

# IPWorks Network Connectivity Overview for KVM

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## USER GUIDE

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# 1 Introduction

This document provides a logical description of IPWorks VNF networking requirements.

## 1.1 Prerequisites

This section states the prerequisites that must be fulfilled:

- The customer has a deep understanding of the virtualized infrastructure on which IPWorks VNF is deployed.
- The customer has a deep understanding of IPWorks. The document *IPWorks Technical Description* has been read and fully understood.



## 1.2 Related Information

Trademark information, typographic conventions, and a definition and explanation of acronyms and terminology can be found in the following documents:

- *Trademark Information*
- *Typographic Conventions*
- *Glossary of Terms and Acronyms*

All the configurations, and the templates and examples throughout this document are referred to:

IPWorks 2+2 configuration: 4 VMs (2 SCs + 2 PLs)



## 2 IPWorks VNF Network Reference Setup

The IPWorks VNF network consists of several logical networks. This document proposes a reference logical network setup for IPWorks VNF, which is realized by the virtual networks that are listed in this document. The reason for using different logical networks is to enable logic separation between different functions owing to, for example, security reasons and traffic control.

It is not mandatory to use the reference logical network setup described in this document to deploy the IPWorks VNF.

The logical network setup can be altered depending on deployment-specific requirements. Any logical network setup other than the IPWorks reference logical network setup is not elaborated further in this document according to customer site environment.

### 2.1 Logical Network Setup

The IPWorks VNF exposes several network interfaces. These interfaces expose IPWorks functionality, or are used by IPWorks to access external network functions, for example Network Time Protocol (NTP). In the reference network setup of the IPWorks VNF, one or more of these network interfaces are allocated to a virtual network.

The following logical networks are part of the IPWorks reference network setup. This document assumes that the same logical networks exist in an operator network, and that the operator requires that the IPWorks VNF is connected to these existing logical networks:

- Operation and Maintenance Network (OAM network and Provisioning network)
- Signaling Network (DNS/ENUM/AAA traffic)
- Data Network (LDAP between IPWorks and CUDB and SOAP traffic between IPWorks and PG)
- Internal Network (IPWorks VNF internal Network for internal DHCP, TFTP, NFS, and so on, and it does not connect to any external network)

Which IPWorks VNF interfaces exposed in each network is described later in the document. It is outside the scope of this document to show how other network entities are connected to the listed logical networks.

Figure 1 shows the overview of the IPWorks VNF 2+2 configuration. The associated pool allocations (profiles), and the logical networks are included in the reference logical network setup. For IPWorks VNF 2+2, scaling-out operation can be performed to change the number of Payload VM instances.

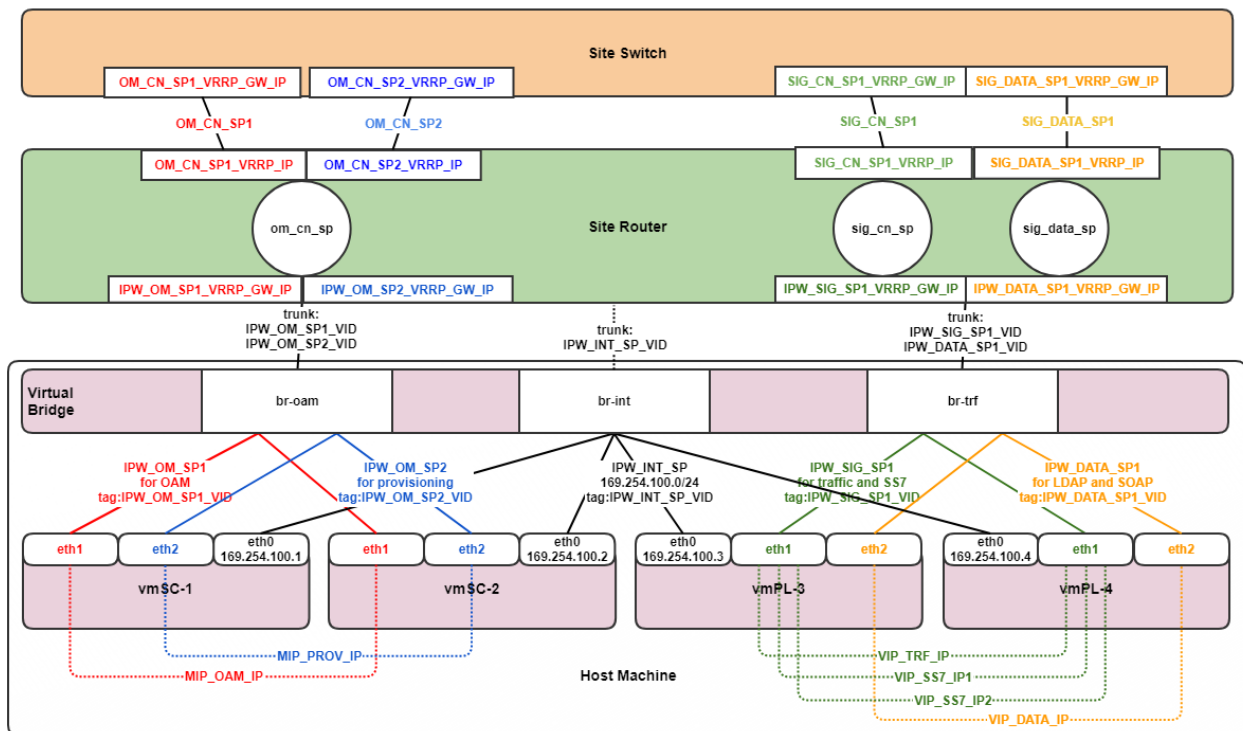


Figure 1 IPWorks VNF Logical Network Setup (for 2+2 Configuration)

## 2.2 Logical Network Overview

The logical networks in IPWorks VNF are realized using one or more networks. There is a detail description in the following sections, including the external network, internal network, and routing rules. The internal network here means the network between IPWorks VNF and router. And the external network here means the network between router and other customer switch and router equipment.

As Figure 1 shows, there are three routers in the router layer:

- Router (sig\_cn\_sp) handles DNS/ENUM/AAA traffic and SS7 traffic.
- Router (sig\_data\_sp) handles LDAP and SOAP traffic.
- Router (om\_cn\_sp) handles OAM and provision traffic.

