

Application Assurance — Asymmetry Removal

In This Chapter

This section describes Application Assurance asymmetry removal configurations.

Topics in this section include:

- [Applicability on page 1358](#)
- [Overview on page 1359](#)
- [Configuration on page 1360](#)
- [Conclusion on page 1373](#)

Applicability

This configuration note is applicable to all 7750 SR and 7450 ESS chassis supporting Application Assurance and was tested on release 11.0R1. Note that Asymmetry Removal is supported on 7750 SR-c12 but not on the 7750 SR-c4. For the Application Assurance Redundancy Protocol (AARP) feature, the diverting flexpath (FP) must be FP2 or higher as it makes use of spoke SDP divert.

The pre-requisites for this configuration note are a base understanding of AA configuration and operation for single homed deployments. This note applies to dual-homed SAPs and spoke SDPs configurations, in a business or residential AA context. AARP is not used for ESM AA subscribers.

Overview

This section is intended for Application Assurance (AA) network architects and engineers. It provides best practices recommendations to configure AA Asymmetry Removal.

Asymmetry means that the two directions of traffic for a given flow (to-sub and from-sub) take different paths through the network. Asymmetry removal is a means of eliminating traffic asymmetry between a set of dual-homed SAP or spoke SDP endpoints. This can be across endpoints within a single node or across a pair of inter-chassis link connected routers, which is the topology explained in this section. Asymmetry removal ensures all packets of a dual-homed AA subscriber are diverted to a given AA ISA in order to achieve accurate per subscriber traffic identification and policy enforcement.

Traffic asymmetry is created when there are dual-homed links for a given service, and the links are simultaneously carrying traffic. Asymmetry removal for transit subscribers must be implemented in the first routed hop on the network side of the subscriber management point, so there will be a deterministic and fixed SAP/spoke SDP representing the downstream subscriber management node. This ensures there are no more than two paths that the flows can take, both covered by the asymmetry removal solution.

Configuration

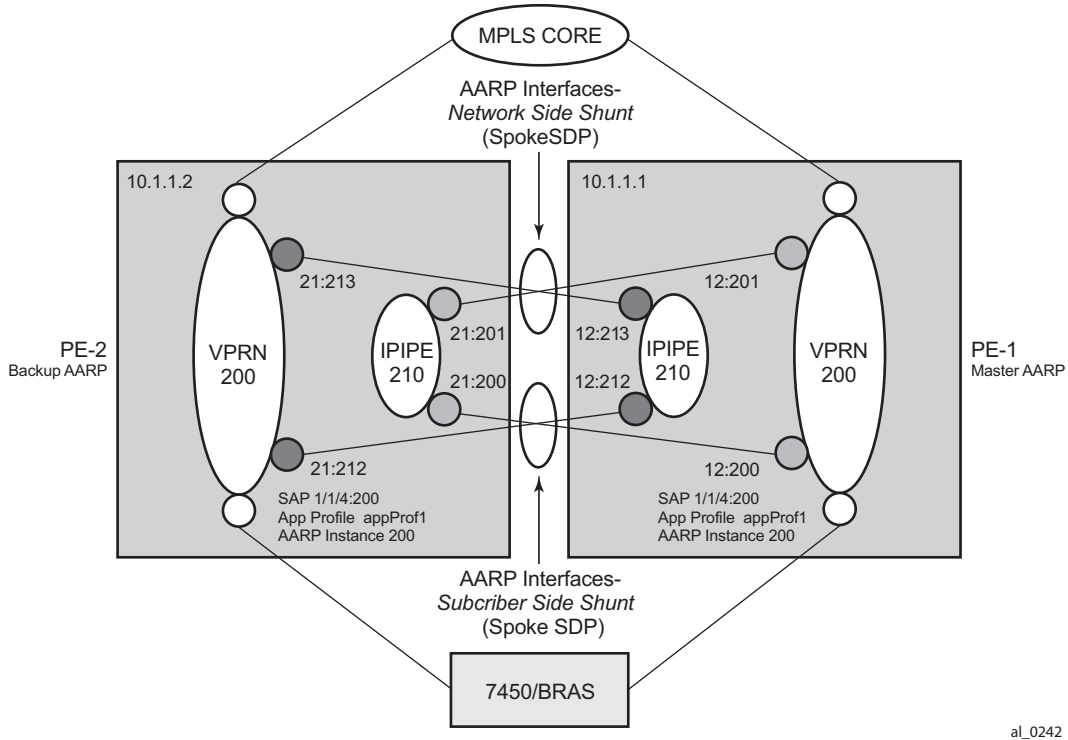
Application Assurance Redundancy Protocol (AARP) provides the data plane connectivity for dynamically keeping a dual-homed AA subscriber's traffic on the same ISA-AA for AA processing. An AARP instance is configured between the dual-homed routers to establish connectivity with the same AARP instance number on each node.

