

BGP-Pfadauswahl in IOS-XR

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Einführung

In diesem Dokument wird die **set path-selection**-Anweisung in einer Routenrichtlinie für Border Gateway Protocol (BGP) in Cisco IOS®-XR beschrieben.

Hintergrundinformationen

Viele Designs streben an, dass BGP mehrere Pfade für ein Präfix auswählt und ankündigt.

Standardmäßig wird nur ein BGP-Pfad als bestmöglicher Pfad ausgewählt, und es wird nur dieser beste Pfad angekündigt. Der BGP-Algorithmus für die beste Pfadauswahl entscheidet:

[BGP – Algorithmus für die Auswahl des besten Pfads](#)

Neben dem besten Pfad kann ein zweitbesten Pfad als Backup-Pfad ausgewählt werden. Dieser Sicherungspfad kann in Designs mit BGP PIC (Prefix Independent Convergence) verwendet

werden.

Das BGP kann mehrere Pfade installieren, um einen Lastenausgleich zu erreichen. Dabei kann es sich um ECMP-Lastenausgleich (Equal Cost Multipath) oder UCMP (Unqual Cost Multipath) handeln. Diese Multipath-Routing-Tabellen (RIB) und die Daten- oder FIB-Tabelle (Forwarding Instance Base) werden installiert, um einen Lastenausgleich zu erreichen. Die FIB-Tabelle wird auch als CEF-Tabelle (Cisco Express Forwarding) bezeichnet.

Der Schwerpunkt dieses Artikels liegt auf zwei Zielen:

- Wie kann BGP mehrere Pfade für die Installation auswählen?
- Wie kann BGP mehrere Pfade ankündigen?

BGP verwendet außerdem zusätzliche Pfade (ADD-Pfade). Mit dieser Funktion kann BGP mehr als einen Pfad über eine BGP-Sitzung angeben.

Zusammenfassung

- Der beste Pfad wird immer vom BGP ausgewählt. Wenn nicht, ist etwas falsch. Dieser Artikel behandelt diese Szenarien nicht.
- Ein Sicherungspfad kann ausgewählt werden, wenn die jeweilige Funktion konfiguriert ist (z. B. BGP PIC).
- Eine Routing-Richtlinie kann unter einer bestimmten Adressfamilie konfiguriert werden, damit BGP die zu installierenden und/oder anzukündigenden Pfade auswählt.
- Vor Cisco IOS®-XR 7.3.1 wird nur eine **festgelegte Pfadauswahlweisung** in der Routenrichtlinie zur Auswahl von Pfaden für ein bestimmtes Präfix unterstützt.
- Zu Beginn mit Cisco IOS®-XR 7.3.1 werden mehrere **festgelegte Pfadauswahlweisungen** in der Routenrichtlinie zur Auswahl von Pfaden für ein bestimmtes Präfix unterstützt.
- Ab Cisco IOS®-XR 7.3.1 wurde eine Funktion hinzugefügt, mit der eine Routingrichtlinie verwendet werden kann, um einem BGP-Nachbarn bestimmte Pfade für ein BGP-Präfix anzukündigen.

Die Auswahl von Multipath-Pfaden durch BGP erfolgt in der Reihenfolge des Empfangs der Pfade. Die Befehle **show bgp** zeigen jedoch die BGP-Pfade in lexikografischer Reihenfolge an.

Mit einem neuen Befehl, der in Cisco IOS®-XR 7.3.1 eingeführt wurde, können die BGP-Pfade in der Reihenfolge angezeigt werden, in der sie empfangen wurden:

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

Dies erleichtert die Überprüfung und Fehlerbehebung von Multipath. Es löst die Hauptfrage, warum ein Pfad als Multipfad und nicht als ein anderer gewählt wird.

Ein Multipath-Protect-Pfad ist ein Backup-Pfad, der kein Multipath-Pfad ist, aber alle anderen Multipath-Pfade schützt.

Beginnend mit Cisco IOS®-XR 7.3.1 gibt es dieses neue Schlüsselwort **multipath-protect-notify** für die **set path-selection**-Anweisung. Sie kann verwendet werden, um den Multi-Path-geschützten

Pfad neben dem Backup-Pfad oder neben den Multipath-Pfaden anzukündigen. Die vollständigen Befehle, die in der Routingrichtlinie verwendet werden, sind:

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

Dies ist eine Übersicht über den Befehl **set path-selection** mit allen seinen Schlüsselwortkombinationen. Eine ausführlichere Erläuterung und Beispiele finden Sie im nächsten Abschnitt.

In allen folgenden Fällen wird der beste Pfad installiert. Ist dies nicht der Fall, ist irgendetwas falsch (z. B. der nächste Hop ist ungültig), aber dies bezieht sich nicht auf den Befehl **set path-selection**.

Damit der Sicherungspfad ausgewählt werden kann, muss für BGP eine Funktion aktiviert sein, die die Auswahl eines BGP-Sicherungspfads ermöglicht: z. B. BGP PIC.

Multipath-Pfade werden im BGP durch den Befehl **maximum-path** der Adressfamilie aktiviert:

