Configuration et vérification de la sélection du chemin BGP dans IOS-XR

Contenu

Introduction

Ce document décrit l'instruction **set path-selection** dans une stratégie de routage pour le protocole BGP (Border Gateway Protocol) dans Cisco IOS®-XR.

Informations générales

De nombreuses conceptions visent à ce que BGP sélectionne et annonce plusieurs chemins pour un préfixe.

Par défaut, un seul chemin BGP est sélectionné comme meilleur chemin et seul ce meilleur chemin est annoncé. L'algorithme de sélection du meilleur chemin BGP décide de ce qui suit :

[Algorithme de sélection de la meilleure route BGP](#)

Outre le meilleur chemin, un deuxième meilleur chemin peut être choisi comme chemin de

sauvegarde. Ce chemin de sauvegarde peut être utilisé dans les conceptions avec BGP PIC (Prefix Independent Convergence).

BGP peut installer plusieurs chemins pour réaliser l'équilibrage de charge. Il peut s'agir d'un équilibrage de charge ECMP (Equal Cost Multipath) ou UCMP (Unequal Cost Multipath). Ces chemins multiples sont installés dans la table de routage (RIB) et le plan de données ou la table FIB (Forwarding Instance Base) afin d'atteindre l'équilibrage de charge. La table FIB est également appelée table CEF (Cisco Express Forwarding).

Cet article se concentre sur deux objectifs :

- Comment obtenir que BGP sélectionne plusieurs chemins à installer ?
- Comment obtenir que BGP annonce plusieurs chemins ?

Une autre fonctionnalité utilisée par BGP est les chemins supplémentaires (ADD-Paths). Cette fonctionnalité permet à BGP d'annoncer plusieurs chemins sur une session BGP.

Résumé

- Le meilleur chemin est toujours choisi par BGP. Sinon, il y a quelque chose qui ne va pas. Cet article ne couvre pas ces scénarios.
- Un chemin de sauvegarde peut être choisi si la fonction spécifique est configurée (par exemple BGP PIC).
- Une stratégie de route peut être configurée sous une famille d'adresses spécifique pour BGP afin de sélectionner les chemins à installer et/ou annoncer.
- Avant Cisco IOS®-XR 7.3.1, une seule instruction **set path-selection** figure dans la stratégie de route pour sélectionner les chemins d'un préfixe spécifique.
- Pour commencer avec Cisco IOS®-XR 7.3.1, il existe une prise en charge de plusieurs instructions **set path-selection** dans la stratégie de route pour la sélection de chemins pour un préfixe spécifique.
- Àpartir de Cisco IOS®-XR 7.3.1, une fonctionnalité a été ajoutée où une stratégie de route peut être utilisée pour annoncer des chemins spécifiques pour un préfixe BGP à un voisin BGP.

La sélection des chemins multichemins par BGP est effectuée dans l'ordre de réception des chemins. Cependant, les commandes **show bgp** affichent les chemins BGP par ordre lexicographique.

Une nouvelle commande -introduite dans Cisco IOS®-XR 7.3.1- peut être utilisée pour afficher les chemins BGP dans l'ordre dans lequel ils ont été reçus :

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

Cela aide à la vérification et au dépannage du multichemin. Il résout la question principale de savoir pourquoi un chemin est choisi comme un multichemin et non comme un autre.

Un chemin de protection par plusieurs chemins est un chemin de sauvegarde qui n'est pas un chemin multichemin mais qui protège tous les autres chemins multichemins.

Àpartir de Cisco IOS®-XR 7.3.1, il y a ce nouveau mot clé **multipath-protection-advertise** pour l'instruction **set path-selection**. Il peut être utilisé pour annoncer le chemin de protection multi-chemins **le long du chemin de sauvegarde** ou **le long des chemins multichemins**. Les commandes complètes à utiliser dans la stratégie de route sont les suivantes :

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

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

Ceci est une présentation de la commande **set path-selection** avec toutes ses combinaisons de mots clés. Une explication et des exemples plus détaillés sont disponibles dans la section suivante.

Dans tous les cas ci-dessous, le meilleur chemin est installé. Si ce n'est pas le cas, quelque chose ne va pas (par exemple, le saut suivant n'est pas valide), mais cela n'est pas lié à la commande **set path-selection**.

Pour que le chemin de sauvegarde soit sélectionné, une fonctionnalité doit être activée pour BGP qui permet la sélection d'un chemin de sauvegarde BGP : par exemple BGP PIC.

Les chemins d'accès multiples sont activés dans BGP par la commande address family **maximum-paths** :

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

Par définition, le meilleur chemin est un chemin multichemin. Le meilleur chemin est le seul chemin installé dans la table de routage si le chemin multiple pour BGP n'est pas activé. Vous pouvez contrôler le nombre de chemins BGP installés dans la table de routage à l'aide de la commande **maximum-paths {ebgp | eibgp | ibgp} <2-32> (coût inégal)**.

Ce tableau fournit une vue d'ensemble de toutes les options avec la commande **set path-selection**. Pour plus de détails et d'exemples, reportez-vous à la section suivante pour chaque cas présenté ici.

