CONFIGURATION GUIDE

RUCKUS SmartZone Data Plane (vSZ-D/SZ100-D/SZ144-D) Configuration Guide

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Contents

Preface **5**
- Contacting RUCKUS Customer Services and Support 5
  - What Support Do I Need? 5
  - Open a Case 5
  - Self-Service Resources 6
- Document Feedback 6
- RUCKUS Product Documentation Resources 6
- Online Training Resources 6
- Document Conventions 7
  - Notes, Cautions, and Safety Warnings 7
- Command Syntax Conventions 7

About This Guide **9**
- New In This Document 9
- SmartLicense Overview 9

SmartZone Data Plane Features **11**
- Virtual SmartZone Data Plane and SmartZone 100 Data Plane Overview 11

Features and Benefits **13**
- Tunneled WLANs and Flexible Traffic Redirection 14
- Architecture and Deployment Flexibility 15
- IPv6 Address Support 16
- vSZ-D/SZ100-D/SZ144-D DP Group 16
- DHCP Server and NAT Service on vSZ-D/SZ100-D/SZ144-D 17
  - DHCP/NAT 18
  - Configuring License Bandwidth 18
  - Configuring the DHCP/NAT License Assignment 19
- L3 Roaming 21
  - Editing L3 Roaming for a vSZ-D/SZ100-D/SZ144-D 22
- Lawful Intercept 23
- Enabling Flexi VPN 24
- Enabling Tunnel Encryption 25

Network Architecture **27**

Communication Workflow **29**

NAT Deployment Topologies **31**
- AP Behind NAT and vSZ-D/SZ100-D/SZ144-D Behind NAT 31
- vSZ and vSZ-D/SZ100-D/SZ144-D at Data Center Behind NAT 31
- vSZ-D/SZ100-D/SZ144-D at Access Site with NAT 32
- vSZ-D/SZ100-D/SZ144-D Behind NAT 33
- DHCP Relay with NAT 34
- DHCP Option 82 and Bridge Profile 35

Configuring the vSZ Controller to Prepare for Network Segmentation **39**
- Configuring the DHCP/NAT License Assignment 39
- Creating Profile-based DHCP 39
- Configuring Global Settings 39

Configuring DHCP Pool Settings 40
Creating Profile-based NAT 41
Configuring NAT Global Settings 41
Configuring NAT Pool Setting 42
Creating an AP Group 42
Creating WLAN for Network Segmentation 44

Creating Network Segmentation Profile on the vSZ Controller 47

Hardware Requirements 51
Important Notes About Hardware Requirements 51
Supported Modes of Operation 52
vSZ-D with DirectI/O 54
vSZ-D with Hypervisor vSwitch Installed 54
vSZ-D and vSZ with Hypervisor vSwitch Installed 55

Recommended NICs and Operation Modes 57

Hypervisor Configuration 59
Supported Hypervisors 59
General Configuration 59
VMware Specific Configuration 59
KVM Specific Configuration 64
Hypervisor Detail 64
CPU Type 65
Memory Allocation 66
Disk Configuration 67
NIC Configuration in Direct IO Mode 70
NIC Configuration in vSwitch Mode 71
Adding a PCI Device to a VM on Virt-Manager 73
NIC Card Setting 74

Deployment of vSZ 75
Deploy vSZ-D with 40GB NIC on ESXi Server 75
Deploy vSZ-D with 40GB NIC on ESXi Server 75
Deploy vSZ-D with 40GB NIC on Linux Server 90
Deploy vSZ-D with 40GB NIC on Linux Server 90

Upgrade Procedure 113
Upgrade Procedure 113

Data Plane Performance Recommendations 117

Preface

- Contacting RUCKUS Customer Services and Support 5
- Document Feedback 6
- RUCKUS Product Documentation Resources 6
- Online Training Resources 6
- Document Conventions 7
- Command Syntax Conventions 7

Contacting RUCKUS Customer Services and Support

The Customer Services and Support (CSS) organization is available to provide assistance to customers with active warranties on their RUCKUS products, and customers and partners with active support contracts.

For product support information and details on contacting the Support Team, go directly to the RUCKUS Support Portal using https://support.ruckuswireless.com, or go to https://www.commscope.com/ruckus and select **Support**.

What Support Do I Need?

Technical issues are usually described in terms of priority (or severity). To determine if you need to call and open a case or access the self-service resources, use the following criteria:

- Priority 1 (P1)—Critical. Network or service is down and business is impacted. No known workaround. Go to the **Open a Case** section.
- Priority 2 (P2)—High. Network or service is impacted, but not down. Business impact may be high. Workaround may be available. Go to the **Open a Case** section.
- Priority 3 (P3)—Medium. Network or service is moderately impacted, but most business remains functional. Go to the **Self-Service Resources** section.
- Priority 4 (P4)—Low. Requests for information, product documentation, or product enhancements. Go to the **Self-Service Resources** section.

Open a Case

When your entire network is down (P1), or severely impacted (P2), call the appropriate telephone number listed below to get help:

- Continental United States: 1-855-782-5871
- Canada: 1-855-782-5871
- Europe, Middle East, Africa, Central and South America, and Asia Pacific, toll-free numbers are available at https://support.ruckuswireless.com/contact-us and Live Chat is also available.
- Worldwide toll number for our support organization. Phone charges will apply: +1-650-265-0903

We suggest that you keep a physical note of the appropriate support number in case you have an entire network outage.

Self-Service Resources

The RUCKUS Support Portal at https://support.ruckuswireless.com offers a number of tools to help you to research and resolve problems with your RUCKUS products, including:

- Technical Documentation—https://support.ruckuswireless.com/documents
- Community Forums—https://community.ruckuswireless.com
- Knowledge Base Articles—https://support.ruckuswireless.com/answers
- Software Downloads and Release Notes—https://support.ruckuswireless.com/#products_grid
- Security Bulletins—https://support.ruckuswireless.com/security

Using these resources will help you to resolve some issues, and will provide TAC with additional data from your troubleshooting analysis if you still require assistance through a support case or RMA. If you still require help, open and manage your case at https://support.ruckuswireless.com/case_management.

Document Feedback

RUCKUS is interested in improving its documentation and welcomes your comments and suggestions.

You can email your comments to RUCKUS at #Ruckus-Docs@commscope.com.

When contacting us, include the following information:

- Document title and release number
- Document part number (on the cover page)
- Page number (if appropriate)

For example:

- RUCKUS SmartZone Upgrade Guide, Release 5.0
- Part number: 800-71850-001 Rev A
- Page 7

RUCKUS Product Documentation Resources

Visit the RUCKUS website to locate related documentation for your product and additional RUCKUS resources.

Release Notes and other user documentation are available at https://support.ruckuswireless.com/documents. You can locate the documentation by product or perform a text search. Access to Release Notes requires an active support contract and a RUCKUS Support Portal user account. Other technical documentation content is available without logging in to the RUCKUS Support Portal.

White papers, data sheets, and other product documentation are available at https://www.commscope.com/ruckus .

Online Training Resources

To access a variety of online RUCKUS training modules, including free introductory courses to wireless networking essentials, site surveys, and products, visit the RUCKUS Training Portal at https://commscopeuniversity.myabsorb.com/. The registration is a two-step process described in this video. You create a CommScope account and then register for, and request access for, CommScope University.

Document Conventions

The following table lists the text conventions that are used throughout this guide.

TABLE 1 Text Conventions

Convention	Description	Example
`monospace`	Identifies command syntax examples	`device(config)# interface ethernet 1/1/6`
bold	User interface (UI) components such as screen or page names, keyboard keys, software buttons, and field names	On the **Start** menu, click **All Programs**.
italics	Publication titles	Refer to the *RUCKUS Small Cell Release Notes* for more information.

Notes, Cautions, and Safety Warnings

Notes, cautions, and warning statements may be used in this document. They are listed in the order of increasing severity of potential hazards.

NOTE
A NOTE provides a tip, guidance, or advice, emphasizes important information, or provides a reference to related information.

ATTENTION
An ATTENTION statement indicates some information that you must read before continuing with the current action or task.

CAUTION
A CAUTION statement alerts you to situations that can be potentially hazardous to you or cause damage to hardware, firmware, software, or data.

DANGER
A DANGER statement indicates conditions or situations that can be potentially lethal or extremely hazardous to you. Safety labels are also attached directly to products to warn of these conditions or situations.

Command Syntax Conventions

Bold and italic text identify command syntax components. Delimiters and operators define groupings of parameters and their logical relationships.

Convention	Description
bold text	Identifies command names, keywords, and command options.
italic text	Identifies a variable.
[ ]	Syntax components displayed within square brackets are optional. Default responses to system prompts are enclosed in square brackets.
{**x**| **y**| **z**}	A choice of required parameters is enclosed in curly brackets separated by vertical bars. You must select one of the options.
x|**y**	A vertical bar separates mutually exclusive elements.
< >	Nonprinting characters, for example, passwords, are enclosed in angle brackets.
...	Repeat the previous element, for example, *member*[*member*...].
\	Indicates a “soft” line break in command examples. If a backslash separates two lines of a command input, enter the entire command at the prompt without the backslash.

About This Guide

- New In This Document..... 9
- SmartLicense Overview..... 9

New In This Document

TABLE 2 Key Features and Enhancements in SmartZone 6.1.1 (December 2022)

Feature	Description	Location
NIC Driver support	**Updated**: Removed the NIC model supported fields for VMXNET3/virtIO and Virtio.	Recommended NICs and Operation Modes on page 57
Upgrade Procedu	Controller and vSZ-D/SZ100-D/SZ144-D Firmware Compatibility Matrix	Upgrade Procedure on page 113

SmartLicense Overview

This guide is intended for use by those responsible for managing the RUCKUS Wireless network controller. Therefore, it assumes basic working knowledge of the RUCKUS wireless network controller and Access Point (AP) products.

The controller (SmartZone) currently includes a licensing feature that stores proprietary license files. As part of this feature, the new license feature implementation uses *Flexera* licensing to handle license management.

The controller uses a Flexera license server as the primary license source and periodically retrieves the license from the server for any updates. The manual upload of a binary license file from the local machine is also supported.

In addition displaying all assigned license entitlements on the user interface, the user interface provides a method to set the Local License Server (LLS) address, and allows you to manually retrieve license data from the license server from the controller. The user interface enforces the system upgrade process by checking the availability of supported licenses.

The SmartZone (controller) user interface provides information about licensing and the licenses you are currently using to determine when you may require more licenses (or fewer licenses) over time.

For the purposes of this document, the following assumptions are made:

- You have already deployed your SmartZone system.
- You have purchased a license or are using the 90-day trial license.

SmartZone Data Plane Features

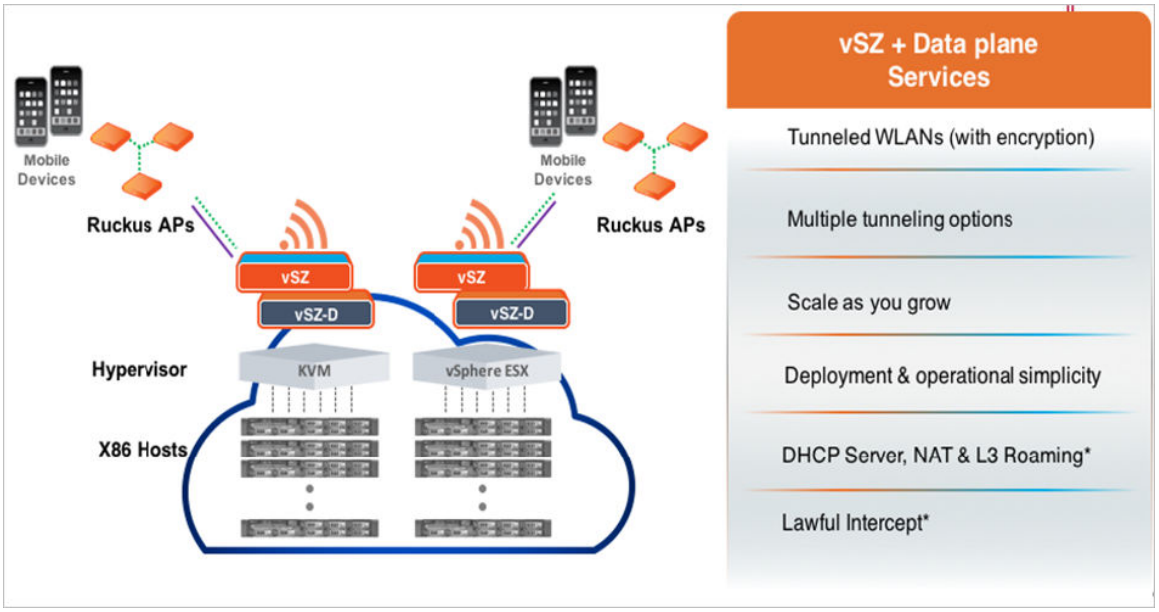
- Virtual SmartZone Data Plane and SmartZone 100 Data Plane Overview.....11

Virtual SmartZone Data Plane and SmartZone 100 Data Plane Overview

The RUCKUS Virtual SmartZone controller platform is the industry's most scalable Wi-Fi controller platform that enables service providers and enterprises to leverage virtualization technologies to deploy superior Wi-Fi management systems.

With the introduction of the Virtual Data Plane (vSZ-D) in SZ 3.2 release and SZ100-D in 5.1, the SmartZone platform launched sophisticated data plane capabilities. This is truly differentiated and distinguished offering that provides compelling business benefits for varied deployment scenarios.

FIGURE 1 vSZ-D/SZ100-D/SZ144-D Services



Features and Benefits

- Tunneled WLANs and Flexible Traffic Redirection 14
- Architecture and Deployment Flexibility 15
- IPv6 Address Support 16
- vSZ-D/SZ100-D/SZ144-D DP Group 16
- DHCP Server and NAT Service on vSZ-D/SZ100-D/SZ144-D 17
- L3 Roaming 21
- Lawful Intercept 23
- Enabling Flexi VPN 24
- Enabling Tunnel Encryption 25

vSZ-D is a virtualized service to segregate and securely tunnel user data traffic.

NOTE

You can create a maximum of 2047 multicast groups on vSZ-D/SZ100-D/SZ144-D.

Some of the key use cases for the vSZ-D/SZ100-D/SZ144-D are:

FIGURE 2 Use cases

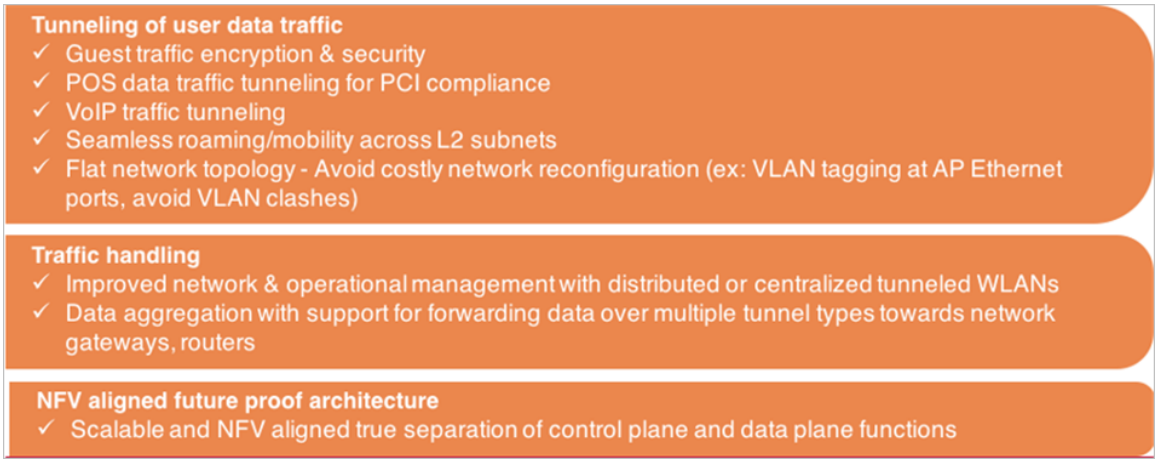


TABLE 3 Feature and Benefits

Feature	Benefit
Secure data plane tunneling	Manages the creation of aggregated user data streams through secure tunnel
Multiple Hypervisor Support	Supports the most widely deployed VMware and KVM hypervisors, applicable only to vSZ-D.
Dynamic data plane scaling	Supports 1Gbps, 10Gbps or even higher throughput capacities to support all types of enterprise and carrier deployments that can be dynamically tuned without needing software updates

TABLE 3 Feature and Benefits (continued)

Feature	Benefit
Seamless integration with vSZ controller	• Simple integration and management with vSZ controller clustering architecture enables support for multiple vSZ-D/SZ100-D/SZ144-D instances • vSZ + Data Plane services – 20 vSZ-D/SZ100-D/SZ144-D instances per vSZ instance – 80 vSZ-D/SZ100-D/SZ144-D instances per vSZ cluster of 4 instances Workaround: – If CALEA/Flexi-VPN/L3 Roaming/Network Segmentation is enabled, user shall not be able to approve more than 40 DPs. – If CALEA/Flexi-VPN/L3 Roaming/Network Segmentation is not enabled and the user adds more than 40 DPs, then CALEA/Flexi-VPN/L3 Roaming/Network Segmentation setting shall be greyed out. • The controller runs in Active/Active (3+1) mode for extremely high availability. • Each vSZ-D runs as an independent virtual machine instance that is managed by the controller. • With vSZ-D/SZ100-D/SZ144-D DP Group enabled, it is possible to support a distributed vSZ-D/SZ100-D/SZ144-D instance on a per vSZ Zone basis.
Superior data plane functions	Encrypted tunnel aggregation from all types of WLANs (Captive portal, 802.1x, HS2.0), VLANs, DHCP Relay, DHCP Server, NAT, L3 Roaming, Lawful Intercept, IPv6 Support and NAT traversal between AP and vSZ-D/SZ100-D/SZ144-D.
Scalable Deployment Architectures	Provides the ability to service distributed and centralized network configurations
Deployment and operational simplicity	Simple integration and management with vSZ-E and vSZ-H installations
Site level QoS and policy control	Service policy management and data stream (will be supported in a later release)

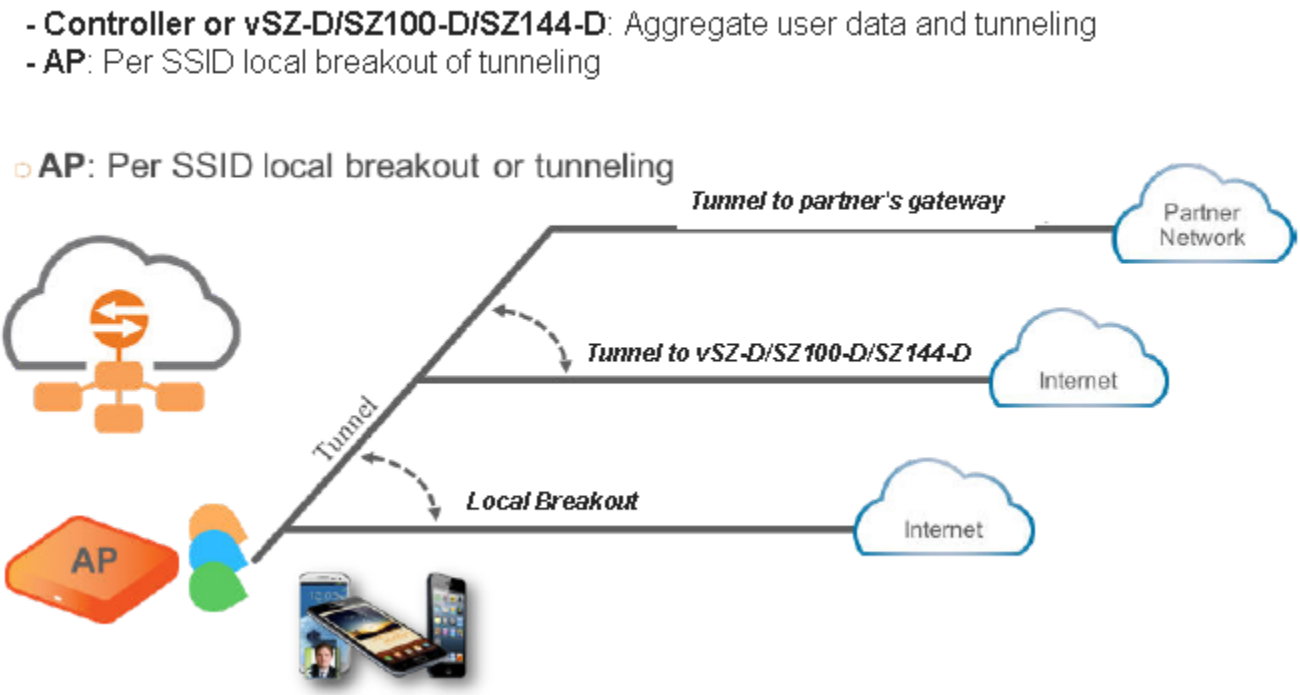
Tunneled WLANs and Flexible Traffic Redirection

Many WiFi deployments have requirements to support tunneled WLANs for guest isolation and encryption, POS data security, VoIP traffic management, and seamless roaming across L2 subnets. One of the most deployed and easily managed way to meet these requirements is to enable a flat network topology by tunneling traffic to a controller.

With the vSZ-D/SZ100-D/SZ144-D , it is now possible to support tunneled WLANs on RUCKUS APs that are managed by a vSZ controller. In addition, both the RUCKUS APs and the vSZ-D/SZ100-D/SZ144-D support encryption capabilities on tunnels for data protection. This is especially important when tunneling guest traffic and in use cases where the service provider or enterprise operator does not have control on the backhaul links.

NOTE
SZ100 and SZ144 controllers are not supported with external DPs (vSZ-D/SZ100-D/SZ144-D).