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

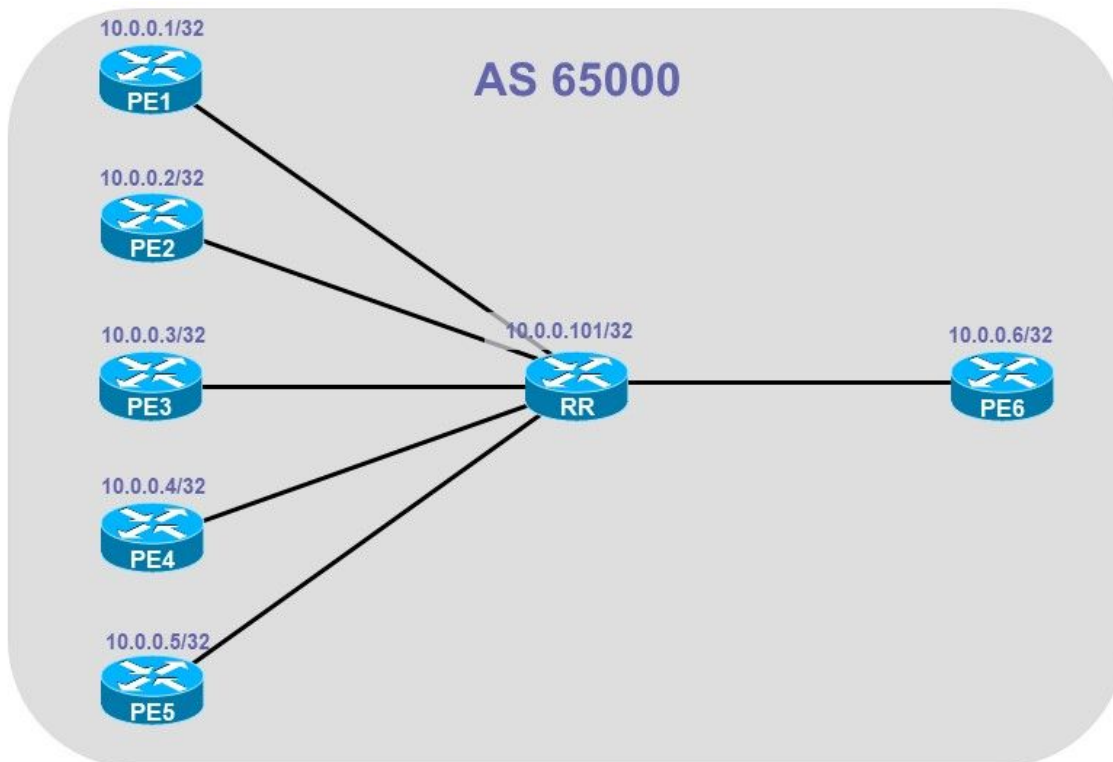
Der beste Pfad ist definitionsgemäß ein Multipath-Pfad. Der beste Pfad ist der einzige in der Routing-Tabelle installierte Pfad, wenn Multipath für BGP nicht aktiviert ist. Mit dem Befehl **maximum-path {ebgp}** können Sie steuern, wie viele BGP-Pfade in der Routing-Tabelle installiert sind. | **eibgp | ibgp} <2-32> (ungleiche Kosten)**.

Diese Tabelle bietet eine Übersicht über alle Optionen mit dem Befehl **set path-selection**. Weitere Details und Beispiele finden Sie im nächsten Abschnitt für jeden Fall, der hier vorgestellt wird.

Fall	Command	Installieren	Werbung
1	set path select backup 1 install	1 Backup-Pfad installiert.	Es wird nur der beste angegeben.
2	Festlegen von Pfad- Auswahl-Backup 1 kündigen	Der Sicherungspfad ist nicht installiert.	Der Sicherungspfad v angekündigt.
3	set path-selection backup 1 kündigt Installation an	Der Sicherungspfad ist installiert.	Der Sicherungspfad v angekündigt.
4	Pfadauswahl aller Anzeigen festlegen	Der Sicherungspfad ist nicht installiert. Die Multipath-Pfade werden installiert.	Alle Pfade werden angekündigt (bester P Sicherungspfad, Mult Non-Multipath-Pfad).
5	Festlegen des besten Pfads für die Pfadauswahl	Die Multipath-Pfade werden installiert.	Es wird nur der beste angegeben.
6	Einstellen von Pfadauswahl-Multipath- Werbung	Die Multipath-Pfade werden installiert.	Die Multipath-Pfade werden angekündigt.
7	set path-selection backup	Die Multipath-Pfade	Es wird nur der beste

		werden installiert. Ein anderer Pfad wird als Backup-Pfad installiert (der Pfad "backup(protect multipath)", wenn es immer noch Pfade neben den Multipath-Pfaden gibt.	
8	1 install multipath-protect set path-selection backup 1 install multipath-protect-andame	Die Multipath-Pfade werden installiert. Ein anderer Pfad wird als Backup-Pfad installiert (der Pfad "backup(protect multipath)", wenn es immer noch Pfade neben den Multipath-Pfaden gibt.	Der beste Pfad und d Sicherungspfad werd angekündigt. Der Backup-Pfad (Multipath schützen) v nicht angekündigt.
9	Festlegen von Pfad-Auswahl Gruppe Best Advertisement	Die Auswahl der besten Gruppen ist der beste Pfad pro AS und auch pro Next-Hop. Die Multipath-Pfade werden installiert.	Alle gruppenbesten P werden angekündigt.
10	set path-selection backup 1 install multipath-protect andood-protect multipath- protect-protect-inerate	Die Multipath-Pfade werden installiert. Ein anderer Pfad wird als Backup-Pfad installiert (der Pfad "backup(protect multipath)", wenn es immer noch Pfade neben den Multipath-Pfaden gibt.	Der beste Pfad, der Sicherungspfad und d Backup-Pfad (Protect multipath) werden angekündigt.
11	Einrichtung von Pfad-Auswahl Multipath kündigen Multipath-Schutz an	Die Multipath-Pfade werden installiert.	Die Multipath-Pfade werden angekündigt. Der Backup-Pfad (Multipath schützen) v nicht angekündigt.
12	Einrichtung von Pfad-Auswahl Multipath kündigen Multipath-Protect Multipath-Protect- Advertisement	Die Multipath-Pfade werden installiert. Ein anderer Pfad wird als Backup-Pfad installiert (der Pfad "backup(protect multipath)", wenn es immer noch Pfade neben den Multipath-Pfaden gibt.	Die Multipath-Pfade werden angekündigt. Der Pfad für die Siche (Multipath schützen) v angekündigt.

Dies ist die in diesem Dokument verwendete Topologie.



In allen Fällen ist ADD-PATH zwischen RR (Route-Reflector) und PE6 aktiviert.

PE1, PE2, PE3, PE4, PE5 und PE6 weisen alle dasselbe Präfix wie die Vpnv4-Unicast-Route zum RR aus.

PE6 ist der Eingangs-PE, der dieses Präfix vom RR erhält.

Sofern nicht anders angegeben, ist ADD-PATH für jede BGP-Sitzung aktiviert, und auf dem RR wird "maximum-path ibgp 3" für "address-family vpnv4 unicast" konfiguriert.

Hinweis: In den RIB- und CEF-Tabellen ist maximal ein Backup-Pfad installiert. Es ist nicht mehr als eine möglich/unterstützt. Der Pfad wird in der BGP-Tabelle, der RIB-Tabelle und der CEF-Tabelle als Backup markiert.

Die Backup-Route wird in diesem Artikel immer vom BGP gewählt. Eine Backup-Route kann von einer anderen Funktion ausgewählt werden, aber hier ist sie immer BGP.

