de topologie die door dit document wordt gebruikt.



In alle gevallen is ADD-PATH ingeschakeld tussen de RR (routerreflector) en PE6.

PE1, PE2, PE3, PE4, PE5 en PE6 adverteren met hetzelfde voorvoegsel als vpnv4-enastroute naar de RR.

PE6 is de ingang van PE, die dit voorvoegsel van de RR ontvangt.

Tenzij anders vermeld is ADD-PATH ingeschakeld op elke BGP-sessie en IPgp 3-paden is ingesteld op de RR voor adresfamilie vpnv4 unicast.

Opmerking: Er is maximaal één reservepad geïnstalleerd in de RIB- en CEF-tabellen. Meer dan één is niet mogelijk/ondersteund. Het pad wordt gemarkeerd als een back-up in de BGP-tabel, de RIB-tabel en de CEF-tabel.

De back-uproute wordt altijd door BGP gekozen in dit artikel. Een back-uproute kan worden gekozen door een andere optie, maar hier is het altijd BGP.

Als multipath is ingesteld voor BGP, kunnen er multipath (ECMP of UCMP)-paden zijn geïnstalleerd in de BGP-tabel. Ze worden gemarkeerd met **meerdere snijpad**. Het back-uppad is het op één na beste pad, dus indien er een is, zou het een van de multipath paden moeten zijn. Dit betekent dat er een reservekopie (bescherm multipath) kan zijn dat door BGP is gekozen als deze optie is geconfigureerd (het **multipath**-beschermings sleutelwoord in de **set path-selectie route-policy** statement). Als dit probleem zich voordoet, is dit **back-uppad (bescherming multipath)** het reservepad in de RIB- en CEF-tabel. Het **back-uppad** dat door BGP is gekozen en als zodanig door BGP is gemarkeerd, is dan geen reservepad, maar een multipath.

Een back-uproute op een RR heeft niet veel zin als die RR alleen de rol van een RR heeft.

In dit artikel wordt aangenomen dat de RR ook een PE-router is. In dat geval, selecteert en

installeert u een backup route. De back-uproute kan worden gebruikt voor BGP PIC.

Een back-uproute wordt gemarkeerd met **back-up** in het RIB als het specifieke prefix wordt gespecificeerd of met **!** als het prefix niet wordt gespecificeerd.

```
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
```

Pad-selectie-opdrachten in routebeleid instellen

Deze sectie beslaat alle **ingestelde pad-selectie** verklaringen die in het route-beleid voor de specifieke adresfamilie onder router BGP worden gebruikt.

Dit is onafhankelijk van de Cisco IOS®-XR versie is pre-of post-Cisco IOS®-XR 7.3.1.

Configuratie:

```
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
!
!
!

```

Het route-beleid met de set pad-selectie verklaringen wordt toegepast onder de adresfamilie vpv4 unicast.

Het route-beleid met de set pad-selectie verklaringen wordt ook toegepast op VRF. Dit is nodig als een reserveroute moet worden geïnstalleerd in de VRF RIB/CEF-tabel (of geadverteerd via de BGP-sessie via de PE-CE-link).

Op dit punt zijn beide routebeleidslijnen hetzelfde, maar er kunnen verschillende worden toegepast onder de adresfamilie versus de VRF.

Maximum-path *ibgp 3* wordt gebruikt onder VRF één, waarbij gespecificeerd wordt dat er maximaal drie ECMP-paden in de RIB/CEF-tabel kunnen zijn.

Deze gevallen tonen alle mogelijkheden voor het route-beleid met **vastgestelde pad-selectie**.

1. back-up voor maken van pad selecteren 1 installatie

```

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

```

```
RP/0/RP0/CPU0:RR#show bgp vpv4 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}

```

Controleer de geadverteerde paden:

```

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

```

Conclusie: Er is 1 reservepad geïnstalleerd op de RR in VRF. Alleen het beste pad wordt geadverteerd.