When asymmetry exists between dual-chassis redundant systems, Ipipe spoke SDPs are used to interconnect these services between peer nodes over an Inter-Chassis Link (ICL). The following sections explain the configuration and operation of the services for use with the Application Assurance Redundancy Protocol.

AARP Service Configuration

The following services must be configured to establish communications between the AARP instances in each of the paired nodes.

- Network topology is a VPRN (or IES) service configured in each node, with a dual-homed SAP from each node to a downstream access element.
- Assumes starting point with AA ISAs installed with identical AA policy and divert enabled in each node.
- Also, the system needs basic routing and LDP configuration for the SDP and the spoke SDPs to be established.



al_0242

Figure 200: Application Assurance Asymmetry Removal Topology

Table 8: Application Assurance Asymmetry Removal Topology

| On PE-2 | On PE-1 |
|----------------------------|----------------------------|
| system ip: 10.1.1.2 | system ip: 10.1.1.1 |
| dual-homed service: 200 | dual-homed service: 200 |
| dual-homed sap: 1/1/4:200 | dual-homed sap: 1/1/4:200 |
| app-profile diverting: yes | app-profile diverting: yes |

Configuration Commands for AARP

To enable AARP, AARP instances and AARP interfaces on both nodes must be configured. AARP operation has the following dependencies between the nodes:

- Shunt links configured and operationally up, both subscriber side shunt and network side shunt.
- Peer communications established between nodes, AARP instance operational status will be up when peers are communicating.
- Dual-homed sap/spoke SDP configured with a unique AARP instance (matched by dual-homed interface).
- App-profile configured against sap/spoke SDP with divert enabled (making the sub an aa-sub). The app-profile is the trigger to divert the traffic node with the active AARP instance to one of the ISAs in that node, per normal AA divert behavior.

Begin with PE-2:

```
configure
  aarp 200 create
    description "aarp protecting a dual-homed sap"
    peer 10.1.1.1
    priority 100
    no shutdown
  exit
```

Ipipe shunt configuration

```
configure service
  sdp 21 mpls create
    far-end 10.1.1.1
    ldp
    keep-alive
    shutdown
  exit
  no shutdown
exit
ipipe 210 customer 1 vc-switching create
  service-mtu 9174
  spoke-sdp 21:200 create
    aarp 200 type subscriber-side-shunt
    no shutdown
  exit
  spoke-sdp 21:201 create
    aarp 200 type network-side-shunt
    no shutdown
  exit
  no shutdown
exit
```

Dual-homed and Interface Shunt Configuration

```

vprn 200 customer 1 create
description "VPRN 200 Dual Homed Routed Service"
interface "bras1" create
  sap 1/1/10:4 create
    app-profile "appProf1"
    aarp 200 type dual-homed
  exit
exit
aarp-interface "subside_1" create
  spoke-sdp 21:212 create
    aarp 200 type subscriber-side-shunt
    no shutdown
  exit
exit
aarp-interface "netside_1" create
  spoke-sdp 21:213 create
    aarp 200 type network-side-shunt
    no shutdown
  exit
exit

```

Then similarly configure the associated AARP configuration on PE-1:

```

configure
  application-assurance
    aarp 200 create
      description "aarp protecting a dual-homed sap"
      peer 10.1.1.2
      priority 200
      no shutdown
    exit

```

Ipipe Shunt Configuration

```

sdp 12 mpls create
  far-end 10.1.1.2
  ldp
  keep-alive
  shutdown
  exit
  no shutdown
exit
ipipe 210 customer 1 vc-switching create
  service-mtu 9174
  spoke-sdp 12:212 create
    aarp 200 type subscriber-side-shunt
    no shutdown
  exit
  spoke-sdp 12:213 create
    aarp 200 type network-side-shunt
    no shutdown
  exit
  no shutdown
exit