Wenn Multipath für BGP konfiguriert ist, können in der BGP-Tabelle Multipath-Pfade (ECMP oder UCMP) installiert werden. Sie sind mit **Multipath** markiert. Der Sicherungspfad ist der zweitbeste Pfad, daher sollte er einer der Multipath-Pfade sein, falls vorhanden. Dies bedeutet, dass bei einer Konfiguration dieser Funktion (dem **Multipath-Protect**-Schlüsselwort in der **Anweisung set path-selection route-policy**) vom BGP eine Sicherung(Protect multipath) ausgewählt werden kann. In diesem Fall ist dieser **Backup-Pfad (Multipath schützen)** der Backup-Pfad in der RIB- und CEF-Tabelle. Der **Backup-Pfad**, der vom BGP ausgewählt und vom BGP als solcher gekennzeichnet wurde, ist dann kein Backup-Pfad, sondern lediglich ein Multipath-Pfad.

Eine Backup-Route auf einem RR ist nicht sinnvoll, wenn dieser RR nur die Rolle eines RR übernimmt.

In diesem Artikel wird davon ausgegangen, dass der RR auch ein PE-Router ist. In diesem Fall ist es sinnvoll, eine Backup-Route auszuwählen und zu installieren. Die Backup-Route könnte für BGP PIC verwendet werden.

Eine Backup-Route wird bei Angabe des jeweiligen Präfix mit **Backup** in der RIB markiert oder mit "!", wenn das Präfix nicht angegeben wird.

```
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
```

Festlegen von Pfadauswahlbefehlen in Routingrichtlinien

In diesem Abschnitt werden alle in der Routenrichtlinie für die spezifische Adressfamilie unter Router BGP verwendeten **Set-Path-Selektionsanweisungen** behandelt.

Dies gilt unabhängig von der Cisco IOS®-XR-Version vor oder nach Cisco IOS®-XR 7.3.1.

Konfiguration:

```
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
!
!
!

```

Die Routingrichtlinie mit den festgelegten Pfadauswahl-Anweisungen wird unter der address-family-VPNv4-Unicast angewendet.

Die Routingrichtlinie mit den Statements zur Pfadauswahl wird auch auf die VRF-Instanz angewendet. Dies ist erforderlich, wenn eine Backup-Route in der VRF-RIB/CEF-Tabelle installiert (oder über die PE-CE-Verbindung über die BGP-Sitzung angekündigt) werden muss.

Hier sind beide Routenrichtlinien identisch, aber unter der Adressfamilie können verschiedene Richtlinien angewendet werden, im Gegensatz zur VRF-Instanz.

Maximum-path *ibgp 3* wird unter VRF one verwendet, wobei angegeben wird, dass in der RIB/CEF-Tabelle bis zu drei ECMP-Pfade vorhanden sein können.

Diese Fälle zeigen alle Möglichkeiten für die Routenrichtlinie mit **festgelegter Pfadauswahl**.

1. set path select backup 1 install

```

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

```

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

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

```
Versions:
```

```

Process          bRIB/RIB  SendTblVer
Speaker          5         5

```

```
Last Modified: Sep 17 13:14:35.907 for 00:04:41
```

```
Paths: (5 available, best #1)
```

```
Advertised to update-groups (with more than one peer):
```

```
0.2 0.3
```

```
Path #1: Received by speaker 0
```

```
Advertised to update-groups (with more than one peer):
```

```
0.2 0.3
```

```
Local, (Received from a RR-client)
```

```
10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1)
```

```
Received Label 24012
```

```
Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, multipath,
```

```
import-candidate, imported
```

```
Received Path ID 0, Local Path ID 1, version 5
```

```
Extended community: RT:65000:1
```

```
Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

```
Path #2: Received by speaker 0
```

```
Not advertised to any peer
```

```
Local, (Received from a RR-client)
```

```
10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2)
```



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

```
RP/0/RP0/CPU0:RR#show route vrf one 10.1.1.1/32
```

```
Routing entry for 10.1.1.1/32
```

```
Known via "bgp 65000", distance 200, metric 0
```

```
Number of pic paths 1 , type internal
```

```
Installed Sep 17 13:25:25.064 for 00:03:27
```

```
Routing Descriptor Blocks
```

```
  10.0.0.1, from 10.0.0.1, BGP multi path
```

```
    Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
```

```
    Route metric is 0
```

```
  10.0.0.2, from 10.0.0.2, BGP backup path
```

```
    Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
```

```
    Route metric is 0
```

```
  10.0.0.3, from 10.0.0.3, BGP multi path
```

```
    Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
```

```
    Route metric is 0
```

```
  10.0.0.4, from 10.0.0.4, BGP multi path
```

```
    Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
```

```
    Route metric is 0
```

```
No advertising protos.
```

```
RP/0/RP0/CPU0:RR#show cef vrf one 10.1.1.1/32
```

```
10.1.1.1/32, version 119, internal 0x5000001 0x30 (ptr 0xd96a770) [1], 0x0 (0xe3662a8), 0xa08 (0xf4e10a8)
```

```
Updated Sep 17 13:25:25.068
```

```
Prefix Len 32, traffic index 0, precedence n/a, priority 3
```

```
via 10.0.0.1/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
```

```
path-idx 0 NHID 0x0 [0xdab2bc0 0x0], Internal 0xd6a2730
```

```
recursion-via-/32
```

```

next hop VRF - 'default', table - 0xe0000000
next hop 10.0.0.1/32 via 24003/0/21
  next hop 10.1.101.1/32 Gi0/0/0/0    labels imposed {ImplNull 24012}
via 10.0.0.2/32, 2 dependencies, recursive, backup [flags 0x6100]
  path-idx 1 NHID 0x0 [0xdab2e48 0x0]
  recursion-via-/32
next hop VRF - 'default', table - 0xe0000000
next hop 10.0.0.2/32 via 24001/0/21
  next hop 10.2.101.2/32 Gi0/0/0/4    labels imposed {ImplNull 24012}
via 10.0.0.3/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
  path-idx 2 NHID 0x0 [0xdab2060 0x0], Internal 0xd6a2550
  recursion-via-/32
next hop VRF - 'default', table - 0xe0000000
next hop 10.0.0.3/32 via 24007/0/21
  next hop 10.3.101.3/32 Gi0/0/0/6    labels imposed {ImplNull 24012}
via 10.0.0.4/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
  path-idx 3 NHID 0x0 [0xdab2c98 0x0], Internal 0xd6a2190
  recursion-via-/32
next hop VRF - 'default', table - 0xe0000000
next hop 10.0.0.4/32 via 24000/0/21
  next hop 10.4.101.4/32 Gi0/0/0/7    labels imposed {ImplNull 24013}

```

Überprüfen Sie die angegebenen Pfade:

```

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

```

Fazit: Auf dem RR in der VRF-Instanz ist ein Sicherungspfad installiert. Es wird nur der beste Pfad angegeben.

2. Festlegen von Pfad-Auswahl-Backup 1 kündigen

```

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
Nextthop 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}
```

Überprüfen Sie die angegebenen Pfade:

```
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
```

Fazit: Die Backup-Route ist nicht installiert. Der Sicherungspfad wird angekündigt.

3. set path-selection backup 1 kündigt Installation an

```
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}
```

Überprüfen Sie die angegebenen Pfade:

```
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

Fazit: Die Backup-Route ist installiert. Der Sicherungspfad wird angekündigt. Das ist 1. und 2.