Cas	Commande	Installer	Annoncer
1	set path-selection backup 1 install	1 chemin de sauvegarde installé.	Seul le meilleur chem... annoncé.
2	set path-selection backup 1 advertise	Le chemin de sauvegarde n'est pas installé.	Le chemin de sauveg... est annoncé.
3	set path-selection backup 1 advertise install	Le chemin de sauvegarde est installé.	Le chemin de sauveg... est annoncé.
4	set path-selection all advertise	Le chemin de sauvegarde n'est pas installé. Les chemins multichemins sont installés.	Tous les chemins son... annoncés (meilleur chemin, chemin de sauvegarde, chemin multichemin, chemin multichemin).
5	set path-selection best-	Les chemins multichemins	Seul le meilleur chem...

	path	sont installés.	annoncé.
6	set path-selection multipath advertise	Les chemins multichemins sont installés.	Les chemins multiche… sont annoncés.
7	set path-selection backup 1 install multipath-protection	Les chemins multichemins sont installés. Un autre chemin est installé en tant que chemin de sauvegarde (le chemin de sauvegarde (protection multichemin) s'il y a encore des chemins à côté des chemins de multichemin.	Seul le meilleur chem… annoncé.
8	set path-selection backup 1 install multipath-protection advertise	Les chemins multichemins sont installés. Un autre chemin est installé en tant que chemin de sauvegarde (le chemin de sauvegarde (protection multichemin) s'il y a encore des chemins à côté des chemins de multichemin.	Le meilleur chemin et chemin de sauvegard… sont annoncés. Le chemin de sauveg… (protection multichem… n'est pas annoncé.
9	set path-selection group-best advertise	La sélection du meilleur groupe est le meilleur chemin par AS et aussi par tronçon suivant. Les chemins multichemins sont installés.	Tous les meilleurs ch… de groupe sont annon…
10	set path-selection backup 1 install multipath-protection advertise multipath-protection-advertise	Les chemins multichemins sont installés. Un autre chemin est installé en tant que chemin de sauvegarde (le chemin de sauvegarde (protection multichemin) s'il y a encore des chemins à côté des chemins de multichemin.	Le meilleur chemin, l… chemin de sauvegard… le chemin de sauvega… (protection multichem… sont annoncés.
11	set path-selection multipath advertise multipath-protection	Les chemins multichemins sont installés.	Les chemins multiche… sont annoncés. Le chemin de sauveg… (protection multichem… n'est pas annoncé.
12	set path-selection multipath advertise multipath-protection multipath-protection-	Les chemins multichemins sont installés. Un autre chemin est installé en tant que chemin	Les chemins multiche… sont annoncés. Le chemin de sauveg… (protection multichem…

| | advertise | de sauvegarde (le chemin de sauvegarde (protection multichemin) s'il y a encore est annoncé. des chemins à côté des chemins de multichemin. |

Il s'agit de la topologie utilisée dans ce document.
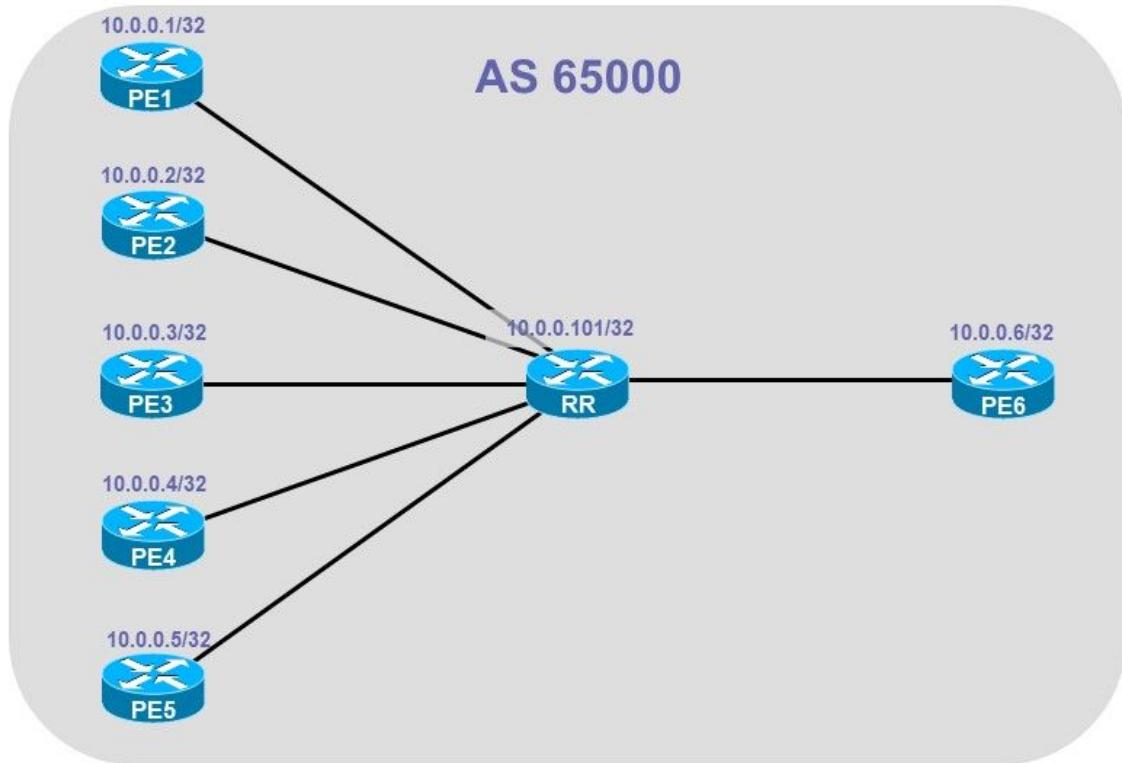
Dans tous les cas, ADD-PATH est activé entre le RR (Route-Reflector) et le PE6.

PE1, PE2, PE3, PE4, PE5 et PE6 annoncent tous le même préfixe que la route de monodiffusion vpnv4 vers le RR.

PE6 est le PE d'entrée, qui reçoit ce préfixe du RR.