2. reserve 1-advertenties instellen voor pad-selectie

```

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}

Controleer de geadverteerde paden:

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

Conclusie: De back-uproute is niet geïnstalleerd. Het reservepad wordt geadverteerd.

3. reserve 1-advertenties instellen voor pad-selectie

```
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}

Controleer de geadverteerde paden:

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

```

Conclusie: De back-uproute is geïnstalleerd. Het reservepad wordt geadverteerd. Dit is 1. en 2.

4. pad selectie alle advertenties instellen

```

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}

```

Controleer de geadverteerde paden:

```
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
```

Conclusie: De back-proute is niet geïnstalleerd. Alle (5) paden worden geadverteerd.

5. pad instellen

```
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}

```

Conclusie: Alleen het beste pad en de meerdere paden worden geïnstalleerd. Alleen het beste pad wordt geadverteerd. Er is geen reservepad geselecteerd, geïnstalleerd of geadverteerd.

6. pad-selectie multipath-advertenties instellen

Adversiteit is een verplicht sleutelwoord.

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

Om dit te laten werken moet er een multipath zijn dat is ingeschakeld voor BGP voor de specifieke adresfamilie.

Hier is het multipath voor ipv4 unicast in VRF één ingeschakeld.

```
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}

```

Controleer de geadverteerde paden:

```
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
```

- De VPN4-paden zijn gemarkeerd met multipath.
- De 3 meerdere paden worden in het RIB geïnstalleerd.
- De 3 multipath-paden worden geadverteerd.
- Er is geen back-uppad.

Conclusie: Multipath-paden worden geïnstalleerd in de RIB en geadverteerd. Er is geen back-up geselecteerd, geïnstalleerd of geadverteerd.

7. reserve pad selectie 1 installeren multipath-beveiliging

```
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}

```

Controleer de geadverteerde paden:

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

Er is mogelijk geen **back-up-pad (bescherming multipath)**. Als er bijvoorbeeld **maximaal BGP-paden 2** zijn geconfigureerd en er slechts 2 paden worden ontvangen, dan zijn twee paden multipath en is er geen **back-up (beschermen multipath)** pad.

Conclusie: Alle multipath paden zijn geïnstalleerd in het RIB. Een ander pad is geïnstalleerd als back-uppad (het **reservepad (beschermen multipath)**). Alleen het beste pad wordt geadverteerd.

8. reserve pad selectie 1 installatie multipath-beschermd advertenties

```
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}
```

Controleer de geadverteerde paden:

```
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
```

- Er zijn drie multipath-paden.
- Er is één pad voor back-up (bescherming multipath). Dit is het geïnstalleerde back-uppad in de RIB/CEF-tabel.
- Het vijfde pad is niet gemarkeerd.
- Het beste pad en het reservepad worden geadverteerd.

Er is mogelijk geen **back-up-pad (bescherming multipath)**. Als er bijvoorbeeld **maximaal BGP-paden 2** zijn geconfigureerd en er slechts 2 paden worden ontvangen, dan zijn twee paden multipath en is er geen **back-up (beschermen multipath)** pad.

Dit geadverteerde back-uppad is een van de multipath paden (duidelijke back-up in de BGP-tabel).

Dit is met maximum paden ibgp 1:

```
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}

Controleer de geadverteerde paden:

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

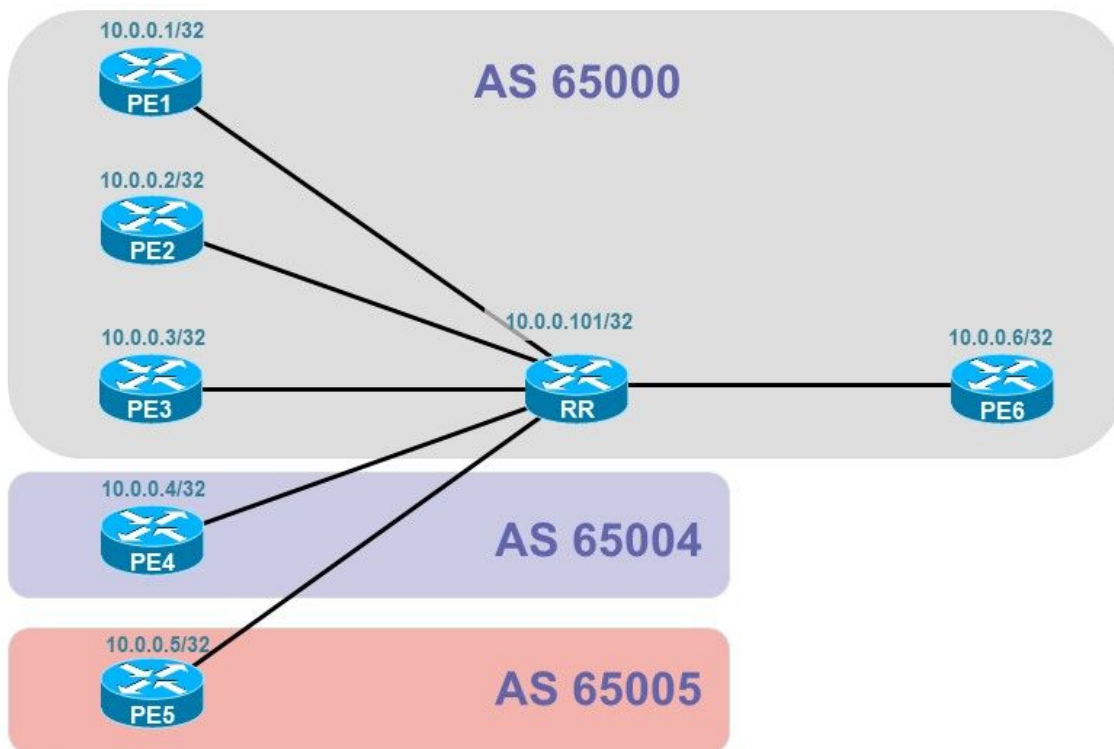
- Er is geen ECMP op RR.
- Het tweede beste pad is het back-uppad. Het wordt geïnstalleerd in de RIB/CEF-tabel.
- Het beste pad en backup pad worden geadverteerd.
- Er is geen **backup-pad (bescherm multipath)**.