4. Pfadauswahl aller Anzeigen festlegen

```
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}

```

Überprüfen Sie die angegebenen Pfade:

```
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
```

Fazit: Die Backup-Route ist nicht installiert. Alle (5) Pfade werden angekündigt.

5. Festlegen des besten Pfads für die Pfadauswahl

```
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}
```

Fazit: Es werden nur der beste Pfad und die Multipath-Pfade installiert. Es wird nur der beste Pfad angegeben. Es ist kein Sicherungspfad ausgewählt, installiert oder angekündigt.

6. Einstellen von Pfadauswahl-Multipath-Werbung

Werbung ist ein Pflichtschlüsselwort.

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

Damit dies funktioniert, muss für BGP für die spezifische Adressfamilie Multipath aktiviert sein.

Hier ist der Multipath für ipv4-Unicast in VRF One aktiviert.

```
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}
```

Überprüfen Sie die angegebenen Pfade:

```
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
```

- Die vpnv4-Pfade sind mit Multipath markiert.
- Die drei Multipath-Pfade werden in der RIB installiert.
- Die drei Multipath-Pfade werden angekündigt.
- Es gibt keinen Sicherungspfad.

Fazit: Multipath-Pfade werden in der RIB installiert und angekündigt. Es ist kein Backup ausgewählt, installiert oder angekündigt.

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

```
route-policy BGP-Path-Selection
```

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

```
end-policy
```

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

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

Versions:

Process	bRIB/RIB	SendTblVer
Speaker	5	5

Last Modified: Sep 17 15:46:17.907 for 00:04:59

Paths: (5 available, best #1)

Advertised to update-groups (with more than one peer):

0.2 0.3

Path #1: Received by speaker 0

Advertised to update-groups (with more than one peer):

0.2 0.3

Local, (Received from a RR-client)

10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1)

Received Label 24012

Origin incomplete, metric 0, localpref 100, valid, internal, **best**, group-best, **multipath**, import-candidate, imported

Received Path ID 0, Local Path ID 1, version 5

Extended community: RT:65000:1

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

Path #2: Received by speaker 0

Not advertised to any peer

Local, (Received from a RR-client)

10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2)

Received Label 24012

Origin incomplete, metric 0, localpref 100, valid, internal, **multipath**, **backup**, add-path, import-candidate, imported

Received Path ID 0, Local Path ID 2, version 5

Extended community: RT:65000:1

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

Path #3: Received by speaker 0

Not advertised to any peer

Local, (Received from a RR-client)

10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3)

Received Label 24012

Origin incomplete, metric 0, localpref 100, valid, internal, **backup(protect multipath)**, add-path, import-candidate, imported

Received Path ID 0, Local Path ID 3, version 5

Extended community: RT:65000:1

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

Path #4: Received by speaker 0

Not advertised to any peer

Local, (Received from a RR-client)

10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4)

Received Label 24013

Origin incomplete, metric 0, localpref 100, valid, internal, **multipath**, import-candidate, imported

Received Path ID 0, Local Path ID 0, version 0

Extended community: RT:65000:1

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

Path #5: Received by speaker 0

Not advertised to any peer

Local, (Received from a RR-client)

10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5)

Received Label 24014

Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported

Received Path ID 1, Local Path ID 0, version 0

Extended community: RT:65000:1

Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1

RP/0/RP0/CPU0:RR#show route vrf one 10.1.1.1/32

```

Routing entry for 10.1.1.1/32
Known via "bgp 65000", distance 200, metric 0
Number of pic paths 1 , type internal
Installed Sep 17 15:46:17.904 for 00:05:14
Routing Descriptor Blocks
 10.0.0.1, from 10.0.0.1, BGP multi path
   Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
   Route metric is 0
 10.0.0.2, from 10.0.0.2, BGP multi path
   Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
   Route metric is 0
 10.0.0.3, from 10.0.0.3, BGP backup path
   Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
   Route metric is 0
 10.0.0.4, from 10.0.0.4, BGP multi path
   Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
   Route metric is 0
No advertising protos.

```

```

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

```

Überprüfen Sie die angegebenen Pfade:

```

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
```

Möglicherweise gibt es keinen **Backup-Pfad (Multipath schützen)**. Wenn beispielsweise **BGP-Pfade für maximal 2** konfiguriert sind und nur 2 Pfade empfangen werden, sind zwei Pfade Multipath und es gibt keinen **Backup-(Multipath schützen)** Pfad.

Fazit: Alle Multipath-Pfade werden in der RIB installiert. Ein anderer Pfad wird als Backup-Pfad installiert (der **Backup-Pfad (Multipath schützen)**). Es wird nur der beste Pfad angegeben.

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

```
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}

```

Überprüfen Sie die angegebenen Pfade:

```
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

- Es gibt drei Multipath-Pfade.
- Es gibt einen Backup-Pfad (MultiPath schützen). Dies ist der installierte Sicherungspfad in der RIB/CEF-Tabelle.
- Der fünfte Pfad ist nicht markiert.
- Der beste Pfad und der Sicherungspfad werden angekündigt.

Möglicherweise gibt es keinen **Backup-Pfad (MultiPath schützen)**. Wenn z. B. **BGP-Pfade 2** konfiguriert sind und nur zwei Pfade empfangen werden, sind zwei Pfade Multipath und es gibt keinen **Backup-Pfad (MultiPath schützen)**.

Dieser angekündigte Sicherungspfad ist einer der Multipfad-Pfade (in der BGP-Tabelle als Backup markiert).

Dies ist bei **ibgp 1** mit maximalen Pfaden:

```
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

Nextthop 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**

Nextthop 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}

Überprüfen Sie die angegebenen Pfade:

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

- Es gibt keinen ECMP auf RR.
- Der zweitbeste Pfad ist der Sicherungspfad. Sie wird in der RIB/CEF-Tabelle installiert.
- Der beste Pfad und der beste Sicherungspfad werden angegeben.

- Es gibt keinen **Backup-Pfad (Multipath schützen)**.

Fazit: Alle Multipath-Pfade werden in der RIB installiert. Ein anderer Pfad wird als Backup-Pfad installiert. Der beste Pfad und der Sicherungspfad werden angekündigt.