FIGURE 3 Traffic redirection flexibility with the Virtual SmartZone platform

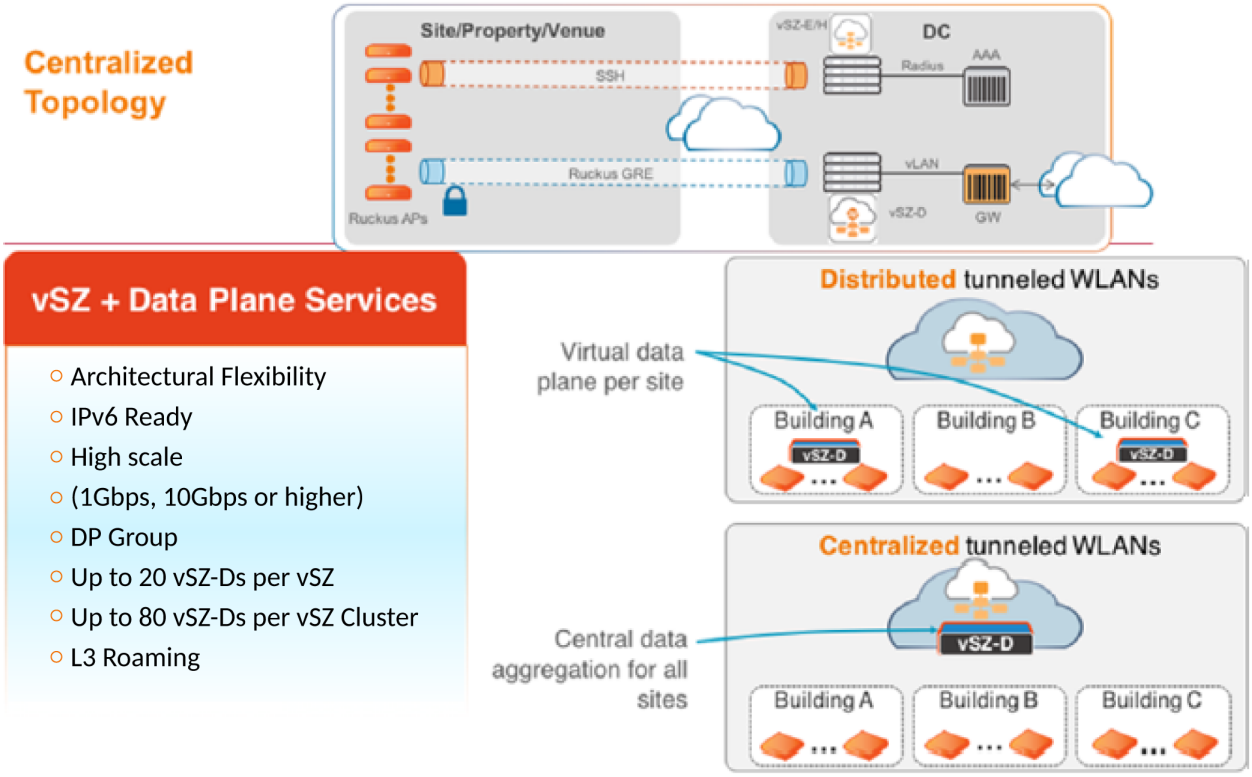


Architecture and Deployment Flexibility

Existing architectures for supporting tunneled WLANs involve tunneling data back into controllers. This results in architectures where a complete controller needs to be deployed on each site or all the tunneled WLAN traffic being backhauled into a centralized data center. This also results in dependencies on choices for controller platforms with different capacity profiles, which increase the capital and operating expenses of the entire solution without actually solving the real problem.

With the vSZ-D/SZ100-D/SZ144-D , it is now possible to deploy the same software either on-premise (on cheaper COTS hardware) when needed, as well as deploy it at the data center (on higher end COTS hardware) and the entire Wi-Fi management controller by the vSZ controller.

FIGURE 4 Unmatched architecture flexibility



IPv6 Address Support

The vSZ-D/SZ100-D/SZ144-D supports IPv6 addresses for the data plane interface. The vSZ-D/SZ100-D/SZ144-D also supports client IPv6 addresses for DHCP Relay only.

NOTE
vSZ-D/SZ100-D/SZ144-D does not support IPv6 addresses for northbound soft-GRE tunnels.

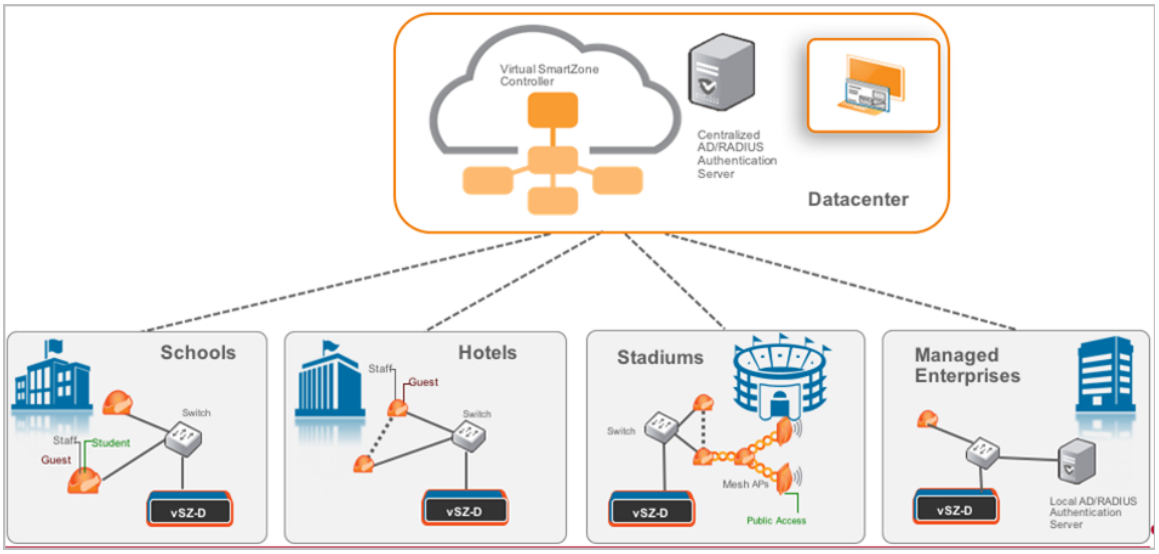
vSZ-D/SZ100-D/SZ144-D DP Group

It is now possible to dedicate vSZ-D/SZ100-D/SZ144-D instance on a per distributed site basis.

This is especially useful for managed service providers and ISPs who manage remote distributed sites through a central or regional data center. In this architecture, the vSZ is in the provider's data center managing APs across all remote distributed sites.

On sites where there is a need for tunneling, they can introduce the vSZ-D/SZ100-D/SZ144-D and bind them to that particular site so that all APs on that site shall tunnel traffic locally to the vSZ-D/SZ100-D/SZ144-D DP Group on that site.

FIGURE 5 vSZ-D/SZ100-D/SZ144-D DP Group



DHCP Server and NAT Service on vSZ-D/SZ100-D/SZ144-D

Highly scalable and optimized DHCP Server on vSZ-D/SZ100-D/SZ144-D is designed from the ground up for WiFi networks. It also introduces NAT capability.

NOTE
DHCP Server/NAT function if enabled is supported only for wireless client IPv4 address assignment.

NOTE
DHCP Server and NAT service configuration is supported using AP and web user interface. Refer to Administrator Guide for configuring DHCP server and NAT service on the web interface.

DHCP Server

The DHCP Server is designed in-line in the data plane and provides extreme scale in terms of IP address assignment to clients. This feature is especially useful in high density and dynamic deployments like stadiums, train stations where large number of clients continuously move in & out of WiFi coverage. The DHCP server in the network needs to scale to meet these challenging requirements. The DHCP server on the vSZ-D/SZ100-D/SZ144-D provides high scale IP assignment and management with minimal impact on forwarding latency. DHCP Server supports 63 pools with profile support.

NOTE
The DHCP service can scale for a maximum of 101K IP leases per data plane. You can incrementally add-on license on a per-group basis of two DPs.

NAT Service

With NAT service enabled, all the WiFi client traffic is NATed by vSZ-D/SZ100-D/SZ144-D before being forwarded to the core network. Each vSZ-D/SZ100-D/SZ144-D supports up to 16 public IP addresses for NAT. This feature essentially reduces the network overhead significantly since this reduces the MAC-table considerations on the UP-stream switches significantly. Again, very useful in high density deployments.

NOTE
Only single subnet is supported.

NOTE
The NAT service scales a maximum of 2 million sessions/ flows per Data Plane. You can incrementally add-on license on a per-Data Plane basis.

DHCP/NAT

DHCP/NAT functionality on SZ-managed APs and DPs (data planes) allows customers to reduce costs and complexity by removing the need for DHCP server/NAT router to provide IP addresses to clients. For data traffic aggregation and services delivery you can choose appropriate user profile for DHCP and NAT services on vSZ-D/SZ100-D/SZ144-D.

AP-based DHCP/NAT

In highly distributed environments, particularly those with only a few APs per site, the ability for an AP or a set of APs to provide DHCP/NAT support to local client devices simplifies deployment by providing all-in-one functionality on the AP, which eliminates the need for a separate router and DHCP server for each site. It also eases site management by providing central control and monitoring of the distributed APs and their clients.

Three general DHCP scenarios are supported:

- SMB Single AP: DHCP is running on a single AP only. This AP also functions as the Gateway AP.
- SMB Multiple APs (<12): DHCP service is running on all APs, among which two of the APs will be Gateway APs. These two Gateway APs will provide the IP addresses as well as Internet connectivity to the clients via NAT.
- Enterprise (>12): For Enterprise sites, an additional on site vSZ-D/SZ100-D/SZ144-D will be deployed at the remote site which will assume the responsibilities of performing DHCP/NAT functions. Therefore, DHCP/NAT service will not be running on any APs (they will serve clients only), while the DHCP/NAT services are provided by the onsite vSZ-D/SZ100-D/SZ144-D.

Profile-based DHCP

The DHCP Server is designed in-line in the data plane and provides extreme scale in terms of IP address assignment to clients. This feature is especially useful in high density and dynamic deployments like stadiums, train stations where large number of clients continuously move in & out of WiFi coverage. The DHCP server in the network needs to scale to meet these challenging requirements. The DHCP server on the vSZ-D/SZ100-D/SZ144-D provides high scale IP assignment and management with minimal impact on forwarding latency. DHCP Server supports 440K IP addresses and 64 pools with profile support.

NOTE
DHCP Server/NAT function if enabled is supported only for wireless client IPv4 address assignment.

Profile-based NAT

With NAT service enabled, all the WiFi client traffic is NATed by the vSZ-D/SZ100-D/SZ144-D before being forwarded to the core network. Each vSZ-D/SZ100-D/SZ144-D supports up to 990K ports and 16 public IP addresses for NAT. This feature essentially reduces the network overhead significantly since this reduces the MAC-table considerations on the UP-stream switches significantly. Again, very useful in high density deployments.

Configuring License Bandwidth

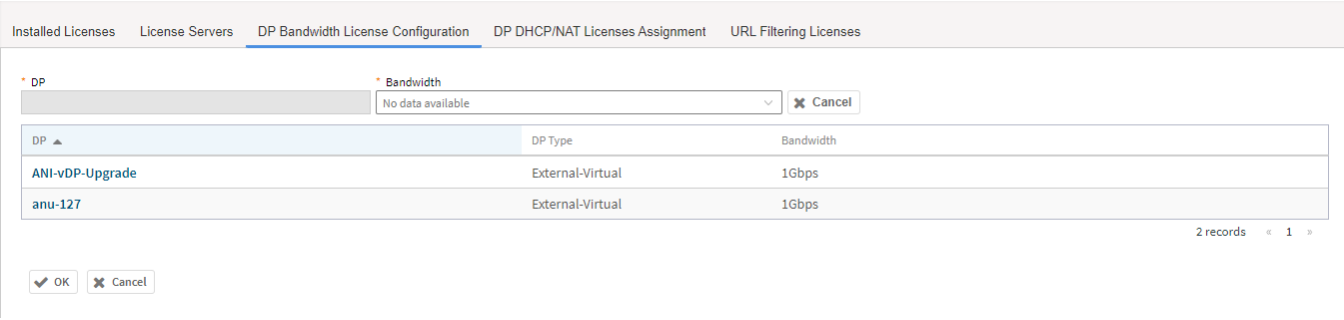
You can assign a license bandwidth for a data plane provided it is already approved. Each data plane can be configured with only one bandwidth license. Only vSZ-D support License Bandwidth.

1. Go to **Administration** > **Administration** > **Licenses**.

2. Select the **License Bandwidth Configuration** tab.

   The **License Bandwidth Configuration** page appears.

   FIGURE 6 License Bandwidth Configuration



3. Select a DP from the Data Plane table, the **DP** name is automatically displayed.
4. From the **Bandwidth** drop-down menu, select one of the following bandwidth license:
   - 1Gbps (default)
   - 10Gbps for customers using 10G NIC card
   - Unlimited for customers using 40G NIC card.
5. Click **OK**. The data plane with the assigned license bandwidth is displayed.
6. Click **OK**.

   The message `Submitting form` appears, and the data plane is assigned a bandwidth.

You have successfully assigned a license bandwidth to the data plane.

Configuring the DHCP/NAT License Assignment

Creating DHCP License Assignment

Licensing needs to be created on a per SZ Controller Cluster basis. The default license, **CAPACITY-DP-SVDS-DEFAULT**, supports 1K DHCP address leases.

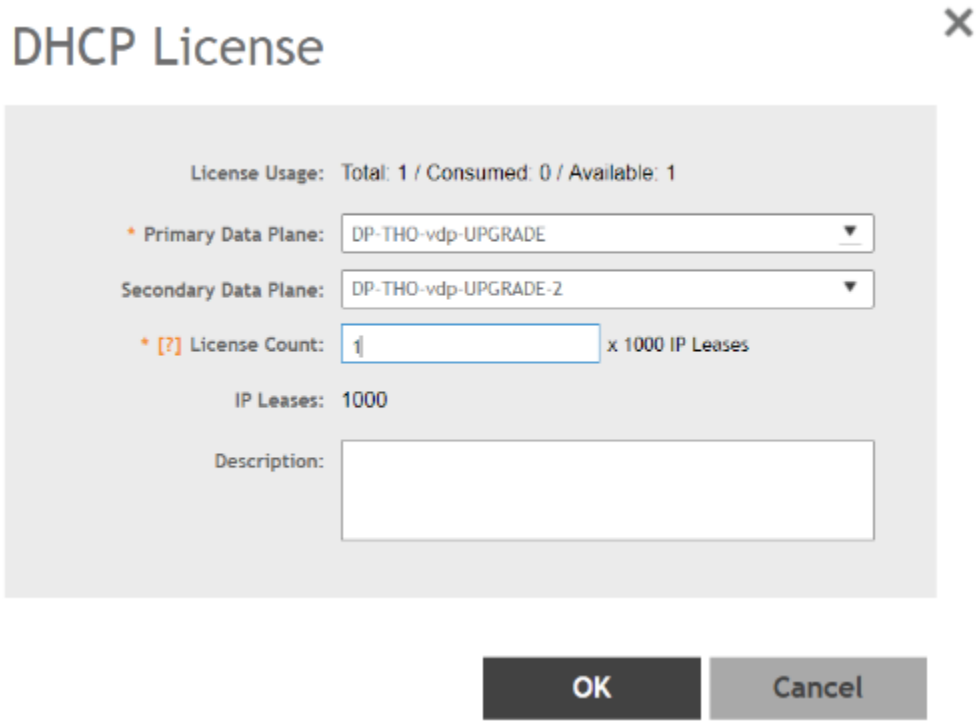
To create the DHCP License assignment:

1. Go to **Administration** > **Administration** > **Licenses**.
2. Select the **DP DHCP/NAT Licenses Assignment** tab.

3. From the **DHCP License** area, click **Create**.

   The **DHCP License** form appears.

   FIGURE 7 DHCP License Assignment



- **License Usage**: Lists the details of license consumption and availability.
- **Primary Data Plane**: Select the primary data plane from the drop-down. To remove the Data Plane from the DHCP license assignment, select **Clear**.
- **Secondary Data Plane**: Select the secondary data plane from the drop-down. To remove the Data Plane from the DHCP license assignment, select **Clear**.
- **License Count**: Enter the number of license. Range: 1 through 101.
- **IP Leases**: Lists the number of IPs assigned.
- **Description**: Enter a short description about the license assignment.

4. Click **OK**.

You have created the DHCP license assignment.

NOTE
To edit or remove the license assignment on the data plane, select the assignment from the list and click **Configure** or **Delete** respectively.

Creating NAT License Assignment

Licensing needs to be created on a per SZ Controller Cluster basis. The default license, **CAPACITY-DP-SNAT-DEFAULT**, supports 100K NAT sessions.

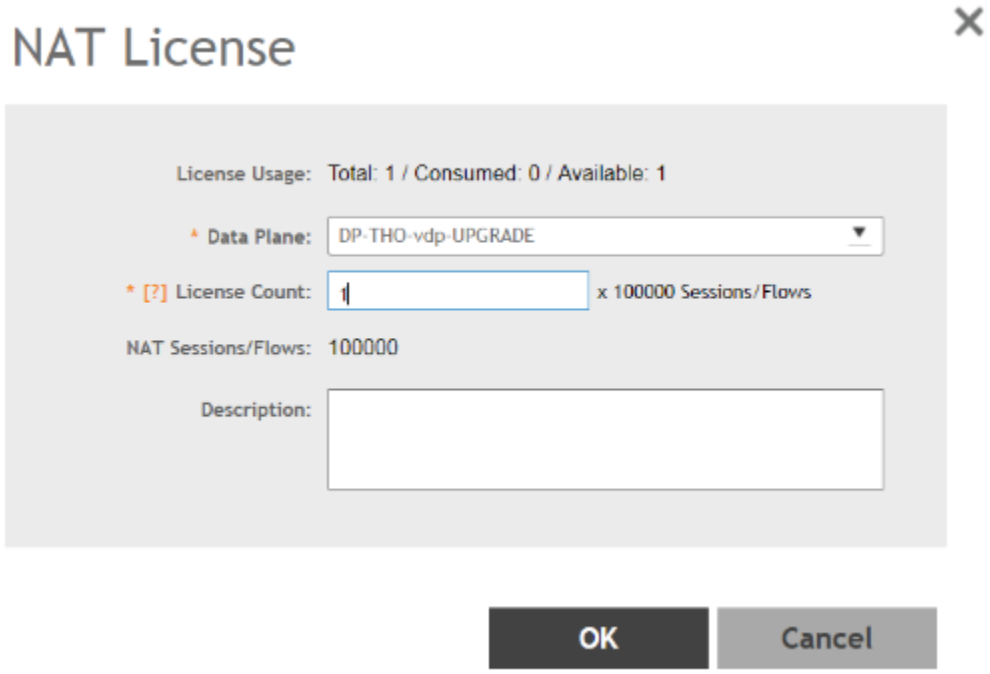
To create the NAT License assignment:

1. Go to **Administration** > **Administration** > **Licenses**.

2. Select the **DP DHCP/NAT Licenses Assignment** tab.
3. From the **NAT License** area, click **Create**.

   The **NAT License** form appears.

   FIGURE 8 NAT License Assignment



   - **License Usage**: Lists the details of license consumption and availability.
   - **Data Plane**: Select the data plane from the drop-down. To remove the Data Plane from the NAT license assignment, select **Clear**.
   - **License Count**: Enter the number of license for the data plane. Range: 1 through 20.
   - **NAT Sessions/Flows**: Lists the number of NAT sessions/flows.
   - **Description**: Enter a short description about the license assignment.
4. Click **OK**.

You have created the NAT license assignment.

NOTE
To edit or remove the license assignment on the data plane, select the assignment from the list and click **Configure** or **Delete** respectively.

L3 Roaming

RUCKUS vSZ and vSZ-D/SZ100-D/SZ144-D architecture now supports L3 Roaming without the need for additional mobility controllers.

The key use cases for L3 Roaming are well-understood,. Typically, a large WLAN network where APs are separated on different VLAN segments and there is a need for IP address preservation and potentially session persistence. Most common deployments are large campus networks designed with multiple switches and VLANs and there is a need to support L3 Roaming.

On vSZ-D/SZ100-D/SZ144-D, RUCKUS Wi-Fi can now support L3 Roaming with IP Address preservation. Below is the high level use case that describes the feature functions. A large network that is broken up into various campuses and there is a need to support L3 Roaming. Below figure depicts 2 campuses, which are L2 separated but need L3 Roaming.

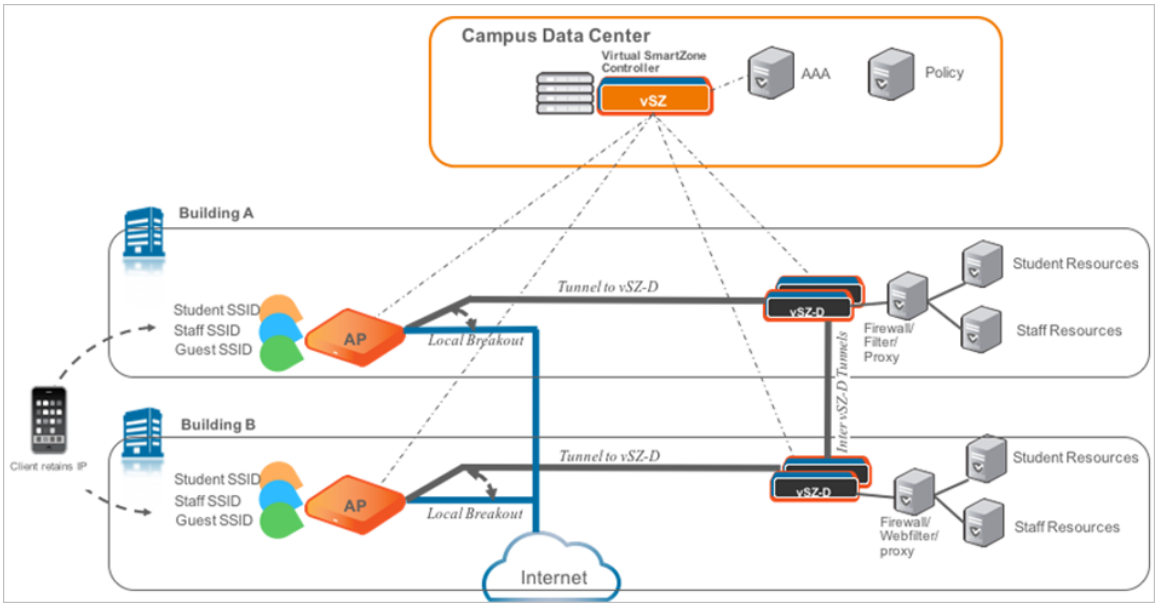
The APs in campus A setup a tunneled WLAN to the vSZ-D (Using DP Group) and APs in building B setup a tunneled WLAN to the vSZ-D in their building.