Conclusie: Alle multipath paden zijn geïnstalleerd in het RIB. Een ander pad wordt als back-uppad geïnstalleerd. Het beste pad en het reservepad worden geadverteerd.

9. Pad-selectie groepsbeste advertenties instellen

- Groepsbestel kan alleen met **reclame** worden gebruikt.
- Group-best selectie is het beste pad per AS (Autonoom Systeem) en ook per volgende hop.
- Het prefix voortkomt uit verschillende autonome systemen.

Voor dit geval wordt een andere topologie gebruikt. De routers zijn hetzelfde als in afbeelding 1, maar PE4 is nu in AS 65004 en PE5 in AS 65005. Alle andere routers zijn nog steeds in AS 65000.



Afbeelding 2

Dit betekent dat er nu een eBGP-sessie is tussen de RR en PE4 en tussen de RR en PE5.

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

```
RP/0/RP0/CPU0:RR#show bgp vpv4 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}

De RR heeft nog drie ECMP-paden geïnstalleerd in de RIB- en CEF-tabel.

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

```

RR adverteert het groepsbeste pad uit de drie paden die van AS 65000 zijn ontvangen. Afgezien van dit pad, adverteert de RR ook het groepsbeste pad dat van AS 65004 is ontvangen en het pad van AS 65005.

Er zijn drie groepsbeste paden omdat de drie paden een ander buurland AS hebben. Al deze paden worden geadverteerd. De multipath-paden worden niet geadverteerd.

Conclusie: Alle group-best paden worden geadverteerd.

10. Stel een pad-selectie back-up in en installeer multi-path-beschermd advertenties met multipath-beveiliging

Deze optie is alleen beschikbaar vanaf Cisco IOS®-XR 7.3.1.

Om met Cisco IOS®-XR 7.3.1 te beginnen, is er een nieuwe sleutelwoord **multipath-protection-advertentie**.

Dit maakt het mogelijk om het **multi-path-security** pad naast het **back-up** pad te adverteren. Vóór Cisco IOS®-XR 7.3.1 is het **multi-path security** pad geïnstalleerd, maar niet geadverteerd. (Zie zaak 8.)

```

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}

```

Controleer de geadverteerde paden:

```
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
```

Conclusie: Alle multipath paden zijn geïnstalleerd in het RIB. Een ander pad - **back-up (bescherming multipath)** wordt als back-uppad geïnstalleerd. Het beste pad, het reservepad en het reservepad (**beschermt multipath**) worden geadverteerd.

11. pad-selectie multipath-advertenties instellen met multipath-beveiliging

Deze optie is alleen beschikbaar vanaf Cisco IOS®-XR 7.3.1.

```
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}

```

Controleer de geadverteerde paden:

```
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

- Het derde pad is het back-uppad. Het wordt gemarkeerd als back-up (bescherming tegen multipath) in BGP en als back-uppad in de RIB geïnstalleerd.
- Het beste pad en de multipath-paden worden geadverteerd.
- Het "backup-pad (bescherm multipath)"-pad wordt niet geadverteerd.

12. pad-selectie multipath-advertenties instellen met multipath-bescherming tegen multipath-security-advertenties

Dit maakt het mogelijk om het multi-path-security pad te installeren en geadverteerd naast de

multipath paden.

