

# Associating Communities with Static and Aggregate Routes

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## In This Chapter

This section provides information about associating communities with static and aggregate routes configurations.

Topics in this section include:

- [Applicability on page 1806](#)
- [Overview on page 1808](#)
- [Configuration on page 1810](#)
- [Conclusion on page 1836](#)

Applicability

## **Applicability**

This example is applicable to all the 7750 SR, 7450 ESS in mixed-mode and 7950 XRS series and was tested on release 12.0.R1. There are no pre-requisites for this configuration.

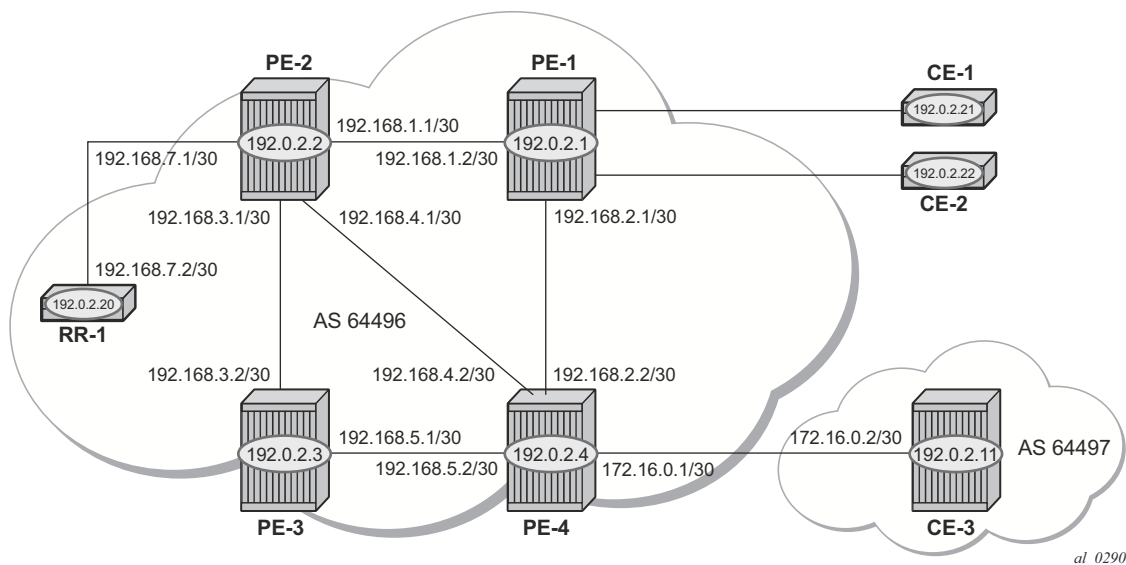
## Introduction

Border Gateway Protocol (BGP) Communities are optional, transitive attributes attached to BGP route prefixes to carry additional information about that route prefix. A number of route prefixes can have the same community attached such that it can be matched by a route policy. As a result, the presence of a community value can be used to influence and control route policy.

A BGP community is a 32-bit value that is written as two separate 16 bit numbers separated by a colon. The first number usually represents the Autonomous System (AS) number that defines or originates the community whilst the second is set by the network administrator.

Knowledge of RFC 4271 (BGP-4) and RFC 1997 (BGP Communities Attribute) is assumed throughout this document, as well as knowledge of Multi-Protocol BGP (MP-BGP) and RFC 4364 (BGP/MPLS IP VPNs).

## Overview



**Figure 280: Network Topology**

The network topology is displayed in [Figure 280](#). The setup uses 7750/7450/7710 Service Router (SR) nodes. PE-1 to PE-4 and the Route Reflector (RR-1) are located in the same Autonomous System (AS); AS6696. CE-3 is in a separate AS 64497 and peers using eBGP with its directly connected neighbor, PE-4.

The objectives are:

- To configure static-routes in a VPRN in PE-1 with various community values – including well-known communities – export them to other PEs within the same AS, and then via eBGP to CE-3. During this process, the community values for each route will be examined to ensure that the transitive nature of the attribute is maintained.
- To associate a community with an aggregate route that represents a larger number of composite prefixes. The aggregate will be advertised in place of the composite prefixes.

The following configuration tasks should be completed as a pre-requisite:

- Full mesh ISIS or OSPF between each of the PE routers and route reflector.
- iBGP between the RR and all PEs.
- eBGP between PE-4 and CE-3.
- Link-layer LDP between each PE.

## Associating Communities with Static and Aggregate Routes

It is possible to add a single community value to a static and aggregate route without using a router policy.

The community value can be in the 4-byte format comprising of a 2-byte AS value, followed by a 2 byte decimal value, separated by a colon. It can also be the name of a well-know standard community; no-export, no-advertise, no-export-subconfed.

Any community added can be matched using a route policy.

The purpose of this example is to provision static and aggregate IPv4 route prefixes and associate a community with each route. These routes are then redistributed into the BGP protocol and advertised to other BGP speakers.

This is shown for IPv4 routes within a VPRN. Well-known, standard communities will also be configured to show that the correct behavior is observed.

## Configuration

The first step is to configure an iBGP session between each of the PEs and the Route Reflector (RR). The address family negotiated between peers is vpn-ipv4.

The configuration for PE-1 is:

```
configure router bgp
  group internal
    family vpn-ipv4
    type internal
    neighbor 192.0.2.20
  exit
exit all
```

The configuration for the other PEs is very similar. The IP addresses can be derived from [Figure 280](#).

The configuration for the RR is:

```
configure router bgp
  cluster 0.0.0.1
  group rr_clients
    type internal
    family vpn-ipv4
    neighbor 192.0.2.1
  exit
    neighbor 192.0.2.2
  exit
    neighbor 192.0.2.3
  exit
    neighbor 192.0.2.4
  exit
exit all
```

On RR-1, show that BGP sessions with each PE are established, and have correctly negotiated the VPN IPv4 address family capability.

```
A:RR-1# show router bgp summary
=====
BGP Router ID:192.0.2.20      AS:64496      Local AS:64496
=====
BGP Admin State      : Up          BGP Oper State      : Up
Total Peer Groups    : 1           Total Peers         : 4
Total BGP Paths      : 18          Total Path Memory   : 3336
Total IPv4 Remote Rts : 0           Total IPv4 Rem. Active Rts : 0
Total McIPv4 Remote Rts : 0         Total McIPv4 Rem. Active Rts: 0
Total McIPv6 Remote Rts : 0         Total McIPv6 Rem. Active Rts: 0
Total IPv6 Remote Rts : 0           Total IPv6 Rem. Active Rts : 0
Total IPv4 Backup Rts : 0           Total IPv6 Backup Rts  : 0
```

