AOS-CX 10.6 Update
November, 2020

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IPv6 BGP peering for EVPN AF

Aruba Switching TME

IPv6 BGP peering for EVPN Address-Family

Agenda

1. Overview
2. Use Cases
3. Details / Caveats
4. Configuration
5. Best Practices
6. Troubleshooting

Overview

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Overview

IPv6 BGP peering for EVPN Address-Family

- EVPN address-family is hosted in the default VRF.
- Before 10.6, BGP peering for EVPN AF could be established only between IPv4 IP addresses.
- Since 10.6, IPv6 address can be used for BGP peers to exchange EVPN routes.
- This is valid for both iBGP and eBGP peering.

Use Cases

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Use cases

- **Phase1 of IPV6 underlay** support for EVPN-based-VXLAN fabric
- **There is not yet any use-case for this feature in 10.6**.
  Reason: only IPv4 address is supported for VXLAN tunnel address.

```
8325-1(config)# int vxlan 1
8325-1(config-vxlan-if)# source
  ip  IP information
8325-1(config-vxlan-if)# source ip
  A.B.C.D  Set the tunnel source IP
```

- When VXLAN IPv6 source address is available, then the use-case of a full IPv6 underlay for EVPN-VXLAN fabric will require such feature that is released as part of 10.6.
- Why is it in the scope of 10.6 then?
  This was a very small development effort to add this feature in 10.6, providing the necessary control-plane pre-requisite for IPv6 fabric underlay.

Details

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Platform Support

10.6

Routing Protocols	6200	6300	6400	8360	8320	8325	8400
IPv6 MP-BGP peering EVPN AF	N/A	Yes	Yes	Yes	Yes	Yes	Yes
IPv6 VXLAN interface	N/A	No	No	No	No	No	No

IPv6 BGP peering for EVPN AF - Details

- Dual-stack underlay BGP peering is not supported as not tested. IPv6 peer state might become “Connect” (verification pending):

```
8325-1# show bgp l2vpn evpn summary
VRF : default
BGP Summary
-----------
 Local AS               : 65001        BGP Router Identifier  : 192.168.1.3
 Peers                  : 3            Log Neighbor Changes   : Yes
 Cfg. Hold Time         : 180          Cfg. Keep Alive        : 60
 Confederation Id       : 0

 Neighbor        Remote-AS MsgRcvd MsgSent   Up/Down Time State        AdminStatus
 192.168.1.1     65001       52      674     00h:01m:25s  Established   Up
 fd00:192:168:1::1
                 65001       0       0       00h:00m:00s  Connect       Up
```

Configuration

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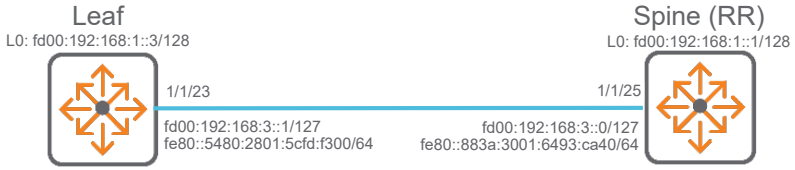
IPv6 BGP peering configuration

Leaf/Spine iBGP example: OSPFv3 underlay



Leaf

```
interface 1/1/23
    no shutdown
    mtu 9198
    ip mtu 9198
    ipv6 address fd00:192:168:3::1/127
    ipv6 ospfv3 1 area 0.0.0.0
    no ipv6 ospfv3 passive
    ipv6 ospfv3 network point-to-point
    ipv6 ospfv3 authentication ipsec spi 256 sha1 ciphertext <snipped>
!
interface loopback 0
    ipv6 address fd00:192:168:1::3/128
    ipv6 ospfv3 1 area 0.0.0.0
!
router ospfv3 1
    router-id 192.168.1.3
    max-metric router-lsa include-stub on-startup 300
    passive-interface default
    area 0.0.0.0
```

```
leaf# show ipv6 route fd00:192:168:1::1/128

Displaying ipv6 routes selected for forwarding

'[x/y]' denotes [distance/metric]

fd00:192:168:1::1/128, vrf default, tag 0
        via  fe80::883a:3001:6493:ca40%1/1/23,  [110/10],  ospf
```