```
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}
```

Controleer de geadverteerde paden:

```
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

```

Conclusie:

- Alle 3 paden zijn gemarkeerd als multipath in BGP.
- 3 ECMP-paden worden geïnstalleerd in de RIB/CEF-tabel.
- Het tweede pad is het back-uppad. Als back-up gemarkeerd (bescherming tegen multipath) in BGP en als back-uppad geïnstalleerd in de RIB/CEF-tabel.
- Het beste pad, de meerdere paden en de 'backup(bescherm multipath)' paden worden geadverteerd.

Nieuw pad selectietraject vanaf Cisco IOS®-XR 7.3.1

Vanaf Cisco IOS®-XR 7.3.1 is dit veranderd:

- Per buurpad selectie is mogelijk. Voor Cisco IOS®-XR 7.3.1 was dit slechts per adresfamilie.
- De meerdere set pad-selectie verklaringen zijn toegestaan in één route-beleid.
- De BGP-paden kunnen worden weergegeven in de volgorde waarin ze worden ontvangen.

Per buurpad selectie mogelijk

Dit is de pad selectie beschikbaar in een route-beleid:

```
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
```

Het beste pad is de standaard.

Dit wordt ondersteund op het niveau van de adresfamilie.

Configuratievoorbeeld:

```
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
 !
 !
 !
```

Om met Cisco IOS®-XR 7.3.1 te beginnen, worden sommige opties van de padselectie in een route-beleid ook op het buurniveau ondersteund. Dit leidt tot een meer gedetailleerde controle op welke paden worden geadverteerd waaraan de BGP-buren zich houden. Als voorbeeld zou een spreker van BGP de beste weg en één reserveweg aan één BGP burcht kunnen adverteren, maar adverteer het multipath en beschermt het multipath aan een andere buur.

Op het niveau van de buurlanden:

```

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

```

Waarschuwing: Het beste pad is multipath als de BGP-opdracht **maximum-path** is ingesteld. Als echter de enige conditie die in het route-beleid is ingesteld **is multi-path**, worden alleen de multipath paden die niet het beste pad zijn, geadverteerd! Dit hangt af van het BGP-ontwerp, maar als de multipath-paden moeten worden geadverteerd, moet ook het beste pad worden geadverteerd.

De **is-all** en **is-multipath-protection** worden pas geïntroduceerd met Cisco IOS®-XR 7.3.1.

De meerdere set pad-selectie Statements zijn toegestaan in Eén routebeleid

Vanaf Cisco IOS®-XR 7.3.1 kunt u **meerdere pad-selectie** verklaringen hebben in één route-beleid gerelateerd aan één prefix. Vóór Cisco IOS®-XR 7.3.1 was dit niet toegestaan en zou dit leiden tot onvoorspelbaar BGP-padgedrag.

Per prefix wordt gekeken naar meer dan één pad selectie of niet.

Bijvoorbeeld, **vóór** Cisco IOS®-XR 7.3.1 wordt het volgende niet ondersteund:

```

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

```

U hebt twee **set pad-selectie** verklaringen in één route-beleid toegepast op dezelfde prefixes.

Echter, **vóór** Cisco IOS®-XR 7.3.1, wordt het volgende ondersteund. De reden is dat de verschillende pad selectie verklaringen zijn voor verschillende prefixes, omdat **als** statements met een selectie (bestemming, gemeenschap, ...) worden gebruikt.

Voorbeeld 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

```

Dit is goed aangezien de **set-path selectie** statements betrekking hebben tot verschillende prefixes (deze zijn in twee verschillende **if** statements).