## Associating Communities with Static and Aggregate Routes

```

Total Supressed Rts      : 0          Total Hist. Rts          : 0
Total Decay Rts          : 0

Total VPN Peer Groups    : 0          Total VPN Peers          : 0
Total VPN Local Rts      : 0
Total VPN-IPv4 Rem. Rts  : 8          Total VPN-IPv4 Rem. Act. Rts: 0
Total VPN-IPv6 Rem. Rts  : 0          Total VPN-IPv6 Rem. Act. Rts: 0
Total VPN-IPv4 Bkup Rts  : 0          Total VPN-IPv6 Bkup Rts   : 0

Total VPN Supp. Rts      : 0          Total VPN Hist. Rts      : 0
Total VPN Decay Rts      : 0

Total L2-VPN Rem. Rts    : 0          Total L2VPN Rem. Act. Rts : 0
Total MVPN-IPv4 Rem Rts  : 0          Total MVPN-IPv4 Rem Act Rts : 0
Total MDT-SAFI Rem Rts   : 0          Total MDT-SAFI Rem Act Rts  : 0
Total MSPW Rem Rts       : 0          Total MSPW Rem Act Rts     : 0
Total RouteTgt Rem Rts   : 0          Total RouteTgt Rem Act Rts  : 0
Total McVpnIPv4 Rem Rts  : 0          Total McVpnIPv4 Rem Act Rts : 0
Total MVPN-IPv6 Rem Rts  : 0          Total MVPN-IPv6 Rem Act Rts : 0
Total EVPN Rem Rts       : 0          Total EVPN Rem Act Rts     : 0
Total FlowIpv4 Rem Rts   : 0          Total FlowIpv4 Rem Act Rts  : 0
Total FlowIpv6 Rem Rts   : 0          Total FlowIpv6 Rem Act Rts  : 0

```

=====

BGP Summary

```

=====
Neighbor
          AS PktRcvd InQ Up/Down   State|Rcv/Act/Sent (Addr Family)
          PktSent OutQ
-----
192.0.2.1
          64496   2089   0 17h20m25s 7/0/8 (VpnIPv4)
                   2091   0
192.0.2.2
          64496   2083   0 17h20m16s 0/0/8 (VpnIPv4)
                   2091   0
192.0.2.3
          64496   2082   0 17h19m44s 0/0/8 (VpnIPv4)
                   2089   0
192.0.2.4
          64496   2084   0 17h20m19s 1/0/8 (VpnIPv4)
                   2091   0
-----

```

A:RR-1#

VPRN: IPv4

## VPRN: IPv4

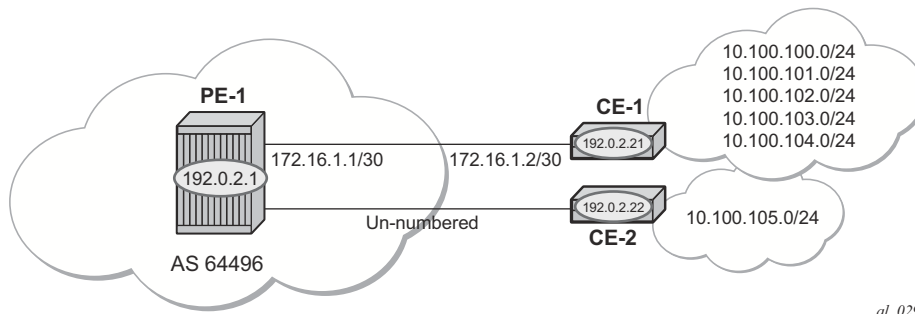


Figure 281: CE Connections for Next-Hops

The VPRN configuration for PE-1 is shown below:

```
A:PE-1# configure service vprn 3
-----
route-distinguisher 64496:3
auto-bind ldp
vrf-target target:64496:3
interface "int-PE-1-CE-1" create
  address 172.16.1.1/30
  sap 1/2/1:1.0 create
  exit
exit
interface "int-PE-1-CE-2" create
  unnumbered "loop1"
  sap 1/2/2:1.0 create
  exit
exit
interface "loop1" create
  address 192.0.2.100/32
  loopback
exit
```

LDP is used as the label-switching protocol for next-hop resolution.

The configuration is very similar for the other PEs.

PE-4 is configured with an interface towards CE-3 that supports eBGP, as follows:

```
A:PE-4# configure service vprn 3
A:PE-4>config>service>vprn# info
-----
autonomous-system 64496
route-distinguisher 64496:3
auto-bind ldp
vrf-target target:64496:3
```



## Associating Communities with Static and Aggregate Routes

```
interface "int-PE-4-CE-3" create
  address 172.16.0.1/30
  sap 1/1/4:3 create
  exit
exit
bgp
  export "PE-4-VPN-BGP"
  group "VPRN-3-ext"
    peer-as 64497
    neighbor 172.16.0.2
  exit
  exit
  no shutdown
exit
no shutdown
```

## Static Routes with Communities

A static route has a number of next-hop options – direct connected IP address, black-hole, indirect IP address and interface-name.

Figure 281 shows a pair of Customer Edge (CE) routers connected to PE1. The link to CE-1 is a numbered link. The link to CE-2 is an un-numbered link. The loopback interface address is used as a reference address for the un-numbered Ethernet interface.

Beyond CE-1 are a number of /24 subnets. Static routes to these individual subnets are created on PE-1 using a static route with a next-hop type of “interface address” or an “indirect address”. The indirect address is learned using a static route.

Beyond CE-2 is a single /24 subnet. A static route to this subnet is created using an interface-name next-hop type.

There are a number of well-known, standard communities:

- no-export: the route is not advertised to any external peer. This should be observed in the route tables of all BGP speakers in the originating AS, but not in those in neighboring ASs.
- no-advertise: the route is not advertised to any peer. This should not be observed in any router as BGP-learned route.

The requirement for each subnet is

- 10.100.100.0/24 must not be advertised outside of the AS. This must be associated with the standard, well-known community no-export. The community value is encoded as 65535:65281 (0xFFFFF01), but the CLI requires the keyword **no-export**.

```
A:PE-1>config>service vprn 3
static-route 10.100.100.0/24 next-hop 172.16.1.2 community no-export
```

- 10.100.101.0/24 must be advertised with a community of 64496:101

```
A:PE-1>config> service vprn 3
static-route 10.100.101.0/24 next-hop 172.16.1.2 community 64496:101
```

- 10.100.102.0/24 must not be advertised to any BGP peer. This must be associated with the standard, well-known community **no-advertise**. The community value is encoded as 65535:65282 (0xFFFFF02), but the CLI requires the keyword **no-advertise**.

```
A:PE-1>config> service vprn 3
static-route 10.100.102.0/24 next-hop 172.16.1.2 community no-advertise
```

- 10.100.103.0/24 must be advertised with a community of 64496:103 and a route tag of 10.