Sauf mention contraire, ADD-PATH est activé sur chaque session BGP et maximum-paths ibgp 3 est configuré sur le RR pour la monodiffusion vpnv4 de la famille d'adresses.

Note: Un chemin de sauvegarde maximum est installé dans les tables RIB et CEF. Plus d'un n'est pas possible/pris en charge. Le chemin est marqué comme une sauvegarde dans la table BGP, la table RIB et la table CEF.

La route de sauvegarde est toujours choisie par BGP dans cet article. Une route de secours peut être choisie par une autre fonctionnalité, mais ici c'est toujours BGP.

Si le multichemin est configuré pour BGP, il peut y avoir des chemins multichemins (ECMP ou

UCMP) installés dans la table BGP. Ils sont marqués d'un **multichemin**. Le chemin de sauvegarde est le deuxième meilleur chemin, il doit donc être l'un des chemins multichemins s'il y en a. Cela signifie qu'il peut y avoir une sauvegarde (protection multichemin) choisie par BGP si cette fonctionnalité est configurée (le mot clé **multichemin-protection** dans l'instruction **set path-selection route-policy**). Si c'est le cas, ce **chemin de sauvegarde (protection multichemin)** est le chemin de sauvegarde dans la table RIB et CEF. Le chemin de **sauvegarde** choisi par BGP et marqué comme tel par BGP n'est alors pas un chemin de sauvegarde, mais simplement un chemin multichemin.

Une route de secours sur un RR n'a pas beaucoup de sens si ce RR a uniquement le rôle d'un RR.

Dans cet article, il est supposé que le RR est également un routeur PE. Dans ce cas, sélectionnez et installez une route de secours. La route de secours peut être utilisée pour le PIC BGP.

Une route de sauvegarde est marquée avec **sauvegarde** dans le RIB lorsque vous spécifiez le préfixe spécifique ou avec « ! » si vous ne spécifiez pas le préfixe.

```
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
```

Définir les commandes de sélection de chemin dans les

stratégies de routage

Cette section couvre toutes les instructions **set path-selection** utilisées dans la stratégie de route pour la famille d'adresses spécifique sous le routeur BGP.

Cela indépendamment de la version de Cisco IOS®-XR antérieure ou postérieure à Cisco IOS®-XR 7.3.1.

Configuration:

```
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
    !
    !
!
```

La stratégie de route avec les instructions set path-selection est appliquée sous la monodiffusion vpnv4 address-family.

La politique de route avec les instructions set path-selection est également appliquée au VRF. Cela est nécessaire si une route de secours doit être installée dans la table RIB/CEF VRF (ou annoncée sur la session BGP sur la liaison PE-CE).

Ici, les deux stratégies de route sont identiques, mais des stratégies différentes peuvent être appliquées sous la famille d'adresses par rapport au VRF.

Maximum-path *ibgp 3* est utilisé sous VRF 1, en spécifiant qu'il peut y avoir jusqu'à trois chemins ECMP dans la table RIB/CEF.

Ces cas montrent toutes les possibilités de la politique de route avec **set path-selection**.

1. set path-selection 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}
```

Vérifiez les chemins annoncés :

```
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
```

Conclusion: Il y a 1 chemin de sauvegarde installé sur le RR dans le VRF. Seul le meilleur chemin est annoncé.

2. set path-selection backup 1 advertise

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

```
RP/0/RP0/CPU0:RR#show bgp vpnv4 unicast rd 1:1 10.1.1.1/32
BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
 Process           bRIB/RIB  SendTblVer
 Speaker                  5           5
Last Modified: Sep 17 13:38:03.907 for 00:02:04
Paths: (5 available, best #1)
 Advertised to update-groups (with more than one peer):
   0.2 0.3
 Path #1: Received by speaker 0
 Advertised to update-groups (with more than one peer):
   0.2 0.3
 Local, (Received from a RR-client)
   10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, multipath,
import-candidate, imported
     Received Path ID 0, Local Path ID 1, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #2: Received by speaker 0
 Advertised to update-groups (with more than one peer):
   0.3
 Local, (Received from a RR-client)
   10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, multipath, backup, add-path,
import-candidate, imported
     Received Path ID 0, Local Path ID 2, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #3: Received by speaker 0
 Not advertised to any peer
 Local, (Received from a RR-client)
   10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
     Received Path ID 0, Local Path ID 0, version 0
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #4: Received by speaker 0
 Not advertised to any peer
 Local, (Received from a RR-client)
   10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4)
     Received Label 24013
     Origin incomplete, metric 0, localpref 100, valid, internal, multipath, import-candidate,
imported
     Received Path ID 0, Local Path ID 0, version 0
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #5: Received by speaker 0
 Not advertised to any peer
 Local, (Received from a RR-client)
   10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5)
```

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


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


RP/0/RP0/CPU0:RR#show cef vrf one 10.1.1.1/32
10.1.1.1/32, version 135, internal 0x5000001 0x30 (ptr 0xd96a770) [1], 0x0 (0xe3662a8), 0xa08
(0xf696158)
 Updated Sep 17 13:38:04.236
 Prefix Len 32, traffic index 0, precedence n/a, priority 3
  via 10.0.0.1/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
   path-idx 0 NHID 0x0 [0xdab2bc0 0x0]
   recursion-via-/32
   next hop VRF - 'default', table - 0xe0000000
   next hop 10.0.0.1/32 via 24003/0/21
    next hop 10.1.101.1/32 Gi0/0/0/0    labels imposed {ImplNull 24012}
  via 10.0.0.2/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
   path-idx 1 NHID 0x0 [0xdab2e48 0x0]
   recursion-via-/32
   next hop VRF - 'default', table - 0xe0000000
   next hop 10.0.0.2/32 via 24001/0/21
    next hop 10.2.101.2/32 Gi0/0/0/4    labels imposed {ImplNull 24012}
  via 10.0.0.4/32, 3 dependencies, recursive, bgp-multipath [flags 0x6080]
   path-idx 2 NHID 0x0 [0xdab2c98 0x0]
   recursion-via-/32
   next hop VRF - 'default', table - 0xe0000000
   next hop 10.0.0.4/32 via 24000/0/21
    next hop 10.4.101.4/32 Gi0/0/0/7    labels imposed {ImplNull 24013}
```
Vérifiez les chemins annoncés :

```
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
```
Conclusion: La route de secours n'est pas installée. Le chemin de sauvegarde est annoncé.