9. Festlegen von Pfad-Auswahl Gruppe Best Advertisement

- Gruppen-Best können nur mit **Werbung** verwendet werden.
- Die Auswahl der besten Gruppen ist der beste Pfad pro AS (Autonomous System) und auch pro Next-Hop.
- Das Präfix stammt von verschiedenen autonomen Systemen.

In diesem Fall wird eine andere Topologie verwendet. Router sind identisch mit Bild 1, PE4 ist jedoch jetzt in AS 65004 und PE5 in AS 65005. Alle anderen Router befinden sich weiterhin im AS 65000.

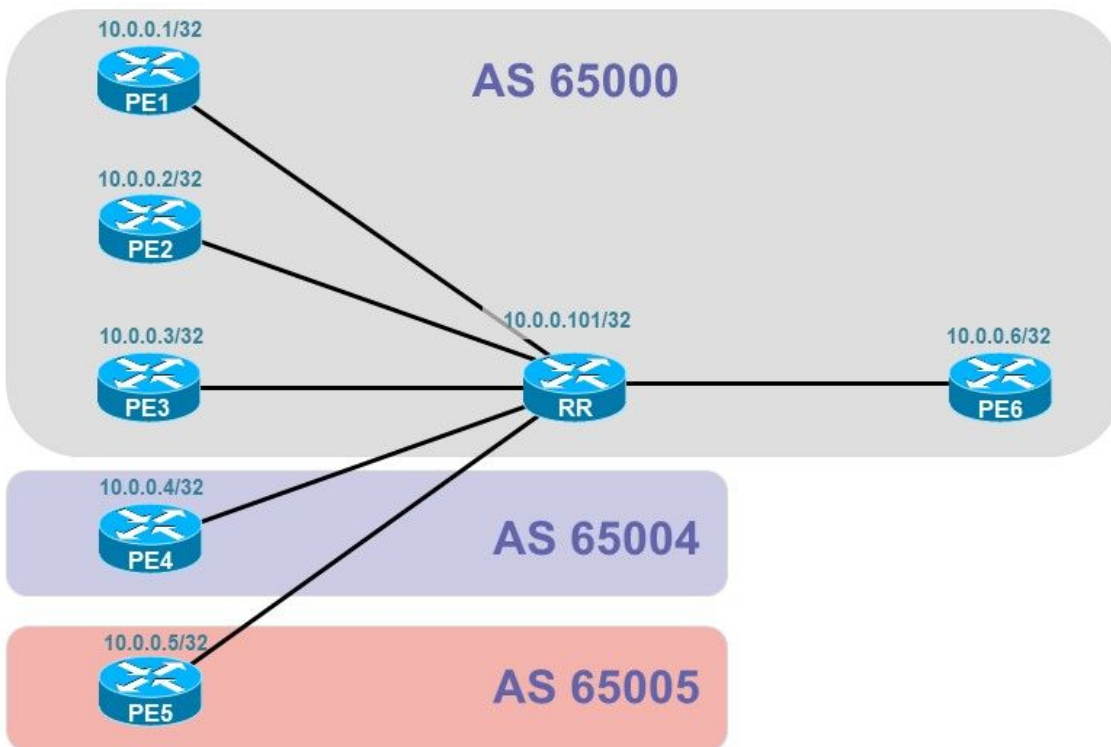


Bild 2

Dies bedeutet, dass nun eine eBGP-Sitzung zwischen RR und PE4 sowie zwischen RR und PE5 besteht.

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

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

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

```
Versions:
```

Process	bRIB/RIB	SendTblVer
Speaker	5	5

```
Local Label: 24010
```

```
Last Modified: Sep 21 06:06:29.117 for 00:02:18
```

```
Paths: (5 available, best #1)
Advertised to update-groups (with more than one peer):
  0.3 0.4
Path #1: Received by speaker 0
Advertised to update-groups (with more than one peer):
  0.3 0.4
Local, (Received from a RR-client)
  10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1)
    Received Label 24014
    Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, multipath,
import-candidate, imported
    Received Path ID 1, Local Path ID 1, version 5
    Extended community: RT:65000:1
    Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #2: Received by speaker 0
Not advertised to any peer
Local, (Received from a RR-client)
  10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2)
    Received Label 24014
    Origin incomplete, metric 0, localpref 100, valid, internal, multipath, import-candidate,
imported
    Received Path ID 1, Local Path ID 0, version 0
    Extended community: RT:65000:1
    Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #3: Received by speaker 0
Not advertised to any peer
Local, (Received from a RR-client)
  10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3)
    Received Label 24014
    Origin incomplete, metric 0, localpref 100, valid, internal, multipath, import-candidate,
imported
    Received Path ID 1, Local Path ID 0, version 0
    Extended community: RT:65000:1
    Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #4: Received by speaker 0
Advertised to update-groups (with more than one peer):
  0.4
65004
  10.4.101.4 from 10.4.101.4 (10.0.0.4)
    Received Label 24015
    Origin incomplete, metric 0, localpref 100, valid, external, group-best, add-path, import-
candidate, imported
    Received Path ID 0, Local Path ID 2, version 5
    Extended community: RT:65000:1
    Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #5: Received by speaker 0
Advertised to update-groups (with more than one peer):
  0.4
65005
  10.5.101.5 from 10.5.101.5 (10.0.0.5)
    Received Label 24014
    Origin incomplete, metric 0, localpref 100, valid, external, group-best, add-path, import-
candidate, imported
    Received Path ID 0, Local Path ID 3, version 5
    Extended community: RT:65000:1
    Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
```

```
RP/0/RP0/CPU0:RR#show route vrf one 10.1.1.1/32
```

```
Routing entry for 10.1.1.1/32
```

```
Known via "bgp 65000", distance 200, metric 0, type internal
```

```
Installed Sep 20 19:59:07.762 for 10:00:40
```

```
Routing Descriptor Blocks
```

```
  10.0.0.1, from 10.0.0.1, BGP multi path
```

```

    Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
    Route metric is 0
10.0.0.2, from 10.0.0.2, BGP multi path
    Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
    Route metric is 0
10.0.0.3, from 10.0.0.3, BGP multi path
    Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id: 0xe0000000
    Route metric is 0
No advertising protos.