## Associating Communities with Static and Aggregate Routes

```
A:PE-1>config> service vprn 3
    static-route 10.100.103.0/24 next-hop 172.16.1.2 tag 10 community 64496:103
```

- 10.100.104.0/24 must be advertised with a community of 64496:104. It is reachable via 192.0.2.21 which, in turn, is reachable via 172.16.1.2. This is using a static route which does not need to be advertised – hence it is associated with the **no-advertise** community.

```
A:PE-1>config> service vprn 3
    static-route 10.100.104.0/24 indirect 192.0.2.21 community 64496:104
    static-route 192.0.2.21/32 next-hop 172.16.1.2 community no-advertise
```

- 10.100.105.0/24 must be advertised with a community of 64496:105. It is reachable via the un-numbered interface to CE-2.

```
A:PE-1>config> service vprn 3
    static-route 10.100.105.0/24 next-hop "int-PE-1-CE-2" community 64496:105
```

On PE-1 configure static routes that match the static routes from [Figure 281](#), and the conditions from above.

Note that the default behavior of a VPRN is to export all static and connected routes into a BGP labelled route with the appropriate route-target extended community configured in the vrf-target statement. A single community string can be added using the static-route community commands shown above. If multiple communities are required, then a VRF-export policy should be used. This is outside the scope of this note.

Examine the BGP table of PE-1 to establish that routes have been exported correctly in VPN IPv4 towards RR-1.

```
A:PE-1# show router bgp neighbor 192.0.2.20 advertised-routes vpn-ipv4
=====
BGP Router ID:192.0.2.1      AS:64496      Local AS:64496
=====
Legend -
Status codes  : u - used, s - suppressed, h - history, d - decayed, * - valid
Origin codes  : i - IGP, e - EGP, ? - incomplete, > - best, b - backup
=====
BGP VPN-IPv4 Routes
=====
Flag  Network                LocalPref  MED
      Nexthop                Path-Id    Label
      As-Path
-----
i     64496:3:10.100.100.0/24  100        None
      192.0.2.1                None        262142
      No As-Path
i     64496:3:10.100.101.0/24  100        None
      192.0.2.1                None        262142
      No As-Path
i     64496:3:10.100.103.0/24  100        None
      192.0.2.1                None        262142
```

## Static Routes with Communities

```

        No As-Path
i      64496:3:10.100.104.0/24          100      None
      192.0.2.1                        None     262142
        No As-Path
i      64496:3:10.100.105.0/24         100      None
      192.0.2.1                        None     262142
        No As-Path
i      64496:3:172.16.1.0/30           100      None
      192.0.2.1                        None     262142
        No As-Path
i      64496:3:192.0.2.100/32         100      None
      192.0.2.1                        None     262142
        No As-Path

```

```
-----
Routes : 7
=====
```

```
A:PE-1#
```

Note that there are only seven exported routes. The route prefixes associated with the **no-advertise** community are not present, as expected.

Examining the BGP table of PE-4 shows the presence of the expected routes, with the correct community values.

The prefix 10.100.100.0/24 is a member of community **no-export**. This is correctly advertised to PE-4.

```
A:PE-4# show router bgp routes vpn-ipv4 10.100.100.0/24 detail
```

```
=====
BGP Router ID:192.0.2.4      AS:64496      Local AS:64496
=====
Legend -
Status codes : u - used, s - suppressed, h - history, d - decayed, * - valid
Origin codes : i - IGP, e - EGP, ? - incomplete, > - best, b - backup
=====
BGP VPN-IPv4 Routes
=====
-----
Original Attributes

Network       : 10.100.100.0/24
Nextthop     : 192.0.2.1
Route Dist.  : 64496:3          VPN Label    : 262142
Path Id      : None
From        : 192.0.2.20
Res. Nextthop : n/a
Local Pref. : 100              Interface Name : int-PE-4-PE-1
Aggregator AS : None          Aggregator   : None
Atomic Aggr. : Not Atomic     MED          : None
AIGP Metric  : None
Connector    : None
Community    : no-export target:64496:3
Cluster      : 0.0.0.1
Originator Id : 192.0.2.1        Peer Router Id : 192.0.2.20
Fwd Class    : None           Priority      : None
Flags        : Used Valid Best IGP

```

## Associating Communities with Static and Aggregate Routes

```
Route Source      : Internal
AS-Path          : No As-Path
Neighbor-AS      : N/A
VPRN Imported    : 3
```

### Modified Attributes

```
Network          : 10.100.100.0/24
Nexthop          : 192.0.2.1
Route Dist.      : 64496:3          VPN Label       : 262142
Path Id         : None
From            : 192.0.2.20
Res. Nexthop    : n/a
Local Pref.     : 100              Interface Name  : int-PE-4-PE-1
Aggregator AS   : None            Aggregator     : None
Atomic Aggr.    : Not Atomic      MED            : None
AIGP Metric     : None
Connector       : None
Community       : no-export target:64496:3
Cluster         : 0.0.0.1
Originator Id   : 192.0.2.1       Peer Router Id  : 192.0.2.20
Fwd Class       : None            Priority        : None
Flags           : Used Valid Best IGP
Route Source    : Internal
AS-Path        : No As-Path
Neighbor-AS    : N/A
VPRN Imported  : 3
```

```
-----
Routes : 1
=====
```

```
A:PE-4#
```

The prefix 10.100.101.0/24 is a member of community 64496:101. This is correctly advertised to PE-4.

```
A:PE-4# show router bgp routes vpn-ipv4 10.100.101.0/24 detail
```

```
=====
BGP Router ID:192.0.2.4      AS:64496      Local AS:64496
=====
Legend -
Status codes : u - used, s - suppressed, h - history, d - decayed, * - valid
Origin codes  : i - IGP, e - EGP, ? - incomplete, > - best, b - backup
```

```
=====
BGP VPN-IPv4 Routes
=====
```

### Original Attributes

```
Network          : 10.100.101.0/24
Nexthop          : 192.0.2.1
Route Dist.      : 64496:3          VPN Label       : 262142
Path Id         : None
From            : 192.0.2.20
Res. Nexthop    : n/a
Local Pref.     : 100              Interface Name  : int-PE-4-PE-1
Aggregator AS   : None            Aggregator     : None
```

## Static Routes with Communities

```

Atomic Aggr.      : Not Atomic          MED           : None
AIGP Metric      : None
Connector        : None
Community        : 64496:101 target:64496:3
Cluster          : 0.0.0.1
Originator Id    : 192.0.2.1           Peer Router Id : 192.0.2.20
Fwd Class        : None                Priority       : None
Flags            : Used Valid Best IGP
Route Source     : Internal
AS-Path          : No As-Path
Neighbor-AS     : N/A
VPRN Imported    : 3
  