3. set path-selection backup 1 advertise install

```
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}
```

Vérifiez les chemins annoncés :

```
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
```

Conclusion: La route de secours est installée. Le chemin de sauvegarde est annoncé. Voici donc 1. et 2.

4. set path-selection all advertise

```
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}
```
Vérifiez les chemins annoncés :

```
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
```

Conclusion: La route de secours n'est pas installée. Tous les (5) chemins sont annoncés.

5. set path-selection best-path

```
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}
```
Conclusion: Seuls le meilleur chemin et les chemins multichemins sont installés. Seul le meilleur chemin est annoncé. Aucun chemin de sauvegarde n'est sélectionné, installé ou annoncé.

6. set path-selection multipath advertise

Advertise est un mot clé obligatoire.

```
route-policy BGP-Path-Selection
 set path-selection multipath advertise
end-policy
```
Pour que cela fonctionne, il doit y avoir un multichemin activé pour BGP pour la famille d'adresses spécifique.

Ici, le multichemin pour la monodiffusion ipv4 dans VRF 1 est activé.

```
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}
```

Vérifiez les chemins annoncés :

```
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
```
- Les chemins vpnv4 sont marqués d'un chemin multiple.
- Les 3 chemins multichemins sont installés dans le RIB.
- Les 3 chemins multichemins sont annoncés.
- Il n'y a pas de chemin de sauvegarde.

Conclusion: Les chemins à chemins multiples sont installés dans le RIB et annoncés. Aucune sauvegarde n'est sélectionnée, installée ou annoncée.

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

```
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}
```
Vérifiez les chemins annoncés :

```
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
```
Il n'existe peut-être pas de chemin **de sauvegarde (protection multichemin)**. Par exemple, s'il existe **des chemins BGP maximum 2** configurés et que seuls 2 chemins sont reçus, alors deux chemins sont multichemins et il n'y a pas de chemin **de sauvegarde (protection multichemin)**.

Conclusion: Tous les chemins multichemins sont installés dans le RIB. Un autre chemin est installé en tant que chemin de sauvegarde (le chemin de **sauvegarde (protection multichemin)**). Seul le meilleur chemin est annoncé.

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

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

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

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
 Process            bRIB/RIB  SendTblVer
 Speaker                5          5
Last Modified: Sep 17 16:03:00.907 for 00:01:19
Paths: (5 available, best #1)
 Advertised to update-groups (with more than one peer):
   0.2 0.3
 Path #1: Received by speaker 0
 Advertised to update-groups (with more than one peer):
   0.2 0.3
 Local, (Received from a RR-client)
   10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, multipath,
import-candidate, imported
     Received Path ID 0, Local Path ID 1, version 5
     Extended community: RT:65000:1
```

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


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


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

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

Vérifiez les chemins annoncés :

```
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
```

- Il existe trois chemins multichemins.

- Il existe un chemin de sauvegarde (protection multichemin). Il s'agit du chemin de sauvegarde installé dans la table RIB/CEF.
- Le cinquième chemin n'est pas marqué.
- Le meilleur chemin et le chemin de sauvegarde sont annoncés.

Il n'existe peut-être pas de chemin **de sauvegarde (protection multichemin)**. Par exemple, s'il existe **des chemins BGP maximum** *2* configurés et que seuls 2 chemins sont reçus, alors deux chemins sont multichemins et il n'y a pas de chemin **de sauvegarde(protection multichemin)**.

Ce chemin de sauvegarde annoncé est l'un des chemins multichemins (sauvegarde marquée dans la table BGP).

Ceci est avec **maximum-paths ibgp 1** :

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

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
 Process            bRIB/RIB  SendTblVer
 Speaker                   5           5
Last Modified: Sep 17 16:15:48.907 for 00:00:44
Paths: (5 available, best #1)
 Advertised to update-groups (with more than one peer):
   0.2 0.3
 Path #1: Received by speaker 0
 Advertised to update-groups (with more than one peer):
   0.2 0.3
 Local, (Received from a RR-client)
   10.0.0.1 (metric 2) from 10.0.0.1 (10.0.0.1)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, best, group-best, import-
candidate, imported
     Received Path ID 0, Local Path ID 1, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #2: Received by speaker 0
 Advertised to update-groups (with more than one peer):
   0.2
 Local, (Received from a RR-client)
   10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, backup, add-path, import-
candidate, imported
     Received Path ID 0, Local Path ID 2, version 5
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #3: Received by speaker 0
 Not advertised to any peer
 Local, (Received from a RR-client)
   10.0.0.3 (metric 2) from 10.0.0.3 (10.0.0.3)
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
     Received Path ID 0, Local Path ID 0, version 0
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #4: Received by speaker 0
 Not advertised to any peer
 Local, (Received from a RR-client)
   10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4)
     Received Label 24013
```