```

RP/0/RP0/CPU0:RR#show cef vrf one 10.1.1.1/32

10.1.1.1/32, version 114, internal 0x1000001 0x30 (ptr 0xd96a338) [1], 0x0 (0xe366530), 0xa08 (0xf69e0a8)

Updated Sep 20 19:59:07.765

```

Prefix Len 32, traffic index 0, precedence n/a, priority 3
via 10.0.0.1/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
  path-idx 0 NHID 0x0 [0xdab1b98 0x0]
  recursion-via-/32
  next hop VRF - 'default', table - 0xe0000000
  next hop 10.0.0.1/32 via 24008/0/21
  local label 24010
  next hop 10.1.101.1/32 Gi0/0/0/0 labels imposed {ImplNull 24014}
via 10.0.0.2/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
  path-idx 1 NHID 0x0 [0xdab30d0 0x0]
  recursion-via-/32
  next hop VRF - 'default', table - 0xe0000000
  next hop 10.0.0.2/32 via 24000/0/21
  local label 24010
  next hop 10.2.101.2/32 Gi0/0/0/4 labels imposed {ImplNull 24014}
via 10.0.0.3/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
  path-idx 2 NHID 0x0 [0xdab2918 0x0]
  recursion-via-/32
  next hop VRF - 'default', table - 0xe0000000
  next hop 10.0.0.3/32 via 24002/0/21
  local label 24010
  next hop 10.3.101.3/32 Gi0/0/0/6 labels imposed {ImplNull 24014}

```

Der RR verfügt weiterhin über drei ECMP-Pfade in der RIB- und CEF-Tabelle.

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 kündigt den besten Pfad der Gruppe aus den drei Pfaden an, die vom AS 65000 empfangen wurden. Neben diesem Pfad gibt der RR auch den gruppenbesten Pfad an, der von AS 65004 und dem von AS 65005 empfangen wurde.

Es gibt drei Gruppen-beste Pfade, da die drei Pfade ein anderes Nachbarn-AS haben. Alle diese Pfade werden angekündigt. Die Multipath-Pfade werden nicht angekündigt.

Fazit: Alle gruppenbesten Pfade werden angekündigt.

10. set path-selection backup 1 install multipath-protect andood-protect multipath-protect-protect-inserate

Diese Option ist nur ab Cisco IOS®-XR 7.3.1 verfügbar.

Zu Beginn von Cisco IOS®-XR 7.3.1 gibt es ein neues Schlüsselwort **multipath-protect-inserse**.

Dadurch kann der **Multi-Path-Protect-Pfad neben dem Backup-Pfad** angekündigt werden. Vor Cisco IOS®-XR 7.3.1 wurde der **Multi-Path-Protect-Pfad** installiert, aber nicht angekündigt. (Siehe Fall 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}
```

Überprüfen Sie die angegebenen Pfade:

```
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

```

Fazit: Alle Multipath-Pfade werden in der RIB installiert. Ein anderer Pfad - **backup(protect multipath) Pfad** - wird als Backup-Pfad installiert. Der beste Pfad, der Sicherungspfad und der Sicherungspfad (**Multipath schützen**) werden angekündigt.

11. Einrichtung von Pfad-Auswahl Multipath kündigen Multipath-Schutz an

Diese Option ist nur ab Cisco IOS®-XR 7.3.1 verfügbar.

```

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 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}

```

Überprüfen Sie die angegebenen Pfade:

```
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

- Der dritte Pfad ist der Sicherungspfad. Er wird im BGP als Backup(protect multipath) markiert und als Backup-Pfad in der RIB installiert.
- Der beste Pfad und die Multipath-Pfade werden angekündigt.
- Der Pfad "backup(protect multipath)" wird nicht angekündigt.

12. Einrichtung von Pfad-Auswahl Multipath kündigen Multipath-Protect Multipath-Protect-Advertisement

Auf diese Weise kann der Multi-Path-Protect-Pfad installiert und neben den Multipath-Pfaden angekündigt werden.

```
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}
```


Überprüfen Sie die angegebenen Pfade:

```
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
```

Fazit:

- Alle drei Pfade sind im BGP als Multipath markiert.
- In der RIB/CEF-Tabelle sind drei ECMP-Pfade installiert.
- Der zweite Pfad ist der Sicherungspfad. Als Backup (Protect Multipath) im BGP gekennzeichnet und als Backup-Pfad in der RIB/CEF-Tabelle installiert.
- Der beste Pfad und die Multipath-Pfade sowie die Pfade "backup(protect multipath)" werden angekündigt.

Neues Pfadauswahlverhalten von Cisco IOS®-XR 7.3.1

Seit Cisco IOS®-XR 7.3.1 hat sich Folgendes geändert:

- Die Pfadauswahl nach Nachbarn ist möglich. Vor Cisco IOS®-XR 7.3.1 war dies nur pro Adressfamilie möglich.
- Mehrere festgelegte Pfadauswahlweisungen sind in einer Routenrichtlinie zulässig.
- Die BGP-Pfade können in der Reihenfolge angezeigt werden, in der sie empfangen werden.

Per Neighbor-Pfadauswahl möglich

Dies ist die Pfadauswahl, die in einer Routenrichtlinie verfügbar ist:

```
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
```

Der **beste Pfad** ist der Standardwert.

Dies wird auf der Ebene der Adressfamilie unterstützt.

Konfigurationsbeispiel:

```
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
!
!
!
```

Zu Beginn mit Cisco IOS®-XR 7.3.1 werden einige Pfadauswahloptionen in einer Routenrichtlinie auch auf Nachbar-Ebene unterstützt. Dies führt zu einer präziseren Kontrolle, welche Pfade für

welche BGP-Nachbarn angekündigt werden. Beispielsweise kündigt ein BGP-Sprecher einem BGP-Nachbarn den besten Pfad und einen Backup-Pfad an, meldet aber den Multipath an und schützt den Multipath-Pfad vor einem anderen Nachbarn.

Auf Nachbarebene gibt es:

```
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
```

Warnung: Der beste Pfad ist Multipath, wenn der BGP-Befehl **maximum-path** konfiguriert ist. Wenn jedoch die einzige Bedingung, die in der Route-Policy konfiguriert ist, **Multipath ist**, werden nur die Multipath-Pfade angekündigt, die nicht der beste Pfad sind! Dies hängt vom BGP-Design ab, aber es ist wahrscheinlich, dass, wenn die Multipath-Pfade angekündigt werden, auch der beste Pfad angekündigt werden sollte.

Der **All-** und **Multipath-Schutz** sind neu in Cisco IOS®-XR 7.3.1 integriert.

Mehrere Pfadauswahlweisungen sind in einer Route-Policy zulässig.

Ab Cisco IOS®-XR 7.3.1 können Sie in einer Routingrichtlinie für ein Präfix **mehrere** Pfadauswahlweisungen festlegen. Vor Cisco IOS®-XR 7.3.1 war dies nicht zulässig und führte zu unvorhersehbarem BGP-Pfadverhalten.

