

# Active-Active Geographical Redundancy Network Configuration Guide

Ericsson Service-Aware Policy Controller

USER GUIDE

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# 1 Active-Active Geographical Redundancy Network Configuration Guide Introduction

The purpose of this document is to define the network configuration needed to run the SAPC in an Active-Active Geographical Redundancy deployment.

There are many configuration aspects in common with standalone deployments, for more information about the hardware, software and network components definition, refer to:

- BSP 8100 Network Configuration Guide or NSP 6.1 Network Configuration Guide, when the SAPC runs in a PNF deployment.
- SAPC VNF Network Configuration Guide, when the SAPC runs in a VNF deployment.





## 2 Active-Active Geographical Redundancy Network Configuration Guide Overview

This section provides an overview of the general network description for Active-Active Geographical Redundancy deployment.

The Geographical Redundancy deployment allows two SAPC peers to be used in a mated pair providing a highly available configuration based on a Active-Active system (1+1 redundancy). An Active-Active solution, means that any of the SAPC peers, can handle traffic and provisioning requests from the neighbor SAPC, maintaining synchronization between them. Any active SAPC is always able to take over the traffic handle by the mated peer, in the event of a failure in this peer SAPC.

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### Warning!

If a SAPC peer receives a traffic request for a subscriber session that is not owned, that is, was previously managed by the mated peer, there is a response time performance penalty. To avoid such performance penalty, it is required to configure the DRA (or diameter peers) sending traffic to SAPC with subscriber/session stickiness, and guarantee that all traffic request for the same subscriber session (for example Gx, Rx, Sy), reach the same SAPC peer.

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Seen from the external network, the two SAPC peers are as if they were two different standalone deployments, both of them with the capacity of handling traffic and provisioning. The redundant SAPC solution exposes a pair of VIP addresses for each service (for traffic and provisioning services).

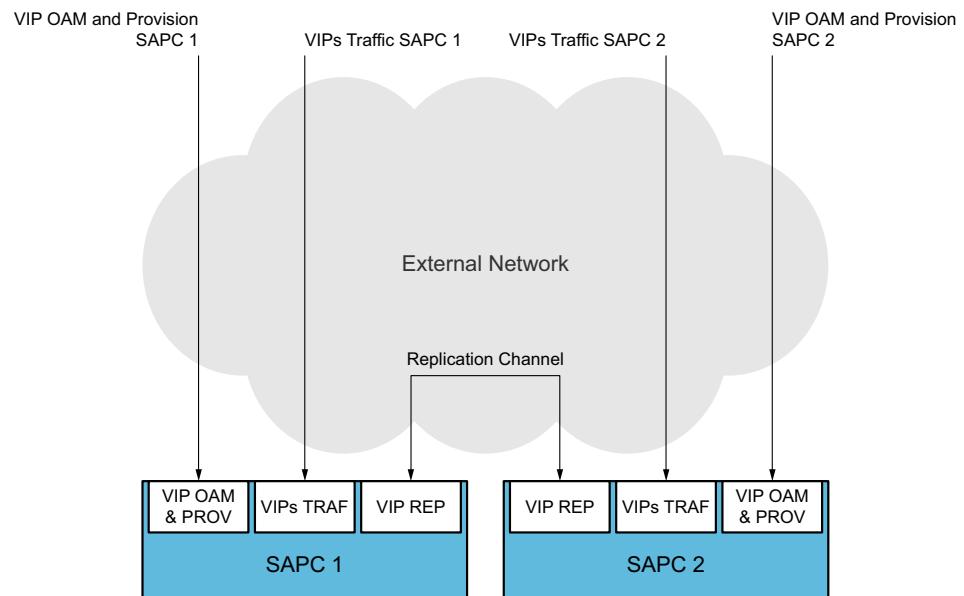


Figure 1 Geographical Redundancy

The Geographical Redundancy network configuration can be added to every standalone deployment described in:

- BSP 8100 Network Configuration Guide or NSP 6.1 Network Configuration Guide, when the SAPC runs in a PNF deployment.
- SAPC VNF Network Configuration Guide, when the SAPC runs in a VNF deployment.





## 3 Networks Allocation

This section specifies how the two SAPC peers are connected to the external network. All the networks and IP addresses described are routable through customer network. Before starting to configure the SAPC peers network, all the details (IP addresses, Network, and so on) referenced in this section should be agreed with the customer.