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


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


RP/0/RP0/CPU0:RR#show cef vrf one 10.1.1.1/32
10.1.1.1/32, version 297, internal 0x5000001 0x30 (ptr 0xd96a770) [1], 0x0 (0xe3662a8), 0xa08
(0xf6960a8)
 Updated Sep 17 16:15:48.903
 Prefix Len 32, traffic index 0, precedence n/a, priority 3
  via 10.0.0.1/32, 3 dependencies, recursive [flags 0x6000]
    path-idx 0 NHID 0x0 [0xdab2bc0 0x0], Internal 0xd6a2190
    recursion-via-/32
    next hop VRF - 'default', table - 0xe0000000
    next hop 10.0.0.1/32 via 24003/0/21
     next hop 10.1.101.1/32 Gi0/0/0/0    labels imposed {ImplNull 24012}
  via 10.0.0.2/32, 2 dependencies, recursive, backup [flags 0x6100]
    path-idx 1 NHID 0x0 [0xdab2e48 0x0]
    recursion-via-/32
    next hop VRF - 'default', table - 0xe0000000
    next hop 10.0.0.2/32 via 24001/0/21
     next hop 10.2.101.2/32 Gi0/0/0/4    labels imposed {ImplNull 24012}
```
Vérifiez les chemins annoncés :

```
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
```

- Il n'y a pas d'ECMP sur RR.
- Le deuxième meilleur chemin est le chemin de sauvegarde. Il est installé dans la table RIB/CEF.
- Le meilleur chemin et le meilleur chemin de sauvegarde sont annoncés.
- Il n'existe aucun chemin **de sauvegarde (protection multichemin)**.

Conclusion: Tous les chemins multichemins sont installés dans le RIB. Un autre chemin est installé comme chemin de sauvegarde. Le meilleur chemin et le chemin de sauvegarde sont annoncés.

9. set path-selection group-best advertise

- Group-best ne peut être utilisé qu'avec **la publicité**.
- La sélection du meilleur groupe est le meilleur chemin par AS (système autonome) et par saut suivant.
- Le préfixe provient de différents systèmes autonomes.

Une topologie différente est utilisée pour ce cas. Les routeurs sont identiques à ceux de l'image 1, mais PE4 se trouve maintenant dans AS 65004 et PE5 dans AS 65005. Tous les autres routeurs sont toujours dans AS 65000.
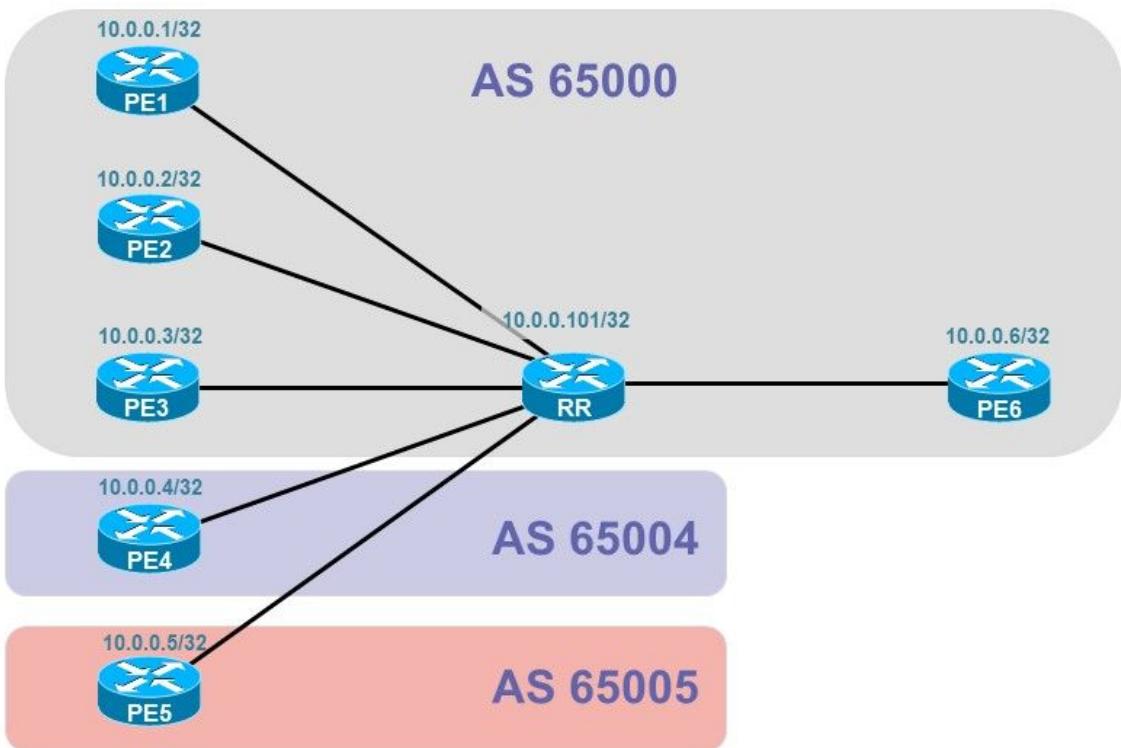
Image 2

Cela signifie qu'il existe maintenant une session eBGP entre le RR et le PE4 et entre le RR et le PE5.

```
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}
```

Le RR a toujours trois chemins ECMP installés dans la table RIB et CEF.

```
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 annonce le meilleur chemin de groupe à partir des trois chemins reçus de l'AS 65000. En plus de ce chemin, le RR annonce également le meilleur chemin de groupe reçu de l'AS 65004 et celui

de l'AS 65005.

Il existe trois meilleurs chemins de groupe, car les trois chemins ont un AS voisin différent. Tous ces chemins sont annoncés. Les chemins multichemins ne sont pas annoncés.