```

### Modified Attributes

```

Network          : 10.100.101.0/24
Nexthop          : 192.0.2.1
Route Dist.      : 64496:3            VPN Label      : 262142
Path Id          : None
From             : 192.0.2.20
Res. Nexthop     : n/a
Local Pref.      : 100                Interface Name : int-PE-4-PE-1
Aggregator AS    : None                Aggregator     : None
Atomic Aggr.     : Not Atomic          MED           : None
AIGP Metric      : None
Connector        : None
Community        : 64496:101 target:64496:3
Cluster          : 0.0.0.1
Originator Id    : 192.0.2.1           Peer Router Id : 192.0.2.20
Fwd Class        : None                Priority       : None
Flags            : Used Valid Best IGP
Route Source     : Internal
AS-Path          : No As-Path
Neighbor-AS     : N/A
VPRN Imported    : 3
  
```

```

-----
Routes : 1
=====
  
```

```
A:PE-4#
```

The prefix 10.100.103.0/24 is a member of community 64496:103. This is correctly advertised to PE-4.

```
A:PE-4# show router bgp routes vpn-ipv4 10.100.103.0/24 detail
```

```

=====
BGP Router ID:192.0.2.4      AS:64496      Local AS:64496
=====
  
```

### Legend -

```

Status codes : u - used, s - suppressed, h - history, d - decayed, * - valid
Origin codes  : i - IGP, e - EGP, ? - incomplete, > - best, b - backup
  
```

```

=====
BGP VPN-IPv4 Routes
=====
  
```

```
-----
Original Attributes
  
```

## Associating Communities with Static and Aggregate Routes

```
Network      : 10.100.103.0/24
Nextthop    : 192.0.2.1
Route Dist.  : 64496:3          VPN Label     : 262142
Path Id      : None
From        : 192.0.2.20
Res. Nextthop : n/a
Local Pref.  : 100              Interface Name : int-PE-4-PE-1
Aggregator AS : None           Aggregator    : None
Atomic Aggr. : Not Atomic      MED           : None
AIGP Metric  : None
Connector    : None
Community    : 64496:103 target:64496:3
Cluster      : 0.0.0.1
Originator Id : 192.0.2.1      Peer Router Id : 192.0.2.20
Fwd Class    : None           Priority       : None
Flags        : Used Valid Best IGP
Route Source : Internal
AS-Path      : No As-Path
Neighbor-AS  : N/A
VPRN Imported : 3
```

### Modified Attributes

```
Network      : 10.100.103.0/24
Nextthop    : 192.0.2.1
Route Dist.  : 64496:3          VPN Label     : 262142
Path Id      : None
From        : 192.0.2.20
Res. Nextthop : n/a
Local Pref.  : 100              Interface Name : int-PE-4-PE-1
Aggregator AS : None           Aggregator    : None
Atomic Aggr. : Not Atomic      MED           : None
AIGP Metric  : None
Connector    : None
Community    : 64496:103 target:64496:3
Cluster      : 0.0.0.1
Originator Id : 192.0.2.1      Peer Router Id : 192.0.2.20
Fwd Class    : None           Priority       : None
Flags        : Used Valid Best IGP
Route Source : Internal
AS-Path      : No As-Path
Neighbor-AS  : N/A
VPRN Imported : 3
```

-----  
Routes : 1  
=====

A:PE-4#

The prefix 10.100.104.0/24 is a member of community 64496:104. This is correctly advertised to PE-4.

A:PE-4# show router bgp routes vpn-ipv4 10.100.104.0/24 detail

```
=====
BGP Router ID:192.0.2.4      AS:64496      Local AS:64496
=====
```

Legend -

## Static Routes with Communities

```
Status codes : u - used, s - suppressed, h - history, d - decayed, * - valid
Origin codes : i - IGP, e - EGP, ? - incomplete, > - best, b - backup
=====
BGP VPN-IPv4 Routes
=====
-----
Original Attributes

Network      : 10.100.104.0/24
Nextthop    : 192.0.2.1
Route Dist. : 64496:3          VPN Label      : 262142
Path Id      : None
From        : 192.0.2.20
Res. Nextthop : n/a
Local Pref. : 100              Interface Name : int-PE-4-PE-1
Aggregator AS : None          Aggregator    : None
Atomic Aggr. : Not Atomic     MED           : None
AIGP Metric  : None
Connector    : None
Community    : 64496:104 target:64496:3
Cluster      : 0.0.0.1
Originator Id : 192.0.2.1        Peer Router Id : 192.0.2.20
Fwd Class    : None           Priority       : None
Flags        : Used Valid Best IGP
Route Source : Internal
AS-Path      : No As-Path
Neighbor-AS  : N/A
VPRN Imported : 3

Modified Attributes

Network      : 10.100.104.0/24
Nextthop    : 192.0.2.1
Route Dist. : 64496:3          VPN Label      : 262142
Path Id      : None
From        : 192.0.2.20
Res. Nextthop : n/a
Local Pref. : 100              Interface Name : int-PE-4-PE-1
Aggregator AS : None          Aggregator    : None
Atomic Aggr. : Not Atomic     MED           : None
AIGP Metric  : None
Connector    : None
Community    : 64496:104 target:64496:3
Cluster      : 0.0.0.1
Originator Id : 192.0.2.1        Peer Router Id : 192.0.2.20
Fwd Class    : None           Priority       : None
Flags        : Used Valid Best IGP
Route Source : Internal
AS-Path      : No As-Path
Neighbor-AS  : N/A
VPRN Imported : 3

-----
Routes : 1
=====
A:PE-4#
```



## Associating Communities with Static and Aggregate Routes

The prefix 10.100.105.0/24 is a member of community 64496:105. This is correctly advertised to PE-4.

```
A:PE-4# show router bgp routes vpn-ipv4 10.100.105.0/24 detail
=====
BGP Router ID:192.0.2.4      AS:64496      Local AS:64496
=====
Legend -
Status codes  : u - used, s - suppressed, h - history, d - decayed, * - valid
Origin codes  : i - IGP, e - EGP, ? - incomplete, > - best, b - backup
=====
BGP VPN-IPv4 Routes
=====
-----
Original Attributes

Network       : 10.100.105.0/24
Nexthop      : 192.0.2.1
Route Dist.  : 64496:3          VPN Label    : 262142
Path Id      : None
From        : 192.0.2.20
Res. Nexthop : n/a
Local Pref.  : 100              Interface Name : int-PE-4-PE-1
Aggregator AS : None           Aggregator    : None
Atomic Aggr. : Not Atomic      MED           : None
AIGP Metric  : None
Connector    : None
Community    : 64496:105 target:64496:3
Cluster      : 0.0.0.1
Originator Id : 192.0.2.1       Peer Router Id : 192.0.2.20
Fwd Class    : None            Priority       : None
Flags        : Used Valid Best IGP
Route Source : Internal
AS-Path      : No As-Path
Neighbor-AS  : N/A
VPRN Imported : 3

Modified Attributes

Network       : 10.100.105.0/24
Nexthop      : 192.0.2.1
Route Dist.  : 64496:3          VPN Label    : 262142
Path Id      : None
From        : 192.0.2.20
Res. Nexthop : n/a
Local Pref.  : 100              Interface Name : int-PE-4-PE-1
Aggregator AS : None           Aggregator    : None
Atomic Aggr. : Not Atomic      MED           : None
AIGP Metric  : None
Connector    : None
Community    : 64496:105 target:64496:3
Cluster      : 0.0.0.1
Originator Id : 192.0.2.1       Peer Router Id : 192.0.2.20
Fwd Class    : None            Priority       : None
Flags        : Used Valid Best IGP
Route Source : Internal
AS-Path      : No As-Path
Neighbor-AS  : N/A
```