Die Auswahl von mehr als einem Pfad wird pro Präfix überprüft.

Beispielsweise wird **vor** Cisco IOS®-XR 7.3.1 Folgendes nicht unterstützt:

```
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
```

Sie haben zwei **festgelegte Pfadauswahlweisungen** in einer Routingrichtlinie, die auf dieselben Präfixe angewendet werden.

Vor Cisco IOS®-XR 7.3.1 wird jedoch Folgendes unterstützt. Der Grund hierfür ist, dass die verschiedenen Pfadauswahlweisungen für verschiedene Präfixe gelten, da **wenn** Anweisungen mit einer Auswahl (Ziel, Community, ...) verwendet werden.

Beispiel 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

```

Dies ist gut, da sich die **set-path-Auswahlweisungen** auf verschiedene Präfixe beziehen (sie sind in zwei verschiedenen **if**-Anweisungen vorhanden).

Beispiel 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

```

Dies ist gut, da sich die Anweisungen zur Pfadauswahl auf verschiedene Präfixe beziehen (sie befinden sich in zwei verschiedenen Teilen der **if**-Anweisung).

Ab Cisco IOS®-XR 7.3.1 wird dies unterstützt.

Dies ist ein Beispiel für eine Routenrichtlinie mit mehr als einer **festgelegten Pfadauswahlweisung**:

```

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

```

Die Route-Policy für jeden Nachbarn legt fest, welche Pfade diesem Nachbarn angekündigt werden. Jeder Pfad kann nur aus den bereits markierten Pfaden auf der Ebene der Adressfamilie ausgewählt werden.

Auf der Ebene der Adressfamilie wird der Pfad ausgewählt:

```

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

```

Auf Nachbarebene gibt es:

```

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
```

Warnung: Der beste Pfad ist Multipath, wenn der BGP-Befehl **maximum-path** konfiguriert ist. Wenn jedoch die einzige Bedingung, die in der Route-Policy konfiguriert ist, **Multipath ist**, werden nur die Multipath-Pfade angekündigt, die nicht der beste Pfad sind! Dies hängt vom BGP-Design ab, aber es ist wahrscheinlich, dass, wenn die Multipath-Pfade angekündigt werden, auch der beste Pfad angekündigt werden sollte.

Der **All-** und **Multipath-Schutz** sind neu in Cisco IOS®-XR 7.3.1 integriert.

Bei diesem Ansatz kann die **Markierung** der Pfadauswahl eine Mischung der Pfadauswahlmodi sein, die Sie haben (z. B. alle, Backup-, Multipath-, Multipath-Protect- usw.).

Die Nachbarrichtlinie steuert die **Werbung** anhand der Pfadmarkierung.

Für den Markierungsteil: Beispielsweise können Backup und Multipath in der Routingrichtlinie auf der Ebene der Adressfamilie gemeinsam konfiguriert werden:

```
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
!
```

Die beiden obigen Pfadauswahlweisungen werden ab Cisco IOS®-XR 7.3.1 neu unterstützt. Auch wenn im Beispiel "maximum path ibgp 3" konfiguriert ist, gibt es Folgendes:

- Ermöglicht die Anzeige des besten Pfads und aller Multipath-Pfade.
- Ermöglicht die Anzeige des besten Pfads und des Sicherungspfads (Multipath schützen).

Diese Kombination war vor Cisco IOS®-XR 7.3.1 nicht möglich. Dies bedeutet, dass entweder (1) oder (2) in Kraft wäre.

Dies ist das Ergebnis:

```
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}

Überprüfen Sie die angegebenen Pfade:

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

```

Es ist jetzt möglich, einem Nachbarn den primären (besten Pfad) und Backup-Pfade anzukündigen, basierend auf *dem besten Pfad oder dem Backup-Pfad*.

Für einen anderen Nachbarn kann der Multipfad mit **is-multi-path** angekündigt werden.

Beispiel für eine benachbarte Routenrichtlinie (verwendet mit der Routingrichtlinie auf der Ebene der Adressfamilie):

```

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
!

```

Wenn der RR über folgende BGP-Pfade verfügt:

```

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

```

Dann für den ersten Pfad der Route-Policy des Nachbarn, d. h.:

```

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

```

Der Nachbar-PE6 erhält folgende Pfade:

```
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
```

Diese beiden Pfade sind der beste Pfad und der Sicherungspfad auf RR.

Für den zweiten Teil der Route-Policy für Nachbargeräte:

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

Der Nachbar-PE6 erhält folgende Pfade:

```
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

Diese Pfade sind die Multipath-Pfade (aber **nicht** den besten Pfad!) und der Backup-Pfad (Multipath schützen).

Anzeigen der BGP-Pfade in der Reihenfolge, in der sie empfangen wurden

Die BGP-Pfade werden in lexikografischer Reihenfolge angezeigt.

Mit einem neuen Befehl, der in Cisco IOS®-XR 7.3.1 eingeführt wurde, können die BGP-Pfade in der Reihenfolge angezeigt werden, in der sie empfangen wurden:

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

Dieser Befehl ist hilfreich, um zu sehen, warum Pfade als Multipath markiert wurden. Die zuvor empfangenen Pfade sind als Multipath markiert und werden im RIB als Maximum-Path-Routen installiert. Der Befehl **show route** zeigt das **BGP Multi-Path**-Schlüsselwort für die als solche installierten Routen.

Um zu überprüfen, welcher Pfad als multipath markiert ist, kann der neue Befehl verwendet werden, um die Reihenfolge zu überprüfen, in der alle Pfade empfangen wurden. Die neueren Pfade befinden sich oben in der Ausgabe.

Beispiel:

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

Es gibt keine Änderungen im Prozess für die Entscheidung für den besten Pfad, und die Pfade haben keine Attribute (z. B. lokale Präferenz), die den Entscheidungsprozess für den besten Pfad beeinflussen.

Der RR hat die folgende BGP-Pfadauswahl:

```
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

Warum ist der Pfad von 10.0.0.1 der beste Weg? Warum ist der Pfad von 10.0.0.2 der Sicherungspfad? Warum ist der Pfad von 10.0.0.3 Multipath? Warum ist der Pfad von 10.0.0.4 die Sicherung (Multipath schützen)? Warum ist der Pfad von 10.0.0.5, nicht der beste Pfad, nicht der Multipath, und nicht der Backup-Pfad (Multipath schützen)?