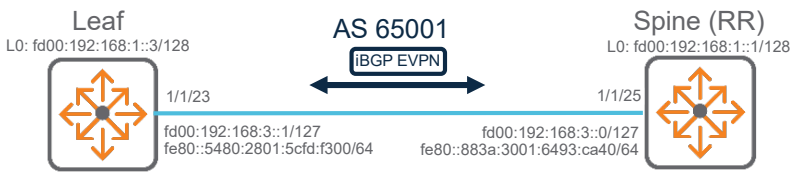
Spine

```
interface 1/1/25
    no shutdown
    mtu 9198
    routing
    ip mtu 9198
    ipv6 address fd00:192:168:3::0/127
    ipv6 ospfv3 1 area 0.0.0.0
    no ipv6 ospfv3 passive
    ipv6 ospfv3 network point-to-point
    ipv6 ospfv3 authentication ipsec spi 256 sha1 ciphertext <snipped>
!
interface loopback 0
    ipv6 address fd00:192:168:1::1/128
    ipv6 ospfv3 1 area 0.0.0.0
!
router ospfv3 1
    router-id 192.168.1.1
    max-metric router-lsa include-stub on-startup 300
    passive-interface default
    area 0.0.0.0
```

```
spine# show ipv6 route fd00:192:168:1::3/128

Displaying ipv6 routes selected for forwarding

'[x/y]' denotes [distance/metric]

fd00:192:168:1::3/128, vrf default, tag 0
        via  fe80::5480:2801:5cfd:f300%1/1/25,  [110/10],  ospf
```

IPv6 BGP peering configuration

Leaf/Spine iBGP example: IPv6 BGP peering



Leaf

```
router bgp 65001
    bgp router-id 192.168.1.3
    neighbor spine-RRv6 peer-group
    neighbor spine-RRv6 remote-as 65001
    neighbor spine-RRv6 description Spine and RR peer-group for IPv6
    neighbor spine-RRv6 password ciphertext <snipped>
    neighbor spine-RRv6 fall-over
    neighbor spine-RRv6 update-source loopback 0
    neighbor fd00:192:168:1::1 peer-group spine-RRv6
    address-family l2vpn evpn
        neighbor spine-RRv6 send-community extended
        neighbor fd00:192:168:1::1 activate
    exit-address-family
```

```
leaf# show bgp l2vpn evpn summary
VRF : default
BGP Summary
-----------
 Local AS               : 65001        BGP Router Identifier  : 192.168.1.3
 Peers                  : 4            Log Neighbor Changes   : Yes
 Cfg. Hold Time         : 180          Cfg. Keep Alive        : 60
 Confederation Id       : 0

 Neighbor        Remote-AS MsgRcvd MsgSent   Up/Down Time State
AdminStatus
 fd00:192:168:1::1
                 65001       49      30      00h:11m:37s  Established   Up
```

Spine

```
router bgp 65001
    bgp router-id 192.168.1.1
    neighbor leafv6 peer-group
    neighbor leafv6 remote-as 65001
    neighbor leafv6 description Leaf RR Clients
    neighbor leafv6 password ciphertext <snipped>
    neighbor leafv6 fall-over
    neighbor leafv6 update-source loopback 0
    neighbor fd00:192:168:1::3 peer-group leafv6
    neighbor fd00:192:168:1::4 peer-group leafv6
    address-family l2vpn evpn
        neighbor spine-RRv6 send-community extended
        neighbor fd00:192:168:1::3 activate
    exit-address-family
```

```
spine# show bgp l2vpn evpn summary
VRF : default
BGP Summary
-----------
 Local AS               : 65001        BGP Router Identifier  : 192.168.1.1
 Peers                  : 6            Log Neighbor Changes   : Yes
 Cfg. Hold Time         : 180          Cfg. Keep Alive        : 60
 Confederation Id       : 0

 Neighbor        Remote-AS MsgRcvd MsgSent   Up/Down Time State
AdminStatus
 fd00:192:168:1::3
                 65001       32      54      00h:13m:47s  Established   Up
 fd00:192:168:1::4
                 65001       30      62      00h:14m:13s  Established   Up
```

Best Practices

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IPv6 BGP peering for EVPN AF - Best Practices

- iBGP pering with IPv6 GUA (or ULA).
- eBGP peering with IPv6 GUA/ULA or with LLA ?
  - Currently (10.6), BGP peering with LLA is not permitted:

```
8325-1(config-bgp)# neighbor fe80::883a:3001:6493:ca40  peer-group spine-RRv6
Invalid IPV4 or IPV6 address
```