In the customer network, these three routers could be physical routers, virtual routers or some suites of routing rules on L3 switch, which can realize routing requirements in the following logical networks. In this document, they are routing rules on two physical routers working in VRRP.

Static routing (with VRRP) provides IPWorks with a suitable redundancy mechanism. Whether VRRP provides redundancy in the network depends on the customer requirements. You can configure VRRP for site router or another



equipment in the external network based on the site requirements. It is out of this document scope.

In this document, uses VRRP as example.

## 2.3 Logical Network for Operation and Maintenance

This section describes the logical network OAM.

### 2.3.1 Purpose

This logical network `IPW_OM_SP1` is used for the common OAM IP traffic of an application (for example, OSS). Also, it provides access to the SC VMs for management. For network `IPW_OM_SP1`, the related vNIC port is `eth1` in SC.

The system management network is configured by using static IP address allocated on the SC VMs and a MIP configured for the SCs. The MIP is available on the SC VMs where COM is available. The MIP always associates with the active COM instance. COM runs in active-standby mode in 2 SCs.

The IPWorks VNF exposes the following MIP interface on the logical network Operation and Maintenance (OAM):

- IPWorks OAM MIP interface

The IPWorks VNF exposes the unique public routable IP address to all Controller Profile VM instances. Direct IP interface in this context means public addressable IP address.

### 2.3.2 Description

The IPWorks `IPW_OM_SP1` network is used for IPWorks SNMP communication with the OSS. The OSS traffic (related to OSS-RC connection, SSH, Netconf connection, NTP connection) enters and exits IPWorks through site router and virtual bridge.

The Router `om_cn_sp` takes the responsibility for routing OAM traffic between internal network `IPW_OM_SP1` and external network `OM_CN_SP1`.

There are two kinds of VLAN in this IPWorks logical network:

- `OM_CN_SP1_VID` in external network for OAM traffic
- `IPW_OM_SP1_VID` in internal network for OAM traffic

In the IPWorks network `IPW_OM_SP1`, OAM traffic is switched with VLAN tag `IPW_OM_SP1_VID` between virtual bridge and site router. To access SC VMs, OAM traffic from the external network `OM_CN_SP1` must be tagged with VLAN tag `IPW_OM_SP1_VID`.

The default gateway address `IPW_OM_SP1_VRRP_IP` of network `IPW_OM_SP1` must be configured to IPWorks VNF parameter `<IPW_OM_SP1_VRRP_GW_IP>` in `cluster.conf` file.

Figure 2 shows the realization of the logical network setup for operation and maintenance of 2+2 configuration.

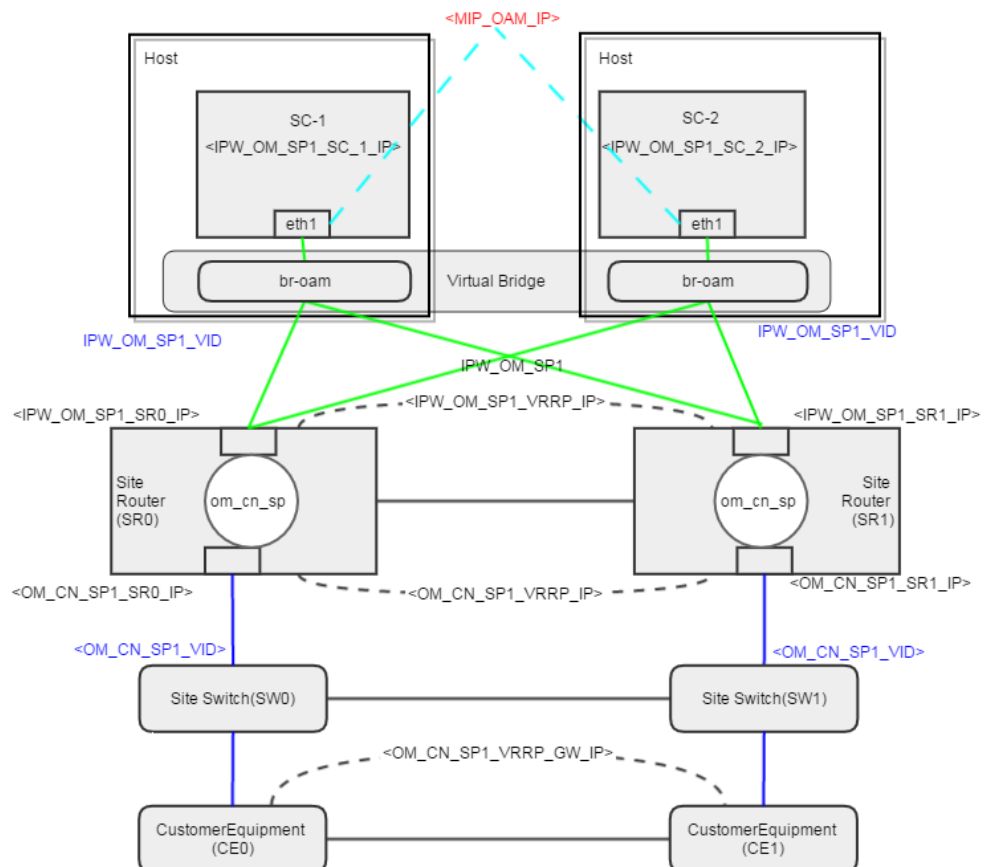


Figure 2 Realization of Logical Network Setup Operation and Maintenance

In Figure 2, the objects **Site Router**, **Site Switch**, and **CustomerEquipment** are not part of the IPWorks node. They are examples of customer network equipment. And in general, the site router also takes the responsibility for L2 connections of L2 connection of virtual bridges.

### 2.3.3 External Network OM\_CN\_SP1

The following configuration requirements apply to this network:

- Externally accessible

It must be possible to access this network from, for example, the OSS. That is, IPWorks OAM MIP is published to the OSS through this network.



- IP address range

At least one IP address for each of the endpoints is required in Router om\_cn\_sp.