### 3.1 IP Addressing

Each SAPC requires a set of IP addresses agreed with the customer before configuring the SAPC peers.

#### 3.1.1 IP Addresses

Table 1 IP Addresses

IP Address (Suggested value)	Usage
<VIP-OAM> SAPC1	OAM IP address for the first SAPC.
<VIP-OAM> SAPC2	OAM IP address for the second SAPC.
<VIP-Traffic> SAPC1 (1)	Traffic IP address for the first SAPC.
<VIP-Traffic> SAPC2 (1)	Traffic IP address for the second SAPC.
<VIP-Replication> SAPC1	Replication IP address for the first SAPC.
<VIP-Replication> SAPC2	Replication IP address for the second SAPC.
<VIP-Provisioning> SAPC1 (2)	Provisioning IP address for the first SAPC. This additional VIP is accessible from the External Network through the same FEEs than VIP-OAM.
<VIP-Provisioning> SAPC2 (2)	Provisioning IP address for the second SAPC. This additional VIP is accessible from the External Network through the same FEEs than VIP-OAM.

(1) Several Traffic VIPs can be configured

(2) Only for deployment that requires Provisioning Address different than OAM Address.





## 4 Network Configurations for Geographical Redundancy in VNF Deployments

This section describes the mapping, in the different pieces of networking equipment, of Networks to vNICs in VNF deployments.

### 4.1 Geographical Redundancy without Virtual Routers

This section describes the default and recommended configuration, for each SAPC, without Virtual Routers and using static routes to the external network. The default configuration includes:

- One OAM Network to serve Operations and Managements functions.
- One Traffic Network to provide Policy Controller functions to the rest of the nodes.
- One Replication Network to provide data mirroring

Next figure shows the general network overview:

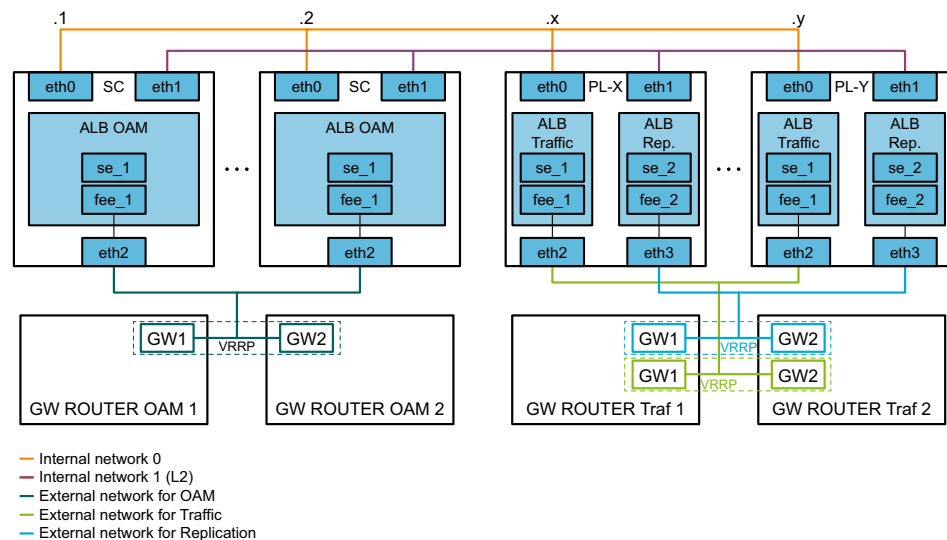


Figure 2 SAPC network solution without VRs for Geographical Redundancy Active-Active

#### 4.1.1 Internal Network Configuration

In this section applies the same configuration for internal networks described in SAPC VNF Network Configuration Guide.



## 4.1.2 External Networks Configuration

### 4.1.2.1 External Networks and IP Addresses

The following networks and IP addresses are configured by the `adapt_cluster` tool. For further details, see [Adapt Cluster Tool](#). to interconnect the SAPC with the customer network.

