Troubleshoot PBB-EVPN ESI, ES Import RT and Source MAC Mismatch on ASR 9000

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Introduction

This document describes how to troubleshoot Ethernet Segment Identifier (ESI), Import Route Target (Import RT) and Source MAC mismatch in PBB-EVPN multi-homed networks (MHN).

Prerequisites

Requirements

The reader should have an overview of EVPN and PBB-EVPN solutions.

Components Used

The information in this document is based on these software and hardware versions:

- Cisco ASR 9000 Series Aggregation Services Routers
- Cisco IOS XR Software that supports PBB-EVPN feature

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document is started with a cleared (default) configuration. If your network is live, make sure that you understand the potential impact of any command.

Conventions

Refer to Cisco Technical Tips Conventions for more information on document conventions.

Problem

In PBB-EVPN, Ethernet Segment Identifier (ESI) represents a ‘site’ connected to one or more PEs. Multi-homed PEs discover each other by seeing the same ESI as its local one. But sometimes the default ESIs generated on these PEs don't match. This issue is seen when the PEs run on different software versions. In this case, a PE only sees itself as the nexthop of the ES, and the topology is single-homed (SH).

```
RP/0/RSP0/CPU0:ASR9001-PE2#show evpn ethernet-segment detail
......
Ethernet Segment Id      Interface      Nexthops
------------------------ -------------- ----------------------------------------
8000.00c8.4c75.d7ee.0001 BE1            2.2.2.2
......
 Topology          :
     Operational    : SH
```

In additional to ESI, multi-homed PEs also use Import RT to filter BGP EVPN routes from each other, and advertise Source MAC to remote PEs as the next hop of the ES. If Import RT or Source MAC on the PEs are incomplete or mismatch, MHN cannot work properly.

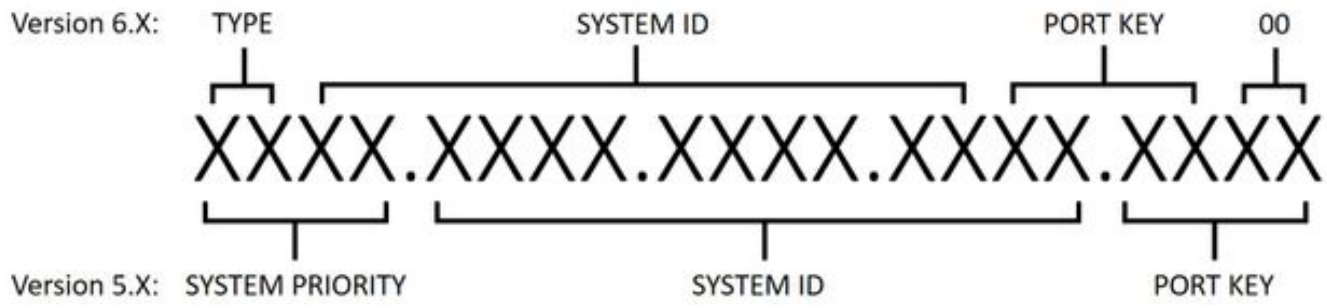
```
RP/0/RSP1/CPU0:ASR9010-PE1#show evpn ethernet-segment detail
......
Ethernet Segment Id      Interface      Nexthops
------------------------ -------------- ----------------------------------------
0080.03c8.4c75.d7ee.8000 BE1            1.1.1.1
......
  ES Import RT      : 0000.0000.0000 (Incomplete Configuration)
  Source MAC        : 0000.0000.0000 (Incomplete Configuration)
```

Solution

Background

Starting from ASR 9000 version 6.0, PBB-EVPN ESI format is changed to be RFC 7432 complaint. This means ESI auto-sensing cannot work between a PE running on 6.X and a PE on previous versions.

This diagram shows how the default ESI is generated for version 6.X and older versions.



Step 1: Troubleshoot ESI

Run **show evpn ethernet-segment detail** to check if the default ESI matches on all PEs. If not,

manually configure ESI.

When configuring ESI, different software versions have different requirements. To meet these requirements, it is recommended to change ESI on all devices.

- In version 6.X the first byte is always TYPE(00) so only the other 9 bytes are configurable.
- In version 5.X all fields are configurable, but "system ID" field requires that the multicast and admin bits are set to 1.

Configure ESI on version 6.X:

```
RP/0/RSP1/CPU0:ASR9010-PE1#show evpn ethernet-segment detail
......
Ethernet Segment Id      Interface      Nexthops
------------------------ -------------- ----------------------------------------
0080.03c8.4c75.d7ee.8000 BE1            1.1.1.1
......
  ES Import RT      : 0000.0000.0000 (Incomplete Configuration)
  Source MAC        : 0000.0000.0000 (Incomplete Configuration)
```

Configure ESI on version 5.X:

```
RP/0/RSP1/CPU0:ASR9010-PE1#show evpn ethernet-segment detail
......
Ethernet Segment Id      Interface      Nexthops
------------------------ -------------- ----------------------------------------
0080.03c8.4c75.d7ee.8000 BE1            1.1.1.1
......
  ES Import RT      : 0000.0000.0000 (Incomplete Configuration)
  Source MAC        : 0000.0000.0000 (Incomplete Configuration)
```

Step 2: Troubleshoot Load Balancing Mode

There are 2 load balancing modes, all-active per flow (AApF) and single-active per vlan (AApS). The default mode is AApF, and mode setting should be the same on all PEs.