Each vSZ-D/SZ100-D/SZ144-D in the building can be configured to run a DHCP Server and NAT the traffic or be setup as a DHCP Relay. When a client roams from an AP in building A to an AP in building B, the vSZ-D/SZ100-D/SZ144-D in building B detects the roaming event and forwards the traffic (or assigns the same IP back to the client) to the vSZ-D in building A (home vSZ-D/SZ100-D/SZ144-D or anchor vSZ-D/SZ100-D/SZ144-D) to ensure that service to the client is not interrupted.

One additional unique benefit of this architecture over other L3 Roaming solutions is that with this architecture, the roamer client can still have access to his home network resources (this is similar to mobile roaming on 3G/4G networks).

NOTE
Traffic between inter vSZ-D/SZ100-D/SZ144-D tunnels in Figure 9 can be encrypted by enabling tunnel encryption. Refer to Enabling Tunnel Encryption on page 25 for more information.

FIGURE 9 Usage of L3 roaming



Editing L3 Roaming for a vSZ-D/SZ100-D/SZ144-D

For L3 roaming to work without session break, the data planes between which the roaming happens must both be enabled with the L3 Roaming feature.

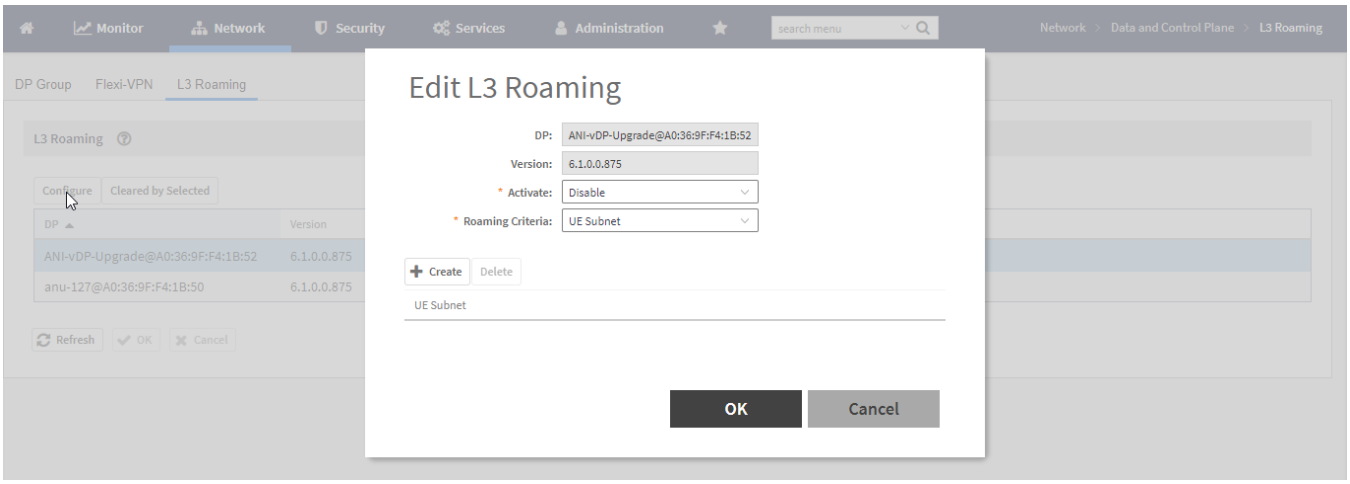
NOTE
If the IP address of the UE changes, then the session breaks.

1. Go to **Network** > **Data and Control Plane**.

2. Select **L3 Roaming**.

   The **Enabling L3 Roaming** page is displayed.

   FIGURE 10 Enabling L3 Roaming



3. Click **Configure** to edit the L3 roaming settings.

   The **Edit L3 Roaming** page is displayed.

4. From **Activate**, you can enable the feature for the DP by selecting Enable or Disable from the drop-down menu.
5. From the **Roaming Criteria** list, select one of the following options to define the data format to establish connection between DPs: UE Subnet or WLAN VLAN.
6. Click **OK**.

   You have successfully enabled L3 roaming, and also set the roaming criteria based on which DPs would connect within the network.

You have enabled L3 roaming in the selected vSZ-D/SZ100-D/SZ144-D.

Lawful Intercept

An important carrier class feature that is being introduced on the vSZ-D/SZ100-D/SZ144-D is to support Lawful Intercept requirements.

These are slowly becoming mandatory and stringent on SP-WiFi deployments where Service Providers need to meet the CALEA standard requirements.

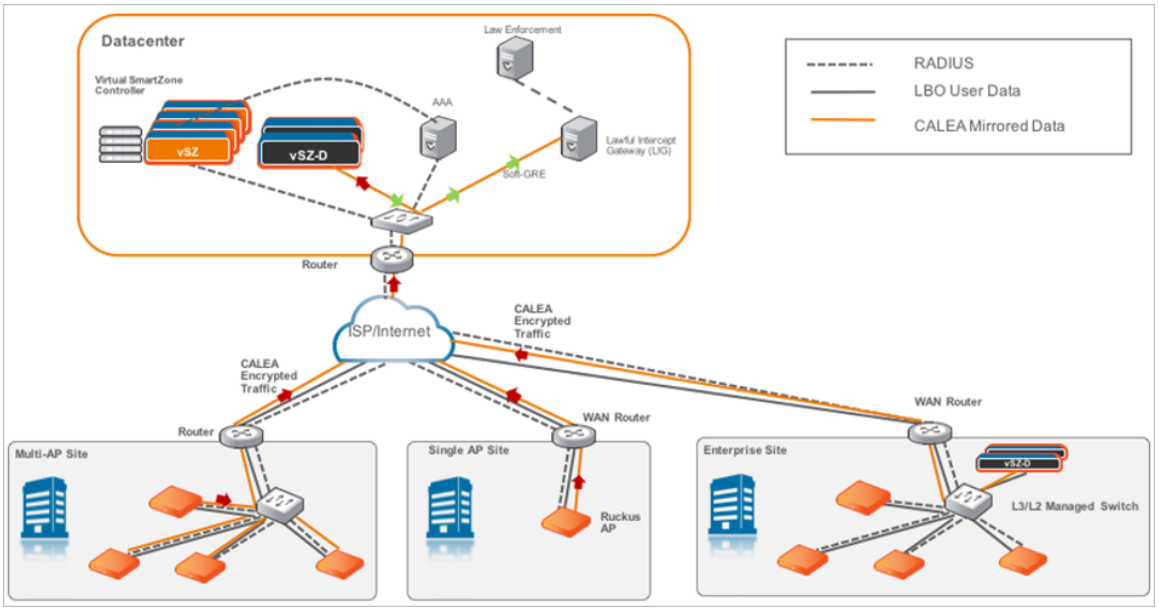
RUCKUS vSZ-D/SZ100-D/SZ144-D now supports the ability to identify a device that has a LI warrant issued against it and mirror the client data traffic to a LIG (Lawful Intercept Gateway) that is hosted in the SP's data center over L2oGRE.

The figure below illustrates the high level architecture that is supported for Lawful Intercept capabilities. It aslo depicts an architecture where smaller sites (with lesser number of APs) that do not need data tunneling to vSZ-D/SZ100-D/SZ144-D (depicted as Multi-AP and Single AP sites) but need Lawful Intercept. On the other side is a large enterprise site with large number of APs and need tunneling (depicted as Enterprise site with vSZ-D/SZ100-D/SZ144-D on premise) with Lawful intercept.

NOTE
As mentioned in this document, the flexibility of the RUCKUS vSZ/vSZ-D architecture is that WiFi service providers can deploy the vSZ-D/SZ100-D/SZ144-D only on premises where there is a need (typically larger venues) for tunneling.

The RUCKUS architecture simply involves spinning up a vSZ-D/SZ100-D/SZ144-D instance at the central data center and designate that vSZ-D/SZ100-D/SZ144-D instance as a CALEA mirroring agent. All of this configuration is centrally managed through the vSZ. Once the network is setup appropriately, when a client device with a matching MAC address that has a warrant is detected on any of the access sites, the APs (or the vSZ-D/SZ100-D/SZ144-D) will mirror the packets to the vSZ-D (CALEA Mirroring agent) in the DC which will then forward the traffic to the LIG (Lawful Intercept Gateway) either in the DC or SP DC.

FIGURE 11 Usage of Lawful Intercept



Enabling Flexi VPN

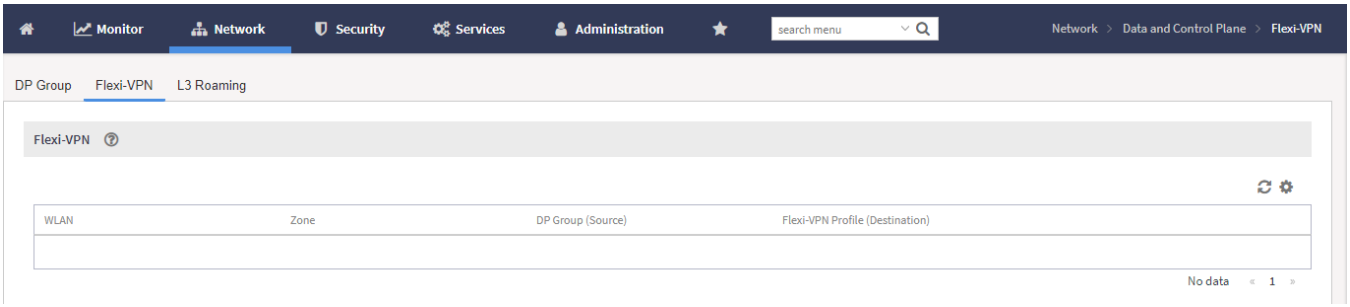
You can enable Flexi-VPN and limit the network resources that a UE can access. Flexi-VPN allows an administrator to customize the network topology, and is thereby able to control the network resources accessible to the end-user. This feature is only supported on vSZ-E and vSZ-H, and is enabled by purchasing the Flexi-VPN license.

1. Select **Network** > **Data and Control Plane**.

2. Select **Flexi-VPN**.

   The **Flexi-VPN** status page is displayed.

   FIGURE 12 Enabling Flexi-VPN



   NOTE
   The Flexi-VPN option is available only if the Access-VLAN ID is configured in manual mode, and when VLAN Pooling, Dynamic VLAN and Core Network VLAN options, and Tunnel NAT are disabled.

   NOTE
   Flexi-VPN is activated when a Flexi-VPN profile is assigned to a WLAN.

   NOTE
   A maximum of 1024 WLAN IDs can be applied to a Flexi-VPN profile.
   Flexi-VPN supports IPv4 addressing formats and RUCKUS GRE tunnel protocol. It does not support IPv6 addressing formats.

The following record table indicates that the Flexi-VPN profile is successfully applied to the WLAN:

- WLAN: displays the name of the WLAN
- Zone: displays the name of the zone
- DP Group: displays the name of the source data plane from which tunneled traffic starts
- Flexi-VPN Profile: displays the name of the destination data plane to where the tunneled traffic terminates

Enabling Tunnel Encryption

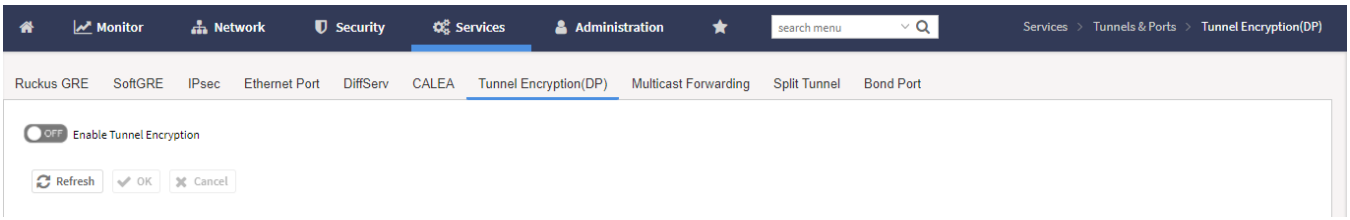
You can use the tunnel encryption feature to encrypt data for a private network, through a public network. This feature is available in vSZ-H and vSZ-E.

1. Go to **Services** > **Tunnels and Ports**.

2. Select the **Tunnel Encryption(DP)** tab.

   The **Tunnel Encryption (DP)** page appears.

   FIGURE 13 Tunnel Encryption (DP)



3. Select the **Enable Tunnel Encryption** check-box.
4. Click **OK**.

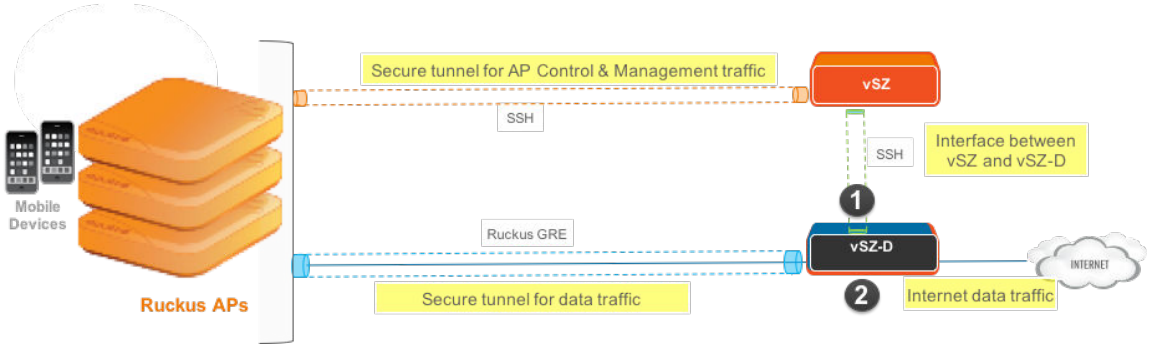
You have successfully enabled tunnel encryption.

Network Architecture

vSZ-D/SZ100-D/SZ144-D requires at least two physical interfaces: one for control/management and another for data plane.

The control/management interface is used for communication with the vSZ controller, as well as the command line interface. The data plane interface is used to tunnel user data traffic from the APs.

FIGURE 14 vSZ-D logical interfaces



The access layer (southbound) is used to tunnel traffic to and from managed APs. The following connections exist on the access layer.

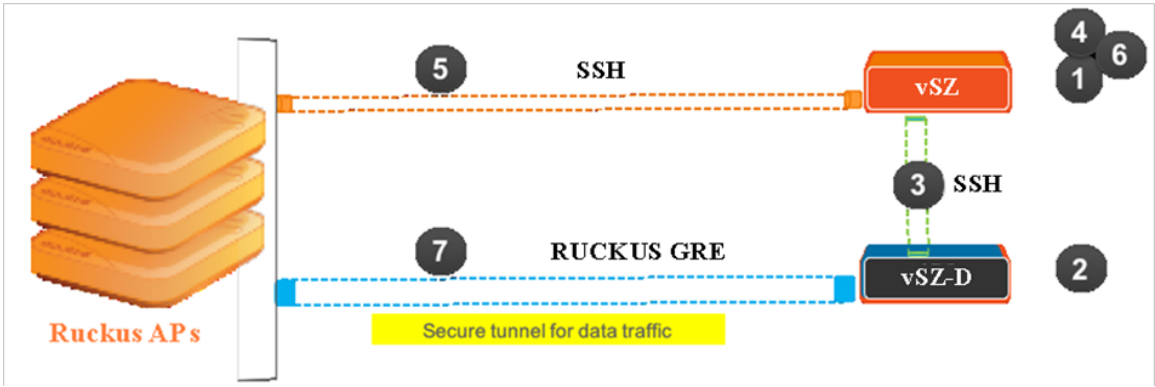
1. AP to and from vSZ-D/SZ100-D/SZ144-D: Data plane, secured by RUCKUS GRE tunnel.
2. vSZ to and from vSZ-D/SZ100-D/SZ144-D: Control plane, for vSZ to manage vSZ-D/SZ100-D/SZ144-D
3. AP to and from vSZ: Control plane, for vSZ to manage the AP

The core layer (northbound) is used by vSZ-D/SZ100-D/SZ144-D to forward traffic to and from the core network.

Communication Workflow

The figure below captures a high level end-to-end communication flow between RUCKUS APs, vSZ and vSZ-D/SZ100-D/SZ144-D.

FIGURE 15 Communication workflow between RUCKUS APs, vSZ, and vSZ-D/SZ100-D/SZ144-D



The following are the steps seen in the above figure.

1. Update the vSZ controller to the latest release or perform a fresh install of the vSZ controller with the latest release

   NOTE
   If you are upgrading the vSZ controller and the vSZ-D/SZ100-D/SZ144-D, RUCKUS recommends the update of vSZ controller before the update of vSZ-D/SZ100-D/SZ144-D

2. Install vSZ-D/SZ100-D/SZ144-D and point it to the vSZ-E or vSZ-H controller by using the following options:
   - Set vSZ-E or vSZ-H control interface IP address or FQDN or configure the controller IP address via DHCP option 43.
   - For vSZ-E or vSZ-H configured with three (3) IP interfaces, the IP address to use is the vSZ control interface IP address.
3. The vSZ-D/SZ100-D/SZ144-D management interface connects with the vSZ-E or vSZ-H controller control interface
4. The vSZ-E or vSZ-H controller administrator approves the vSZ-D/SZ100-D/SZ144-D connection request
5. The vSZ informs the AP of the vSZ-D/SZ100-D/SZ144-D data interface
6. The vSZ-D/SZ100-D/SZ144-D is displayed as active and managed on vSZ-E or vSZ-H
7. AP establishes a RUCKUS GRE tunnel with the vSZ-D/SZ100-D/SZ144-D data interface when a tunnelling WLAN is configured

Figure 15 depicts logical network architecture. In real-world deployments, there may be network routers, gateways, firewalls and other devices; these typical network devices are not shown in the figure to focus on the vSZ-D/SZ100-D/SZ144-D interfaces and communication protocol aspects between the various entities.

It is also important to note that support for distributed or centralized deployment topologies introduce NAT routers/gateway devices. The communication interfaces between RUCKUS APs, vSZ and vSZ-D/SZ100-D/SZ144-D are designed to support NAT traversal so as to support such NAT Deployment Topologies on page 31.

NAT Deployment Topologies

vSZ-D/SZ100-D/SZ144-D supports several deployment topologies.

AP Behind NAT and vSZ-D/SZ100-D/SZ144-D Behind NAT

When an AP is behind NAT, it is assumed that AP is sitting in the private world and wants to talk to vSZ-D/SZ100-D/SZ144-D in the public world through NAT. The AP obtains its private IP address and communicate with the vSZ-D/SZ100-D/SZ144-D through NAT. During communication with vSZ-D/SZ100-D/SZ144-D, the NAT router will intercept the packet and change the source IP address (which is the AP IP address) to a public IP address and add a new source port number before forwarding the packet to vSZ-D/SZ100-D/SZ144-D. vSZ-D/SZ100-D/SZ144-D, in this case, is insensitive to the NAT router's operation. When the packet comes back from vSZ-D/SZ100-D/SZ144-D to the AP, the NAT router will intercept the packet and translate the destination IP address and port number back to the appropriate (original) AP IP address and port number.

When vSZ-D/SZ100-D/SZ144-D is behind NAT, it is assumed that vSZ-D/SZ100-D/SZ144-D is sitting in the private world and wants to talk to the AP in the public world through NAT. In this case, it is needed to setup the NAT IP (public IP) and a port number pair in vSZ-D/SZ100-D/SZ144-D "setup" process. vSZ picks up this public address and the associated port number and informs the AP that this is the vSZ-D/SZ100-D/SZ144-D address/port (public-IP, port) pair to connect to.

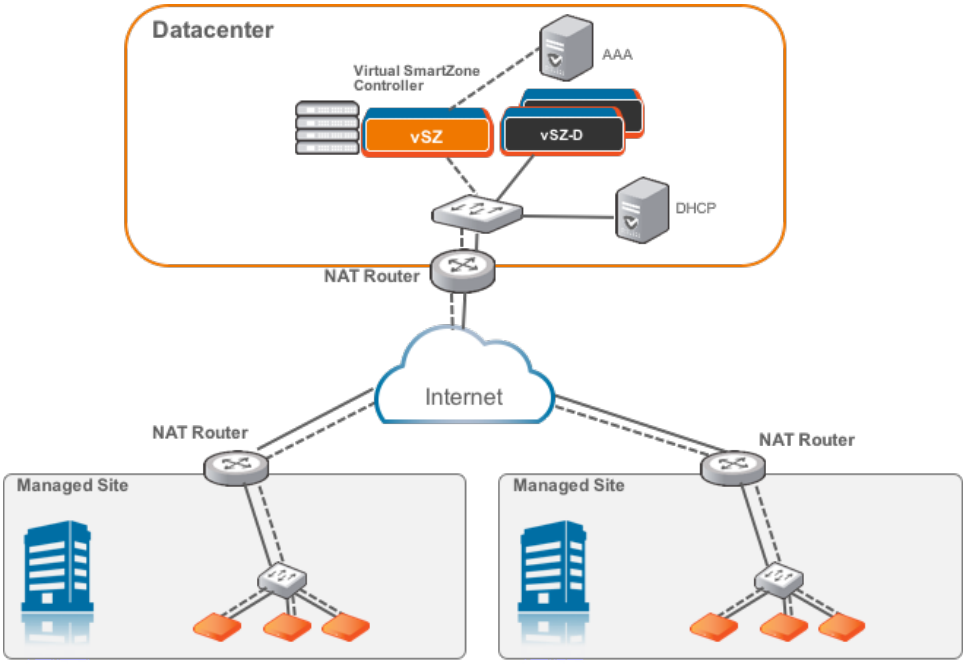
It is also needed to configure the NAT device and enter the port mapping, basically, (public-IP, port) <-> (private-IP, 23233) into NAT's rule table. Thus, when NAT receives the packet bound for vSZ-D/SZ100-D/SZ144-D (sent to public-IP/port) from the AP, it will translate it to (private-IP, 23233) based on the rule table before sending it to vSZ-D/SZ100-D/SZ144-D, and conversely, for packet from vSZ-D/SZ100-D/SZ144-D, NAT router will look at the srcIP/srcPort (IP, 23233), and convert it to public IP address or port based on the rule table before sending it to AP.