  - peering with GUA/ULA address is anyhow simpler. Next-hop IPv6 address will be accepted.
  - peering with LLA address seems simpler but is actually more complex:
    (example: it might require to specify the source interface and to apply a route-map to set a valid GUA next-hop)
- All well known recommendations for IPv4 neighboring apply as well for IPv6 case:
  - fall-over, password, description, ttl-security-hops…

Troubleshooting

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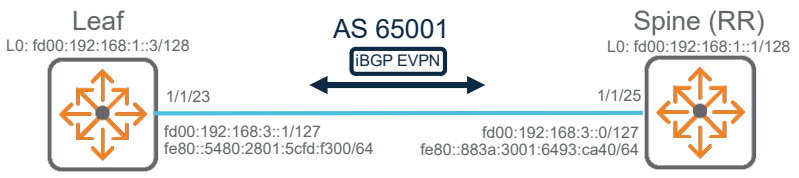
Troubleshooting

Leaf/Spine iBGP example: show bgp commands



Missing: show bgp l2vpn evpn neighbors <ipv6_address>

Leaf

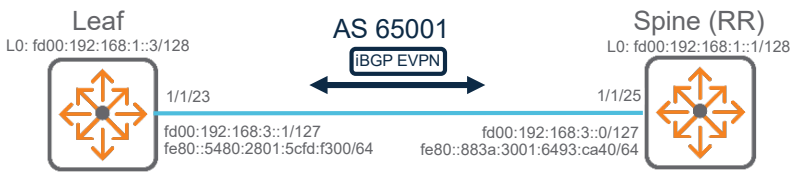
```
leaf# show bgp l2vpn evpn neighbors
Codes: ^ Inherited from peer-group

VRF : default

BGP Neighbor fd00:192:168:1::1 (Internal)
    Description         : Spine and RR peer-group for IPv6^
    Peer-group          : spine-RRv6

    Remote Router Id    : 192.168.1.1        Local Router Id    : 192.168.1.3
    Remote AS           : 65001              Local AS           : 65001
    Remote Port         : 179                Local Port         : 39015
    State               : Established        Admin Status       : Up
    Conn. Established   : 1                  Conn. Dropped      : 0
    Passive             : No                 Update-Source      : loopback0^
    Cfg. Hold Time      : 180                Cfg. Keep Alive    : 60
    Neg. Hold Time      : 180                Neg. Keep Alive    : 60
    Up/Down Time        : 00h:40m:14s        Alt. Local-AS      : 0
    Local-AS Prepend    : No
    BFD                 : Disabled
    Password            : 0xaoyEjQJp2MjcFY1IIqqEbZyuMyDkoDN0zeQbI8qY0=^
    Last Err Sent       : Cease
    Last SubErr Sent    : Connection Rejected
    Last Err Rcvd       : No Error
    Last SubErr Rcvd    : No Error

    Graceful-Restart    : Enabled            Gr. Restart Time   : 120
    Gr. Stalepath Time  : 300                Remove Private-AS  : No
    TTL                 : 255                Local Cluster-ID   :
    Weight              : 0                  Fall-over          : Yes^
    Confederation-Peers : No

    Message statistics       Sent     Rcvd
    -------------------      -----    -----
    Open                         1        1
    Notification                 2        0
    Updates                     20       54
    Keepalives                  43       36
    Route Refresh                0        0
    Total                       66       91

    Capability                          Advertised      Received
    -----------                         -----------     ----------
    Route Refresh                       Yes             Yes
    Graceful Restart                    Yes             Yes
    Add-Path                            No              No
    Four Octet ASN                      Yes             Yes
    Address family IPv4 Unicast         No              No
    Address family IPv6 Unicast         No              No
    Address family L2VPN EVPN           Yes             Yes

    Address Family : L2VPN EVPN
    ----------------------------

    Rt. Reflect. Client : No                 Send Community     : extended^
```