```

Dual-homed and Interface Shunt Configuration

```
vprn 200 customer 1 create
    interface "bras1" create
        sap 1/1/4:200 create
            description "AA enabled SAP"
            aarp 200 type dual-homed
            app-profile "appProf1"
        exit
    exit
aarp-interface "subside_1" create
    spoke-sdp 12:200 create
        aarp 200 type subscriber-side-shunt
        no shutdown
    exit
exit
aarp-interface "netside_1" create
    spoke-sdp 12:201 create
        aarp 200 type network-side-shunt
        no shutdown
    exit
exit
```


Show Commands for AARP

Verify correct configuration on each node. The following output displays the example configuration for PE-1.

Starting with the AARP instance in each node, verify that the AARP instance operational state is up (if everything is properly configured as intended):

```
*A:PE-1# show application-assurance aarp 200
=====
AARP Instance 200
=====
Description      : aarp protecting dual homed sap
Admin State      : Up                               Oper State       : Up

Local IP         : 10.1.1.1                         Peer IP          : 10.1.1.2
Local State      : master                           Peer State       : backup
Local Priority    : 200                             Peer Priority     : 100

Local Flags      : none
Peer Flags       : none
Peer End-Point   : none

Master Selection Mode      : minimize-switchovers
-----
Service References
-----
Service              Reference              Reference Type
-----
VPRN 200             1/1/4:200             Dual-Homed
Ipipe 210            12:212                Subscriber-Side Pipe Shunt
Ipipe 210            12:213                Network-Side Pipe Shunt
VPRN 200             12:200                Subscriber-Side AARP-Interface Shunt
VPRN 200             12:201                Network-Side AARP-Interface Shunt
-----
No. of service references: 5
```

Verifying that the AARP instance is up is an indication that the dual-node communications for AARP is working (instance, shunts, etc.). In addition, in the above output, verify on both PE nodes that the intended SAPs are dual-homed for that instance.

Now a detailed review of the configured AARP shunt infrastructure services can be shown to make sure they are all properly configured with intended AARP parameters (such as AARP ID and Type on the network and subscriber side shunts) as displayed in the following output:

```
*A:PE-1>show# service id 210 all
=====
Service Detailed Information
=====
Service Id          : 210                               Vpn Id           : 0
Service Type        : Ipipe
Name                : (Not Specified)
Description         : (Not Specified)
```

Show Commands for AARP

```
Customer Id       : 1                Creation Origin   : manual
Last Status Change: 05/29/2013 12:48:25
Last Mgmt Change  : 05/27/2013 13:47:32
Admin State       : Up                Oper State        : Up
MTU               : 9174
Vc Switching     : True
SAP Count        : 0                SDP Bind Count    : 2
CE IPv4 Discovery : n/a
CE IPv6 Discovery : n/a            Stack Cap Sig     : n/a
```

ETH-CFM service specifics

```
Tunnel Faults    : ignore
```

Service Destination Points(SDPs)

```
Sdp Id 12:212   -(10.1.1.2)
```

```
Description      : (Not Specified)
SDP Id           : 12:212                Type                : Spoke
Spoke Descr     : (Not Specified)
Split Horiz Grp  : (Not Specified)
VC Type         : Ipipe                  VC Tag              : 0
Admin Path MTU   : 0                    Oper Path MTU       : 9174
Delivery        : MPLS
Far End         : 10.1.1.2
Tunnel Far End   : 10.1.1.2            LSP Types           : LDP
Hash Label      : Disabled              Hash Lbl Sig Cap    : Disabled
Oper Hash Label  : Disabled

Admin State      : Up                    Oper State          : Up
```

```
...
Application Profile: None
Transit Policy    : None
AARP Id          : 200
AARP Type        : subscriber-side-shunt
...
```

IPIPE Service Destination Point specifics

```
Configured CE IPv4 Addr: n/a                Peer CE IPv4 Addr : 0.0.0.0
```

```
Sdp Id 12:213   -(10.1.1.2)
```

```
Description      : (Not Specified)
SDP Id           : 12:213                Type                : Spoke
Spoke Descr     : (Not Specified)
Split Horiz Grp  : (Not Specified)
VC Type         : Ipipe                  VC Tag              : 0
Admin Path MTU   : 0                    Oper Path MTU       : 9174
Delivery        : MPLS
Far End         : 10.1.1.2
Tunnel Far End   : 10.1.1.2            LSP Types           : LDP
Hash Label      : Disabled              Hash Lbl Sig Cap    : Disabled
Oper Hash Label  : Disabled

Admin State      : Up                    Oper State          : Up
```

```
...
```

```

Application Profile: None
Transit Policy      : None
AARP Id            : 200
AARP Type          : network-side-shunt
...