> **NOTE**
> Both TCP and UDP protocols on port 23233 need to be forwarded as both are used (TCP is used for tunnel establishment and UDP for client data)

vSZ and vSZ-D/SZ100-D/SZ144-D at Data Center Behind NAT

In this deployment topology, vSZ-D/SZ100-D/SZ144-D and vSZ are co-located at the data center behind NAT, while Ruckus APs are on the access network behind NAT.

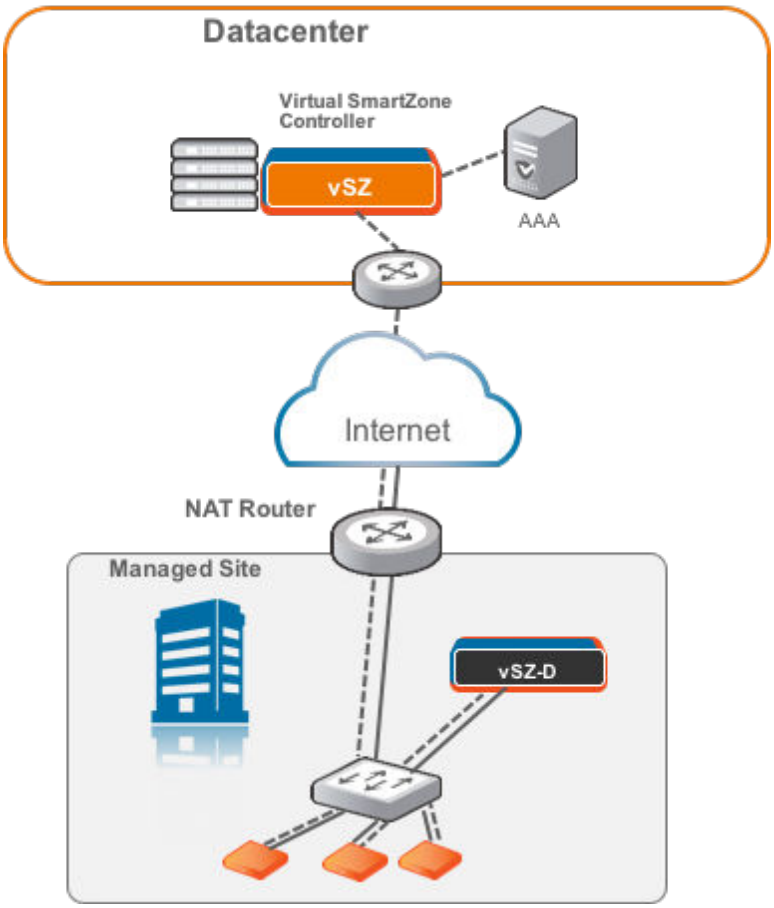
FIGURE 16 vSZ and vSZ-D/SZ100-D/SZ144-D at data center behind NAT



vSZ-D/SZ100-D/SZ144-D at Access Site with NAT

In this deployment topology, vSZ is at the data center and vSZ-D/SZ100-D/SZ144-D is co-located with the Ruckus APs on the access network. In this scenario, there are NAT routers between vSZ and vSZ-D/SZ100-D/SZ144-D/Ruckus APs.

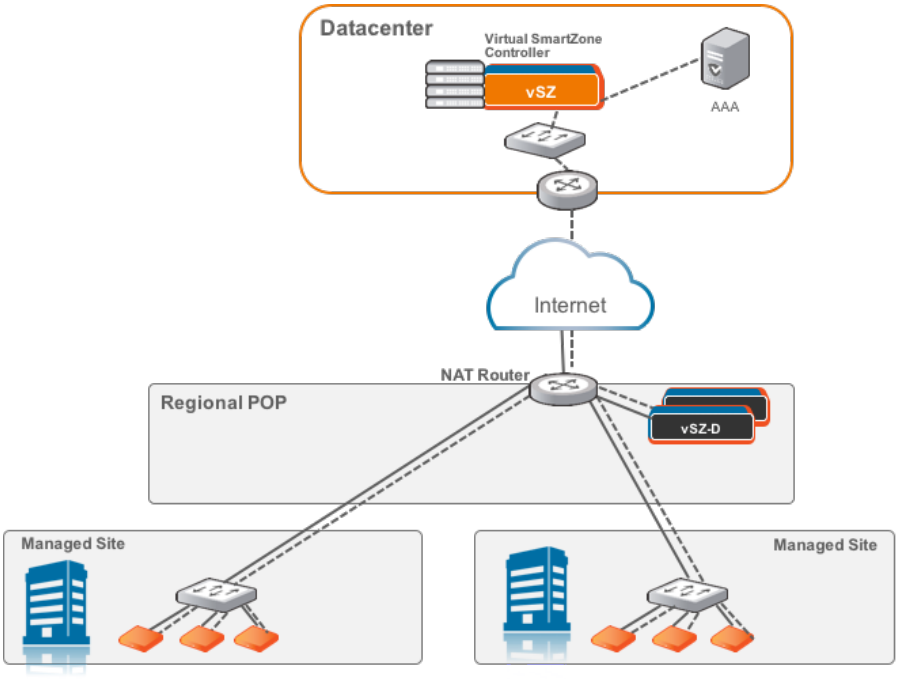
FIGURE 17 vSZ-D/SZ100-D/SZ144-D at access site with a NAT router



vSZ-D/SZ100-D/SZ144-D Behind NAT

In this deployment topology, vSZ is at the data center and vSZ-D/SZ100-D/SZ144-D is in a distributed site but not co-located with the Ruckus APs within the access network. There are NAT routers between vSZ and vSZ-D/SZ100-D/SZ144-D, and between vSZ-D/SZ100-D/SZ144-D and Ruckus APs. The vSZ-D/SZ100-D/SZ144-D port to communicate with vSZ control plane is port 22.

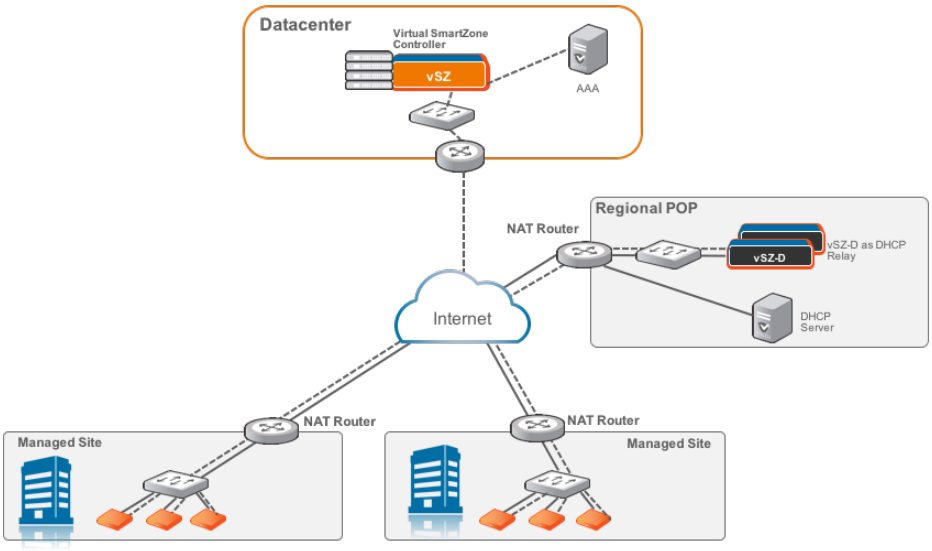
FIGURE 18 vSZ-D/SZ100-D/SZ144-D behind a NAT router



DHCP Relay with NAT

Similar to the *vSZ-D/SZ100-D/SZ144-D Behind NAT*, in this deployment topology, vSZ is at the data center and vSZ-D/SZ100-D/SZ144-D is in a distributed site but not co-located with the Ruckus APs within the access network. There are NAT routers between vSZ and vSZ-D/SZ100-D/SZ144-D, and between vSZ-D/SZ100-D/SZ144-D and Ruckus APs. However, in this topology, the DHCP server assigning client IP addresses is on its own separate subnet. vSZ-D/SZ100-D/SZ144-D provides the DHCP relay function to support such a network configuration.

FIGURE 19 DHCP relay with a NAT router

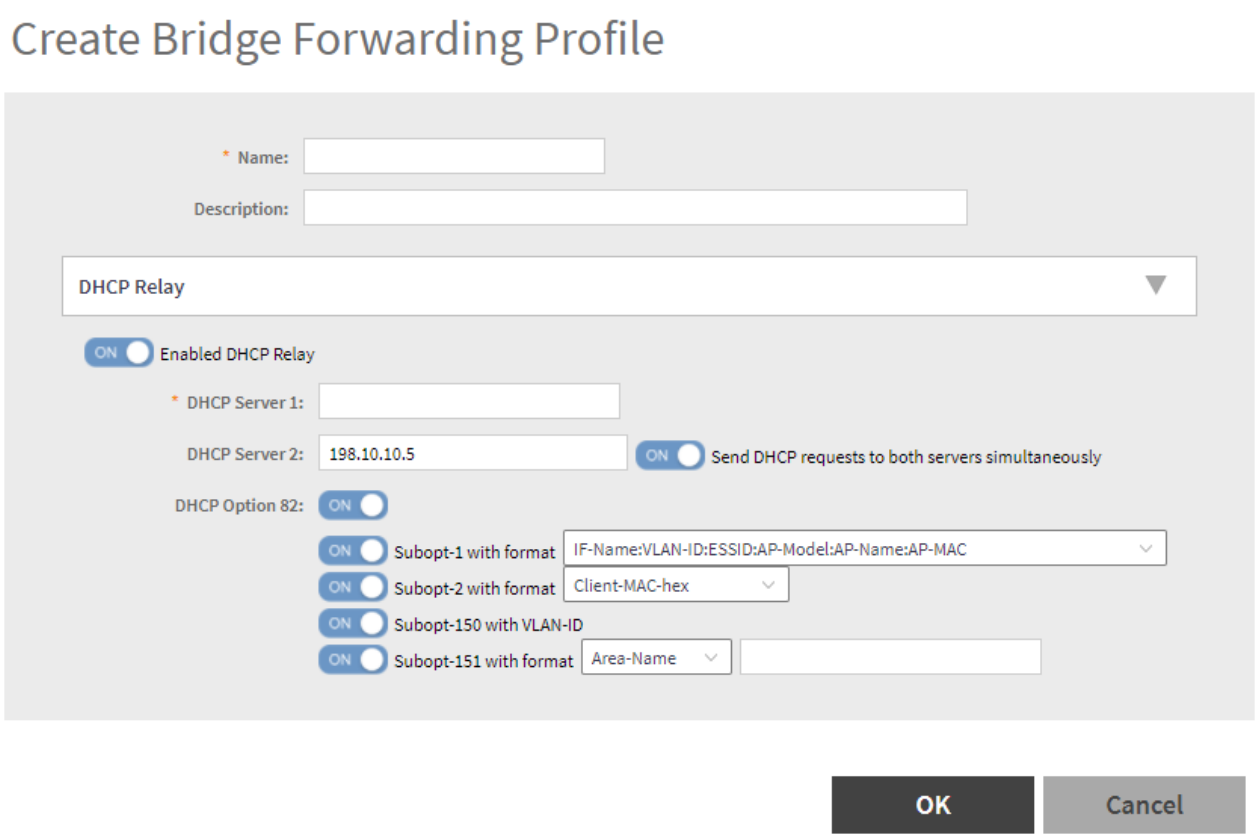


DHCP Option 82 and Bridge Profile

If you are enabling the DHCP Option 82 in WLAN configuration in the controller vSZ, it means that the AP is going to put DHCP Option 82 in the DHCP server and will send it to vSZ-D/SZ100-D/SZ144-D. This is in the format `IF-Name:VLAN-ID:ESSID:AP-Model:AP-Name:AP-MAC`. If you want to give the users the option to choose what needs to be included in DHCP Option 82, you would need to create a *Bridge Service Profile* in the vSZ controller web interface. Follow the steps to create a *Bridge Service Profile*.

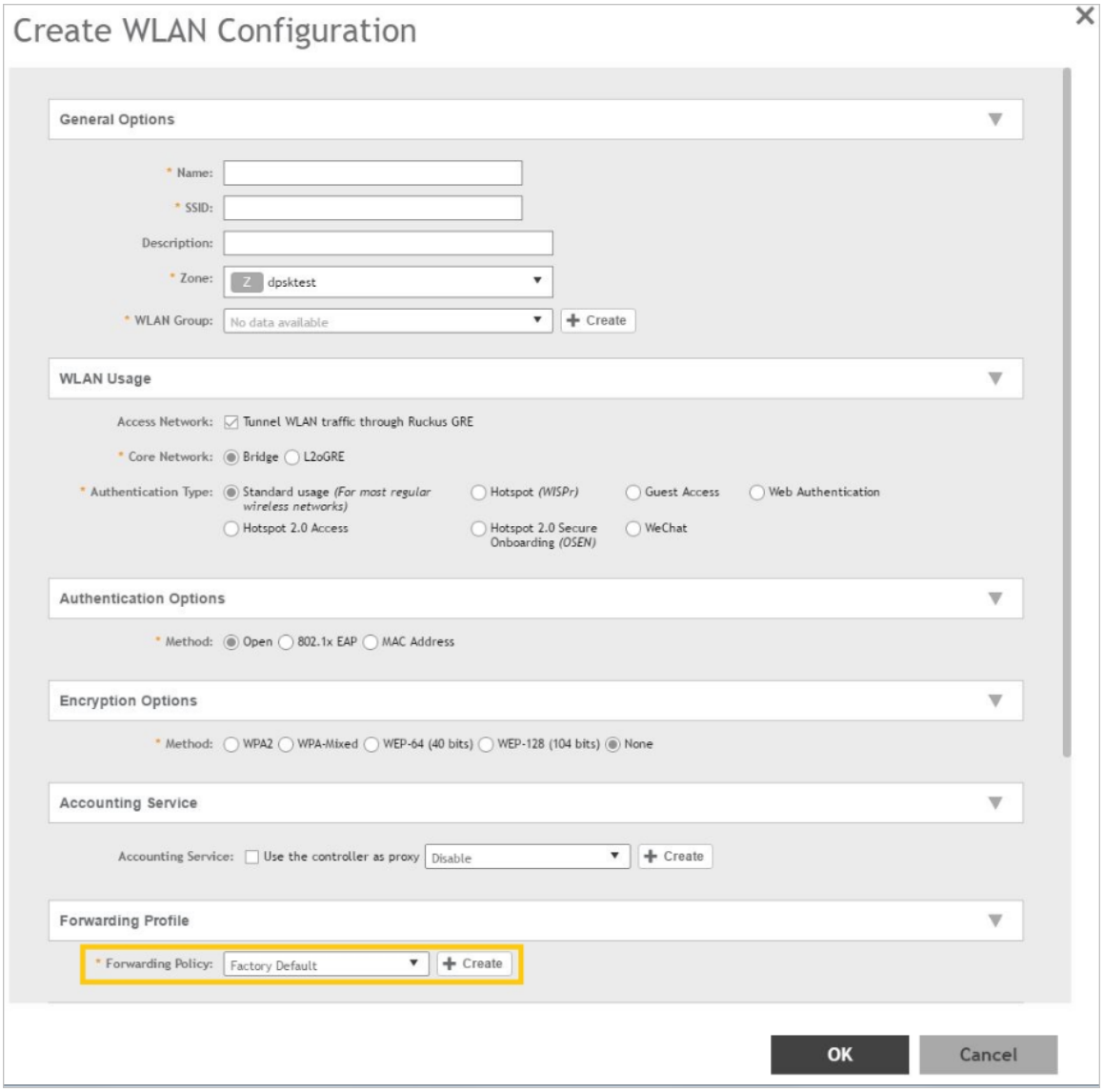
- Go to **vSZ controller web interface** > **Services** > **Tunnels & Ports** > **Core Network Tunnel** > **Bridge**.
- Click on **Create**.
- Enter the bridge forwarding profile information
  - In the **Name** field, type a name for the bridge forwarding profile.
  - In the **Description** field, type a short description for the profile.
  - Ensure the **Enabled DHCP Relay** option is selected.
  - Enter the **DHCP server** IP addresses. Select the **Send DHCP requests to both servers simultaneously** option, if you want to send the request to both the servers.
  - Enable **DHCP Option 82** and choose the sub options based on your requirement or of the user. This will be taken care by vSZ-D/SZ100-D/SZ144-D during DHCP packet relay to the DHCP server.

FIGURE 20 Creating Bridge Profile



- Go to **vSZ controller web interface** > **Network** > **Wireless** > **Wireless LANs**.
- Click on **Create** to add the following new WLAN configuration:
  - **Access Network** as **Tunnel WLAN traffic through Ruckus GRE**
  - **Core Network** as **Bridge**
  - **Authentication Options** > **Method**as **Open**
  - **Encryption Options** > **Method**as **None**
  - **Forwarding Policy** as **Factory Default** . Choose the forwarding policy as the bridge profile.
- Click **OK** to complete and save the configuration.

FIGURE 21 Creating a WLAN Configuration



Configuring the vSZ Controller to Prepare for Network Segmentation

- Configuring the DHCP/NAT License Assignment....39
- Creating Profile-based DHCP....39
- Configuring Global Settings....39
- Configuring DHCP Pool Settings....40
- Creating Profile-based NAT....41
- Configuring NAT Global Settings....41
- Configuring NAT Pool Setting....42
- Creating an AP Group....42
- Creating WLAN for Network Segmentation....44

Configuring the DHCP/NAT License Assignment

License assignment specifies the capability of each Data Plane, which has the ability to assign IPs by DHCP feature and translate packets by NAT feature. Though these features already exist, starting 5.0, customers must purchase license to enable these features.

NOTE
This feature is supported only on virtual platform.

Creating Profile-based DHCP

DHCP profile can be applied to vSZ-D and the vSZ-D server can assign IP to the UE based on the profile rule. Different pools with the same subnet can be created without overlapping IP range.

NOTE
DHCP supports only access-side network.

- Configuring Global Settings on page 39
- Configuring DHCP Pool Settings on page 40

Configuring Global Settings

To configure Profile-based DHCP Global settings:

1. Go to **Services** > **DHCP & NAT** > **DHCP Profiles (DP)**.
2. Click **Create**, the Create DHCP Profile page appears.

3. Configure the following:
   - **Profile Name**: Type a name for the DHCP profile you want to create. AP supports 32 bytes.
   - **Description**: Type a description of the settings you want to create.
   - **Domain Name**: Type the domain name address.
   - **Primary DNS Server**: Type the primary domain name server address.
   - **Secondary DNS Server**: Type the secondary domain name server address.
   - **Lease Time**: Type the duration in Hours, Minutes and Seconds. Range: 1 through 86400 seconds.
   - **DHCP Option43 Space**: Click **Create**, the Create DHCP Option43 Space form appears. Configure the following:
     - **Space Name**: Type a name for Option43 space.
     - **Description**: Type a description for Option43 space.
     - Under **Option43 Sub Option**, click **Create** and configure the following:
       - **Sub Option Name**: Type a sub option name.
       - **Type**: Select the required option from the drop-down.
       - **Code**: Enter a code. Range: 1 through 254.
       - **ClickOK**, you have created Option43 Sub Option.
     - Click **OK**, you have created Option43 Space.
   - **Hosts**: Click **Create**, the Create Host Configuration form appears. Configure the following:
     - **General Options**
       - **Host**: Type a name for the host settings that you want to create.
       - **Description**: Type a description for the host settings that you want to create.
     - **Policy Options**
       - **Mac Address**: Type the MAC address of the DHCP host.
     - **Assigning Options**
       - **Broadcast Address**: Type the broadcast IP address.
       - **Fixed Address**: Type the fixed IP address of the host.
       - **Gateway**: Type the gateway IP address.
       - **DNS Server**: Type the IP address of the DNS server.
       - **Domain Name**: Type the domain name.
       - **Host Name**: Type the host name.
       - **Lease Time**: Type the duration in Hours, Minutes and Seconds. Range: 1 through 86400 seconds.
     - Click **OK**, you have created DHCP Host configuration.
4. Click **OK**.

   You have created DHCP Profile settings.

Configuring DHCP Pool Settings

To configure DHCP pool settings:

1. Go to **Services** > **DHCP & NAT** > **DHCP Profiles (DP)**.
2. Select the DHCP profile from the list for which you want to configure the pool settings.
3. Select the **Pools** tab page.

4. Click Create and configure the following:
   - **General Options**
     - **Pool Name**: Type a name for the pool configuration.
     - **Description**: Type a description for the pool configuration.
   - **Policy Options**
     - **Policy type**: Select VNI type for Network Segmentation.
   - **Assigning Options**
     - **Subnet**: Type the IP address.
     - **Subnet Mask**: Type the network address.
     - **Broadcast Address**: Type the broadcast IP address.
     - **Pool Range**: Type the address range for the pool.
     - **Exclude Pool**: Type the address range that must be excluded.
     - **Primary Gateway**: Type the primary gateway IP address.
     - **Secondary Gateway**: Type the secondary gateway IP address.
     - **Primary DNS Server**: Type the IP address of the primary DNS server.
     - **Secondary DNS Server**: Type the IP address of the secondary DNS server.
     - **Domain Name**: Type the domain name.
     - **Host Name**: Type the host name.
     - **Lease Time**: Type the duration in Hours, Minutes and Seconds. Range: 1 through 86400 seconds.
   - **Option43 Value**
     - Click **Create**, the Create Option43 value form appears. Configure the following:
       - Choose the **Space** Name or click **Create** to configure Option 43 Space Name.
       - Enter a **Description**.
     - Click **OK**, you have configured Option43 value.
5. Click **OK**.

   You have created DHCP pool configuration.

Creating Profile-based NAT

A NAT Profile could be applied to a vSZ-D. The NAT server settings work independently. You must configure the following settings to create a NAT profile:

NOTE
NAT does not support multiple public subnet/VLAN.