Spine

```
spine# show bgp l2vpn evpn neighbors
Codes: ^ Inherited from peer-group

VRF : default

BGP Neighbor fd00:192:168:1::3 (Internal)
    Description         : Leaf RR clients for IPv6^
    Peer-group          : leafv6

    Remote Router Id    : 192.168.1.3        Local Router Id    : 192.168.1.1
    Remote AS           : 65001              Local AS           : 65001
    Remote Port         : 39015              Local Port         : 179
    State               : Established        Admin Status       : Up
    Conn. Established   : 1                  Conn. Dropped      : 0
    Passive             : No                 Update-Source      : loopback0^
    Cfg. Hold Time      : 180                Cfg. Keep Alive    : 60
    Neg. Hold Time      : 180                Neg. Keep Alive    : 60
    Up/Down Time        : 00h:44m:16s        Alt. Local-AS      : 0
    Local-AS Prepend    : No
    BFD                 : Disabled
    Password            : DyAc2JCw6vm8v+6PGCK7i0bZyuMyDkoDN0zeQbI8qY0=^
    Last Err Sent       : Cease
    Last SubErr Sent    : Administrative Shutdown
    Last Err Rcvd       : Cease
    Last SubErr Rcvd    : Connection Rejected

    Graceful-Restart    : Enabled            Gr. Restart Time   : 120
    Gr. Stalepath Time  : 150                Remove Private-AS  : No
    TTL                 : 255                Local Cluster-ID   :
    Weight              : 0                  Fall-over          : Yes^
    Confederation-Peers : No

    Message statistics       Sent     Rcvd
    -------------------      -----    -----
    Open                         3        1
    Notification                 0        2
    Updates                     56       20
    Keepalives                  40       48
    Route Refresh                0        0
    Total                       99       71

    Capability                          Advertised      Received
    -----------                         -----------     ----------
    Route Refresh                       Yes             Yes
    Graceful Restart                    Yes             Yes
    Add-Path                            No              No
    Four Octet ASN                      Yes             Yes
    Address family IPv4 Unicast         No              No
    Address family IPv6 Unicast         No              No
    Address family L2VPN EVPN           Yes             Yes

    Address Family : L2VPN EVPN
    ----------------------------

    Rt. Reflect. Client : Yes^               Send Community     : extended^
```

Troubleshooting

Leaf/Spine iBGP example: show bgp commands



Leaf

```
leaf# show bgp l2vpn evpn
  extcommunity  Display L2VPN EVPN routes with extended communitiescommunity
  neighbors     Display BGP neighbor connection parameters
  paths         Display the AS Path information of the routes in BGP RIB
  route-type    Displays routes filtered by NLRI route type
  summary       Summary of BGP neighbor status
  vni           VXLAN Network Identifier
  vsx-peer      Displays VSX peer switch information
  vtep          Virtual Tunnel Endpoint
  <cr>
8325-1# show bgp l2vpn evpn
Status codes: s suppressed, d damped, h history, * valid, > best, = multipath,
              i internal, e external S Stale, R Removed, a additional-paths
Origin codes: i - IGP, e - EGP, ? - incomplete

EVPN Route-Type 2 prefix: [2]:[ESI]:[EthTag]:[MAC]:[OrigIP]
EVPN Route-Type 3 prefix: [3]:[EthTag]:[OrigIP]
EVPN Route-Type 5 prefix: [5]:[ESI]:[EthTag]:[IPAddrLen]:[IPAddr]
VRF : default
Local Router-ID 192.168.1.3

     Network                                          Nexthop         Metric     LocPrf    Weight   Path
-----------------------------------------------------------------------------------------------------------
Route Distinguisher: 192.168.11.3:10      (L2VNI 10010)
*>  [2]:[0]:[0]:[00:50:56:8e:61:91]:[]                192.168.11.3    0          100        0       ?
* i [2]:[0]:[0]:[00:50:56:8e:61:91]:[]                192.168.11.3    0          100        0       ?
*>  [2]:[0]:[0]:[00:50:56:8e:61:91]:[fe80::250:56ff:fe8e:6191]
                                                     192.168.11.3    0          100        0       ?
*>  [2]:[0]:[0]:[12:00:00:00:01:00]:[10.1.10.1]      192.168.11.3    0          100        0       ?
*>  [2]:[0]:[0]:[12:00:00:00:01:00]:[fe80:10:1:10::1]  192.168.11.3  0          100        0       ?
*>  [3]:[0]:[192.168.11.3]                           192.168.11.3    0          100        0       ?

Route Distinguisher: 192.168.11.5:10      (L2VNI 10010)
*>i [2]:[0]:[0]:[00:50:56:86:2d:79]:[10.1.10.11]     192.168.11.5    0          100        0       ?
*>i [2]:[0]:[0]:[12:00:00:00:01:00]:[10.1.10.1]      192.168.11.5    0          100        0       ?
*>i [3]:[0]:[192.168.11.5]                           192.168.11.5    0          100        0       ?

<omitted output>
```