```

Next, the configuration of the VPRN service of the dual-homed SAP can be reviewed to ensure it reflects the attached endpoints for the shunt Ipipe spoke SDPs:

```

*A:PE-1>show>service>id 200 all
=====
Service Detailed Information
=====
Service Id       : 200                Vpn Id           : 0
Service Type    : VPRN
Name            : (Not Specified)
Description     : (Not Specified)
Customer Id     : 1                  Creation Origin  : manual
Last Status Change: 05/27/2013 13:47:32
Last Mgmt Change  : 05/27/2013 13:47:32
Admin State     : Up                 Oper State       : Up

Route Dist.     : 65004:1           VPRN Type        : regular
AS Number       : None              Router Id        : 10.1.1.1
ECMP            : Enabled           ECMP Max Routes  : 1
Max IPv4 Routes : No Limit          Auto Bind        : LDP
Max IPv6 Routes : No Limit
Ignore NH Metric : Disabled
Hash Label      : Disabled
Vrf Target      : target:65004:200
Vrf Import      : None
Vrf Export      : None
MVPN Vrf Target : None
MVPN Vrf Import : None
MVPN Vrf Export : None
Car. Sup C-VPN  : Disabled
Label mode      : vrf
BGP VPN Backup  : Disabled

SAP Count       : 4                 SDP Bind Count   : 2
...

-----
Service Destination Points(SDPs)
-----
Sdp Id 12:200  -(10.1.1.2)
-----
Description    : (Not Specified)
SDP Id         : 12:200                Type            : Spoke
Spoke Descr    : (Not Specified)
VC Type        : n/a                  VC Tag          : n/a
Admin Path MTU : 0                    Oper Path MTU   : 9174
Delivery       : MPLS
Far End        : 10.1.1.2
Tunnel Far End : 10.1.1.2                    LSP Types       : LDP
Hash Label     : Disabled              Hash Lbl Sig Cap : Disabled

```

Show Commands for AARP

```
Oper Hash Label      : Disabled

Admin State          : Up                    Oper State          : Up
...
Application Profile: None
Transit Policy       : None
AARP Id              : 200
AARP Type            : subscriber-side-shunt
...
-----
IPIPE Service Destination Point specifics
-----
Configured CE IPv4 Addr: n/a                Peer CE IPv4 Addr : 0.0.0.0
-----
Sdp Id 12:201  -(10.1.1.2)
-----
Description          : (Not Specified)
SDP Id               : 12:201                Type                  : Spoke
Spoke Descr          : (Not Specified)
VC Type              : n/a                    VC Tag                 : n/a
Admin Path MTU       : 0                      Oper Path MTU          : 9174
Delivery             : MPLS
Far End              : 10.1.1.2
Tunnel Far End       : 10.1.1.2              LSP Types              : LDP
Hash Label           : Disabled                Hash Lbl Sig Cap       : Disabled
Oper Hash Label      : Disabled

Admin State          : Up                    Oper State          : Up
...

Application Profile: None
Transit Policy       : None
AARP Id              : 200
AARP Type            : network-side-shunt
...
```

Continuing deeper into the same VPRN service show output, it can be verified that the dual-homed SAP itself is properly configured and associated with that service and AARP instance:

```
-----
SAP 1/1/4:200
-----
Service Id           : 200
SAP                  : 1/1/4:200              Encap                  : q-tag
Description          : (Not Specified)
Admin State          : Up                    Oper State          : Up
Flags                : PortOperDown
Multi Svc Site       : None
Last Status Change: 05/27/2013 13:47:32
Last Mgmt Change    : 05/27/2013 13:47:32
Sub Type             : regular
Dot1Q Ethertype      : 0x8100                QinQ Ethertype        : 0x8100
Split Horizon Group: (Not Specified)

Admin MTU            : 1518                    Oper MTU              : 1518
Ingr IP Fltr-Id     : n/a                      Egr IP Fltr-Id       : n/a
```