- Configuring NAT Global Settings on page 41
- Configuring NAT Pool Setting on page 42

Configuring NAT Global Settings

To create a NAT global setting:

1. Go to **Services** > **DHCP & NAT** > **NAT Profiles (DP)**.
2. Click **Create**, the Create NAT Profile page appears.

3. Configure the following:
   - **Profile Name**: Type a name for the NAT profile that you want to create. AP supports 32 bytes.
   - **Description**: Type a description for the profile that you want to create.
   - **Subnet**: Type the IP address.
   - **Policy type** : Select VNI type for Network Segmentation.
   - **Prefix**: Type a prefix value. Maximum range: 31.
   - **Gateway**: Type the gateway IP address.
4. Click **OK**.

   You have created a NAT Profile.

Configuring NAT Pool Setting

To configure NAT pool settings

1. Go to **Services** > **DHCP & NAT** > **NAT Profiles (DP)**.
2. Select the NAT profile from the list and click the **Pools** tab.
3. Click **Create**, the Create Pool Configuration page appears.
4. Configure the following:
   - **General Options**
     - **Pool Name**: Type a name for the NAT pool settings that you want to create.
     - **Description**: Type a description for the pool settings that you want to create.
   - **Policy Options**:
     - **Policy Type**: Select VNI type for Network Segmentation.
   - **Translation Options**
     - **Port Range**: Type the port range. Range: 10000 through 65534. For example: 10000-20000.
     - **Public Address Range**: Type the public address range.

       Note: This public address must not be duplicated with the other public address in the same subnet, which includes applied NAT Profile and vSZ-D's Access and Core Interface Address.
5. Click **OK**.

   You have created a NAT pool setting.

Creating an AP Group

Creating an AP group means creating a configuration profile that defines channels, radio settings, ethernet ports and network segmentation groups and other configurable for all members of the group or for all APs of a specific model in the group.

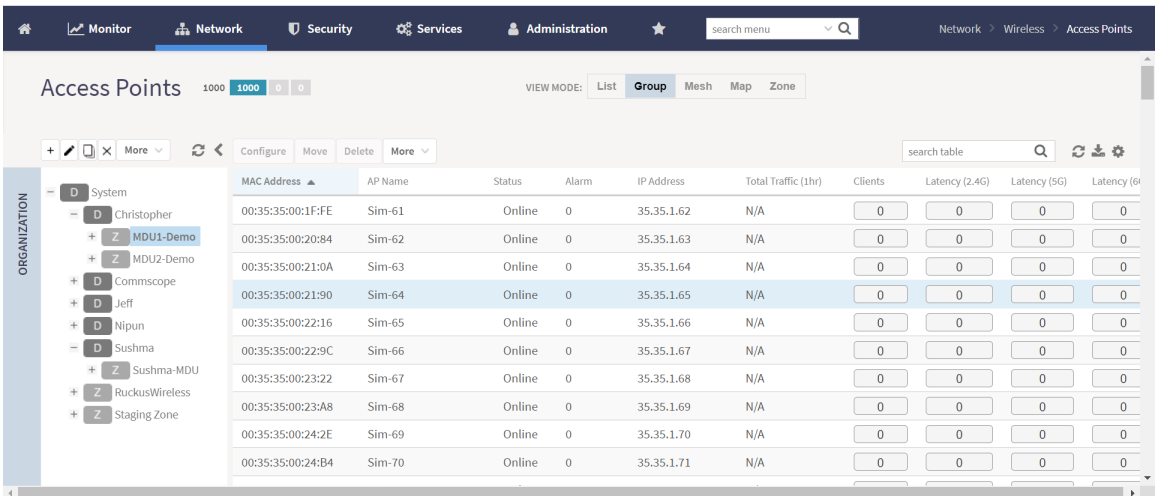
.

Follow these steps to create an AP group.

1. On the main menu, click **Network** > **Access Point**

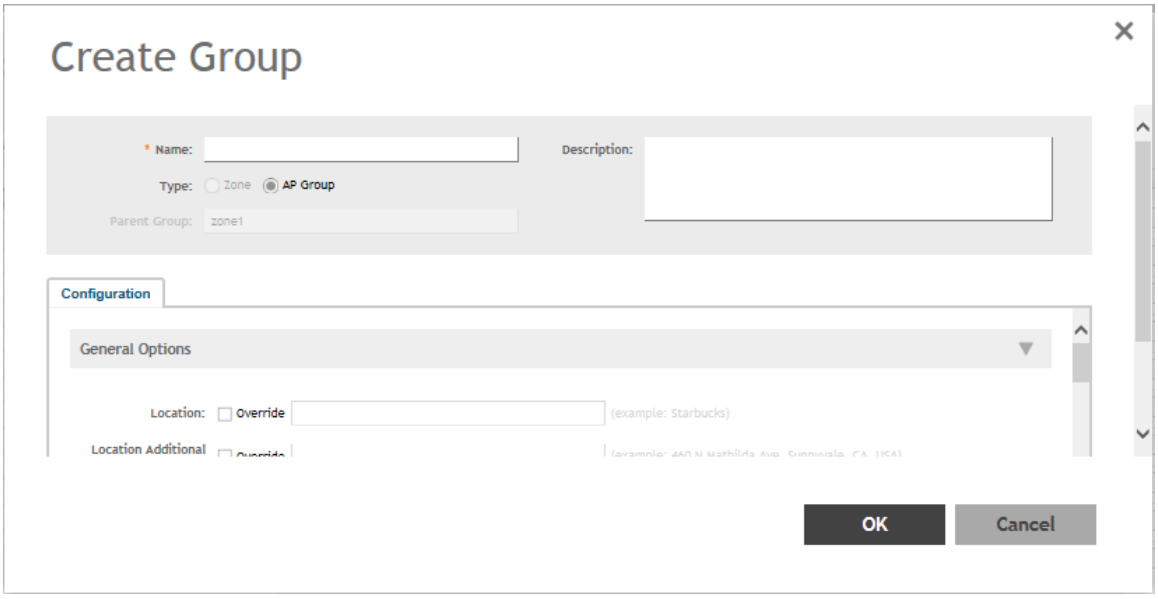
   The **Access Point** page is displayed.

FIGURE 22 Access Point



2. From the System tree hierarchy, select the location (for example: System, Domain, Zone) and click . The following figure appears.

FIGURE 23 Create Groups



3. Enter the details as explained in the following table.

   NOTE

   You can also edit the configuration of default AP group by selecting the default group and clicking the icon.

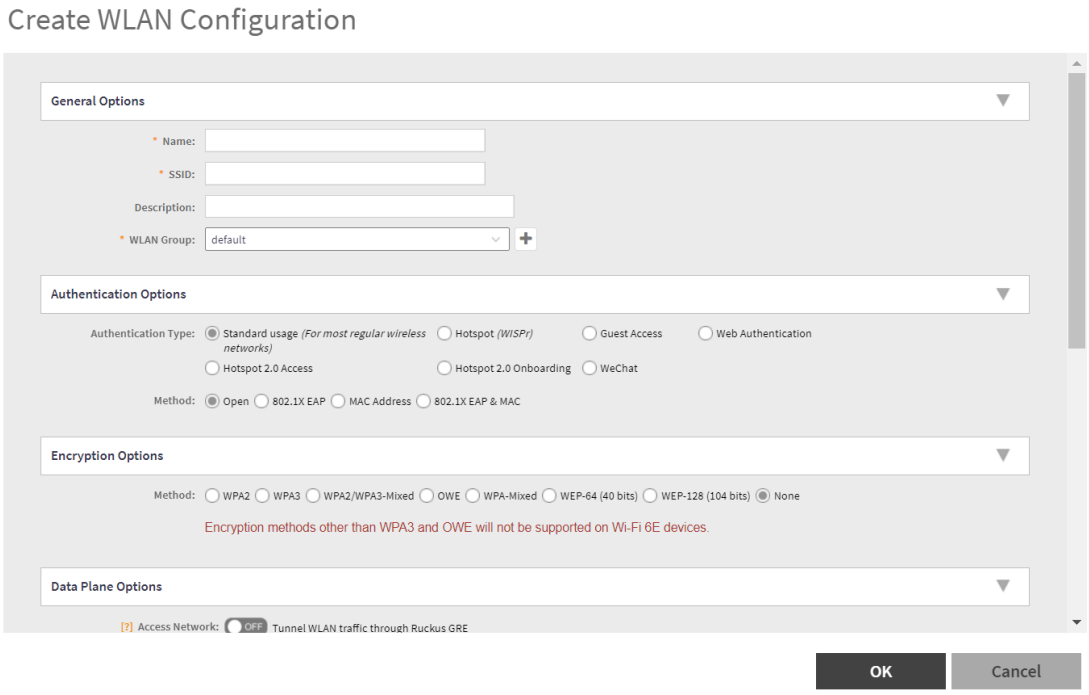
4. Click **OK**.
5. Select the AP's that will be used in the Network Segmentation and move them into the created AP Group(s).

NOTE

You can also edit, clone or delete an AP Group by selecting the options Configure , Clone or Delete respectively, from the Access Points page.

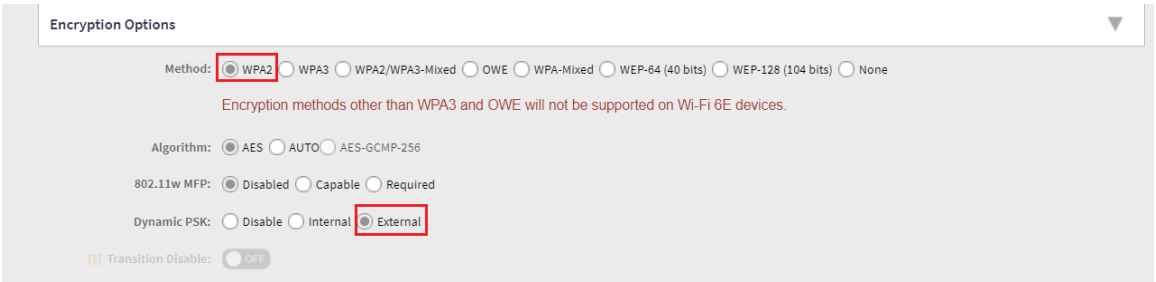
Creating WLAN for Network Segmentation

- Go to the **Network> Wireless Lans> System**.
- Click **Create .**

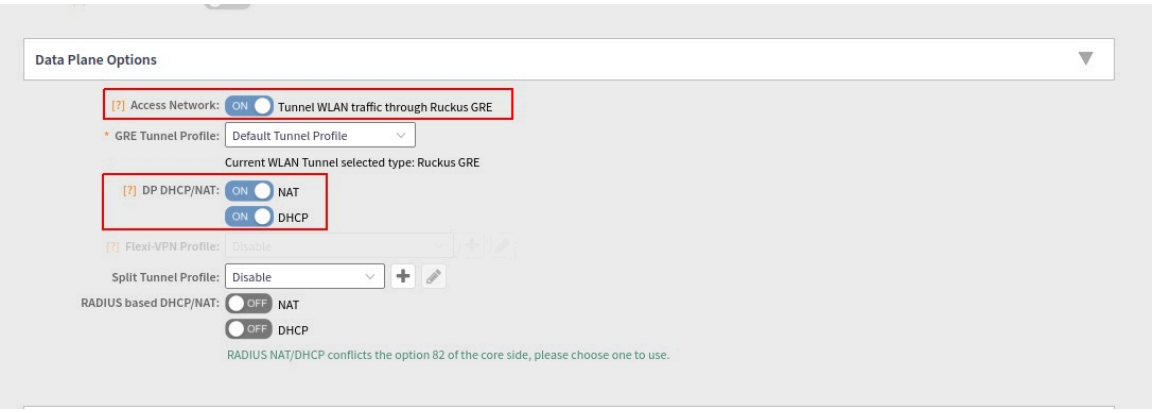


.

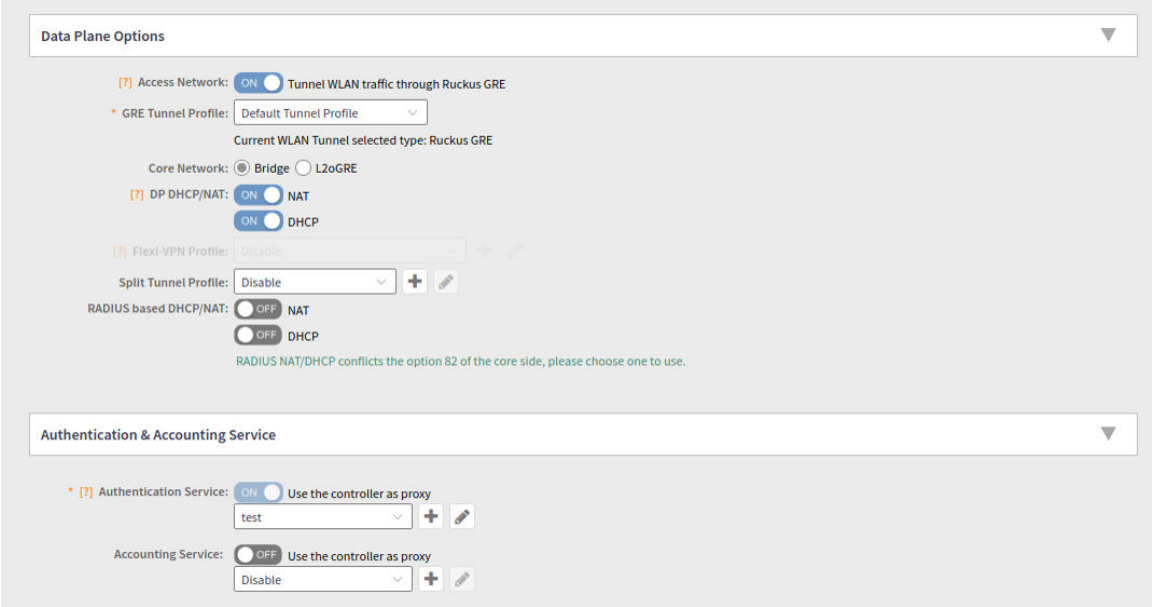
- Enter the "Name" and SSID in general options.
- Select WPA2 in encryption options.
  - Select "External" in Dynamic DPSK.



- In Data plane options, Enable "Access network".
- Enable NAT.
- Enable DHCP.
- Enter GRE tunnel profile with "Ruckus GRE" .



- Enable Authentication Service .



NOTE
WLAN will not be displayed, if any of the above conditions are not met.

For Authentication and Accounting from SmartZone.

NOTE
Refer to RUCKUS SmartZone 300 and Virtual SmartZone-High Scale Administrator Guide, 6.0.0 (Part Number: 800-72580-001 Rev A) and navigate to **Services and Profiles** > **Working with Tunnels and Ports**.

Creating Network Segmentation Profile on the vSZ Controller

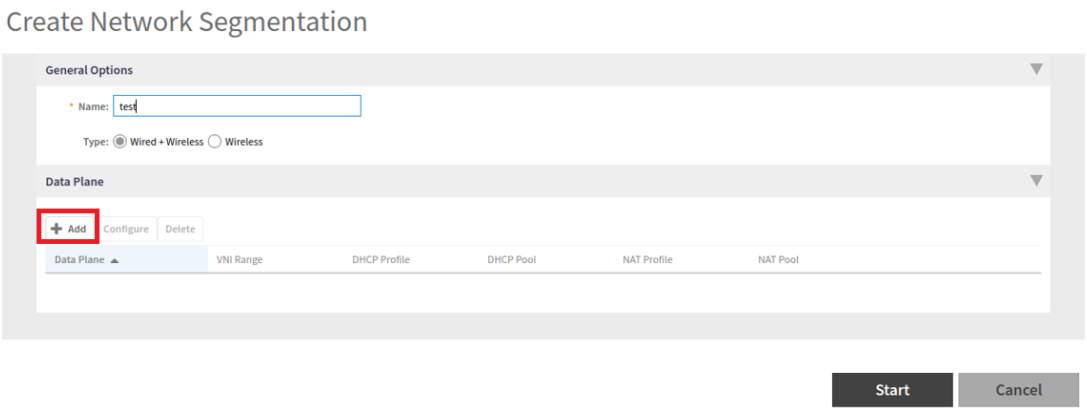
Network Segmentation was designed specifically to target Multi Dwelling Unit (MDU) deployments. Network Segmentation is currently using external Dynamic Pre shared Key (DPSK) to place a single tenant and their devices into their own individual VXLAN (iLAN).

Data Plane (DP) will play the role of Home DP or Partner DP. Each DP plays the home DP role and has its own VXLAN Network Identifier (VNI) range. Home DP facilitates MDU UE, connect with each other based on the same VNI number.

Steps for the creation of Segmentation:

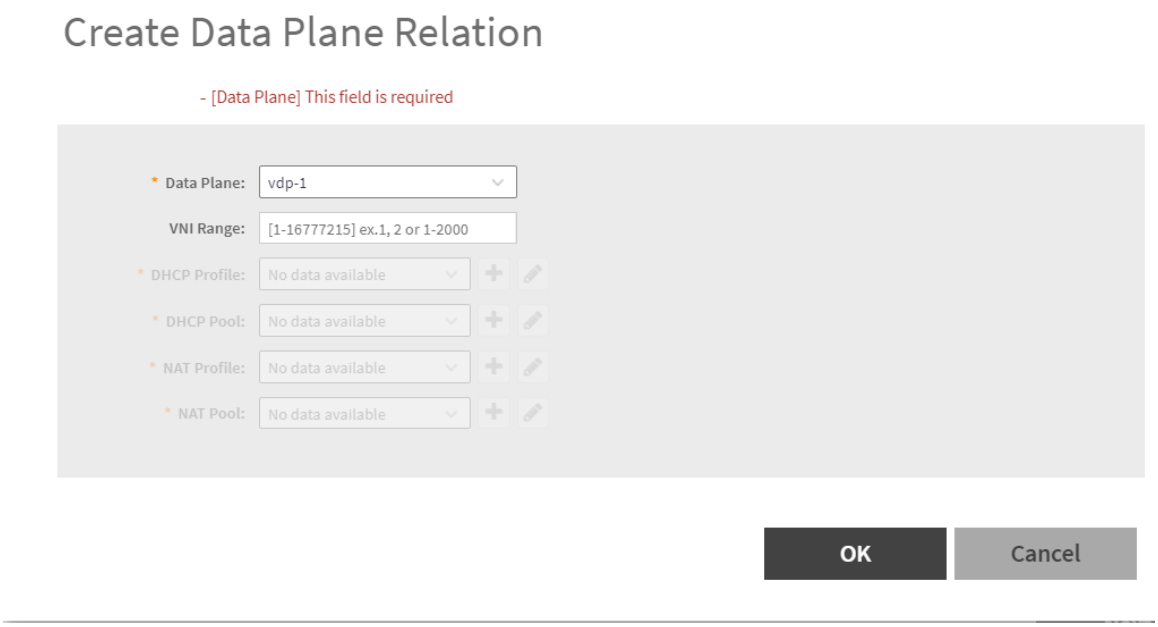
- Go to **Services> Hotspots & Portals > Network Segmentation> Network Segmentation Profiles**
- Click **Create**.

FIGURE 24 Edit Network Segmentation Groups in SmartZone User Interface



- Enter a Network Segmentation Profile name in the Name field.
- Click "Add".

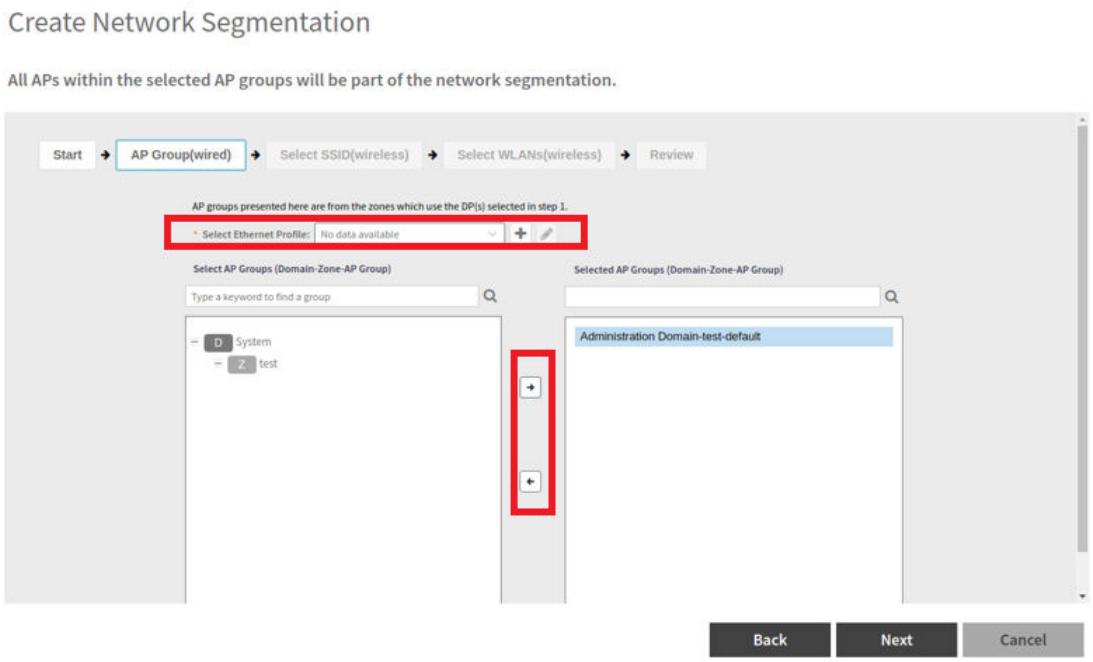
FIGURE 25 Create Data plane Relation



- Select the Data Plane details
- Enter the VNI range; ensure your VNI range is large enough to accommodate all units in the property. Each unit gets its own unique VNI.
- Select/Create DHCP Profile and Pool.
- Select/Create NAT Profile and Pool.
- Click "OK".
- "Select AP Group(s) that will be used for Network Segmentation , refer to the figure below.