- Dynamic Host Configuration Protocol (DHCP) Service

DHCP is disabled on this network.

Table 1 lists the external networks and VLANs for IPWorks OAM network. The GW\_IP in the table is external gateway IP addresses. In the example, it uses VRRP solution.

*Table 1 IP Networks of External Networks and VLANs for OAM*

Networks	Network Configuration	Description
OAM network (OM_CN_SP1: between Site router and switch)	OM_CN_SP1	VLAN name for OAM network to customer network.
	<OM_CN_SP1_VID>	VLAN ID for OM_CN_SP1 to be defined both in internal network and customer network router.
	<OM_CN_SP1_SR0_IP>	Gateway for customer network for OAM towards IPWorks on SR0.
	<OM_CN_SP1_SR1_IP>	Gateway for customer network for OAM towards IPWorks on SR1.
	<OM_CN_SP1_VRRP_IP>	VRRP address used as gateway for customer network for OAM towards IPWorks.
	<OM_CN_SP1_VRRP_GW_IP>	External gateway for OAM traffic on OM_CN_SP1 from both site routers.

### 2.3.4 Internal Network IPW\_OM\_SP1

The following configuration requirements apply to this network:

- IP address range

IP address range includes at least three endpoints:

- One for Router om\_cn\_sp
- Two for VM instances with Controller Profile

- DHCP Service

DHCP is disabled on this network.

Table 2 lists the internal networks and VLANs for IPWorks OAM network. The GW\_IP in the table is internal gateway IP addresses. In this document, VRRP is selected for configuration example.

*Table 2 Internal Networks and VLANs for OAM*

Networks	Network Configuration	Description
OAM network (IPW_OM_SP1)	IPW_OM_SP1	VLAN name for OAM network in internal network.
	<IPW_OM_SP1_NW>	Network CIDR for IPW_OM_SP1 network
	<IPW_OM_SP1_VID>	VLAN ID for IPW_OM_SP1 to be defined in tenant internal network
	<IPW_OM_SP1_SR0_IP>	SR0 IP which belongs to IPW_OM_SP1 network
	<IPW_OM_SP1_SR1_IP>	SR1 IP which belongs to IPW_OM_SP1 network
	<IPW_OM_SP1_SC1_IP>	SC1 IP in IPW_OM_SP1
	<IPW_OM_SP1_SC2_IP>	SC2 IP in IPW_OM_SP1
	<MIP_OAM_IP>	The MIP IP belongs to IPW_OM_SP1 network
	<IPW_OM_SP1_VRRP_GW_IP>	Gateway for IPW_OM_SP1 from IPWorks VNF towards both site routers

### 2.3.5 Router om\_cn\_sp

The following configuration requirement exists for this Router:

- Routing Rules

The Router must define a suite of routing rules for routing IP packets from/to IPWorks network IPW\_OM\_SP1 correctly.

Table 3 displays the routing rules of om\_cn\_sp.

*Table 3 Routing Rules for om\_cn\_sp*

Virtual Router	Destination	Next-hop	VLAN
om_cn_sp	These static routes cover NTP, SNMP, OAM, and provisioning and SQL data replication traffic.	<OM_CN_SP1_VRRP_GW_IP>	om_cn_sp1_VID
	<MIP_OAM_IP>	<IPW_OM_SP1>	IPW_OM_SP1_VID

## 2.4 Logical Network for Provisioning and SQL Data Replication

This section describes the logical network for Provisioning. In Geographic Redundancy deployment, the network is also used for MySQL data replication.



### 2.4.1

#### Purpose

The purposes of logical network `IPW_OM_SP2` are as follows, and the related vNIC port is `eth2` in SC VMs.

- Enable IPWCLI provisioning communication between the client like EMA and the IPWorks SC VM instances.

This includes the sending create/update/delete provisioning request from/to the SC VM instances and querying provisioning request to SC VM instances.

- Enable SQL data replication communication between two sites.

The IPWorks VNF exposes the following MIP interface on the logical network Provisioning:

- IPWorks Provisioning MIP interface

The IPWorks VNF exposes the unique public routable IP address to all SC VM instances. Direct IP interface in this context means public addressable IP address. The MIP is used for both IPWorks provisioning and SQL data replication.

### 2.4.2

#### Description

The IPWorks network `IPW_OM_SP2` is used for provisioning and SQL data replication, these types of traffic enter and exit IPWorks through site router and switch.

The Router `om_cn_sp` takes the responsibility for routing the provisioning and SQL data replication traffic between internal network `IPW_OM_SP2` and external network `OM_CN_SP2`.

There are two kinds of VLAN in this IPWorks logical network:

- `OM_CN_SP2_VID` in external network.
- `IPW_OM_SP2_VID` in internal network.

In IPWorks network `IPW_OM_SP2`, provisioning traffic between virtual bridge and site router is switched with VLAN tag `IPW_OM_SP2_VID`. To access SC VMs correctly, provisioning and SQL data replication traffic from the external network `OM_CN_SP2` must be tagged with VLAN tag `IPW_OM_SP2_VID`.

Figure 3 shows the realization of the logical network setup for provisioning and SQL data replication of 2+2 configuration.