## Static Routes with Communities

```
VPRN Imported : 3
```

```
-----  
Routes : 1  
=====
```

```
A:PE-4#
```

Examine the route table of PE-4 – looking specifically at the BGP-learned routes, the same seven routes are present as valid routes.

```
A:PE-4# show router 3 route-table protocol bgp-vpn
```

```
-----  
Route Table (Service: 3)  
=====
```

Dest Prefix[Flags] Next Hop[Interface Name]	Type	Proto	Age Metric	Pref
10.100.100.0/24 192.0.2.1 (tunneled)	Remote	BGP VPN	17h24m48s 0	170
10.100.101.0/24 192.0.2.1 (tunneled)	Remote	BGP VPN	17h24m48s 0	170
10.100.103.0/24 192.0.2.1 (tunneled)	Remote	BGP VPN	17h24m48s 0	170
10.100.104.0/24 192.0.2.1 (tunneled)	Remote	BGP VPN	17h24m48s 0	170
10.100.105.0/24 192.0.2.1 (tunneled)	Remote	BGP VPN	17h24m48s 0	170
172.16.1.0/30 192.0.2.1 (tunneled)	Remote	BGP VPN	17h24m48s 0	170
192.0.2.100/32 192.0.2.1 (tunneled)	Remote	BGP VPN	17h24m48s 0	170

```
-----  
No. of Routes: 7
```

```
Flags: n = Number of times nexthop is repeated
```

```
B = BGP backup route available
```

```
L = LFA nexthop available  
=====
```

```
A:PE-4#
```

Examine the route table of CE-3 – looking specifically at the BGP-learned routes, six routes are present as valid routes, as expected.

```
A:CE-3# show router route-table protocol bgp
```

```
-----  
Route Table (Router: Base)  
=====
```

Dest Prefix[Flags] Next Hop[Interface Name]	Type	Proto	Age Metric	Pref
10.100.101.0/24 172.16.0.1	Remote	BGP	17h32m32s 0	170
10.100.103.0/24 172.16.0.1	Remote	BGP	17h32m32s 0	170
10.100.104.0/24 172.16.0.1	Remote	BGP	17h32m32s 0	170
10.100.105.0/24 172.16.0.1	Remote	BGP	17h32m32s 0	170
172.16.1.0/30	Remote	BGP	17h32m32s	170

## Associating Communities with Static and Aggregate Routes

```

172.16.0.1
192.0.2.100/32 Remote BGP 17h32m32s 170
172.16.0.1 0

```

```

-----
No. of Routes: 6
Flags: n = Number of times nexthop is repeated
      B = BGP backup route available
      L = LFA nexthop available
=====

```

A:CE-3#

The prefix 10.100.100.0/24 is not received from PE-4 as it is a member of the **no-export** community.

A:CE-3# show router bgp routes community 64496:100

```

=====
BGP Router ID:192.0.2.11 AS:64497 Local AS:64497
=====
Legend -
Status codes : u - used, s - suppressed, h - history, d - decayed, * - valid
Origin codes : i - IGP, e - EGP, ? - incomplete, > - best, b - backup
=====

```

BGP IPv4 Routes

```

=====
Flag Network LocalPref MED
      Nexthop Path-Id Label
      As-Path
=====

```

No Matching Entries Found

A:CE-3#

Static route 10.100.101.0/24 is received with the correct community 64496:101.

A:CE-3# show router bgp routes community 64496:101

```

=====
BGP Router ID:192.0.2.11 AS:64497 Local AS:64497
=====
Legend -
Status codes : u - used, s - suppressed, h - history, d - decayed, * - valid
Origin codes : i - IGP, e - EGP, ? - incomplete, > - best, b - backup
=====

```

BGP IPv4 Routes

```

=====
Flag Network LocalPref MED
      Nexthop Path-Id Label
      As-Path
=====

```

```

-----
u*>i 10.100.101.0/24 None None
      172.16.0.1 None -
      64496
-----

```

Routes : 1

## Static Routes with Communities

A:CE-3#

Static route 10.100.103.0/24 is received with the correct community 64496:103.

A:CE-3# show router bgp routes community 64496:103

```
=====
BGP Router ID:192.0.2.11      AS:64497      Local AS:64497
=====
Legend -
Status codes  : u - used, s - suppressed, h - history, d - decayed, * - valid
Origin codes  : i - IGP, e - EGP, ? - incomplete, > - best, b - backup
=====
BGP IPv4 Routes
=====
Flag  Network                LocalPref  MED
      Nexthop                Path-Id    Label
      As-Path
-----
u*>i  10.100.103.0/24          None       None
      172.16.0.1             None       -
      64496
-----
Routes : 1
=====
A:CE-3#
```

Static route 10.100.104.0/24 is received with the correct community 64496:104.

A:CE-3# show router bgp routes community 64496:104

```
=====
BGP Router ID:192.0.2.11      AS:64497      Local AS:64497
=====
Legend -
Status codes  : u - used, s - suppressed, h - history, d - decayed, * - valid
Origin codes  : i - IGP, e - EGP, ? - incomplete, > - best, b - backup
=====
BGP IPv4 Routes
=====
Flag  Network                LocalPref  MED
      Nexthop                Path-Id    Label
      As-Path
-----
u*>i  10.100.104.0/24          None       None
      172.16.0.1             None       -
      64496
-----
Routes : 1
=====
A:CE-3#
```

Static route 10.100.105.0/24 is received with the correct community 64496:105.

A:CE-3# show router bgp routes community 64496:105

```
=====
BGP Router ID:192.0.2.11      AS:64497      Local AS:64497
=====
```

## Associating Communities with Static and Aggregate Routes

```
=====
Legend -
Status codes : u - used, s - suppressed, h - history, d - decayed, * - valid
Origin codes : i - IGP, e - EGP, ? - incomplete, > - best, b - backup
=====
BGP IPv4 Routes
=====
Flag   Network                               LocalPref  MED
      Nexthop                             Path-Id    Label
      As-Path
-----
u*>i  10.100.105.0/24                         None       None
      172.16.0.1                             None       -
      64496
-----
Routes : 1
=====
A:CE-3#
```

## Aggregate Routes with Communities

An aggregate route can be configured to represent a larger number of prefixes. For example, a set of prefixes 10.101.0.0/24 to 10.101.8.0/24 can be represented as a single aggregate prefix of 10.101.0.0/21.