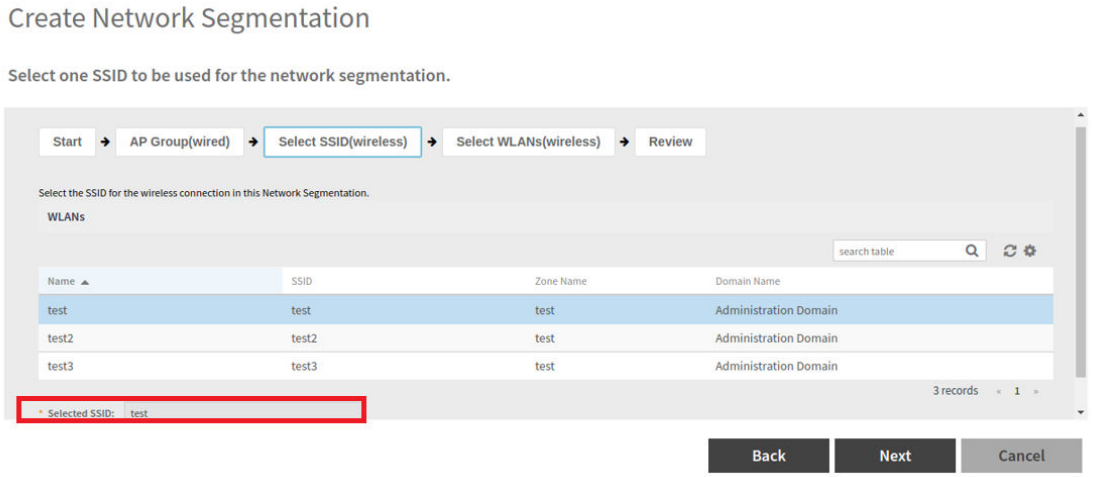
NOTE
This step is not applicable for Wireless group.

FIGURE 26 Add AP Group



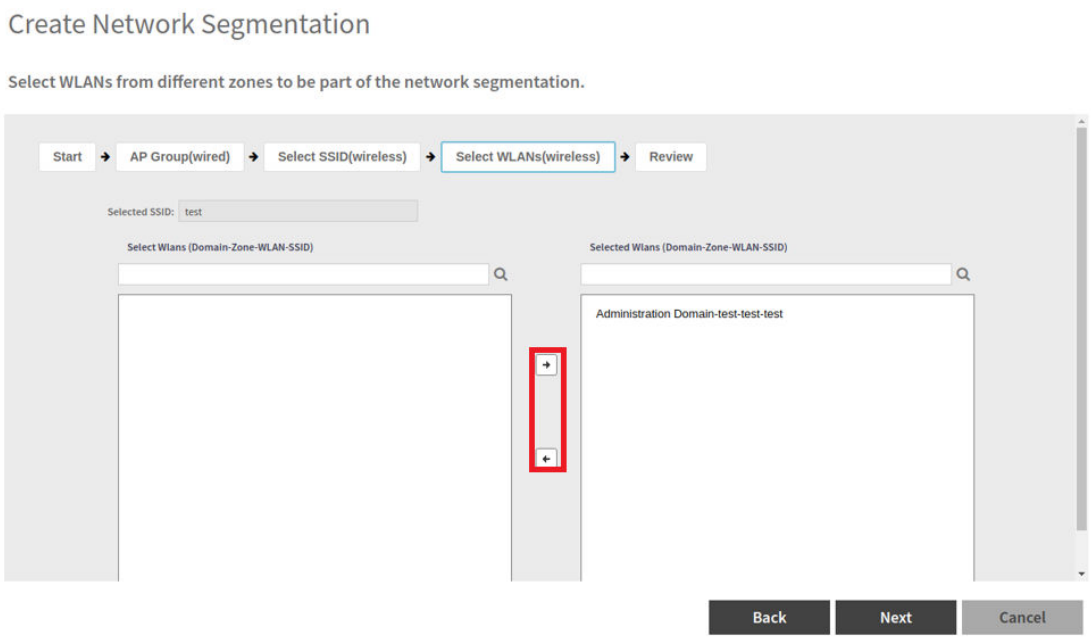
- Create/Select an ethernet profile with enabled Network Segmentation and select AP Model's port to apply.
- Click "Next".
- Select the SSID (wireless) for Network Segmentation.

FIGURE 27 Select SSID(wireless) for Network Segmentation

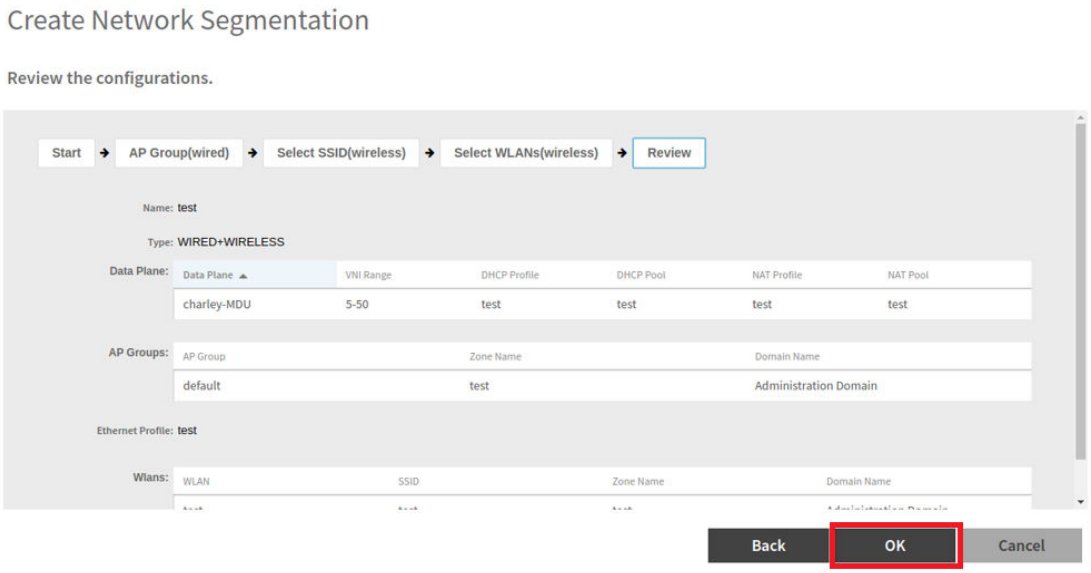


- Click "Next".
- Select WLANs (wireless) for Network Segmentation.

FIGURE 28 Select WLANs (wireless) for Network Segmentation



- Select "Next".
- Review the details entered.



- Click "OK".
- The Network Segmentation Profile is created.

Hardware Requirements

- Important Notes About Hardware Requirements..... 51
- Supported Modes of Operation..... 52

vSZ-D supports auto scaling, which means the number of CPU cores can be expanded without needing a software update. Ruckus has tested from three to six CPU core allocations for the vSZ-D.

NOTE
The minimum memory and CPU requirements for vSZ have changed in this release. You may need to upgrade your infrastructure before upgrading. Please read carefully. This is the minimum requirement recommended. Refer to the Release Notes or the vSZ Getting Started Guide.

The following table lists the minimum hardware requirements recommended for running an instance of vSZ-D.

TABLE 4 vSZ-D hardware requirements

Hardware Component	Requirement
Hypervisor support required by Management Interface	VMWare ESXi 6.7 and later OR KVM (CentOS 7.4 64bit)
Processor	Intel Xeon E55xx and above. Recent Intel E5-2xxx chips are recommended
CPU cores	• Minimum 3 to 6 cores per instance dedicated for data plane processing. • DirectIO mode for best data plane performance. **NOTE** Actual throughput numbers will vary depending on infrastructure and traffic type. • vSwitch mode for flexibility
Memory	Minimum 6 Gb memory per instance
Disk space	10GB per instance
Ethernet interfaces	2
NICs that support Intel DPDK requiredby Data Interface	• Intel NICs igb, ixgbe, i40en • I350 • 82599, 82599EB, 82599ES, X520, X710, XL710

Important Notes About Hardware Requirements

- If you change the number of CPU cores, you must reboot vSZ-D for the changes to take effect.
- The first core is always shared between Linux and NPE. Other cores are dedicated to NPE.
- vSZ-D requires two interfaces and these interfaces must be deployed on different subnets.
- The management interface of the vSZ-D can be any model as long as the NIC is supported by the hypervisor.
- The data interface needs to be Intel DPDK based.

Supported Modes of Operation

vSZ-D supports two modes of operation: direct IO mode and vSwitch mode.

For best performance, Ruckus recommends using the direct IO mode. SR-IOV mode is unsupported. Refer to the table below for mode of operation

NOTE
NICs assigned to direct IO cannot be shared. Moreover, VMware features such as vMotion, DRS, and HA are unsupported.

The hardware configuration for a single vSZ-D instance specified in the guide will scale to handle 10K tunnels (10K APs) and up to 10Gbps of throughput (unencrypted) with appropriate underlying Intel NIC cards (10G interfaces) in directIO mode of operation. This aligns with the number of Ruckus AP that a vSZ controller supports. Refer to the dimensioning table below.

TABLE 5 Hardware Dimensioning

Number of vSZ Instances	Number of vSZ-D Instances	Number of Ruckus APs	Number of Tunnels on vSZ-D	Maximum Throughput (Unencrypted)	Notes
1	1	10000	10000	10 Gbps	It is recommended to have 10G NICS on the vSZ-D considering the high number of Ruckus APs.
1	2	10000	5000 (10K maximum in case of failover)	10 Gbps	Tunnels are load-balanced towards the vSZ-D by the vSZ. This is useful when data plane redundancy is required. It is recommended to have 10G NICS on the vSZ-D considering the high number of Ruckus APs.
2	2	10000	5000 (10K maximum)	10 Gbps	Tunnels are load-balanced towards the vSZ-D by the vSZ. Each vSZ-Dmim tunnels.
2	4	10000	2500 (10K maximum)	10 Gbps	Tunnels are load-balanced towards the vSZ-D by the vSZ. Each vSZ-D instance can handle 10K maximim tunnels.
3	6	20000	3300 (10K maximum)	10 Gbps	Tunnels are load-balanced towards the vSZ-D by the vSZ. Each vSZ-D instance can handle 10K maximim tunnels.
4	8	30000	3750 (10K maximum)	10 Gbps	Tunnels are load-balanced towards the vSZ-D by the vSZ. Each vSZ-D instance can handle 10K maximim tunnels.

TABLE 6 Mode of Operation

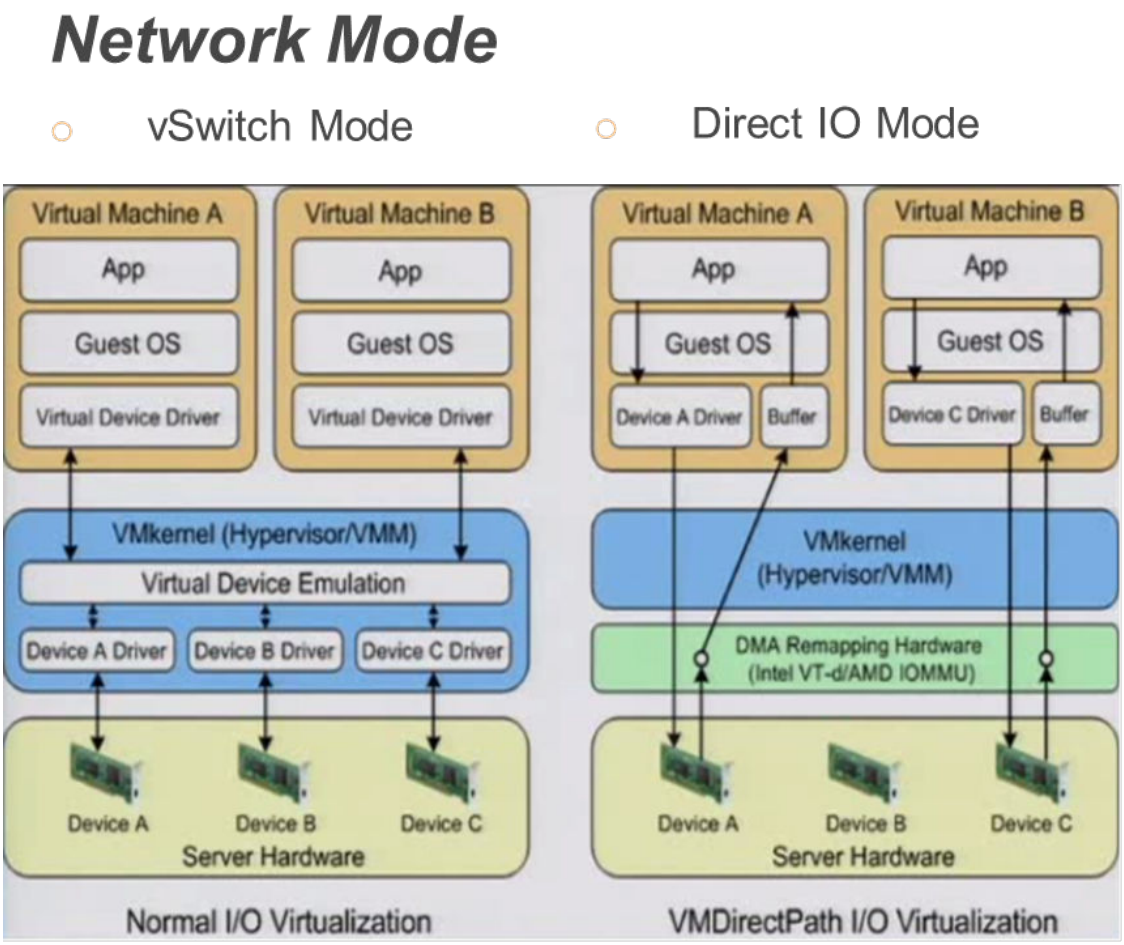
Hypervisor	Number of CPUs	Memory (GB)	Hard Disk (GB)	Number of Tunnels	Tunnel Bandwidth (Intel NIC-10 G) (Unencrypted)	Packet Size (Bytes)
Vmware (DirectIO)	3	6	10	1000	17.6 Gbps	1400
Vmware (DirectIO)	6*	6	10	10000	6.3 Gbps	Random
Vmware (DirectIO)	3	6	10	10000	4.5 Gbps	Random

NOTE

Refer to the Data Plane Performance Recommendations on page 117 chapter for encryption and vSwitch impacts.

NOTE

* vSZ-D needs to increase the CPUs to 6 for sustaining the 10GB line rate in random-byte traffic when the encryption is enabled. Encrypted requires 6 cores and unencrypted requires 3 cores



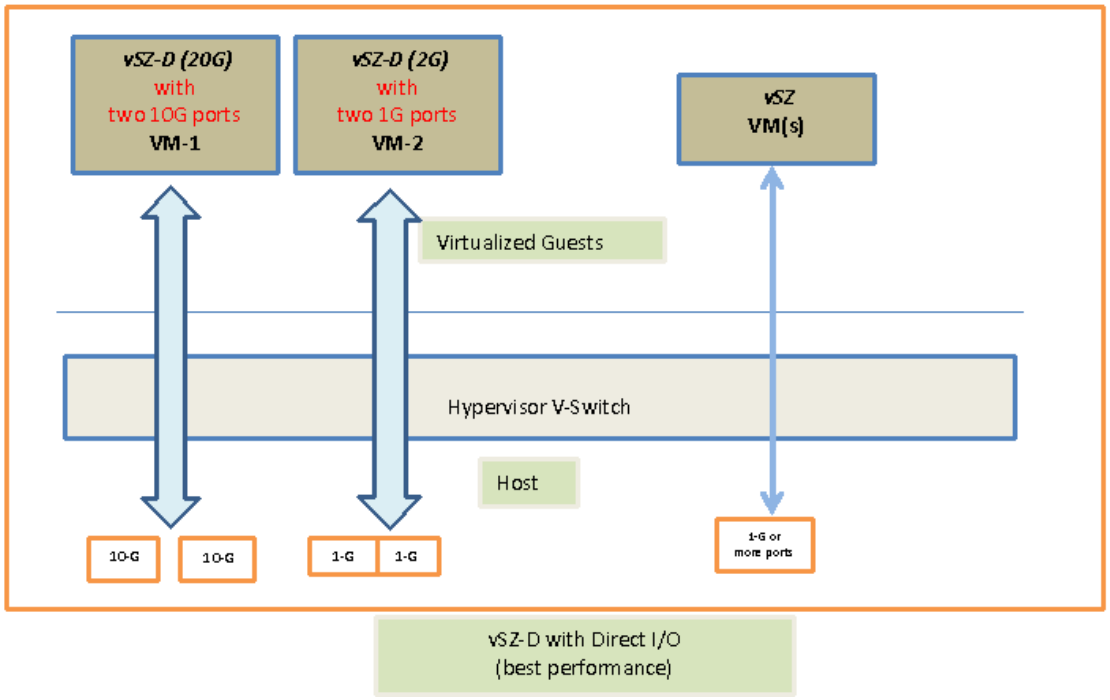
The figure below depicts a sample configuration in DirectIO mode. This is the recommended deployment model for the vSZ-D for best performance benefits. In this setup, cores as well as the NICs are dedicated to the vSZ-D VM only for best performance.

NOTE
In this setup, the vSZ-D data plane interfaces directly with the DPDK NIC, completely bypassing the vSwitch

vSZ-D with DirectI/O

NOTE
The figure below depicts multiple virtual data plane instances for reference purposes only.

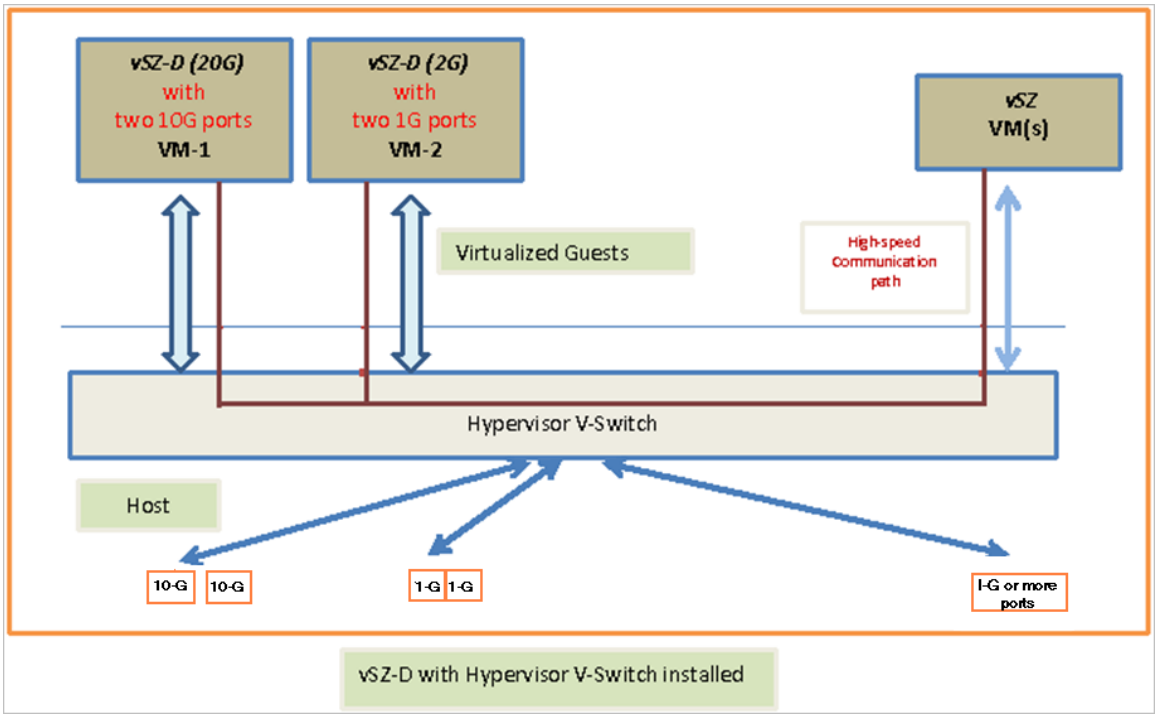
It also depicts a vSZ controller instance running as a separate VM. These VMs can be running on the same underlying host or potentially different hosts.



vSZ-D with Hypervisor vSwitch Installed

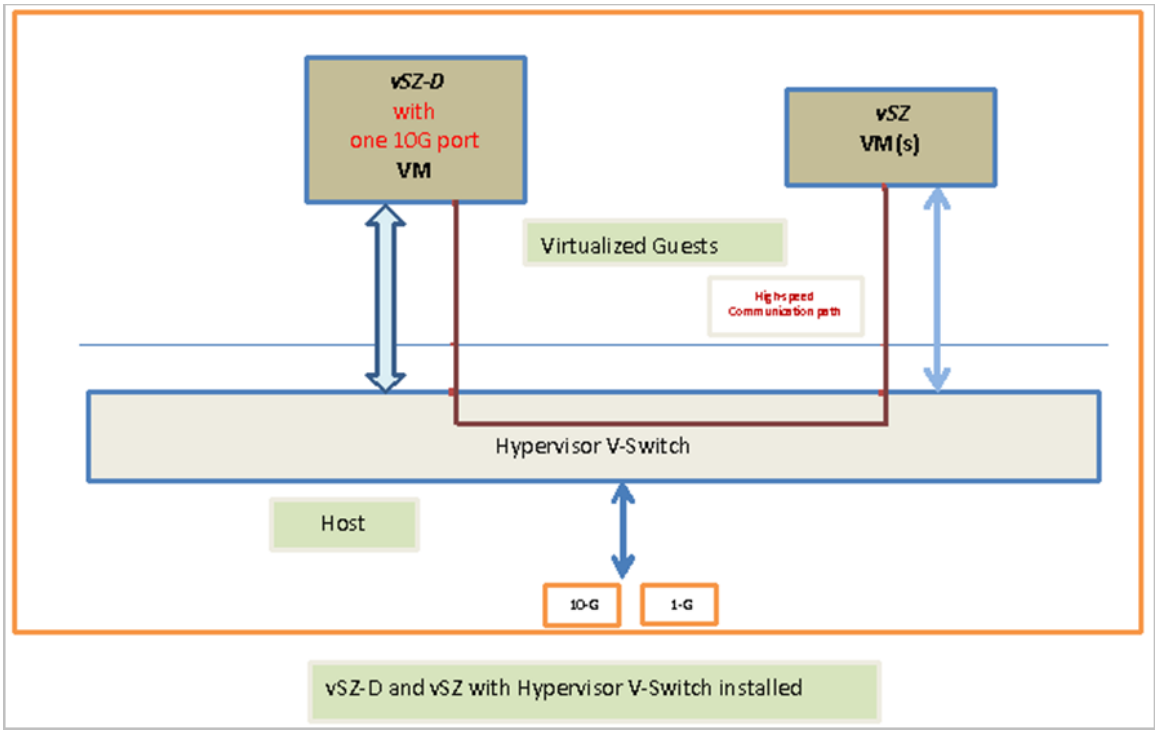
The figure below depicts a sample setup via the vSwitch.