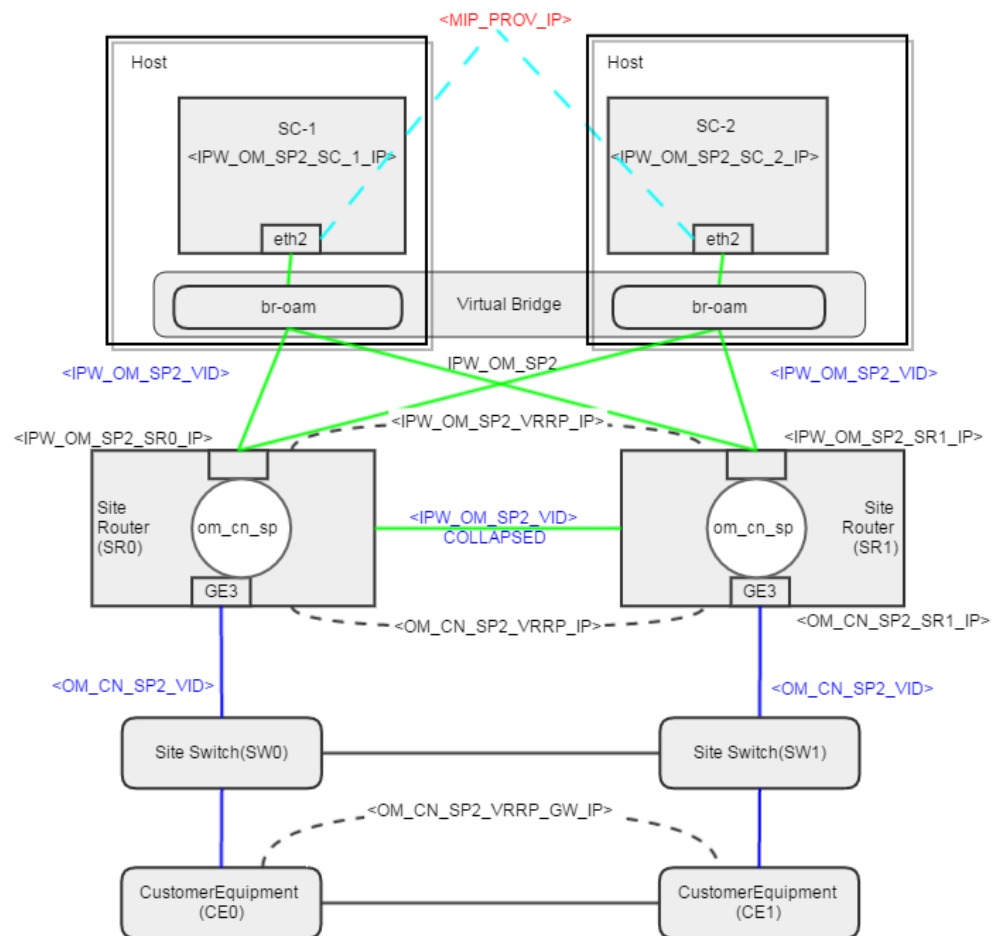


Figure 3 Realization of Logical Network Setup Provisioning

In Figure 3, the objects **Site Router**, **Site Switch**, and **CustomerEquipment** are not part of the IPWorks node. They are examples of customer network equipment. And in general, the site router also takes the responsibility for L2 connection of virtual bridges.

### 2.4.3 External Network OM\_CN\_SP2

The following configuration requirements apply to this network:

- Externally accessible

It must be possible to access this network from the external network. IPWorks Provisioning MIP is published through this network.

- IP address range

At least one IP address for each of the endpoints is required in Router with om\_cn\_sp.



- DHCP Service

DHCP is disabled on this network.

Table 4 lists the external networks and VLANs for IPWorks Provisioning network. The  $GW\_IP$  in the table is external gateway IP addresses. In the example, it uses VRRP solution.

*Table 4 External Networks and VLANs for IPWorks Provisioning*

Networks	Network Configuration	Description
Provisioning network (OM_CN_SP2: between Site router and switch)	OM_CN_SP2	VLAN name for provisioning traffic to customer network.
	<OM_CN_SP2_VID>	VLAN ID for OM_CN_SP2 to be defined both in internal network and customer network router.
	<OM_CN_SP2_SR0_IP>	Gateway for customer network for provisioning traffic towards IPWorks on SR0.
	<OM_CN_SP2_SR1_IP>	Gateway for customer network for provisioning traffic towards IPWorks on SR1.
	<OM_CN_SP2_VRRP_IP>	VRRP address used as gateway for customer network for provisioning traffic towards IPWorks
	<OM_CN_SP2_VRRP_GW_IP>	External gateway for provisioning traffic on OM_CN_SP2 from both Site routers.

#### 2.4.4 Internal Network IPW\_OM\_SP2

The following configuration requirements apply to this network:

- IP address range

IP address range to include at least three endpoints:

- One for Router om\_cn\_sp
- Two VM instances with Controller Profile

- DHCP Service

DHCP is disabled on this network.

Table 5 lists the internal networks and VLANs for IPWorks Provisioning network. The  $GW\_IP$  in the table is internal gateway IP addresses. In this document, VRRP is selected for configuration example.

**Table 5** *Internal Networks and VLANs for IPWorks Provisioning*

Networks	Network Configuration	Description
Provisioning and SQL data replication network (IPW_OM_SP2)	IPW_OM_SP2	VLAN name for provisioning and SQL data replication network in internal network.
	<IPW_OM_SP2_NW>	Network CIDR for IPW_OM_SP2 network
	<IPW_OM_SP2_VID>	VLAN ID for IPW_OM_SP2 to be defined in tenant internal network
	<IPW_OM_SP2_SR0_IP>	SR0 IP which belongs to IPW_OM_SP2 network
	<IPW_OM_SP2_SR1_IP>	SR1 IP which belongs to IPW_OM_SP2 network
	<IPW_OM_SP2_SC1_IP>	SC1 IP in IPW_OM_SP2
	<IPW_OM_SP2_SC2_IP>	SC2 IP in IPW_OM_SP2
	<MIP_PROV_IP>	The MIP IP belongs to IPW_OM_SP2 network
	<IPW_OM_SP2_VRRP_GW_IP>	Gateway for IPW_OM_SP2 from IPWorks VNF towards both Site routers

## 2.4.5 Router om\_cn\_sp

The following configuration requirement exists for this Router:

- Routing Rule

The Router defines a suite of routing rules for routing IP packets from/to IPWorks network IPW\_OM\_SP2 correctly.

**Table 6** *Routing Rules*

Virtual Router	Destination	Next-hop	VLAN
om_cn_sp	These static routes cover NTP, SNMP, OAM, and provisioning and SQL data replication traffic.	<OM_CN_SP2_VRRP_GW_IP>	om_cn_sp2_VID
	<MIP_PROV_IP>	<IPW_OM_SP2>	IPW_OM_SP2_VID

## 2.5 Logical Network for Signaling

This section describes the logical network signaling.

### 2.5.1 Purpose

The purpose of the Logical Network IPW\_SIG\_SP1 is to enable DNS/ENUM/AAA communication between the IPWorks and other network entities. And the related vNIC port is eth1 in PL VMs.