This is due to the fact that the third octet in the range 0 to 15 can be represented by the 8 bits 00000000 to 00000111. The first 5 bits of this octet are common, along with the previous 2 octets, giving a prefix where the first 21 bits are common. Therefore the aggregate can be written as 10.101.0.0/21.

In order to illustrate the configuration of an aggregate, consider following.

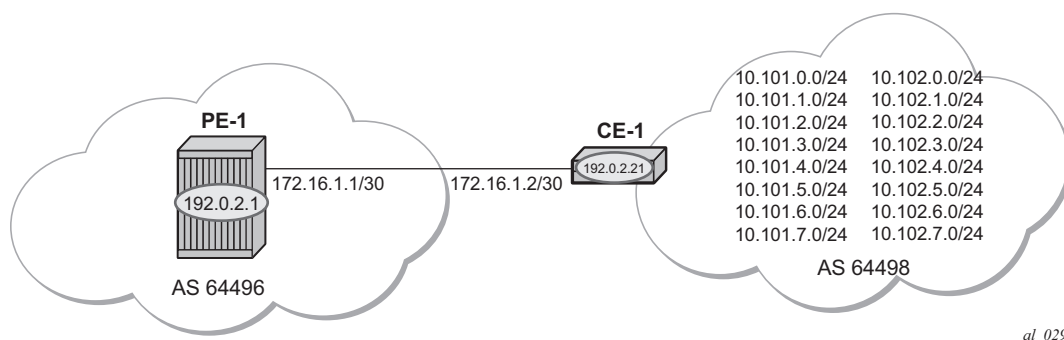


Figure 282: CE-1 Connectivity

Figure 282 shows a CE router (CE-1), in AS 64498, that advertises a series of contiguous prefixes via BGP.

- 10.101.0.0/24 to 10.101.7.0/24
- 10.102.0.0/24 to 10.102.7.0/24

Instead of advertising all of these prefixes out of the VPRN towards an external CE, an aggregate route can be configured that summarizes each set of 8 prefixes and a community can be directly associated with each aggregate route.

The configuration for a VPRN on PE-1, including the external BGP configuration is as follows:

```
B:PE-1>config>service>vprn# info
-----
autonomous-system 64496
route-distinguisher 64496:4
auto-bind mpls
vrf-target target:64496:4
interface "int-PE-1-CE-1" create
```

## Associating Communities with Static and Aggregate Routes

```
        address 172.16.1.1/30
        sap 1/2/1:2.0 create
        exit
    exit
    bgp
        group "external"
            family ipv4
            type external
            peer-as 64498
            neighbor 172.16.1.2
            exit
        exit
        no shutdown
    exit
    no shutdown
```

The neighbor relationship shows:

```
*A:PE-1# show router 4 bgp neighbor
```

```
=====
BGP Neighbor
=====
```

```
-----
Peer   : 172.16.1.2
Group  : external
-----
```

```
-----
Peer AS           : 64498           Peer Port         : 179
Peer Address      : 172.16.1.2
Local AS          : 64496           Local Port        : 50709
Local Address     : 172.16.1.1
Peer Type         : External
State             : Established      Last State        : Active
Last Event        : recvKeepAlive
Last Error        : Unrecognized Error
Local Family      : IPv4
Remote Family     : IPv4
Hold Time         : 90               Keep Alive        : 30
Min Hold Time     : 0
Active Hold Time  : 90               Active Keep Alive : 30
Cluster Id        : None
Preference        : 170              Num of Update Flaps : 0
Recd. Paths       : 1
IPv4 Recd. Prefixes : 16            IPv4 Active Prefixes : 16
IPv4 Suppressed Pfxs : 0            VPN-IPv4 Suppr. Pfxs : 0
VPN-IPv4 Recd. Pfxs : 0            VPN-IPv4 Active Pfxs : 0
Mc IPv4 Recd. Pfxs. : 0            Mc IPv4 Active Pfxs. : 0
Mc IPv4 Suppr. Pfxs : 0            IPv6 Suppressed Pfxs : 0
IPv6 Recd. Prefixes : 0            IPv6 Active Prefixes : 0
VPN-IPv6 Recd. Pfxs : 0            VPN-IPv6 Active Pfxs : 0
VPN-IPv6 Suppr. Pfxs : 0
Mc IPv6 Recd. Pfxs. : 0            Mc IPv6 Active Pfxs. : 0
Mc IPv6 Suppr. Pfxs : 0            L2-VPN Suppr. Pfxs  : 0
L2-VPN Recd. Pfxs  : 0            L2-VPN Active Pfxs  : 0
MVPN-IPv4 Suppr. Pfxs : 0          MVPN-IPv4 Recd. Pfxs : 0
MVPN-IPv4 Active Pfxs : 0          MDT-SAFI Suppr. Pfxs : 0
MDT-SAFI Recd. Pfxs : 0            MDT-SAFI Active Pfxs : 0
Flow-IPv4 Suppr. Pfxs : 0          Flow-IPv4 Recd. Pfxs : 0
Flow-IPv4 Active Pfxs : 0          Rte-Tgt Suppr. Pfxs : 0
```

## Aggregate Routes with Communities

```

Rte-Tgt Recd. Pfxs      : 0
Backup IPv4 Pfxs       : 0
Mc Vpn Ipv4 Recd. Pf*  : 0
Backup Vpn IPv4 Pfxs   : 0
Input Queue           : 0
i/p Messages          : 10
i/p Octets             : 304
i/p Updates           : 1
MVPN-IPv6 Suppr. Pfxs : 0
MVPN-IPv6 Active Pfxs : 0
Flow-IPv6 Suppr. Pfxs : 0
Flow-IPv6 Active Pfxs : 0
Evpn Suppr. Pfxs      : 0
Evpn Active Pfxs      : 0
TTL Security          : Disabled
Graceful Restart      : Disabled
Restart Time          : n/a
Advertise Inactive    : Disabled
Advertise Label       : None
Auth key chain        : n/a
Disable Cap Nego      : Disabled
Flowspec Validate     : Disabled
Aigp Metric           : Disabled
Damp Peer Oscillatio* : Disabled
GR Notification       : Disabled
Rem Idle Hold Time    : 00h00m00s
Next-Hop Unchanged    : None
Local Capability      : RtRefresh MPBGP 4byte ASN
Remote Capability     : RtRefresh MPBGP 4byte ASN
Local AddPath Capabi* : Disabled
Remote AddPath Capab* : Send - None
                     : Receive - None
Import Policy         : None Specified / Inherited
Export Policy         : None Specified / Inherited

```

```
-----
Neighbors : 1
=====
```

```
* indicates that the corresponding row element may have been truncated.
*A:PE-1#
```