NOTE
The figure below depicts multiple virtual data plane instances for reference. It also depicts a vSZ controller instance running as a separate VM.



vSZ-D and vSZ with Hypervisor vSwitch Installed

The figure below depicts an architecture where vSZ and vSZ-D are running on the same underlying host.



Recommended NICs and Operation Modes

The following table lists the modes of operation and network interface cards (NICs) that have been tested by Ruckus. Other NICs that support Intel DPDK architectures may or may not work.

TABLE 7 Recommended NICs and operation modes

Interface	Mode	Supported NIC Driver		NIC Model
Control / management	vSwitch	E1000		I350 Broadcom BCM5720
Data	Direct IO	1GB	igb	I350
		10GB	ixgbe	82599EB 82599 82599ES X520
			i40en	X710
		40GB	i40en	XL710
	vSwitch	VMware	VMXNET3/virtIO	
		KVM	Virtio	

Hypervisor Configuration

- Supported Hypervisors..... 59
- General Configuration..... 59
- VMware Specific Configuration..... 59
- KVM Specific Configuration..... 64

This section covers hypervisor-specific configurations that Ruckus recommends and other settings that you may need to fine tune.

Supported Hypervisors

Unlike the vSZ controller, vSZ-D can only be installed on specific versions of VMware and KVM.

The tables below list the hypervisors and versions on which vSZ and vSZ-D can and cannot be installed.

TABLE 8 vSZ and vSZ-D supported hypervisors

	vSZ	vSZ-D
VMware 5.1	Supported from 2.5	
VMware 5.5 and later	Supported from 3.0	Supported from 3.2
KVM CentOS 6.5 64-bit	Supported from 2.5	
KVM CentOS 7.0 64-bit	Supported from 3.0	Supported from 3.2
Hyper-V	Supported from 3.2	
Azure	Supported from 3.2	
GCE	Supported from 3.2	

General Configuration

Ruckus offers the following general configuration recommendations.

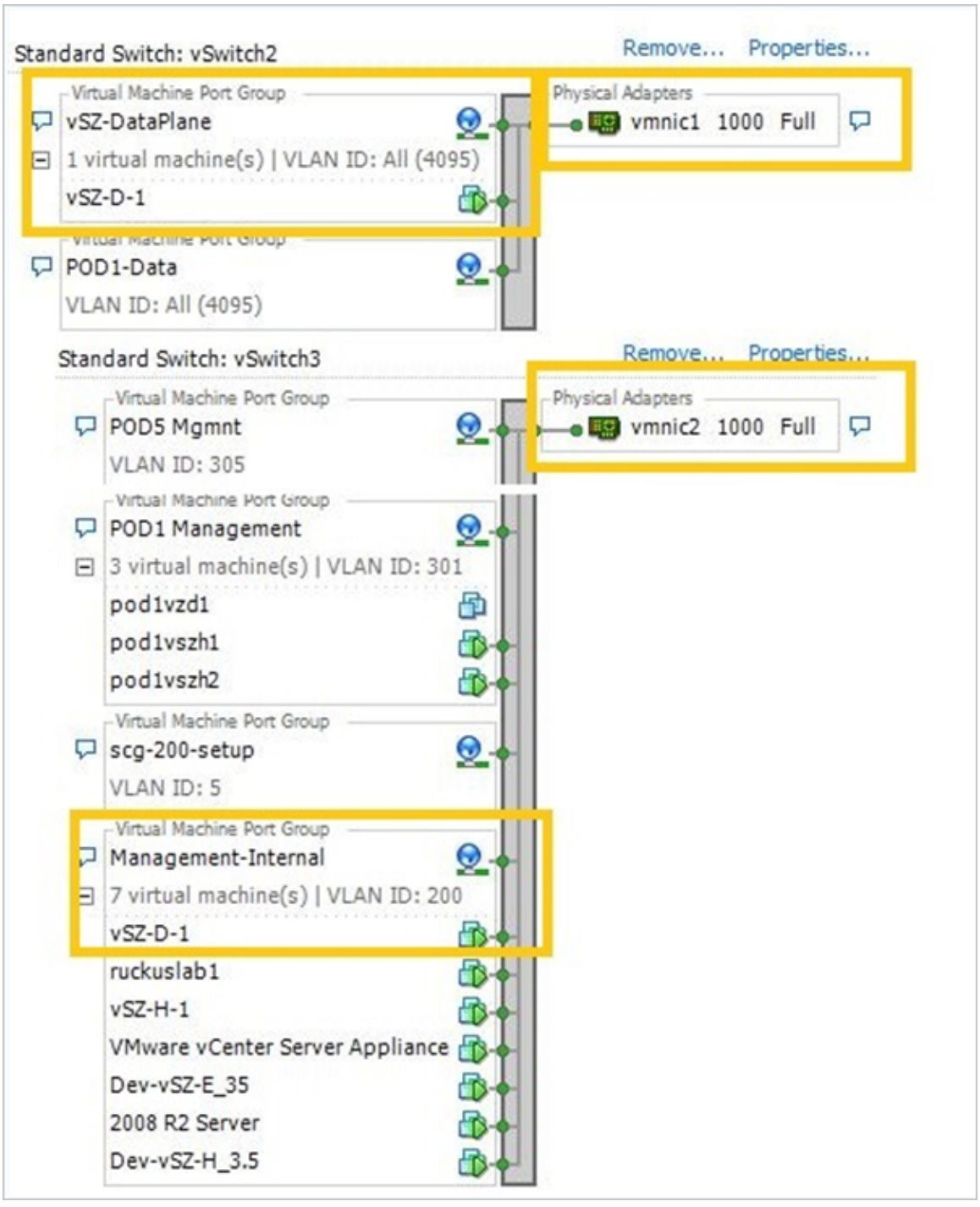
TABLE 9 General vSZ-D configuration recommendations

Component	Minimum Recommendation
Recommended reserved memory	Minimum 6144MB
Recommended number of CPU cores	Minimum three CPU cores. For improved performance in a large-scale deployment, allocate six CPU cores.
Configuration via DirectIO or through vSwitch	To enable passthrough on NIC devices, configure DirectIO mode in ESXi in **Advanced Settings**.

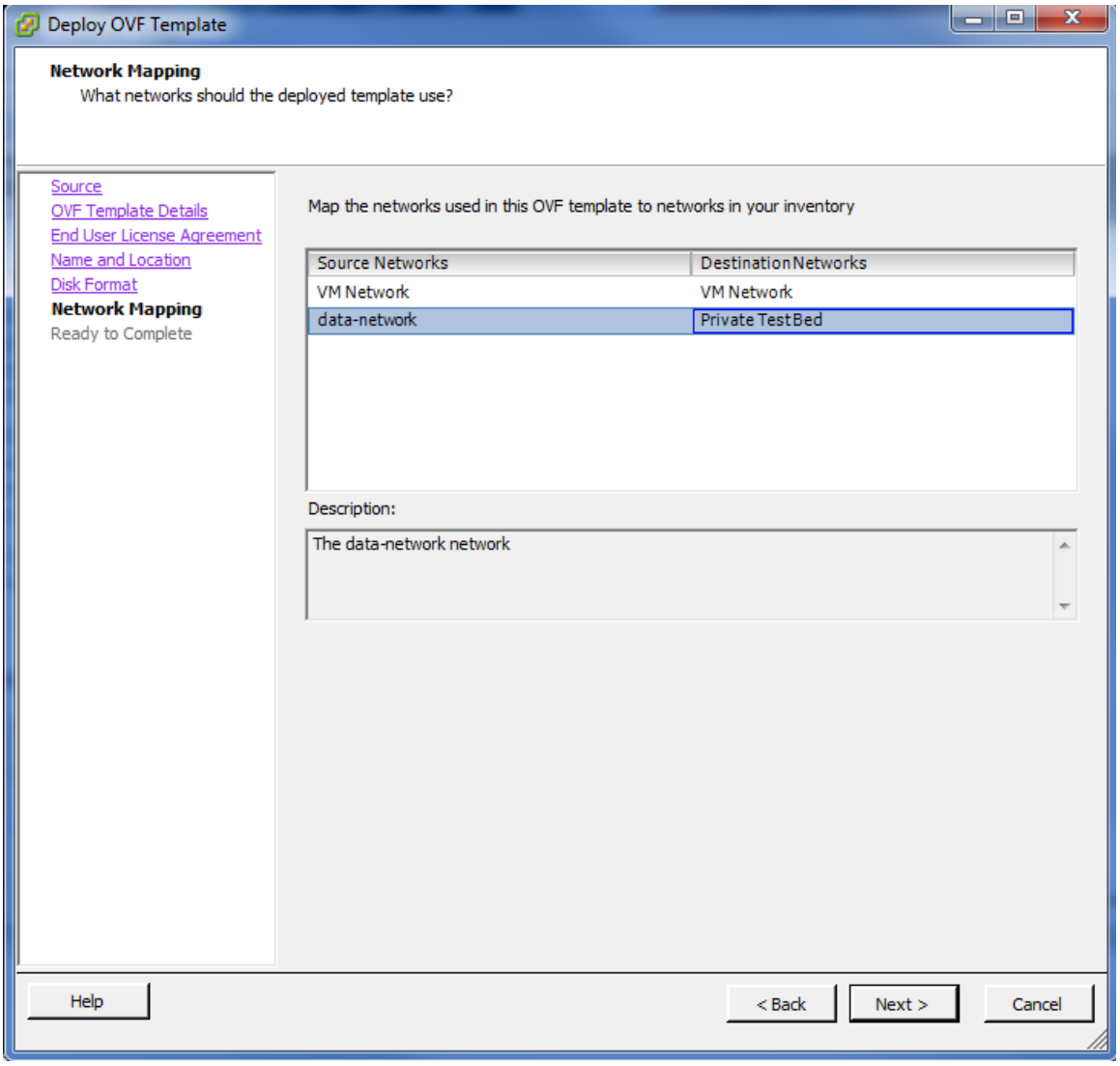
VMware Specific Configuration

If you are installing vSZ-D on VMware, read these VMware specific configuration recommendations from Ruckus.

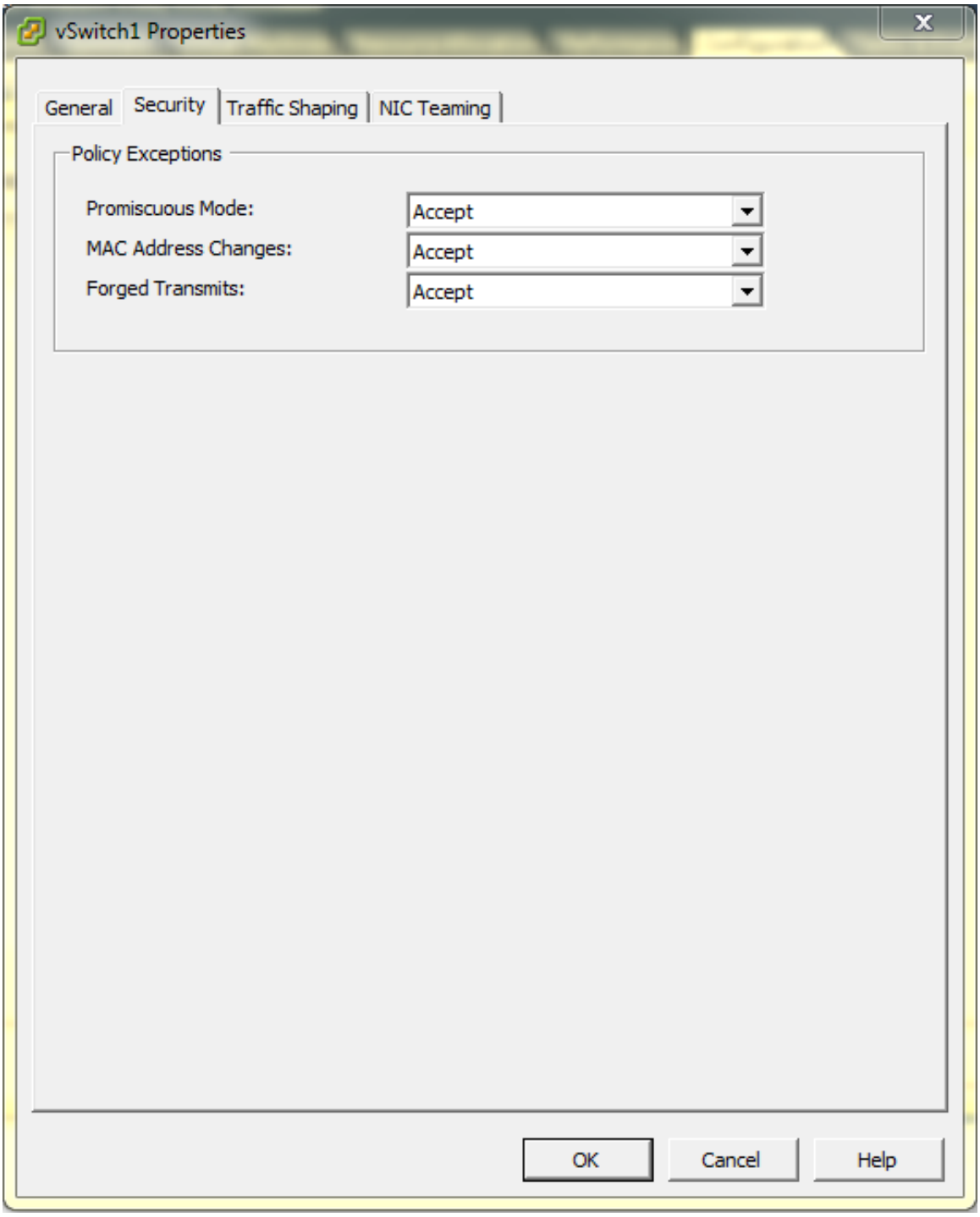
- Deploy vSZ-D on a machine that has at least two physical NICs. Alternatively, deploy to two vSwitch instances with dedicated physical NICs.



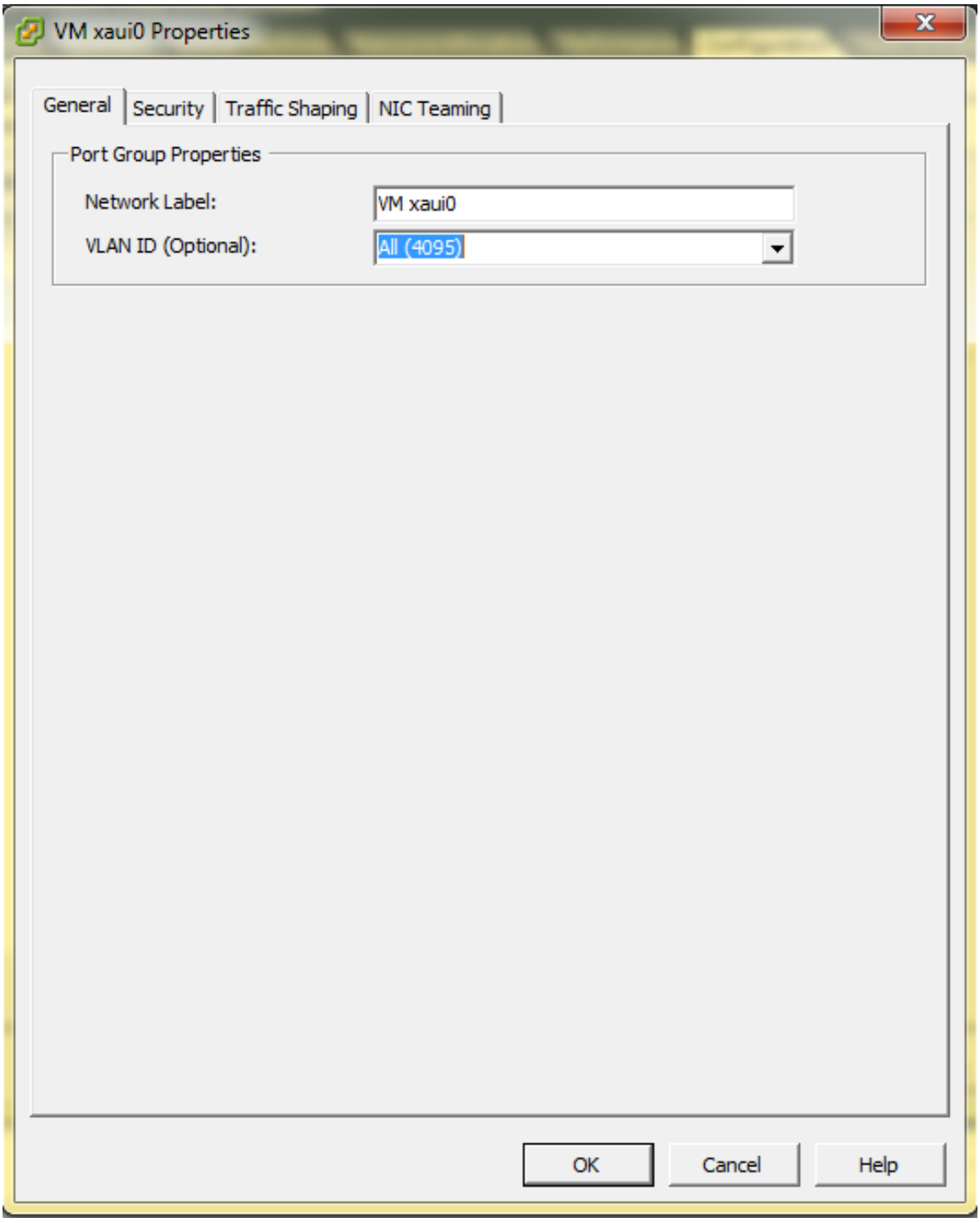
- When deploying an instance of vSZ-D using an OVA file, you must assign the management and data interfaces to two different network groups (vSwitch) on different subnets.



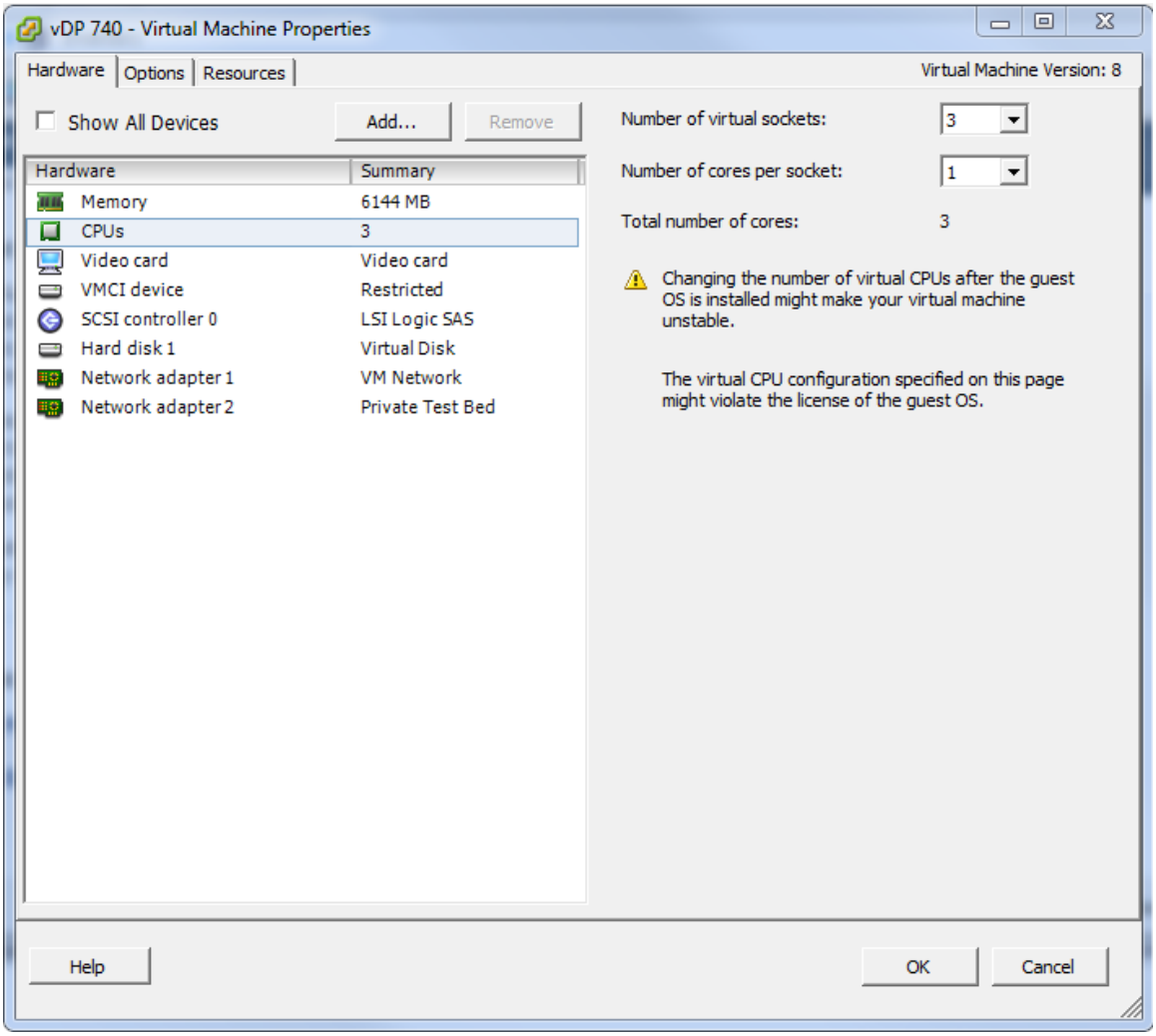
- Enable **Promiscuous** mode in vSwitch Config.



- In **vSwitch Config**, enable VLAN ID for **All**.