Table 2 External Networks and IP Addresses

Network Address	Mask	Type	IP Address	Use
<OAM_FEE_NETWORK>	/28	Private	<OAM_FEE_GATEWAY> <sup>(1)</sup>	VRRP address of the OAM GWs as default Router for OAM network
			<OAM_FEE_ADDRESS> <sup>(1)</sup>	The IP addresses assigned to the FEE nodes in the <OAM_FEE_NETWORK>
<TRF_1_FEE_NETWORK>	/28	Private	<TRF_1_FEE_GATEWAY> <sup>(1)</sup>	VRRP address of the Traffic GWs as default route for signalling traffic network
			<TRF_1_FEE_ADDRESS> <sup>(1)</sup>	The IP addresses assigned to the FEE nodes in the <TRF_1_FEE_NETWORK> for signaling traffic
<TRF_2_FEE_NETWORK>	/28	Private	<TRF_2_FEE_GATEWAY> <sup>(1)</sup>	VRRP address of the Traffic GWs as default route for replication traffic network
			<TRF_2_FEE_ADDRESS> <sup>(1)</sup>	The IP addresses assigned to the FEE nodes in the <TRF_2_FEE_NETWORK> for replication traffic

(1) Optional parameter to fill in the template for the `adapt_cluster` tool.

Refer to [Adapt Cluster Tool](#) to know the default value assigned by the `adapt_cluster` tool when the optional parameter is not included in the configuration file.

### 4.1.2.2 VIP Configuration for External Networks

This section describes the configuration, for each SAPC, to fill in the template for the `adapt_cluster` tool, provided in the [SAPC VNF Deployment Instruction for CEE](#) or [SAPC VNF Deployment Instruction for VMware](#).

In the table below, the distribution of VIP elements is listed. This configuration is already made in the template and adjustment is not required.

Table 3 Distribution of VIP Elements

Abstract Load Balancer (ALB)	VIP	Front-End Element (FEE)	Load Balancer Element (LBE)	Security Element (SE)
alb_oam	<VIP-OAM>	SC-1 (fee_1)	lbe_1	se_1
	<VIP-PROVISIONING>	SC-2 (fee_2)	lbe_2	se_2



Abstract Load Balancer (ALB)	VIP	Front-End Element (FEE)	Load Balancer Element (LBE)	Security Element (SE)
alb_trf_1	<VIP-GX>	PL-3 (fee_1)	lbe_1	se_1
		PL-4 (fee_2)	lbe_2	se_2
		PL-5 (fee_3)	lbe_3	se_3
		PL-6 (fee_4)	lbe_4	se_4
		PL-7 (fee_5)	lbe_5	se_5
		PL-8 (fee_6)	lbe_6	se_6
alb_trf_2	<VIP-REPLICATION>	PL-3 (fee_1)	lbe_1	se_1
		PL-4 (fee_2)	lbe_2	se_2
		PL-5 (fee_3)	lbe_3	se_3
		PL-6 (fee_4)	lbe_4	se_4
		PL-7 (fee_5)	lbe_5	se_5
		PL-8 (fee_6)	lbe_6	se_6

### 4.1.2.3

### IP Addresses of External Elements

This section covers all the IP addresses in the customer network that do not belong to the SAPC but are configured in the SAPC to interoperate with other nodes. No default values are configured for them, since they are customer dependant.

Table 4 IP Addresses of External Elements

IP Address	Network	Use
<NTP-SERVER>	<NTP-NETWORK>/<NTP-NETMASK>	NTP Server
<SNMP-SERVER>	<SNMP-NETWORK>/<SNMP-NETMASK>	SNMP Server
<DNS-SERVER>	<DNS-NETWORK>/<DNS-NETMASK>	DNS Server

NTP servers are configured by the adapt\_cluster tool during deployment. For further details, see [SAPC VNF Descriptor Generator Tool](#).

SNMP servers are configured for Fault Management. For security reasons, it is highly recommended to use [Create SNMPv3 Target](#). Also, legacy versions can be used as [Create SNMPv2C Target](#) and [Create SNMPv1 Target](#).

Optionally, DNS servers can be defined in the SAPC. For further details on their configuration, refer to [LDE Management Guide](#).

### 4.1.3

### Gateway Router Configuration

This section covers all the IP routes to be configured in the Gateway Routers to interoperate with each SAPC.