Application Assurance — Asymmetry Removal

```
Ingr Mac Fltr-Id      : n/a
Ingr IPv6 Fltr-Id    : n/a
BGP IPv4 FlowSpec    : Disabled
BGP IPv6 FlowSpec    : Disabled
tod-suite            : None
Q Frame-Based Acct   : Disabled
Acct. Pol            : None
Anti Spoofing        : None
Avl Static Hosts     : 0
Calling-Station-Id   : n/a
Application Profile:  appProf1
Transit Policy       : ip 200
AARP Id              : 200
AARP Type            : dual-homed
Oper Group           : (none)
Host Lockout Plcy    : n/a
Lag Link Map Prof    : (none)
...

Egr Mac Fltr-Id      : n/a
Egr IPv6 Fltr-Id    : n/a
qinq-pbit-marking    : both
Egr Agg Rate Limit   : max
Collect Stats        : Disabled
Dynamic Hosts        : Enabled
Tot Static Hosts     : 0
Monitor Oper Grp     : (none)
```

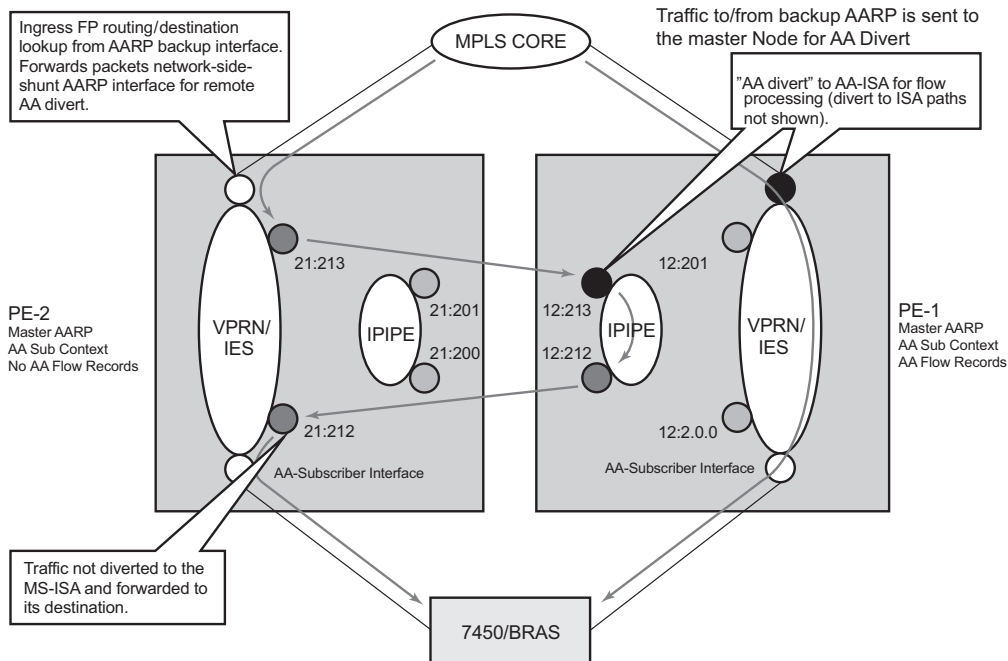
Network to Subscriber Traffic Flow

When the AARP is operationally up, AARP tracks which ISA is the master ISA for each dual-homed AARP instance and uses the inter-chassis services (spoke SDP AARP shunts) to move all traffic for each instance traffic to the node with the Master ISA.

Looking at traffic in the network to subscriber direction (Figure 201):

- Traffic arriving on PE-1 is diverted to the local master ISA, processed, then proceeds to the egress SAP.
- Traffic arriving on PE-2 with the backup AARP interface is sent to the master node for AA processing. The ingress FP forwards packets to network-side-shunt AARP interface for remote AA divert.
- Arriving on PE-1, the packets on the AARP Ipipe are diverted to the master ISA where the packets are processed as if this traffic was travelling in the to-sub direction towards the dual-homed endpoint on PE-1, then returned to PE-2.
- Entering PE-2, the traffic from the subscriber side shunt interface is not diverted to ISAs in that node and egresses on the AARP instance SAP.

With this behavior, traffic always returns to the original ingress node before egressing toward the subscriber (network path for the flows are not modified).