IPWorks VNF exposes the following VIP interfaces on Logical Network Signaling:



- DNS/ENUM VIP interface
- AAA VIP interface
- SS7 VIP interface

## 2.5.2

### Description for Static Routing with VRRP

To realize IPWorks signaling Abstract Load Balancer (ALB) by eVIP function, the router `sig_cn_sp` is required to support static routing with VRRP protocol. A VRRP is created for one or several VLANs that are defined for a IPWorks VNF and carries the same type of traffic.

In this logical network `IPW_SIG_SP1`, static routing is used between the router `sig_cn_sp` and IPWorks VNF. On the router `sig_cn_sp`, the nextTop of the traffic VIP is configured to FEE IP of eVIP. The eVIP FEE provides the high availability, it ensures that if only one FEE is still active, all the static routes are reachable.

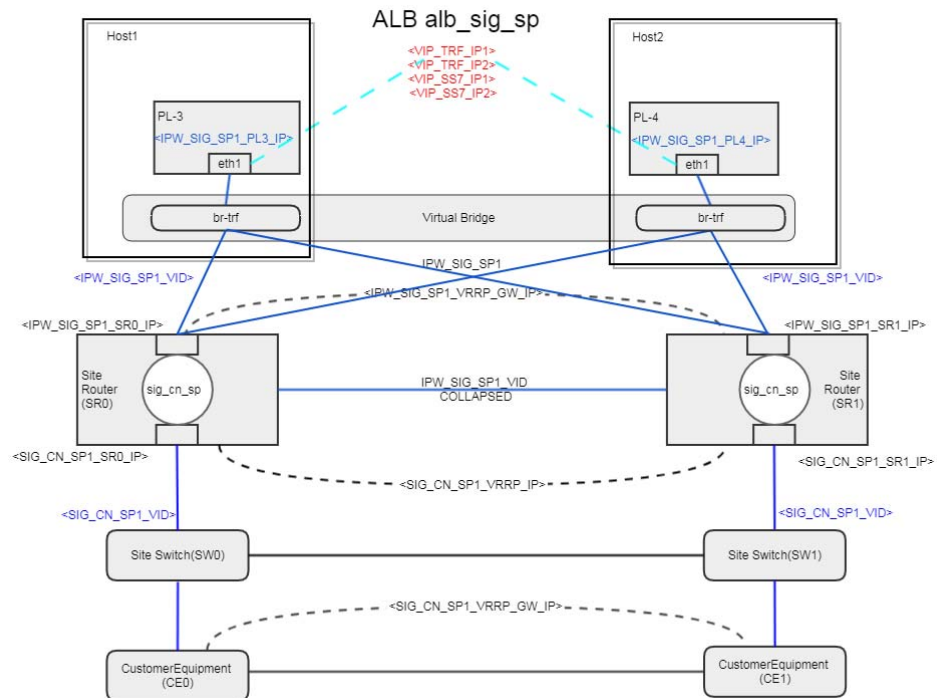
There are two kinds of VLAN in IPWorks VNF:

- `SIG_CN_SP1` in external network
- `IPW_SIG_SP1` in internal network

In the IPWorks network `IPW_SIG_SP1`, signaling traffic switched with VLAN tag `IPW_SIG_SP1_VID` between virtual bridge and site router. To distribute traffic packages to PL VMs correctly, signaling traffic come from the external network `SIG_CN_SP1` also must be tagged with VLAN tag `IPW_SIG_SP1_VID`.

In this logical network `IPW_SIG_SP1`, IP addresses `IPW_SIG_SP1_FEE1_IP` ~ `IPW_SIG_SP1_FEE4_IP`, and `IPW_SIG_SP1_VRRP_GW_IP` must be defined in eVIP configuration file `evip.xml`.

Figure 4 shows the realization of the logical network setup for signaling of 2+2 configuration that uses static routing with VRRP.



**Figure 4** Realization of Logical Network Setup Signaling for 2+2 Configuration (Static Routing with VRRP)

From Figure 4, the objects **Site Router**, **Site Switch**, and **CustomerEquipment** are not part of the IPWorks node. They are examples of customer network equipment. And in general, the site route also takes the responsibility for L2 connection of virtual bridges.

### 2.5.3 External Network SIG\_CN\_SP1

The following configuration requirements apply to this network:

- Externally Accessible

It must be possible to access this network from other network entities.

- IP address range

At least one IP address for each of the endpoints is required in Router with sig\_cn\_sp.

- DHCP Service

DHCP is disabled on this network.

Table 7 lists the external networks and VLANs for SIG\_CN\_SP1.



**Table 7 External Network of SIG\_CN\_SP1**

Networks	Network Configuration	Description
Sig traffic network (between Site router and switch)	SIG_CN_SP1	VLAN name for DNS/ENUM/AAA traffic network to customer network.
	<SIG_CN_SP1_VID>	VLAN ID for SIG_CN_SP1 to be defined both in internal network and customer network router.
	<SIG_CN_SP1_SR0_IP>	Gateway for customer network for DNS/ENUM/AAA traffic towards IPWorks on SR0. Cable is connected to SR0 GE2.
	<SIG_CN_SP1_SR1_IP>	Gateway for customer network for DNS/ENUM/AAA traffic towards IPWorks on SR1. Cable is connected to SR1 GE2.
	<SIG_CN_SP1_VRRP_IP>	VRRP address used as gateway for customer network for DNS/ENUM/AAA traffic towards IPWorks.
	<SIG_CN_SP1_VRRP_GW_IP>	External gateway for DNS/ENUM/AAA traffic on SIG_CN_SP1 from both Site routers.

#### 2.5.4 Internal Network IPW\_SIG\_SP1

The following configuration requirements apply to this network:

- IP address range

At least one IP address for each of the endpoints is required:

- Signaling ALB
- Router sig\_cn\_sp

- DHCP Service

DHCP is disabled on this network.

Table 8 lists all the internal networks and VLANs for IPW\_SIG\_SP1 for 2+2 configuration.