Voorbeeld 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
```

Dit is goed omdat de geselecteerde pad selectie-statements betrekking hebben op verschillende prefixes (deze zijn in twee verschillende delen van de **if** statement).

Om te beginnen met Cisco IOS®-XR 7.3.1, wordt dit ondersteund.

Dit is een voorbeeld van een route-beleid met meer dan één **set pad-selectie** verklaring:

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

Het route-beleid per-buur specificeert welke paden aan die buur worden geadverteerd. Elk pad kan alleen worden gekozen uit de reeds gemarkeerde paden op het niveau van de adresfamilie.

Op het niveau van de adresfamilie, hebt u de volgende opties:

```
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
```

Op het niveau van de buurlanden:

```
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
```

Waarschuwing: Het beste pad is multipath als de BGP-opdracht **maximum-path** is ingesteld. Als echter de enige conditie die in het route-beleid is ingesteld is **multi-path**, worden alleen de multipath paden die niet het beste pad zijn, geadverteerd! Dit hangt af van het BGP-ontwerp, maar als de multipath-paden moeten worden geadverteerd, moet ook het beste pad worden geadverteerd.

De **is-all** en **is-multipath-protection** worden pas geïntroduceerd met Cisco IOS®-XR 7.3.1.

Met deze benadering kan het **markeren** van pad selectie een combinatie zijn van de opties voor padselectie die u hebt (bijvoorbeeld alle opties voor back-up, multipath, multipath-security enzovoort).

Het buurbeleid controleert de **advertentie** op basis van de selectieteken.

Voor het markering: U kunt bijvoorbeeld een back-up- en multipath hebben dat samen is geconfigureerd in het routebeleid op het niveau van de adresfamilie:

```
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
!
```

De twee hierboven gestelde pad-selectie verklaringen zijn wat nieuw ondersteund wordt om te beginnen met Cisco IOS®-XR 7.3.1. Met maximum-pad ibgp 3 nog in het voorbeeld ingesteld, hebt u deze:

- Hiermee kunnen het beste pad en alle multipath-paden worden geadverteerd.
- Hiermee kan het beste pad en de backup-pad worden geadverteerd (bescherming multipath).

Deze combinatie was niet mogelijk vóór Cisco IOS®-XR 7.3.1. Dit betekent dat of (1) of (2) van kracht zouden zijn.

Dit is het resultaat:

```
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}

```

Controleer de geadverteerde paden:

```
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

```

Het is nu mogelijk om aan één buurman de primaire (beste weg) en reservepaden te adverteren, gebaseerd op *is-best-pad* of *is-back-up-pad*.

Voor een andere buur, kan het multipath worden geadverteerd met **is-multi-path**.

Voorbeeld van buurroutebeleid (gebruikt met het routebeleid op het niveau van de adresfamilie):

```

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
!

```

Als de RR deze BGP-paden heeft:

```
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

```

Dan voor de eerste route van het buurroutebeleid:

```

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

```

Het buurland PE6 ontvangt deze paden:

```

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

```

Deze twee paden zijn het beste pad en het reservepad op RR.

Voor het tweede deel van het aangrenzende routebeleid, dat is:

```

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

```

Het buurland PE6 ontvangt deze paden:

```
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

```

Deze paden zijn het multipath-pad (maar **niet** het beste pad!) en het back-up-pad (beschermen multipath).

De BGP-paden tonen in de volgorde waarin ze zijn ontvangen

De BGP-paden worden in lexicografische volgorde weergegeven.

Een nieuwe opdracht - geïntroduceerd in Cisco IOS®-XR 7.3.1 - kan worden gebruikt om de BGP paden te zien in de volgorde waarin ze werden ontvangen:

```
show bgp <afi> rd <rd> <path_details> <age-order>
```

Deze opdracht is handig om in te zien waarom paden zijn gemarkeerd met meerdere paden. De eerder ontvangen paden zijn gemarkeerd met multipath en zijn in RIB geïnstalleerd als maximum-path routes. De opdracht route **tonen** toont het **BGP multi path** sleutelwoord voor de als dusdanig geïnstalleerde routes.

Om te verifiëren welk pad gemarkeerd is met multipath kan de nieuwe opdracht worden gebruikt om de volgorde te controleren waarin alle paden werden ontvangen. De nieuwere paden staan boven de uitvoer.

Bijvoorbeeld, met de volgende configuratie:

```

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

```

Er zijn geen veranderingen in het best-pad beslissingsproces en de paden hebben ook geen eigenschappen (zoals lokale voorkeur) die het best-pad beslissingsproces beïnvloeden.

RR heeft deze BGP-selectie:

```
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

```

Waarom is het pad vanaf 10.0.0.1 het beste pad? Waarom is het pad vanaf 10.0.0.2 het back-uppad? Waarom is het pad van 10.0.0.3 multipath? Waarom is het pad van 10.0.0.4 de back-up (beschermt multipath)? Waarom is het pad vanaf 10.0.0.5 niet het beste pad, niet multipath en niet het back-up- (security multipath) pad?

Je kunt dit zien met dezelfde opdracht met **leeftijdvolgorde** aan het einde. De nieuwere paden staan boven de uitvoer.