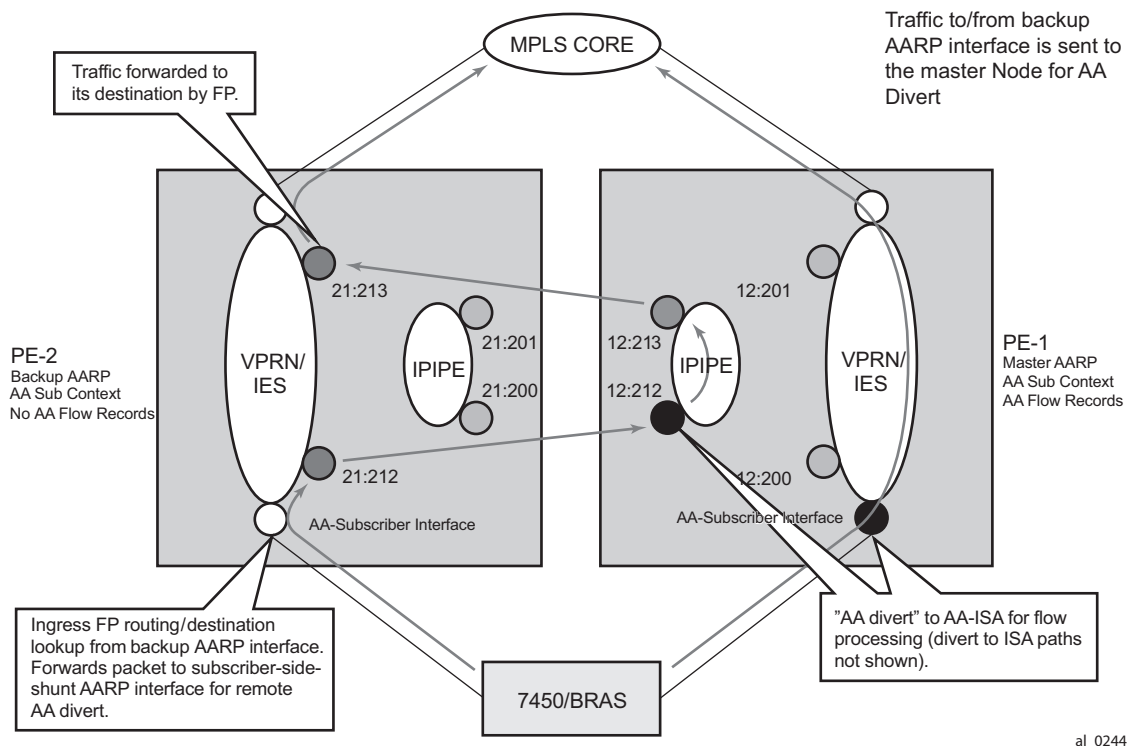
al_0243

Figure 201: Network to Subscriber Traffic Flow

Subscriber to Network Traffic Flow

Looking at traffic in the subscriber to network direction (Figure 202):

- Traffic arriving on PE-1 is diverted to the local master ISA, processed, then proceeds to the egress SAP.
- Traffic arriving on PE-2 with the backup AARP ISA is sent to the master node for AA processing (not diverted to an ISA in PE-2). The ingress FP forwards packets to subscriber-side-shunt AARP interface for remote AA divert.
- Arriving on PE-1, the packets on the AARP Ipipe are diverted to the master ISA where the packets are processed as if the traffic was flowing in the from-sub direction on the dual-homed endpoint, then returned to PE-2 over the Ipipe's AARP subscriber-side-shunt.
- Entering PE-2, the traffic from the network side shunt interface is forwarded by the IES/ VPRN service to its destination.



al_0244

Figure 202: Subscriber to Network Traffic Flow

Typical Configuration Mistakes

Operators configuring AARP can make some typical mistakes listed below that will keep the AARP instance in Operational State down:

- The spoke SDP AARP shunt instances' IDs must be aligned with the respective spoke SDP on the peer node: if not, it will result in a flag indicating **shunt mismatch** in the show output.
- Ipipe service MTU alignment — The Ipipe service MTU values must be the same in both nodes, otherwise it will result in the services be in operational status UP, but the AARP instance will remain down.

Conclusion

This section is intended for Application Assurance (AA) network architects and engineers to provide the information required to understand and configure dual-node asymmetry removal following the intended service configuration as used by the AARP implementation.

Conclusion