**Table 8** Internal IP Address

Networks	Network Configuration	Description
Sig traffic network (IPW_SIG_SP1)	IPW_SIG_SP1	VLAN name for IPWorks traffic network to In internal network.
	<IPW_SIG_SP1_NW>	Network CIDR for IPW_SIG_SP1 network
	<IPW_SIG_SP1_VID>	VLAN ID for IPW_SIG_SP1 to be defined in internal network
	<IPW_SIG_SP1_VRRP_GW_IP>	Gateway for IPW_SIG_SP1 from IPWorks VNF towards both Site routers.
	<IPW_SIG_SP1_SR0_IP>	SR0 IP which belongs to IPW_SIG_SP1 network
	<IPW_SIG_SP1_SR1_IP>	SR1 IP which belongs to IPW_SIG_SP1 network
	<IPW_SIG_SP1_FEE1_IP>	IPWorks VNF resilient FEE IP Addresses for IPW_SIG_SP1 network. For more details, refer to section 2.2.2 Resilient FEE IP Addresses in <i>eVIP Internetworking</i> .
	<IPW_SIG_SP1_FEE2_IP>	IPWorks VNF resilient FEE IP Addresses for IPW_SIG_SP1 network. For more details, refer to section 2.2.2 Resilient FEE IP Addresses in <i>eVIP Internetworking</i> .
	<IPW_SIG_SP1_FEE3_IP>	IPWorks VNF resilient FEE IP Addresses for IPW_SIG_SP1 network. For more details, refer to section 2.2.2 Resilient FEE IP Addresses in <i>eVIP Internetworking</i> .
	<IPW_SIG_SP1_FEE4_IP>	IPWorks VNF resilient FEE IP Addresses for IPW_SIG_SP1 network. For more details, refer to section 2.2.2 Resilient FEE IP Addresses in <i>eVIP Internetworking</i> .

**Table 9** Exported IP Address

Exported IPs	Network Parameters	Description
Public Export ed IP addresses	<VIP_TRF_IP1>	VIP address for DNS/ENUM/AAA traffic
	<VIP_TRF_IP2>	VIP address for AAA traffic <sup>(1)</sup>
	<VIP_SS7_IP1>	VIP address for SS7 traffic for PL
	<VIP_SS7_IP2>	VIP address for SS7 traffic for PL

(1) Only for SCTP Multi-homing function

## 2.5.5 Router sig\_cn\_sp

The following method is used in the router sig\_cn\_sp:

- Static routing configuration with VRRP for IPWorks VNF VIP

The router must define a VRRP for Signaling of IPWorks VNF and configure static routing.

The following configuration requirements exist for this Virtual Routing function:

Table 10 shows the routing rules of Router sig\_cn\_sp for 2+2 configuration.



Table 10 Routing Rules

Virtual Router	Destination	Next-hop	VLAN
sig_cn_sp	This default route covers all DNS/ENUM/AAA/SS7 traffic from IPWorks VNF to external.	<SIG_CN_SP1_VR RP_GW_IP>	sig_cn_sp1_VID
	<VIP_TRF_IP1>	<IPW_SIG_SP1_FE E1_IP>	IPW_SIG_SP1_VID
	<VIP_TRF_IP2>	<IPW_SIG_SP1_FE E2_IP>	
	<VIP_SIG_SS7_IP1>	<IPW_SIG_SP1_FE E3_IP>	
	<VIP_SIG_SS7_IP2>	<IPW_SIG_SP1_FE E4_IP>	

## 2.6 Logical Network for Data

This section describes the logical network of data. This network is optional for KVM, it is only for the deployment with AAA FE, ENUM FE or ERH FE.

### 2.6.1 Purpose

The purpose of logical network `IPW_DATA_SP1` is to enable AAA FE/ENUM FE/ERH FE communication between the IPWorks and PG or CUDB network entities. And the related vNIC port is eth2 in PL VMs.

IPWorks VNF exposes the following VIP interface on Logical Network Data:

- FE LDAP/SOAP VIP interface

### 2.6.2 Description for Static Routing with VRRP

The logical network of data is similar with logical network for signaling. The router `sig_data_sp` is required to support VRRP protocol with static routing to realize IPWorks Data ALB by eVIP function.

In this logical network `IPW_DATA_SP1`, static routing is used between the router `sig_data_sp` and IPWorks VNF. On the router `sig_data_sp`, the nextTop of the traffic VIP are Configured to FEE IP of eVIP.

There are two kinds of VLAN in IPWorks VNF:

- `SIG_DATA_SP1` in external network.
- `IPW_DATA_SP1` in internal network.

In the IPWorks network `IPW_DATA_SP1`, data traffic between virtual bridge and site router is switched with VLAN tag `IPW_DATA_SP1_VID`. To distribute

traffic packages to PL VMs correctly, signaling traffic from the external network SIG\_DATA\_SP1 must be tagged with VLAN tag IPW\_DATA\_SP1\_VID.

In this logical network, IPW\_DATA\_SP1\_FEE1\_IP, IPW\_DATA\_SP1\_FEE2\_IP, IPW\_DATA\_SP1\_FEE3\_IP, IPW\_DATA\_SP1\_FEE4\_IP, and IPW\_DATA\_SP1\_VRRP\_GW\_IP must be defined in eVIP configuration file evip.xml.

Figure 5 show the realization of the logical network setup for data of 2+2 configuration with static routing.