- Configuration in OAM GWs: To get to the OAM VIP, define static routes for the OAM FEEs located in the SCs, that is, one static route for each IP address defined in the `<OAM_FEE_ADDRESS>` parameter.
- Configuration in Traffic GWs.
  - To get to the Traffic VIP, define static routes for the Traffic FEEs located in the PLs, that is, one static route for each IP address defined in the `<TRF_1_FEE_ADDRESS>` parameter.
  - To get to the Replication VIP, define static routes for the Replication FEEs located in the PLs, that is, one static route for each IP address defined in the `<TRF_2_FEE_ADDRESS>` parameter.

ECMP shall be configured for traffic distribution among FEE IP addresses for each traffic type.

## 4.2 Geographical Redundancy with Virtual Routers

This section describes the optional configuration, for each SAPC, with Virtual Routers and using static routes to the external network. This configuration includes:

- One OAM Network to serve Operations and Managements functions.
- One Traffic Network to provide Policy Controller functions to the rest of the nodes.
- One Replication Network to provide data mirroring

Next figure shows the general network overview:

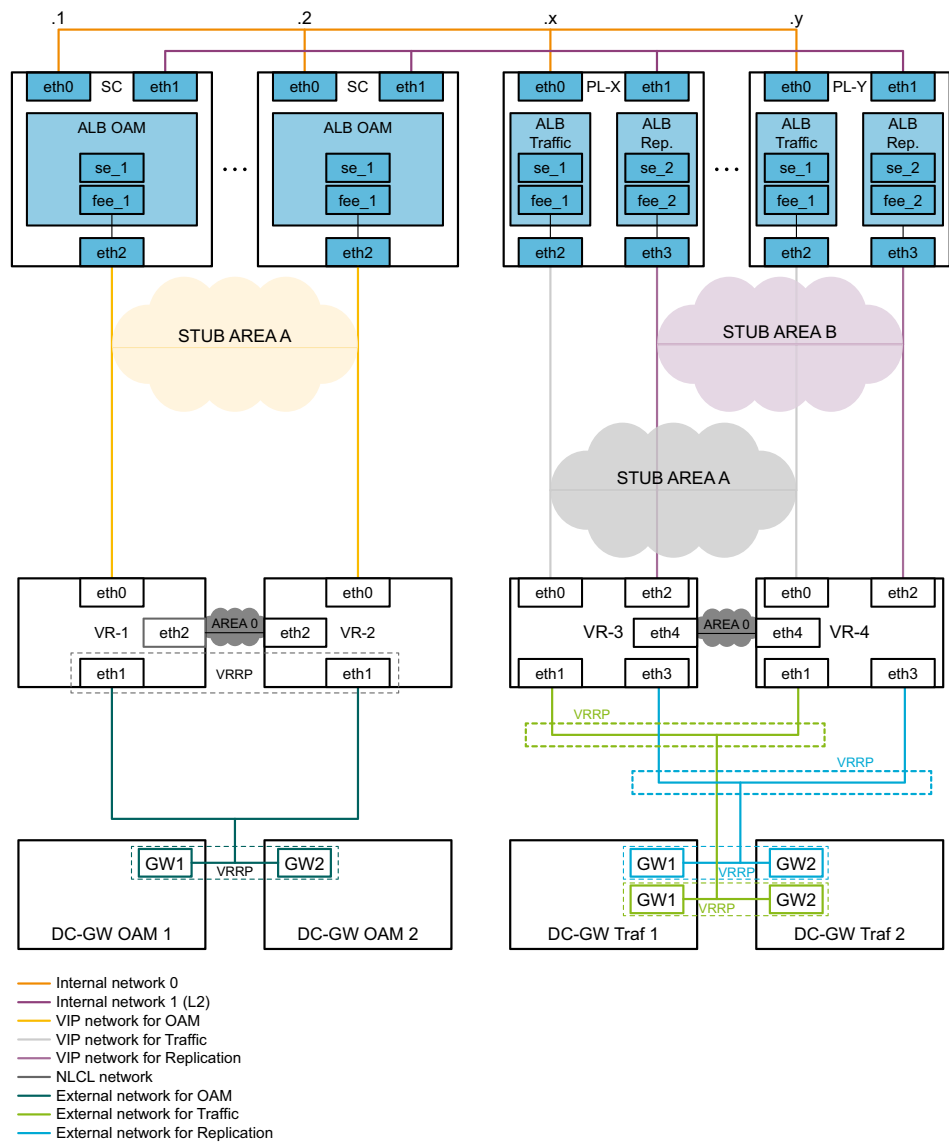


Figure 3 SAPC network solution with VRs for Geographical Redundancy Active-Active

#### 4.2.1

#### Internal Network Configuration

In this section applies the same configuration for internal networks described in SAPC VNF Network Configuration Guide.