Conclusion: Tous les meilleurs chemins de groupe sont annoncés.

10. set path-selection backup 1 install multipath-protection advertise multipath-protection-advertise

Cette option est uniquement disponible à partir de Cisco IOS®-XR 7.3.1.

Pour commencer avec Cisco IOS®-XR 7.3.1, il y a un nouveau mot clé **multipath-protection-advertise**.

Cela permet d'annoncer le chemin **multi-chemin** de **protection en parallèle du chemin de sauvegarde**. Avant Cisco IOS®-XR 7.3.1, le chemin **multi-chemin-protection** a été installé mais n'a pas été annoncé. (Voir cas 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}
```

Vérifiez les chemins annoncés :

```
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
```

Conclusion: Tous les chemins multichemins sont installés dans le RIB. Un autre chemin - chemin de sauvegarde (protection multichemin) - est installé en tant que chemin de sauvegarde. Le meilleur chemin, le chemin de sauvegarde et le chemin de sauvegarde (protection multichemin) sont annoncés.

11. set path-selection multipath advertise multipath-protection

Cette option est uniquement disponible à partir de Cisco IOS®-XR 7.3.1.

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

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

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

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


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


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

```
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
```

- Le troisième chemin est le chemin de sauvegarde. Il est marqué comme backup (protection multichemin) dans BGP et installé comme chemin de sauvegarde dans RIB.
- Le meilleur chemin et les chemins multichemins sont annoncés.
- Le chemin de sauvegarde (protection multichemin) n'est pas annoncé.

12. set path-selection multipath advertise multipath-protection multipath-protection-advertise

Cela permet d'installer et d'annoncer le chemin de protection multichemin le long des chemins multichemin.

```
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}
```
Vérifiez les chemins annoncés :

```
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
```
Conclusion:

- Les 3 chemins sont marqués multichemin dans BGP.
- 3 chemins ECMP sont installés dans la table RIB/CEF.
- Le deuxième chemin est le chemin de sauvegarde. Marqué comme sauvegarde (protection multichemin) dans BGP et installé comme chemin de sauvegarde dans la table RIB/CEF.
- Le meilleur chemin, les chemins multichemins et les chemins de sauvegarde (protection multichemin) sont annoncés.

Nouveau comportement de sélection de chemin à partir de Cisco IOS®-XR 7.3.1

Depuis Cisco IOS®-XR 7.3.1, cela a changé :

- La sélection du chemin par voisin est possible. Avant Cisco IOS®-XR 7.3.1, ce n'était que par famille d'adresses.
- Plusieurs instructions set path-selection sont autorisées dans une seule stratégie de routage.
- Les chemins BGP peuvent être affichés dans l'ordre dans lequel ils sont reçus.

La sélection par chemin de voisin est possible

Voici la sélection de chemin disponible dans une stratégie de route :

```
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
```

Le **meilleur chemin** est la valeur par défaut.

Ceci est pris en charge au niveau de la famille d'adresses.

Exemple de configuration :

```
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
 !
 !
!
```

Pour commencer avec Cisco IOS®-XR 7.3.1, certaines options de sélection de chemin dans une stratégie de route sont également prises en charge au niveau du voisin. Cela permet d'obtenir un contrôle plus précis sur les chemins annoncés vers quels voisins BGP. Par exemple, un haut-parleur BGP peut annoncer le meilleur chemin et un chemin de sauvegarde vers un voisin BGP, mais annoncer le chemin multichemin et protéger le chemin multichemin vers un autre voisin.

Au niveau voisin, il y a :

```
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
```

> **Avertissement :** Le meilleur chemin est multichemin si la commande BGP **maximum-path** est configurée. Cependant, si la seule condition configurée dans la stratégie de route est **est-multi-chemin**, seuls les chemins multichemin qui ne sont pas le meilleur chemin sont annoncés ! Cela dépend de la conception BGP, mais il est probable que si les chemins multichemins doivent être annoncés, le meilleur chemin doit également être annoncé.

La protection **is-all** et **is-multipath** vient d'être introduite avec Cisco IOS®-XR 7.3.1.

Plusieurs instructions set path-selection sont autorisées dans une politique de routage unique

Depuis Cisco IOS®-XR 7.3.1, vous pouvez avoir des instructions **de sélection de chemin** de **plusieurs ensembles** dans une stratégie de route liée à un préfixe. Avant Cisco IOS®-XR 7.3.1, cela n'était pas autorisé et entraînerait un comportement de chemin BGP imprévisible.

Le fait d'avoir plusieurs chemins sélectionnés ou non est examiné par préfixe.

Par exemple, **avant** Cisco IOS®-XR 7.3.1, les éléments suivants ne sont pas pris en charge :

```
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
```

Vous avez deux instructions **set path-selection** dans une politique de route appliquée aux mêmes préfixes.

Toutefois, **avant Cisco IOS®-XR 7.3.1**, les éléments suivants sont pris en charge. La raison est que les différentes instructions de sélection de chemin sont pour différents préfixes, car **si** des instructions avec une sélection (destination, communauté, ...) sont utilisées.

Exemple 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
```

Ceci est valable car les instructions **set-path selection** se rapportent à différents préfixes (ils sont dans deux instructions **if** différentes).