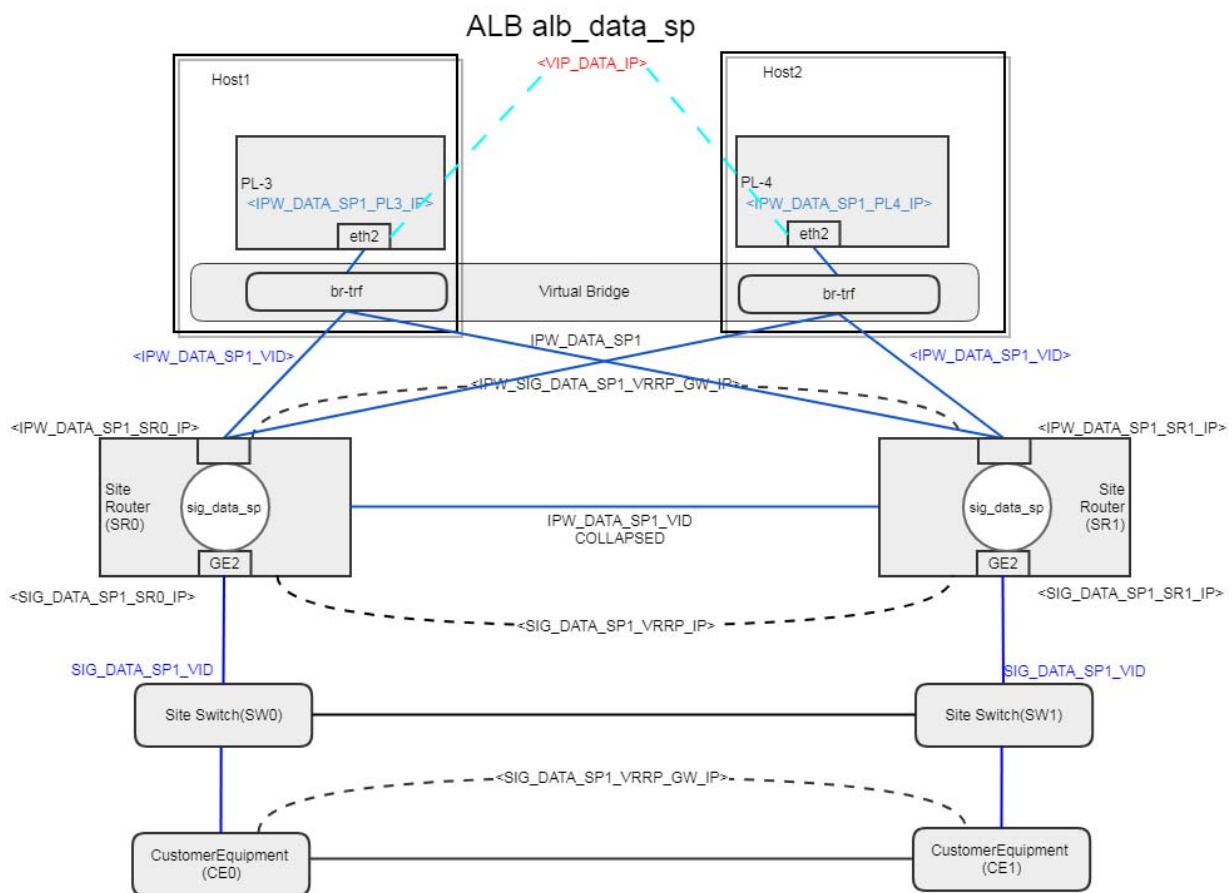


Figure 5 Realization of Logical Network Setup Data for 2+2 Configuration (Static Routing)

### 2.6.3 External Network SIG\_DATA\_SP1

The following configuration requirements apply to this network:

- Externally Accessible

It must be possible to access this network from other network entities.



- IP address range

At least one IP address for each of the endpoints is required in Router with Router sig\_data\_sp.

- DHCP Service

DHCP is disabled on this network.

Table 11 lists all the external networks and VLANs of **SIG\_DATA\_SP1**.

*Table 11 External Network and VLANs of SIG\_DATA\_SP1*

Networks	Network Configuration	Description
Sig data network (between Site router and switch)	SIG_DATA_SP1	VLAN name for LDAP/SOAP traffic(2) network to customer network.
	<SIG_DATA_SP1_VID>	VLAN ID for SIG_DATA_SP1 to be defined both in internal network and customer network router.
	<SIG_DATA_SP1_SR0_IP>	Gateway for customer network for LDAP/SOAP traffic towards IPWorks on SR1. Cable is connected to SR1 GE2.
	<SIG_DATA_SP1_SR1_IP>	Gateway for customer network for LDAP/SOAP traffic towards IPWorks on SR1. Cable is connected to SR1 GE2.
	<SIG_DATA_SP1_VRRP_IP>	VRRP address used as gateway for customer network for LDAP/SOAP traffic towards IPWorks.
	<SIG_DATA_SP1_VRRP_GW_IP>	External gateway for LDAP/SOAP traffic on SIG_DATA_SP1 from both Site routers.

## 2.6.4 Internal Network IPW\_DATA\_SP1

The following configuration requirements apply to this network:

- IP address range

At least one IP address for each of the endpoints is required:

- Data ALB
- Router data\_cn\_sp

- DHCP Service

DHCP is disabled on this network.

Table 12 lists all the internal networks and VLANs for IPW\_DATA\_SP1.



Table 12 Internal IP Address

Networks	Network Configuration	Description
Sig data network (IPW_DATA_SP1)	IPW_DATA_SP1	VLAN name for LDAP/SOAP traffic (2) network to In internal network.
	<IPW_DATA_SP1_NW>	Network CIDR for IPW_DATA_SP1 network
	<IPW_DATA_SP1_VID>	VLAN ID for IPW_DATA_SP1 to be defined in internal network
	<IPW_DATA_SP1_VRRP_GW_IP>	Gateway for IPW_DATA_SP1 from IPWorks VNF towards both Site routers
	<IPW_DATA_SP1_SR0_IP>	SR0 IP which belongs to IPW_DATA_SP1 network
	<IPW_DATA_SP1_SR1_IP>	SR1 IP which belongs to IPW_DATA_SP1 network
	<IPW_DATA_SP1_FEE1_IP>	IPWorks VNF resilient FEE IP Addresses for IPW_DATA_SP1 network. For more details, refer to section 2.2.2 Resilient FEE IP Addresses in <i>eVIP Internetworking</i> .
	<IPW_DATA_SP1_FEE2_IP>	IPWorks VNF resilient FEE IP Addresses for IPW_DATA_SP1 network. For more details, refer to section 2.2.2 Resilient FEE IP Addresses in <i>eVIP Internetworking</i> .
	<IPW_DATA_SP1_FEE3_IP>	IPWorks VNF resilient FEE IP Addresses for IPW_DATA_SP1 network. For more details, refer to section 2.2.2 Resilient FEE IP Addresses in <i>eVIP Internetworking</i> .
	<IPW_DATA_SP1_FEE4_IP>	IPWorks VNF resilient FEE IP Addresses for IPW_DATA_SP1 network. For more details, refer to section 2.2.2 Resilient FEE IP Addresses in <i>eVIP Internetworking</i> .