## 4.2.2 VIP Networks Configuration

### 4.2.2.1 Networks for OSPF v2

The following table shows the networks allocated inside the SAPC images, in which OSPF protocol is enabled. They are already defined by default in the SAPC and in the configuration of the virtual routers to ensure a proper operation after the SAPC deployment in Cloud environment.

Table 5 Private Networks Allocated inside the SAPC for VIPs population Through OSPF Protocol

Network Name	Subnet	Use
OamVip0	172.16.213.0/29	OSPFv2 Attachment between OAM FEEs, VR-1 and VR- 2
TrafficVip0-0	172.16.113.0/28	OSPFv2 Attachment between Traffic-1 FEEs, VR-3 and VR-4
TrafficVip1-0	172.16.113.16/28	OSPFv2 Attachment between Traffic-2 FEEs, VR-3 and VR-4

### 4.2.2.2 VIP Elements

This section describes the configuration, for each SAPC, to fill in the template for the adapt\_cluster tool, provided in the SAPC VNF Deployment Instruction for CEE or SAPC VNF Deployment Instruction for VMware.

In the table below, the distribution of VIP elements is listed. This configuration is already made in the template and adjustment is not required.

Table 6 Distribution of VIP Elements

Abstract Load Balancer (ALB)	VIP	Front-End Element (FEE)	Load Balancer Element (LBE)	Security Element (SE)
alb_oam	<VIP-OAM> <VIP-PROVISIONING>	SC-1 (fee_1) SC-2 (fee_2)	lbe_1 lbe_2	se_1 se_2
alb_trf_1	<VIP-GX>	PL-3 (fee_1) PL-4 (fee_2) PL-5 (fee_3) PL-6 (fee_4) PL-7 (fee_5) PL-8 (fee_6)	lbe_1 lbe_2 lbe_3 lbe_4 lbe_5 lbe_6	se_1 se_2 se_3 se_4 se_5 se_6
alb_trf_2	<VIP-REPLICATION>	PL-3 (fee_1) PL-4 (fee_2) PL-5 (fee_3) PL-6 (fee_4) PL-7 (fee_5) PL-8 (fee_6)	lbe_1 lbe_2 lbe_3 lbe_4 lbe_5 lbe_6	se_1 se_2 se_3 se_4 se_5 se_6





### 4.2.2.3

### OSPF v2 Areas

The traffic is separated into three OSPF v2 areas and ALBs. Each ALB has links with IPs defined for the FEEs and the remote gateway which are the virtual routers in this design. Next table shows how the networks IPs are defined in this Cloud configuration.

Table 7 FEEs and OSPF v2 Configuration

Abstract Load Balancer (ALB)	Front-End Element (FEE)	Network	FEE IP	FEE Interface	Virtual Router IP
alb_oam Area=10.1.13.1 Hello=3 Dead=9 Retransmit =5 Delay=1 Priority=0	fee_1	172.16.213.0/29	.3	SC-1 eth2	VR-1 .1 VR-2 .2
	fee_2		.4	SC-2 eth2	
alb_trf_1 Area=10.1.13.2 Hello=3 Dead=9 Retransmit =5 Delay=1 Priority=0	fee_1	172.16.113.0/28	.3	PL-3 eth2	VR-3 .1 VR-4 .2
	fee_2		.4	PL-4 eth2	
	fee_3		.5	PL-5 eth2	
	fee_4		.6	PL-6 eth2	
	fee_5		.7	PL-7 eth2	
	fee_6		.8	PL-8 eth2	
alb_trf_2 Area=10.1.13.3 Hello=3 Dead=9 Retransmit =5 Delay=1 Priority=0	fee_1	172.16.113.16/28	.19	PL-3 eth3	VR-3 .17 VR-4 .18
	fee_2		.20	PL-4 eth3	
	fee_3		.21	PL-5 eth3	
	fee_4		.22	PL-6 eth3	
	fee_5		.23	PL-7 eth3	
	fee_6		.24	PL-8 eth3	

### 4.2.2.4

### Virtual Router Configuration

Virtual router configurations are part of their images, similarly to other virtual machines composing the SAPC. Apart of the OSPF-related configuration previously described into Section 4.2.2.3 on page 13, the following remarkable configuration has been set up into the respective images and is part of the SAPC delivery.