Sie können dies mit demselben Befehl am Ende mit der **Änderungsreihenfolge** sehen. Die neueren Pfade befinden sich oben in der Ausgabe.

```
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

```

Sie können die Befehle `show bgp` mit dem Schlüsselwort **bestpath-vergleichen** verwenden, um zu überprüfen, warum ein Pfad nicht der beste Pfad ist (ein Grund wird pro Pfad angezeigt).

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

```

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
Process          bRIB/RIB  SendTblVer
Speaker          5         5
  Flags: 0x240692b2+0x00010000; multipath; backup available;
Last Modified: Sep 18 07:31:07.907 for 00:44:59
Paths: (5 available, best #1)
Advertised to update-groups (with more than one peer):
 0.3
Advertised to peers (in unique update groups):
 10.0.0.5
Path #1: Received by speaker 0
Flags: 0x2000000085070205, import: 0x9f
Advertised to update-groups (with more than one peer):
 0.3
Advertised to peers (in unique update groups):
 10.0.0.5
Local, (Received from a RR-client)
 10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1), if-handle 0x00000000
  Received Label 24012
  Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, multipath,
import-candidate, imported
  Received Path ID 0, Local Path ID 1, version 5
  Extended community: RT:65000:1
  best of local AS, Overall best
  Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
Path #2: Received by speaker 0
Flags: 0x2000000084070205, import: 0x96
Advertised to peers (in unique update groups):
 10.0.0.6      10.0.0.5
Local, (Received from a RR-client)
 10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2), if-handle 0x00000000
  Received Label 24012
  Origin incomplete, metric 0, localpref 100, valid, internal, multipath, backup, add-path,
import-candidate, imported

```

```

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

```

Da die meisten Attribute in den BGP-Pfaden zwischen den Pfaden übereinstimmen, wurde der beste Pfad zur niedrigsten Router-ID des BGP-Sprechers gewählt. Dies ist der BGP-Sprecher 10.0.0.1. Der Sicherungspfad ist der zweitbeste Pfad, daher die zweitniedrigste Router-ID des BGP-Sprechers. Hier ist 10.0.0.2.

Die Pfade von 10.0.0.4 und 10.0.0.5 sind keine Multipath-Pfade, da sie später als die Pfade von 10.0.0.1, 10.0.0.2 und 10.0.0.3 installiert wurden.

Backup und Sicherung (Multipath schützen)

```

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

Maximum-path ibgp 3 ist konfiguriert.

Die Sicherung ist der zweitbeste Pfad. Hier wurden die Multipath-Pfade vor dem Backup-Pfad

empfangen. Es gibt also drei Multipath-Pfade, und ein anderer ist ein Backup-Pfad.

```
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
```

Fahren Sie den Nachbarn herunter 10.0.0.5. Jetzt haben Sie:

```
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

```

- Der Pfad von 10.0.0.5 verschwand.
- Der Pfad von 10.0.0.2 ist immer noch backup, aber jetzt auch multipath.
- Da der Sicherungspfad auch ein Multipath-Pfad ist, haben Sie jetzt einen Backup-Pfad (Multipath schützen). Dies ist der Pfad von 10.0.0.4.

Schließen Sie den Nachbarn 10.0.0.5 aus:

```
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

```

An den 4 Pfaden, die zuvor installiert wurden, wurde nichts geändert. Nur der Pfad von 10.0.0.5 wurde hinzugefügt. Es sitzt oben, weil es neuer ist. Es handelt sich nicht um einen Multipath-Pfad oder eine Art Backup-Pfad.

Der Pfad von 10.0.0.5 hat sich nach einer Statusänderung im Pfad von multipath zu non-multipath geändert!

Fazit:

- Die Reihenfolge, in der Pfade empfangen werden, spielt eine Rolle bei der Bestimmung, welche Pfade Multipath sind.
- Die Reihenfolge, in der Pfade empfangen werden, spielt eine Rolle, wenn es einen Backup-Pfad (Multipath schützen) gibt oder nicht.
- Die Reihenfolge, in der Pfade empfangen werden, spielt keine Rolle, in der der Pfad als der beste Pfad oder Sicherungspfad ausgewählt wird.

Bestellung nach IGP-Metrik

Es besteht die Möglichkeit, die Multipath-Pfade gemäß der IGP-Metrik (Interior Gateway Protocol) zu bestellen.

```

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 ?

```

```

order          Order candidate multipaths for selection as per configured number(cisco-support)
selective      Allow multipaths only from marked neighbors
unequal-cost   Allow multipaths to have different BGP nexthop IGP metrics
<cr>
RP/0/RP0/CPU0:RR(config-bgp-vrf-af)#maximum-paths ibgp 3 unequal-cost ?
order          Order candidate multipaths for selection as per configured number(cisco-support)
selective      Allow multipaths only from marked neighbors
<cr>
RP/0/RP0/CPU0:RR(config-bgp-vrf-af)#maximum-paths ibgp 3 unequal-cost order ?
  igp-metric   Order by IGP metric (cisco-support)
RP/0/RP0/CPU0:RR(config-bgp-vrf-af)#maximum-paths ibgp 3 unequal-cost order igp-metric ?
<cr>
RP/0/RP0/CPU0:RR(config-bgp-vrf-af)#maximum-paths ibgp 3 unequal-cost order igp-metric
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#

```

Die ungleichen Kosten sind erforderlich, da ansonsten nur der beste Pfad, ein Backup-Pfad, aber kein Multipath-Routing erforderlich ist, da die gleichen IGP-Kosten als Multipath angesehen werden müssen.

Die IGP-Kosten von RR zu den PE-Routern werden in der Topologie geändert. Die IGP-Kosten werden wie folgt konfiguriert:

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

Es gibt noch folgende:

```

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

```

Vor der IGP-Metrik (die Kosten sind für alle Links gleich) werden folgende Änderungen vorgenommen:

```

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

```

Nach der Änderung der IGP-Metrik:

```
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

- Der beste Pfad ist jetzt der Pfad von 10.0.0.5 aufgrund der niedrigeren IGP-Metrik (Metrik 2).
- Der Sicherungspfad ist jetzt der Pfad mit der zweitbesten IGP-Metrik, dem Pfad von 10.0.0.4 (Metrik 3).
- Der beste Pfad und der beste Sicherungspfad sind auch Multipath, daher bleibt ein Multipath-Pfad zu wählen. Dies ist der Pfad von 10.0.0.3 (Metrik 4).
- Der Sicherungspfad (Protect multipath) ist der Pfad von 10.0.0.2 (Metrik 5).
- Schließlich ist der Pfad von 10.0.0.1 (Metrik 6) überhaupt nicht markiert, da er die schlechteste Metrik hat.