Exemple 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
```

Ceci est valable car les instructions de sélection du chemin d'accès défini se rapportent à différents préfixes (ils se trouvent dans deux parties différentes de l'instruction **if**).

À partir de Cisco IOS®-XR 7.3.1, ceci est pris en charge.

Voici un exemple de route-policy avec plusieurs instructions **set path-selection** :

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

La stratégie de route par voisin spécifie les chemins annoncés à ce voisin. Tout chemin peut uniquement être choisi parmi les chemins déjà marqués au niveau de la famille d'adresses.

Au niveau de la famille d'adresses, vous avez la sélection du chemin :

```
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
```

Au niveau voisin, il y a :

```
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
```

> **Avertissement :** Le meilleur chemin est multichemin si la commande BGP **maximum-path** est configurée. Cependant, si la seule condition configurée dans la stratégie de route est **est-multi-chemin**, seuls les chemins multichemin qui ne sont pas le meilleur chemin sont annoncés ! Cela dépend de la conception BGP, mais il est probable que si les chemins multichemins doivent être annoncés, le meilleur chemin doit également être annoncé.

La protection **is-all** et **is-multipath** vient d'être introduite avec Cisco IOS®-XR 7.3.1.

Avec cette approche, le **marquage** de la sélection de chemin peut être un mélange des modes de sélection de chemin que vous avez (par exemple, tous les modes de sauvegarde, multichemin, protection multichemin, etc.).

La stratégie de voisinage contrôle l'**annonce** en fonction du marquage de sélection du chemin.

Pour la partie de marquage : par exemple, vous pouvez configurer la sauvegarde et le multichemin ensemble dans la stratégie de route au niveau de la famille d'adresses :

```
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
!
```

Les deux instructions set path-selection ci-dessus sont celles qui sont prises en charge depuis Cisco IOS®-XR 7.3.1. Avec maximum-path ibgp 3 toujours configuré dans l'exemple, vous avez ceci :

- Permet d'annoncer le meilleur chemin et tous les chemins multichemins.
- Permet d'annoncer le meilleur chemin et le chemin de sauvegarde (protection multichemin).

Cette combinaison n'était pas possible avant Cisco IOS®-XR 7.3.1. Cela signifie que 1) ou 2) seraient en vigueur.

Voici le résultat :

```
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}
```

Vérifiez les chemins annoncés :

```
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
```

Il est maintenant possible d'annoncer à un voisin les chemins principal (meilleur chemin) et de sauvegarde, en fonction de *is-best-path ou is-backup-path*.

Pour un autre voisin, le multichemin peut être annoncé avec **is-multi-chemin**.

Exemple de route-policy de voisinage (utilisé avec la route-policy au niveau de la famille d'adresses) :

```
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
!
```

Si le RR a ces chemins BGP :

```
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
```

Puis pour le premier chemin de la route-policy de voisinage, qui est ceci :

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

Le voisin PE6 reçoit les chemins suivants :

```
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
```

Ces deux chemins sont le meilleur chemin et le chemin de sauvegarde sur RR.

Pour la deuxième partie de la route-policy de voisinage, qui est la suivante :

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

Le voisin PE6 reçoit les chemins suivants :

```
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
```

Ces chemins sont les chemins à chemins multiples (mais **pas** le meilleur chemin !) et le chemin de sauvegarde (protection multichemin).

Afficher les chemins BGP dans l'ordre dans lequel ils sont reçus

Les chemins BGP sont affichés par ordre lexicographique.

Une nouvelle commande -introduite dans Cisco IOS®-XR 7.3.1- peut être utilisée pour afficher les chemins BGP dans l'ordre dans lequel ils ont été reçus :

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

Cette commande est utile pour voir pourquoi les chemins ont été marqués multichemin. Les chemins reçus plus tôt sont marqués multichemin et sont installés dans le RIB en tant que routes de chemin maximum. La commande **show route** affiche le mot clé **BGP multipath** pour les routes installées en tant que telles.

Afin de vérifier quel chemin est marqué multichemin, la nouvelle commande peut être utilisée pour vérifier l'ordre dans lequel tous les chemins ont été reçus. Les chemins les plus récents se trouvent en haut de la sortie.

Par exemple, avec la configuration suivante :

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

Il n'y a aucune modification dans le processus de décision du meilleur chemin, et les chemins n'ont aucun attribut (comme la préférence locale) qui affecte le processus de décision du meilleur chemin.

Le RR a cette sélection de chemin BGP :

```
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
```

Pourquoi le chemin à partir de 10.0.0.1 est-il le meilleur chemin ? Pourquoi le chemin d'accès à partir de 10.0.0.2 est-il le chemin de sauvegarde ? Pourquoi le chemin à partir du multichemin 10.0.0.3 ? Pourquoi le chemin d'accès à partir de 10.0.0.4 est-il la sauvegarde (protéger le multichemin) ? Pourquoi le chemin à partir de 10.0.0.5 n'est-il pas le meilleur chemin, pas le chemin à chemins multiples et pas le chemin de sauvegarde (protéger le chemin à chemins multiples) ?

Vous pouvez voir ceci avec la même commande avec **âge-ordre** à la fin. Les chemins les plus récents se trouvent en haut de la sortie.

```
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
```

Vous pouvez utiliser les commandes show bgp avec le mot clé bestpath-compare afin de vérifier pourquoi un chemin n'est pas le meilleur chemin (une raison est affichée par chemin).

```
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
```

Puisque la plupart des attributs des chemins BGP sont égaux entre les chemins, la décision de choisir le meilleur chemin est descendue à l'ID de routeur le plus bas du haut-parleur BGP. Voici l'intervenant BGP 10.0.0.1. Le chemin de sauvegarde est le deuxième meilleur chemin, d'où l'ID de routeur le plus bas du haut-parleur BGP. Voici 10.0.0.2.

Les chemins de 10.0.0.4 et 10.0.0.5 ne sont pas des chemins multichemins car ils ont été installés après les chemins de 10.0.0.1, 10.0.0.2 et 10.0.0.3.

Chemin de sauvegarde contre sauvegarde (protection du chemin multichemin)

```
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 est configuré.