Table 8 OSPF Areas for VIP Networks Configuration

OSPF Area	Router IDs	OSPF Parameters	Use
10.1.13.1	172.16.213.1 (Virtual Router 1)	Hello=3 seconds Dead=9 seconds Retransmit =5 seconds Delay=1 second Priority=1	SAPC OAM and Provisioning VIP Addresses
	172.16.213.2 (Virtual Router 2)		
10.1.13.2	172.16.113.1 (Virtual Router 3)		SAPC VIPs Addresses for traffic
	172.16.113.2 (Virtual Router 4)		
10.1.13.3	172.16.113.17 (Virtual Router 3)		SAPC VIP Address for Replication
	172.16.113.18 (Virtual Router 4)		

## 4.2.3 External Networks Configuration

### 4.2.3.1 External Networks and IP Addresses

The following networks and IP addresses are configured by the adapt\_cluster tool to interconnect the SAPC with the customer network.

Table 9 External Networks and IP Addresses

Network Address	Mask	Type	IP Address	Use
<EXT_OAM_NETWORK>	/29	Private	<EXT_OAM_GATEWAY> <sup>(1)</sup>	VRRP address of the OAM GWs as default Router for OAM network
			<EXT_OAM_IP_VR> <sup>(1)</sup>	The IP addresses assigned to the VRs for OAM network
			<EXT_OAM_VRRP_VR> <sup>(1)</sup>	The IP address for the VRRP between both VRs for OAM network
<EXT_TRF_1_NETWORK>	/29	Private	<EXT_TRF_1_GATEWAY> <sup>(1)</sup>	VRRP address of the Traffic GWs as default route for signalling traffic network
			<EXT_TRF_1_IP_VR> <sup>(1)</sup>	The IP addresses assigned to the FEE nodes for signalling traffic network
			<EXT_TRF_1_VRRP_VR> <sup>(1)</sup>	The IP address for the VRRP between both VRs for signalling traffic network



Network Address	Mask	Type	IP Address	Use
<EXT_TRF_2_NET WORK>	/29	Private	<EXT_TRF_2_GATEWAY> <sup>(1)</sup>	VRRP address of the Traffic GWs as default route for replication traffic network
			<EXT_TRF_2_IP_VR> <sup>(1)</sup>	The IP addresses assigned to the FEE nodes for replication traffic network
			<EXT_TRF_2_VRRP_VR> <sup>(1)</sup>	The IP address for the VRRP between both VRs for replication traffic network

(1) Optional parameter to fill in the template for the adapt\_cluster tool.

Refer to [Adapt Cluster Tool](#) to know the default value assigned by the adapt\_cluster tool when the optional parameter is not included in the configuration file.

#### 4.2.3.2 IP Addresses of External Elements

In this section applies the same configuration described into Section 4.1.2.3 on page 9.

#### 4.2.4 Gateway Router Configuration

This section covers all the IP routes to be configured in the Gateway Routers to interoperate with each SAPC.

- Configuration in OAM GWs: To get to the OAM VIP, define static route for the VRRP of the OAM VRs, that is, one static route for the IP address defined in the <EXT\_OAM\_VRRP\_VR> parameter.
- Configuration in Traffic GWs.
  - To get to the Traffic VIP, define static route for the VRRP of the traffic network in Traffic VRs, that is, one static route for the IP address defined in the <EXT\_TRF\_1\_VRRP\_VR> parameter.
  - To get to the Replication VIP, define static routes for the VRRP of the replication network in Traffic VRs, that is, one static route for each IP address defined in the <EXT\_TRF\_2\_VRRP\_VR> parameter.





## 5 Network Configurations for Geographical Redundancy in PNF Deployments

The configuration for each SAPC is described in [BSP 8100 Network Configuration Guide](#) or [NSP 6.1 Network Configuration Guide](#) for PNF deployments.