Table 13 Exported IP Address

Exported IPs	Network Parameters	Description
Public Exported IP addresses	<VIP_DATA_IP>	VIP address for LDAP/SOAP traffic (note: including SOAP notifications from the CUDB related to data changes)

## 2.6.5 Router sig\_data\_sp

The following configuration requirement exist for this Virtual Routing function:

- Static routing configuration with VRRP for IPWorks VNF VIP

The router must define a VRRP for date of IPWorks VNF and configure static routing.



*Table 14 Routing Rules of Router sig\_data\_sp*

Virtual Router	Destination	Next-hop	VLAN
sig_data_sp	This default route covers all LDAP traffic.	<SIG_DATA_SP1_VRRP_GW_IP>	sig_data_sp1_VID
	<VIP_DATA_IP>	IPW_DATA_SP1_FEE1_IP IPW_DATA_SP1_FEE2_IP IPW_DATA_SP1_FEE3_IP IPW_DATA_SP1_FEE4_IP	IPW_DATA_SP1_VID

## 2.7 Logical Network for Internal

This section describes the logical network internal.

### 2.7.1 Purpose

The Logical Network `IPW_INT_SP` is to enable IPWorks VNF internal communication for DHCP, TFTP, NFS, TIPC, and so on, between the 4 VMs in the VNF. The internal network does not communicate with any other network. No route configuration is needed, L2 VLAN configuration is enough. And the related vNIC port is `eth0` in all VMs.

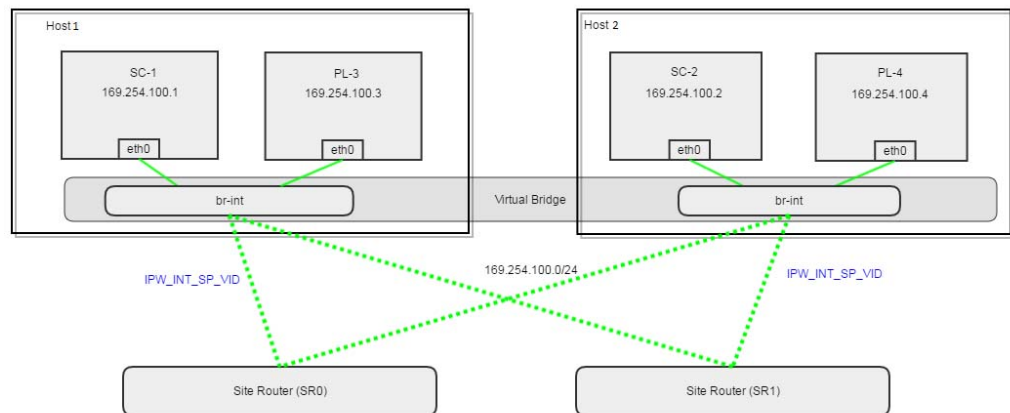
### 2.7.2 Description

Network `IPW_INT_SP` is available when L2 connection is available. In this virtual deployment, this L2 connection is realized by virtual bridge `br-int` which created by OVS. Since it needs no connect to any other network, the route function is not needed. But to separate from another logical network, the VLAN configuration is also required.

There is only one VLAN in IPWorks VNF:

- Internal Network (`IPW_INT_SP_VID`)

Figure 6 shows the realization of the logical network setup for internal connection of a 2+2 configuration.



**Figure 6** Realization of the Logical Network Setup for Internal Connection of a 2+2 Configuration

#### Note:

- In one of situations, for the hardware resource limitation, IPWorks VMs must deploy on different host machines. Then virtual bridge must bond to one of physical ports on host to connect to another host machine by **Site Router**. If there are multiple sets of virtual IPWorks deploy on the same site router, the VLAN tag of network IPW\_INT\_SP in each suite of virtual IPWorks must be different.
- If the host machine is much more powerful, there are multiple sets of virtual IPWorks deployed on it, the VLAN tag of network IPW\_INT\_SP of each virtual IPWorks must be different.

## 2.7.3

### VRRP Network

For IPW\_OM\_SP1, IPW\_OM\_SP2, IPW\_SIG\_SP1, and IPW\_DATA\_SP1 resilience between VRs and the IPWorks VNF is based on VRRP. The interfaces of the two routers are configured to participate in the same VRRP group. The connectivity between the routers is to be one collapsed network, meaning one broadcast domain. When a fault occurs and the VRRP IP address is moved from one side to the other, a gratuitous ARP is sent out to update the ARP table of IPWorks SC VMs and the switches regarding the move.



## 3 eVIP

### 3.1 eVIP Overview

For more details about eVIP, refer to the section *eVIP* in document *IPWorks Network Connectivity Overview*.

### 3.2 Static Routing Overview

For `IPW_SIG_SP1` and `IPW_DATA_SP1`, static routing is used. On eVIP gateway router, a VRRP is created for one or several VLANs that are defined for a IPWorks VNF and carries the same type of traffic. The FEEs of eVIP are connected to eVIP gateway router by VRRP gateway IP. A VRRP is created for IPWorks VNF Signaling traffic type, and another VRRP is for Data traffic type.

When static routing is used, static routes in the eVIP gateway router must be configured with VIP addresses of an ALB as route destination and the "interface addresses" on the FEE side as next hop.

For both IPWorks signaling and data VLANs that are collapsed, IPWorks VNF network connects to the left VR and the right VR.





## Reference List

### Ericsson Documents

- [1] *Trademark Information*
- [2] *Typographic Conventions*
- [3] *Glossary of Terms and Acronyms*
- [4] *IPWorks IPTables Service Configuration*
- [5] *IPWorks Network Connectivity Overview*
- [6] *CEE on BSP*, 1/1551-CNA 403 3045/1 Uen
- [7] *Add VRRP Group*, 10/1543-APR 901 0549/1 Uen
- [8] *Add Static Routing*, 47/1543-APR 901 0549/1 Uen
- [9] *eVIP Internetworking*, 1/155 19-APR 901 0467/3 Uen