```
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

```

U kunt de opdrachten van de bgp van de show gebruiken met **bestpath** om te controleren waarom een pad niet het beste pad is (er wordt een reden per pad weergegeven).

```
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: 0x20000000084060205, 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: 0x20000000084020205, 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

```

Aangezien de meeste eigenschappen in de BGP-paden gelijk zijn tussen de paden, is de beslissing om het beste pad te kiezen gedaald naar de laagste router-ID van de BGP-luidspreker. Hier zie je de BGP-luidspreker 10.0.0.1. Het reservepad is het op een na beste pad en dus de op een na laagste router-ID van de BGP-luidspreker. Hier is dit 10.0.0.2.

De paden van 10.0.0.4 en 10.0.0.5 zijn geen multipath paden, omdat ze later dan de paden van 10.0.0.1, 10.0.0.2 en 10.0.0.3 zijn geïnstalleerd.

Back-up versus back-up (beschermend multipath)

```

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

Max. pad bgp 3 is ingesteld.

De back-up is de op één na beste route. Hier werden de meerdere pad paden ontvangen voor het reservepad. Er zijn dus drie multipath paden en een ander is een back-uppad.

```
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

Sluit de buurman 10.0.0.5. Nu heb je:

```
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

- Het pad vanaf 10.0.0.5 is verdwenen.
- Het pad van 10.0.0.2 is nog steeds back-up, maar het is nu ook multipath.
- Omdat het reservepad ook een multipath is, hebt u nu een back-up (bescherming multipath) pad. Dit is het pad vanaf 10.0.0.4.

Sluit de buurman 10.0.0.5:

```
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: 0x2000000084060205, 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

Er is niets veranderd in de 4 paden die al eerder waren geïnstalleerd. Alleen het pad vanaf 10.0.0.5 werd toegevoegd. Het staat aan de top omdat het nieuwer is. Het is geen multipath of een backup pad.

Het pad van 10.0.0.5 is veranderd van multipath in non-multipath nadat de staat het pad heeft veranderd!

Conclusie:

- De volgorde waarin paden worden ontvangen, speelt een rol in het bepalen van welke paden meerdere paden zijn.
- De volgorde waarin paden worden ontvangen, speelt een rol als er al dan niet een reservekopie (beschermt multipath) is.
- De volgorde waarin paden worden ontvangen, speelt geen rol in welke pad wordt gekozen als het beste pad of back-uppad.

Bestellen via IGP-metriek

Er is een optie om meerdere paden te bestellen per de metriek van het Protocol van de Gateway van het Binnenlandse Zaken (IGP).

```
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#
```

De ongelijke kosten zijn nodig zoals anders, dan eindig je met alleen het beste pad, een reservepad, maar geen multipath omdat multipath dezelfde IGP kosten nodig heeft om als multipath te worden beschouwd.

De IGP kosten van RR aan de PE routers worden in de topologie gewijzigd. De IGP-kosten zijn als volgt ingesteld:

- RR naar PE1: 5
- RR naar PE2: 4
- RR naar PE3: 3
- RR naar PE4: 2
- RR naar PE5: 1

Er zijn nog steeds deze:

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

Voordat de IGP metriek (de kosten zijn hetzelfde voor alle links) verandert:

```
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

```

Na de IGP metrische verandering:

```
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

```

- Het beste pad is nu het pad van 10.0.0.5 vanwege de lagere IGP metrische (metrische 2).
- Het reservepad is nu het pad met de op één na beste IGP metrische, het pad van 10.0.0.4 (metrisch 3).
- Het beste pad en reservepad zijn ook multipath, dus er moet nog één multipath worden gekozen. Dit is het pad van 10.0.0.3 (metrisch 4).
- Het backup-pad (security multipath) is het pad vanaf 10.0.0.2 (metriek 5).
- Ten slotte is het pad van 10.0.0.1 (metriek 6) helemaal niet gemarkeerd, omdat het de slechtste metriek heeft.