Change to single-active per vlan mode on version 6.X:

```
RP/0/RSP1/CPU0:ASR9010-PE1#show evpn ethernet-segment detail
......
Ethernet Segment Id      Interface      Nexthops
------------------------ -------------- ----------------------------------------
0080.03c8.4c75.d7ee.8000 BE1            1.1.1.1
......
  ES Import RT      : 0000.0000.0000 (Incomplete Configuration)
  Source MAC        : 0000.0000.0000 (Incomplete Configuration)
```

Change to single-active per vlan mode on version 5.X:

```
RP/0/RSP1/CPU0:ASR9010-PE1#show evpn ethernet-segment detail
......
Ethernet Segment Id      Interface      Nexthops
------------------------ -------------- ----------------------------------------
0080.03c8.4c75.d7ee.8000 BE1            1.1.1.1
......
  ES Import RT      : 0000.0000.0000 (Incomplete Configuration)
  Source MAC        : 0000.0000.0000 (Incomplete Configuration)
```

Step 3: Troubleshoot Source MAC

Depending on the load balancing mode, PEs' Source MAC may not be automatically generated.

Run **show evpn ethernet-segment detail** to check the Source MAC and manually configure it if it mismatches or shows "incomplete". Note that all-active per flow mode requires the Source MAC to be the same, while single-active per vlan mode requires it to be different for each PE.

Configure Source MAC:

```
RP/0/RSP1/CPU0:ASR9010-PE1#show evpn ethernet-segment detail
......
Ethernet Segment Id      Interface      Nexthops
------------------------ -------------- ----------------------------------------
0080.03c8.4c75.d7ee.8000 BE1            1.1.1.1
......
  ES Import RT      : 0000.0000.0000 (Incomplete Configuration)
  Source MAC        : 0000.0000.0000 (Incomplete Configuration)
```

Step 4: Troubleshoot ES Import RT

Make sure the ES Import RT matches on all PEs. On version 5.X the ES Import RT is not configurable and not listed in the output of **show evpn ethernet-segment detail** . You can run **show bgp l2vpn evpn** to find out the ES Import RT from its locally generated Type 4 EVPN route:

```
RP/0/RSP0/CPU0:ASR9001-PE2#show bgp l2vpn evpn rd 2.2.2.2:0
[4][0080.03c8.4c75.d7ee.8000][2.2.2.2]/128

Thu Jun  8 15:16:00.921 AEST
BGP routing table entry for [4][0080.03c8.4c75.d7ee.8000][2.2.2.2]/128, Route Distinguisher:
2.2.2.2:0
......
      Extended community: EVPN ES Import:01c8.4c75.d7ee
```

On version 6.X you can run **show evpn ethernet-segment detail** to check the ES Import RT. You can also use **bgp route-target** to configure it if it mismatches.

```
RP/0/RSP0/CPU0:ASR9001-PE2#show bgp l2vpn evpn rd 2.2.2.2:0
[4][0080.03c8.4c75.d7ee.8000][2.2.2.2]/128

Thu Jun  8 15:16:00.921 AEST
BGP routing table entry for [4][0080.03c8.4c75.d7ee.8000][2.2.2.2]/128, Route Distinguisher:
2.2.2.2:0
......
      Extended community: EVPN ES Import:01c8.4c75.d7ee
```

Step 5: Verify the Results

After steps 1-4 run **show evpn ethernet-segment detail**. All multi-homed PEs should be listed as next hops of the same ES, the topology should be "MHN" and mode is either "AApF" or "AApS".

```
RP/0/RSP1/CPU0:ASR9010-PE1#show evpn ethernet-segment detail
Tue Jun  6 20:21:00.799 UTC
......

Ethernet Segment Id      Interface      Nexthops
------------------------ -------------- ----------------------------------------
0080.03c8.4c75.d7ee.8000 BE1            1.1.1.1
                                        2.2.2.2
 ES to BGP Gates   : Ready
 ES to L2FIB Gates : Ready
 Main port         :
    Interface name : Bundle-Ether1
    Interface MAC  : 4055.391a.78e3
    IfHandle       : 0x0a000220
```

```
   State          : Up
   Redundancy     : Active
ESI type          : 0
   Value          : 80.03c8.4c75.d7ee.8000
ES Import RT      : 01c8.4c75.d7ee (Local)
Source MAC        : 00c8.4c75.d7ee (Local)
Topology          :
    Operational    : MHN
    Configured     : All-active (AApF) (default)
Primary Services  : Auto-selection
Secondary Services: Auto-selection
Service Carving Results:
   Bridge ports   : 3
   Elected        : 2
   Not Elected    : 1
MAC Flushing mode : STP-TCN
Peering timer     : 3 sec [not running]
Recovery timer    : 30 sec [not running]
```

Troubleshoot Commands

- To check EVPN status, ESI, ES Import RT and source MAC:
  Run **show evpn ethernet-segment detail**
- To check ES Import RT on version 5.X:
  Run **show bgp l2vpn evpn**