The following output shows that 16 BGP routes are received by PE-1.

```

*A:PE-1# show router 4 bgp routes
=====
BGP Router ID:192.0.2.1      AS:64496      Local AS:64496
=====
Legend -
Status codes : u - used, s - suppressed, h - history, d - decayed, * - valid
Origin codes  : i - IGP, e - EGP, ? - incomplete, > - best, b - backup
=====
BGP IPv4 Routes
=====
Flag  Network                               LocalPref  MED
      Nexthop                               Path-Id    Label
      As-Path
-----
u*>i  10.101.0.0/24                          None       None

```



## Associating Communities with Static and Aggregate Routes

```

172.16.1.2
64498
u*>i 10.101.1.0/24
172.16.1.2
64498
u*>i 10.101.2.0/24
172.16.1.2
64498
u*>i 10.101.3.0/24
172.16.1.2
64498
u*>i 10.101.4.0/24
172.16.1.2
64498
u*>i 10.101.5.0/24
172.16.1.2
64498
u*>i 10.101.6.0/24
172.16.1.2
64498
u*>i 10.101.7.0/24
172.16.1.2
64498
u*>i 10.102.0.0/24
172.16.1.2
64498
u*>i 10.102.1.0/24
172.16.1.2
64498
u*>i 10.102.2.0/24
172.16.1.2
64498
u*>i 10.102.3.0/24
172.16.1.2
64498
u*>i 10.102.4.0/24
172.16.1.2
64498
u*>i 10.102.5.0/24
172.16.1.2
64498
u*>i 10.102.6.0/24
172.16.1.2
64498
u*>i 10.102.7.0/24
172.16.1.2
64498
-----
Routes : 16
=====
*A:PE-1#

```

## Aggregate Routes with Communities

PE-4 also has a VPRN 4 instance configured, so that it will receive the imported BGP routes. The configuration for PE-4 is:

```
A:PE-4>config>service>vprn# info
-----
autonomous-system 64496
route-distinguisher 64496:4
auto-bind mpls
vrf-target target:64496:4
interface "int-PE-4-CE-3" create
  address 172.16.0.5/30
  sap 1/1/4:4 create
  exit
exit
bgp
  group "VPRN-4-ext"
    peer-as 64497
    neighbor 172.16.0.6
    exit
  exit
  no shutdown
exit
no shutdown
```

Figure 283 shows the connectivity between PE-4 and CE-3. PE-4 will only forward a summarizing aggregate route towards CE-3.

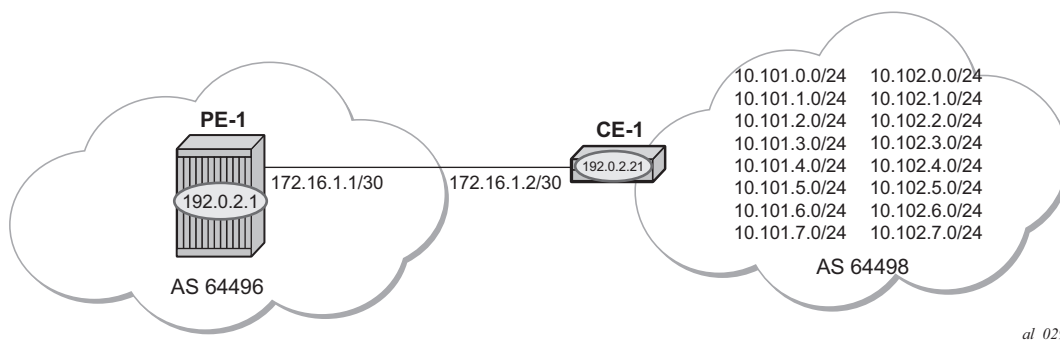


Figure 283: CE-3 Connectivity

PE-4 receives labelled BGP route prefixes from PE-1 via the route reflector and installs them in the FIB for router instance 4:

```
*A:PE-4# show router 4 route-table
=====
Route Table (Service: 4)
=====
Dest Prefix[Flags]                               Type   Proto   Age      Pref
      Next Hop[Interface Name]                   Metric
-----
```

## Associating Communities with Static and Aggregate Routes

```

10.101.0.0/24          Remote BGP VPN 00h00m57s 170
    192.0.2.1 (tunneled)
10.101.1.0/24          Remote BGP VPN 00h00m57s 170
    192.0.2.1 (tunneled)
10.101.2.0/24          Remote BGP VPN 00h00m57s 170
    192.0.2.1 (tunneled)
10.101.3.0/24          Remote BGP VPN 00h00m57s 170
    192.0.2.1 (tunneled)
10.101.4.0/24          Remote BGP VPN 00h00m57s 170
    192.0.2.1 (tunneled)
10.101.5.0/24          Remote BGP VPN 00h00m57s 170
    192.0.2.1 (tunneled)
10.101.6.0/24          Remote BGP VPN 00h00m57s 170
    192.0.2.1 (tunneled)
10.101.7.0/24          Remote BGP VPN 00h00m57s 170
    192.0.2.1 (tunneled)
10.102.0.0/24          Remote BGP VPN 00h00m57s 170
    192.0.2.1 (tunneled)
10.102.1.0/24          Remote BGP VPN 00h00m57s 170
    192.0.2.1 (tunneled)
10.102.2.0/24          Remote BGP VPN 00h00m57s 170
    192.0.2.1 (tunneled)
10.102.3.0/24          Remote BGP VPN 00h00m57s 170
    192.0.2.1 (tunneled)
10.102.4.0/24          Remote BGP VPN 00h00m57s 170
    192.0.2.1 (tunneled)
10.102.5.0/24          Remote BGP VPN 00h00m57s 170
    192.0.2.1 (tunneled)
10.102.6.0/24          Remote BGP VPN 00h00m57s 170
    192.0.2.1 (tunneled)
10.102.7.0/24          Remote BGP VPN 00h00m57s 170
    192.0.2.1 (tunneled)
172.16.0.4/30          Local  Local  00h01m00s  0
    int-PE-4-CE-3
172.16.1.0/30          Remote BGP VPN 00h00m57s 170
    192.0.2.1 (tunneled)

```

```

-----
No. of Routes: 18
Flags: n = Number of times nexthop is repeated
       B = BGP backup route available
       L = LFA nexthop available

```

```

=====
*A:PE-4#

```

## Aggregate Routes with Communities

The CE-3 configuration for an interface towards PE-4 is as follows:

```
*A:CE-3>config>service>ies# info
      interface "int-CE-3-PE-4-2" create
      address 172.16.0.6/30
      sap 1/1/2:4 create
      exit
exit
no shutdown
```

The BGP configuration of CE-3:

```
*A:CE-3>config>router>bgp# info
-----
      group "ext"
      peer-as 64496
      neighbor 172.16.0.5
      exit
exit
```