Spine

```
spine# show bgp l2vpn evpn
Status codes: s suppressed, d damped, h history, * valid, > best, = multipath,
              i internal, e external S Stale, R Removed, a additional-paths
Origin codes: i - IGP, e - EGP, ? - incomplete

EVPN Route-Type 2 prefix: [2]:[ESI]:[EthTag]:[MAC]:[OrigIP]
EVPN Route-Type 3 prefix: [3]:[EthTag]:[OrigIP]
EVPN Route-Type 5 prefix: [5]:[ESI]:[EthTag]:[IPAddrLen]:[IPAddr]
VRF : default
Local Router-ID 192.168.1.1

     Network                                          Nexthop         Metric     LocPrf    Weight   Path
-----------------------------------------------------------------------------------------------------------
Route Distinguisher: 192.168.11.3:10      (L2VNI 10010)
*   [2]:[0]:[0]:[00:50:56:8e:61:91]:[]                192.168.11.3    0          100        0       ?
*>i [2]:[0]:[0]:[00:50:56:8e:61:91]:[]                192.168.11.3    0          100        0       ?
* i [2]:[0]:[0]:[00:50:56:8e:61:91]:[]                192.168.11.3    0          100        0       ?
* i [2]:[0]:[0]:[00:50:56:8e:61:91]:[fe80::250:56ff:fe8e:6191]
                                                     192.168.11.3    0          100        0       ?
*>i [2]:[0]:[0]:[00:50:56:8e:61:91]:[fe80::250:56ff:fe8e:6191]
                                                     192.168.11.3    0          100        0       ?
* i [2]:[0]:[0]:[00:50:56:8e:61:91]:[fe80::250:56ff:fe8e:6191]
                                                     192.168.11.3    0          100        0       ?
* i [2]:[0]:[0]:[12:00:00:00:01:00]:[10.1.10.1]      192.168.11.3    0          100        0       ?
*>i [2]:[0]:[0]:[12:00:00:00:01:00]:[10.1.10.1]      192.168.11.3    0          100        0       ?
* i [2]:[0]:[0]:[12:00:00:00:01:00]:[10.1.10.1]      192.168.11.3    0          100        0       ?
* i [2]:[0]:[0]:[12:00:00:00:01:00]:[fe80:10:1:10::1]  192.168.11.3  0          100        0       ?
*>i [2]:[0]:[0]:[12:00:00:00:01:00]:[fe80:10:1:10::1]  192.168.11.3  0          100        0       ?
* i [2]:[0]:[0]:[12:00:00:00:01:00]:[fe80:10:1:10::1]  192.168.11.3  0          100        0       ?
* i [3]:[0]:[192.168.11.3]                           192.168.11.3    0          100        0       ?
*>i [3]:[0]:[192.168.11.3]                           192.168.11.3    0          100        0       ?
* i [3]:[0]:[192.168.11.3]                           192.168.11.3    0          100        0       ?

Route Distinguisher: 192.168.11.5:10      (L2VNI 10010)
*>i [2]:[0]:[0]:[00:50:56:86:2d:79]:[10.1.10.11]     192.168.11.5    0          100        0       ?
* i [2]:[0]:[0]:[00:50:56:86:2d:79]:[10.1.10.11]     192.168.11.5    0          100        0       ?
*>  [2]:[0]:[0]:[00:50:56:86:2d:79]:[]                192.168.11.5    0          100        0       ?
*   [2]:[0]:[0]:[00:50:56:86:2d:79]:[]                192.168.11.5    0          100        0       ?
*>i [2]:[0]:[0]:[12:00:00:00:01:00]:[10.1.10.1]      192.168.11.5    0          100        0       ?
* i [2]:[0]:[0]:[12:00:00:00:01:00]:[10.1.10.1]      192.168.11.5    0          100        0       ?
*>i [3]:[0]:[192.168.11.5]                           192.168.11.5    0          100        0       ?
•   i [3]:[0]:[192.168.11.5]                           192.168.11.5    0          100        0       ?

<omitted output>
```

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Thank you

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