La sauvegarde est le deuxième meilleur chemin. Ici, les chemins multichemins ont été reçus avant le chemin de sauvegarde. Il y a donc trois chemins à chemins multiples et un autre chemin de sauvegarde.

```
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
```

Arrêtez le voisin 10.0.0.5. Maintenant, vous avez :

```
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
```

- Le chemin d'accès de 10.0.0.5 a disparu.
- Le chemin à partir de 10.0.0.2 est toujours de sauvegarde, mais il est maintenant également multichemin.
- Comme le chemin de sauvegarde est également un chemin à chemins multiples, vous disposez maintenant d'un chemin de sauvegarde (protéger le chemin à chemins multiples). Il s'agit du chemin d'accès à partir de 10.0.0.4.

Désactivez le voisin 10.0.0.5 :

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

BGP routing table entry for 10.1.1.1/32, Route Distinguisher: 1:1
Versions:
 Process           bRIB/RIB  SendTblVer
  Speaker                10         10
   Flags: 0x2406b2b2+0x00010000; multipath; backup available;
Last Modified: Sep 18 09:08:42.907 for 00:00:00
Paths: (5 available, best #4)
 Advertised to update-groups (with more than one peer):
   0.3
 Advertised to peers (in unique update groups):
   10.0.0.5
 Path #1: Received by speaker 0
 Flags: 0x2000000084020205, import: 0x96
 Not advertised to any peer
 Local, (Received from a RR-client)
   10.0.0.5 (metric 2) from 10.0.0.5 (10.0.0.5), if-handle 0x00000000
     Received Label 24014
     Origin incomplete, metric 0, localpref 100, valid, internal, import-candidate, imported
     Received Path ID 1, Local Path ID 0, version 0
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #2: Received by speaker 0
 Flags: 0x2000000084060205, import: 0x96
 Advertised to peers (in unique update groups):
   10.0.0.5       10.0.0.6
 Local, (Received from a RR-client)
   10.0.0.4 (metric 2) from 10.0.0.4 (10.0.0.4), if-handle 0x00000000
     Received Label 24013
     Origin incomplete, metric 0, localpref 100, valid, internal, backup(protect multipath),
add-path, import-candidate, imported
     Received Path ID 0, Local Path ID 5, version 7
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #3: Received by speaker 0
 Flags: 0x2000000084070205, import: 0x96
 Advertised to peers (in unique update groups):
   10.0.0.5       10.0.0.6
 Local, (Received from a RR-client)
   10.0.0.2 (metric 2) from 10.0.0.2 (10.0.0.2), if-handle 0x00000000
     Received Label 24012
     Origin incomplete, metric 0, localpref 100, valid, internal, multipath, backup, add-path,
import-candidate, imported
     Received Path ID 0, Local Path ID 2, version 10
     Extended community: RT:65000:1
     Source AFI: VPNv4 Unicast, Source VRF: one, Source Route Distinguisher: 1:1
 Path #4: Received by speaker 0
 Flags: 0x2000000085070205, import: 0x9f
 Advertised to update-groups (with more than one peer):
```

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

Rien n'a changé pour les 4 chemins qui étaient installés auparavant. Seul le chemin d'accès de 10.0.0.5 a été ajouté. Il est en haut parce qu'il est plus récent. Il ne s'agit pas d'un chemin à chemins multiples ou d'un chemin de sauvegarde quelconque.

Le chemin de 10.0.0.5 est passé de multichemin à non-multichemin après un changement d'état dans le chemin !

Conclusion:

- L'ordre dans lequel les chemins sont reçus joue un rôle dans la détermination des chemins multichemins.
- L'ordre dans lequel les chemins sont reçus joue un rôle s'il existe un chemin de sauvegarde (protection multichemin) ou non.
- L'ordre dans lequel les chemins sont reçus ne joue pas de rôle dans lequel le chemin est choisi comme meilleur chemin ou chemin de sauvegarde.

Commande par métrique IGP

Il est possible de commander les chemins multichemins par mesure IGP (Interior Gateway Protocol).

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

```
RP/0/RP0/CPU0:RR(config-bgp-vrf-af)#end
RP/0/RP0/CPU0:RR#
```

Le coût inégal est nécessaire comme autrement, vous finissez avec seulement le meilleur chemin, un chemin de sauvegarde, mais pas de chemin multiple parce que le chemin multichemin a besoin du même coût IGP pour être considéré comme un chemin multichemin.

Le coût IGP de RR vers les routeurs PE est modifié dans la topologie. Le coût IGP est configuré comme suit :

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

Il y en a encore :

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

Avant la modification de la métrique IGP (le coût est le même sur toutes les liaisons) :

```
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
```

Après la modification de la métrique IGP :

```
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
```

- Le meilleur chemin est maintenant le chemin à partir de 10.0.0.5 en raison de la métrique IGP inférieure (métrique 2).
- Le chemin de sauvegarde est maintenant le chemin avec la deuxième meilleure métrique IGP, le chemin à partir de 10.0.0.4 (métrique 3).
- Le meilleur chemin et le meilleur chemin de sauvegarde sont également multichemin, il reste donc un chemin multichemin à choisir. Il s'agit du chemin d'accès à partir de 10.0.0.3 (métrique 4).
- Le chemin de sauvegarde (protection multichemin) est le chemin d'accès à partir de 10.0.0.2 (métrique 5).
- Enfin, le chemin à partir de 10.0.0.1 (métrique 6) n'est pas marqué du tout, car il a la pire métrique.