The BGP neighbor state for PE-4:

```
*A:PE-4# show router 4 bgp neighbor 172.16.0.6
=====
BGP Neighbor
=====
-----
Peer   : 172.16.0.6
Group  : VPRN-4-ext
-----
Peer AS           : 64497           Peer Port         : 179
Peer Address      : 172.16.0.6
Local AS          : 64496           Local Port        : 50539
Local Address     : 172.16.0.5
Peer Type         : External
State             : Established     Last State        : Active
Last Event        : recvKeepAlive
Last Error        : Unrecognized Error
Local Family      : IPv4
Remote Family     : IPv4
Hold Time         : 90              Keep Alive        : 30
Min Hold Time     : 0
Active Hold Time  : 90              Active Keep Alive : 30
Cluster Id        : None
Preference        : 170             Num of Update Flaps : 0
Recd. Paths       : 0
IPv4 Recd. Prefixes : 0             IPv4 Active Prefixes : 0
IPv4 Suppressed Pfxs : 0           VPN-IPv4 Suppr. Pfxs : 0
VPN-IPv4 Recd. Pfxs : 0           VPN-IPv4 Active Pfxs : 0
Mc IPv4 Recd. Pfxs. : 0           Mc IPv4 Active Pfxs. : 0
Mc IPv4 Suppr. Pfxs : 0           IPv6 Suppressed Pfxs : 0
IPv6 Recd. Prefixes : 0           IPv6 Active Prefixes : 0
VPN-IPv6 Recd. Pfxs : 0           VPN-IPv6 Active Pfxs : 0
VPN-IPv6 Suppr. Pfxs : 0
Mc IPv6 Recd. Pfxs. : 0           Mc IPv6 Active Pfxs. : 0
```

## Associating Communities with Static and Aggregate Routes

```

Mc IPv6 Suppr. Pfxs : 0
L2-VPN Recd. Pfxs : 0
MVPN-IPv4 Suppr. Pfxs: 0
MVPN-IPv4 Active Pfxs: 0
MDT-SAFI Recd. Pfxs : 0
Flow-IPv4 Suppr. Pfxs: 0
Flow-IPv4 Active Pfxs: 0
Rte-Tgt Recd. Pfxs : 0
Backup IPv4 Pfxs : 0
Mc Vpn Ipv4 Recd. Pf*: 0
Backup Vpn IPv4 Pfxs : 0
Input Queue : 0
i/p Messages : 4
i/p Octets : 102
i/p Updates : 0
MVPN-IPv6 Suppr. Pfxs: 0
MVPN-IPv6 Active Pfxs: 0
Flow-IPv6 Suppr. Pfxs: 0
Flow-IPv6 Active Pfxs: 0
Evpn Suppr. Pfxs : 0
Evpn Active Pfxs : 0
TTL Security : Disabled
Graceful Restart : Disabled
Restart Time : n/a
Advertise Inactive : Disabled
Advertise Label : None
Auth key chain : n/a
Disable Cap Nego : Disabled
Flowspec Validate : Disabled
Aigp Metric : Disabled
Damp Peer Oscillatio*: Disabled
GR Notification : Disabled
Rem Idle Hold Time : 00h00m00s
Next-Hop Unchanged : None
Local Capability : RtRefresh MPBGP 4byte ASN
Remote Capability : RtRefresh MPBGP 4byte ASN
Local AddPath Capabi*: Disabled
Remote AddPath Capab*: Send - None
: Receive - None
Import Policy : None Specified / Inherited
Export Policy : PE-4-VPN-Agg
-----

```

Neighbors : 1

\* indicates that the corresponding row element may have been truncated.  
\*A:PE-4#

In order to advertise a summarizing aggregate route with an associated community string, an aggregate route is required. In this case, the 10.101.x.0/24 group of prefixes will be associated with community 64496:101. The 10.102.x.0/24 group of prefixes will be associated with the standard community **no-export**, so that it will not be advertised to any external peer.

The configuration required is:

```

*A:PE-4>config>service>vprn#
    aggregate 10.101.0.0/21 community 64496:101

```

## Aggregate Routes with Communities

```
aggregate 10.102.0.0/21 community no-export
```

An export policy is required to allow the advertising of the aggregate route. Note that no community is applied using this policy.

```
*A:PE-4>config>router>policy-options# begin
  policy-statement "PE-4-VPN-Agg"
    entry 10
      from
        protocol aggregate
      exit
      action accept
      exit
    exit
  exit
commit
```

This is applied as an export policy within the group context of the BGP configuration of the VPRN.

```
*A:PE-4>config>service>vprn#
  bgp
    group "VPRN-4-ext"
      export "PE-4-VPN-Agg"
    exit
  no shutdown
exit
```

The aggregate route 10.101.0.0/21 is received at CE-3 via BGP. The community that was associated with this prefix is seen – 64496:101. Note that the route is seen as an aggregate, with PE-4 as the aggregating router (192.0.2.4). Note also that the “Atomic Aggregate” attribute is present, meaning that PE-4 has not advertised any details of the AS Paths of the composite routes.

```
A:CE-3# show router bgp routes 10.101.0.0/21 hunt
=====
BGP Router ID:192.0.2.11      AS:64497      Local AS:64497
=====
Legend -
Status codes : u - used, s - suppressed, h - history, d - decayed, * - valid
Origin codes : i - IGP, e - EGP, ? - incomplete, > - best, b - backup
=====
BGP IPv4 Routes
=====
RIB In Entries
-----
Network      : 10.101.0.0/21
Nexthop      : 172.16.0.5
Path Id      : None
From         : 172.16.0.5
Res. Nexthop : 172.16.0.5
Local Pref.  : None
Aggregator AS : 64496
Interface Name : int-CE-3-PE-4
Aggregator   : 192.0.2.4
```

## Associating Communities with Static and Aggregate Routes

```
Atomic Aggr.      : Atomic                MED                : None
AIGP Metric      : None
Connector        : None
Community        : 64496:101
Cluster         : No Cluster Members
Originator Id    : None                  Peer Router Id : 192.0.2.4
Fwd Class       : None                  Priority       : None
Flags           : Used Valid Best IGP
Route Source     : External
AS-Path         : 64496
Neighbor-AS     : 64496
```

```
-----
RIB Out Entries
-----
-----
```

```
Routes : 1
```

```
=====
A:CE-3#
```

The aggregate route 10.102.0.0/21 is not received at CE-3, as PE-4 does not advertise it, due to the fact that it is associated with the “no-export” community.

```
A:CE-3# show router bgp routes 10.102.0.0/21 hunt
```

```
=====
BGP Router ID:192.0.2.11      AS:64497      Local AS:64497
=====
```

```
Legend -
```

```
Status codes : u - used, s - suppressed, h - history, d - decayed, * - valid
```

```
Origin codes : i - IGP, e - EGP, ? - incomplete, > - best, b - backup
```

```
=====
BGP IPv4 Routes
=====
```

```
No Matching Entries Found
=====
```

```
A:CE-3#
```

## Conclusion

Community strings can be added to static and aggregate routes. This example shows the configuration of communities with both static and aggregate routes, together with the associated show outputs which can be used to verify and troubleshoot them.