- After the vSZ-D instance is ready, modify the number of CPU cores (if needed) before powering on vSZ-D.



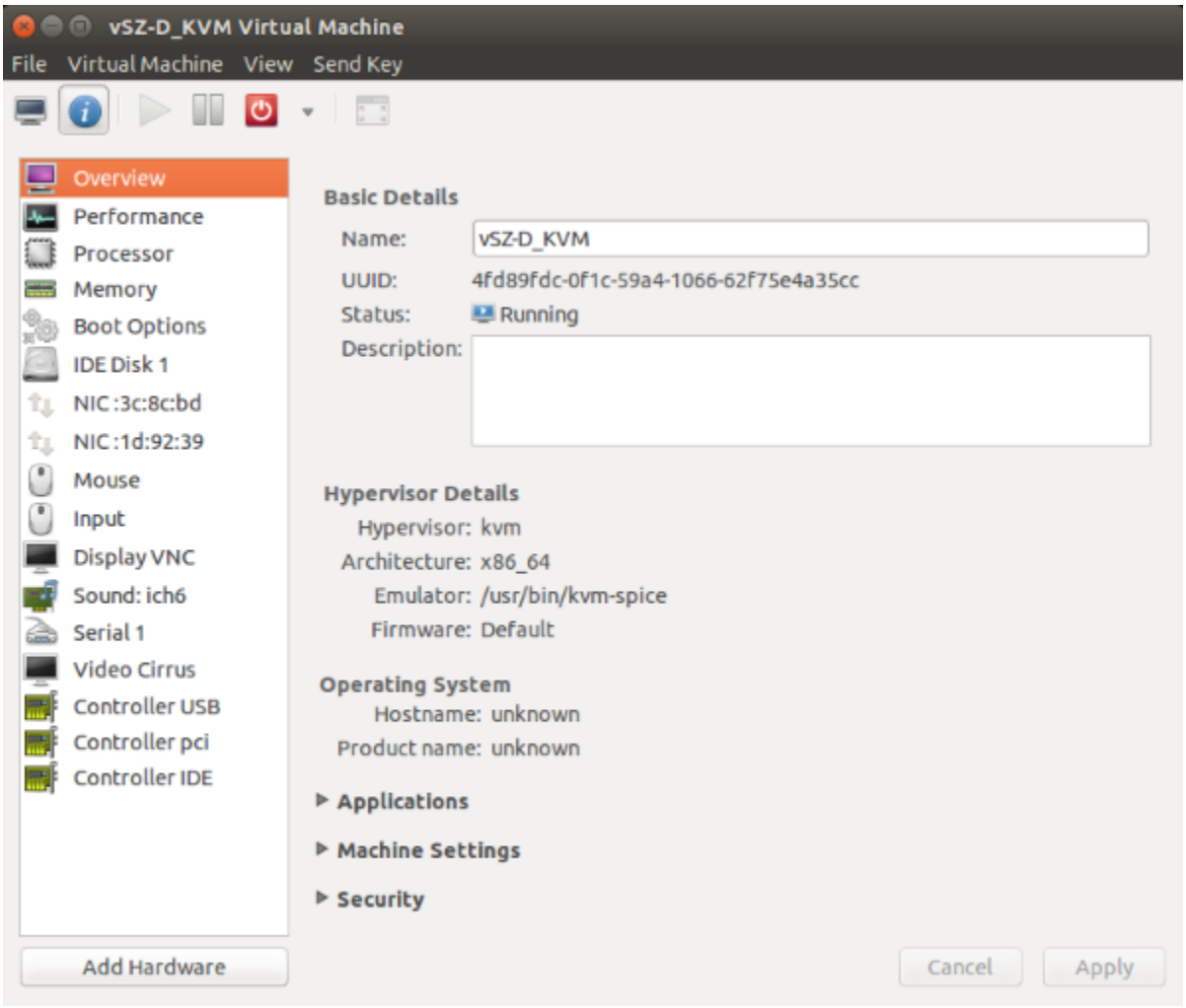
- For advanced CPU and memory resource configuration recommendations, refer to the *vSphere Resource Management Guide*, which is available on the VMware website.

KVM Specific Configuration

If you are installing a KVM on VMware, read these KVM specific configuration recommendations from Ruckus.

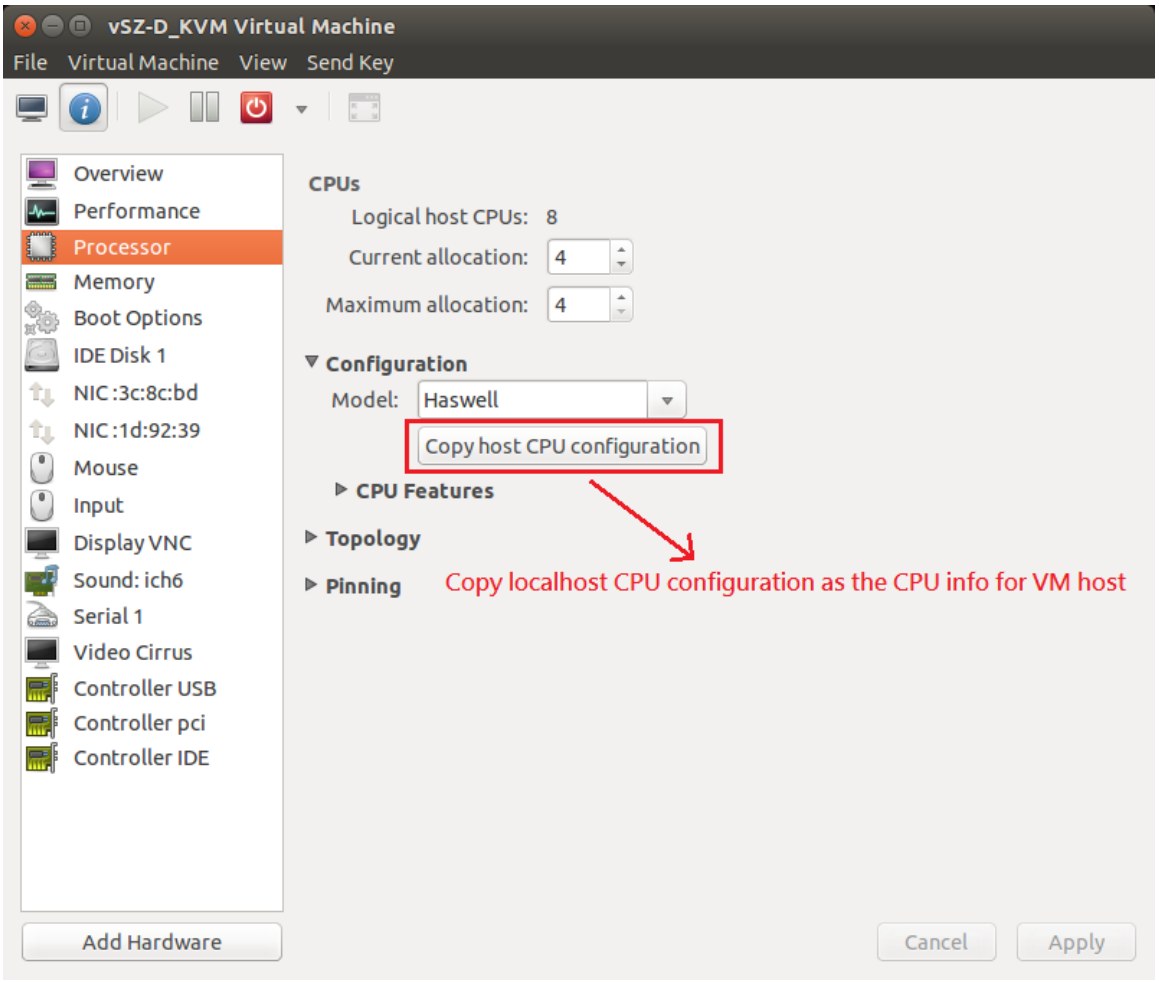
Hypervisor Detail

You can view the details of the hypervisor.



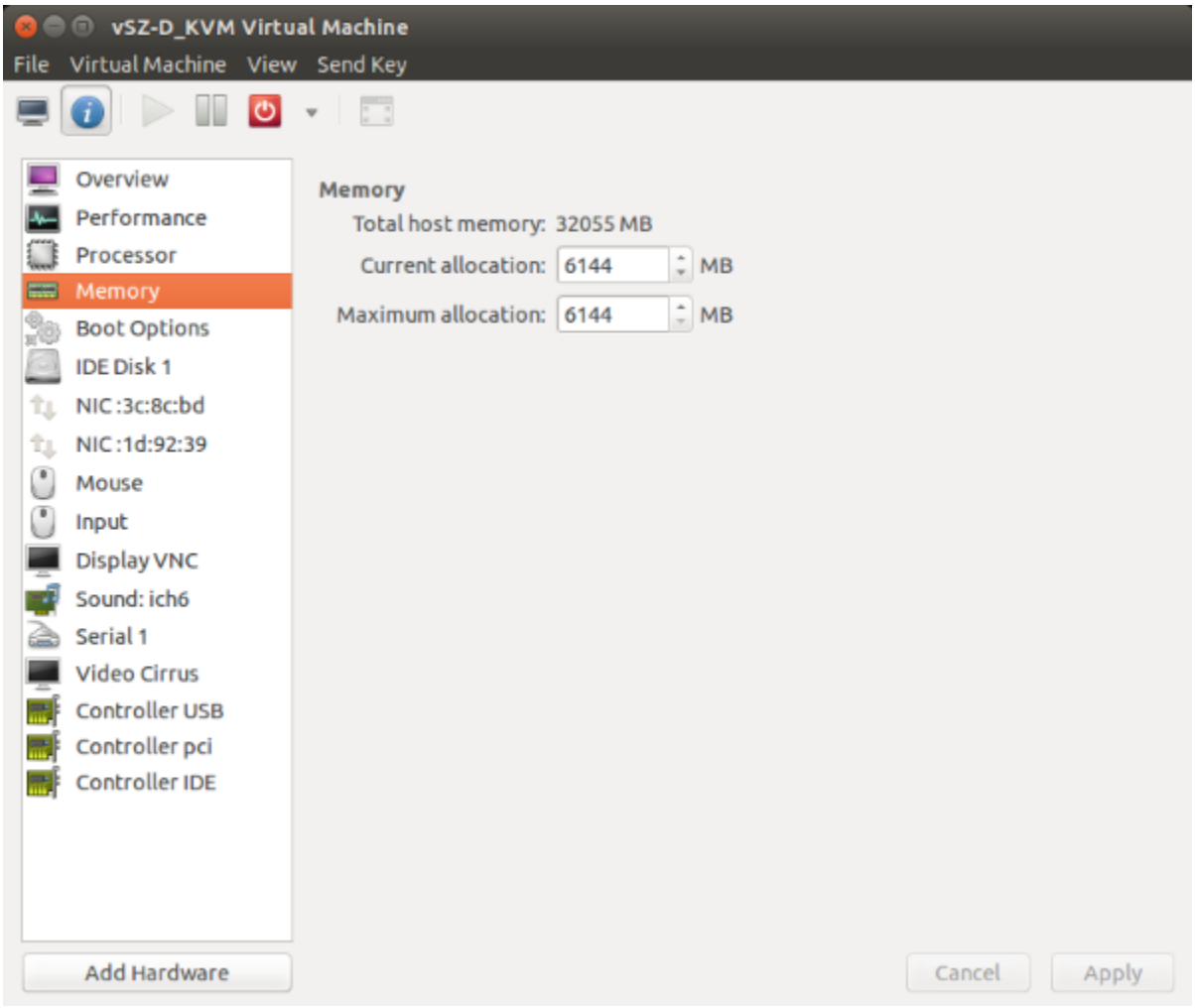
CPU Type

When selecting the CPU model, make sure you select one that is higher than Intel Core 2 Duo. On Linux, you can this information in `/proc/cpuinfo`.



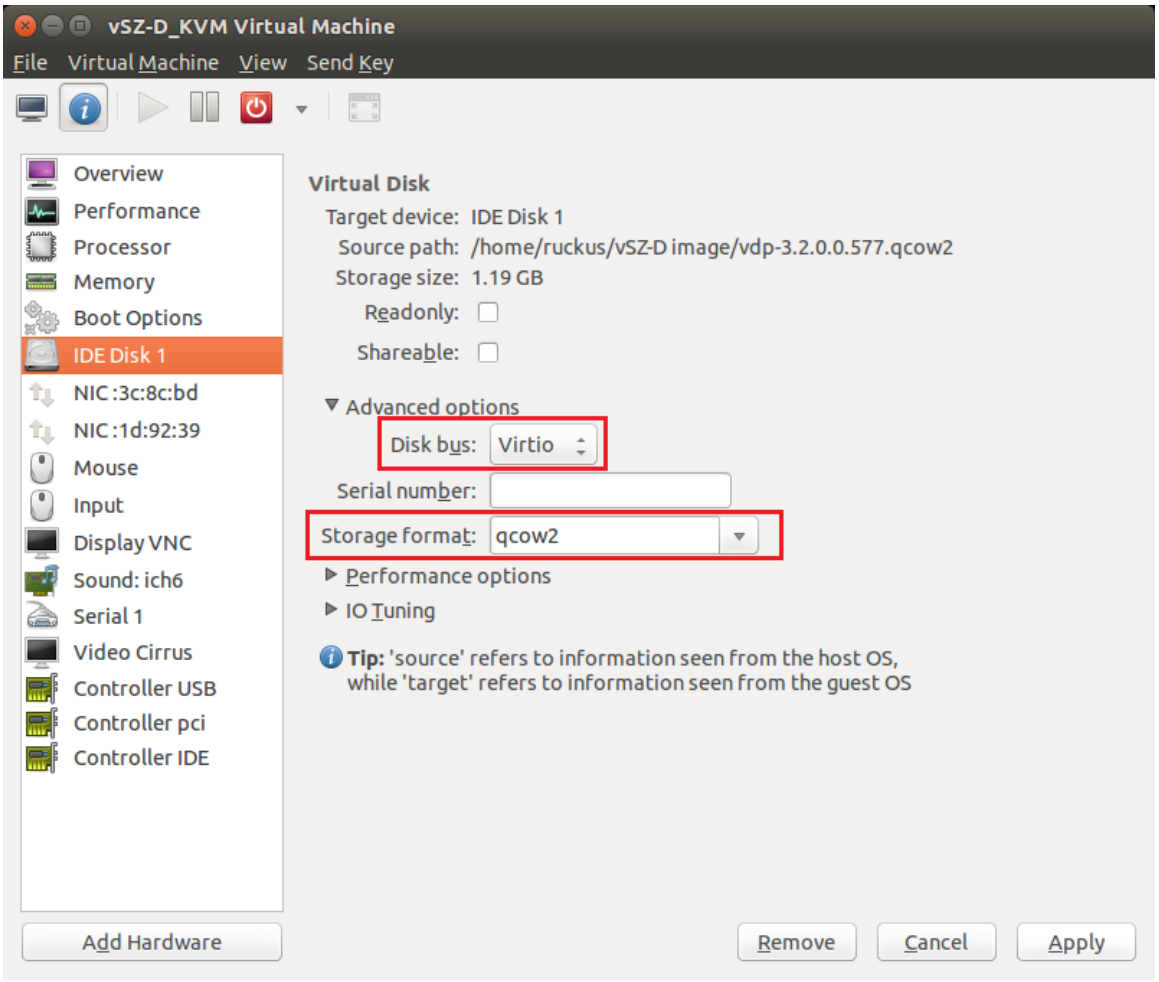
Memory Allocation

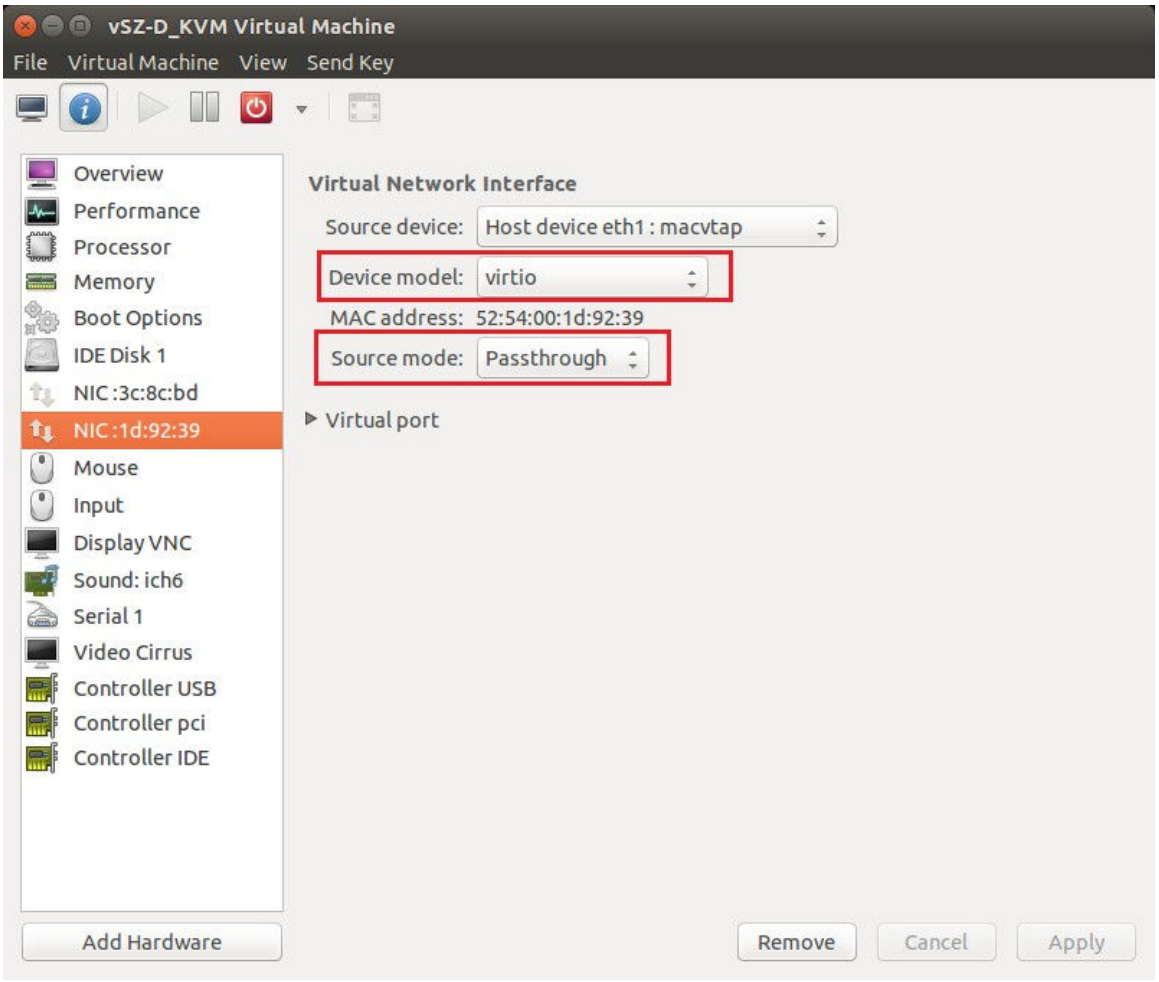
You must allocate a minimum of 6G (6144 MByte) memory for vSZ-D.



Disk Configuration

Ruckus recommends using Virtio as the disk bus and qcow2 as the storage format.


vSZ-D_KVM Virtual Machine
File Virtual Machine View Send Key
Overview
Performance
Processor
Memory
Boot Options
IDE Disk 1
NIC :3c:8c:bd
NIC :1d:92:39
Mouse
Input
Display VNC
Sound: ich6
Serial 1
Video Cirrus
Controller USB
Controller pci
Controller IDE
Virtual Disk
Target device: IDE Disk 1
Source path: /home/ruckus/vSZ-D image/vdp-3.2.0.0.577.qcow2
Storage size: 1.19 GB
Readonly:
Shareable:
Advanced options
Disk bus: Virtio
Serial number:
Storage format: qcow2
Performance options
IO Tuning
Tip: 'source' refers to information seen from the host OS, while 'target' refers to information seen from the guest OS
Add Hardware
Remove
Cancel
Apply


vSZ-D_KVM Virtual Machine
File
Virtual Machine
View
Send Key
Overview
Performance
Processor
Memory
Boot Options
IDE Disk 1
NIC :3c:8c:bd
NIC :1d:92:39
Mouse
Input
Display VNC
Sound: ich6
Serial 1
Video Cirrus
Controller USB
Controller pci
Controller IDE
Virtual Network Interface
Source device:
Host device eth1 : macvtap
Device model:
virtio
MAC address: 52:54:00:1d:92:39
Source mode:
Passthrough
Virtual port
Add Hardware
Remove
Cancel
Apply

NIC Configuration in Direct IO Mode

NOTE

Only the data interface needs to be configured to direct PCI passthrough. The management interface should always be configured to e1000 as the NIC driver.

Before adding a PCI device to the KVM, you need to complete the following steps:

1. Enable VT-d (for Intel processors) in the motherboard BIOS. Intel's VT-d ("Intel Virtualization Technology for Directed I/O") is available on most i7 family processors.
2. Add kernel boot parameters via GRUB to enable IOMMU (see figure below). To enable IOMMU in the kernel of Intel processors, pass **intel_iommu=on** boot parameter on Linux. For more information, read this tutorial.
3. After configuring the boot parameter, reset the computer.

   You can add kernel boot parameters during boot time.

   - For Debian or Ubuntu:
     a. Edit GRUB config template at `/etc/default/grub`.
     b. Add a kernel parameter as "*name=value*" in *GRUB_CMDLINE_LINUX_DEFAULT* variable.

        ```
        $ sudo -e /etc/default/grub
        GRUB_CMDLINE_LINUX_DEFAULT="...... intel_iommu=on"
        ```

     c. Then run the following command to generate the GRUB config file.

        ```
        $ sudo update-grub
        ```

        If the command "update-grub" is not found, you can install it as follows:

        ```
        $ sudo apt-get install grub2-common
        ```

   - For Fedora
     a. Edit GRUB config template at `/etc/default/grub`.
     b. Add a kernel parameter as "*name=value*" in *GRUB_CMDLINE_LINUX* variable.

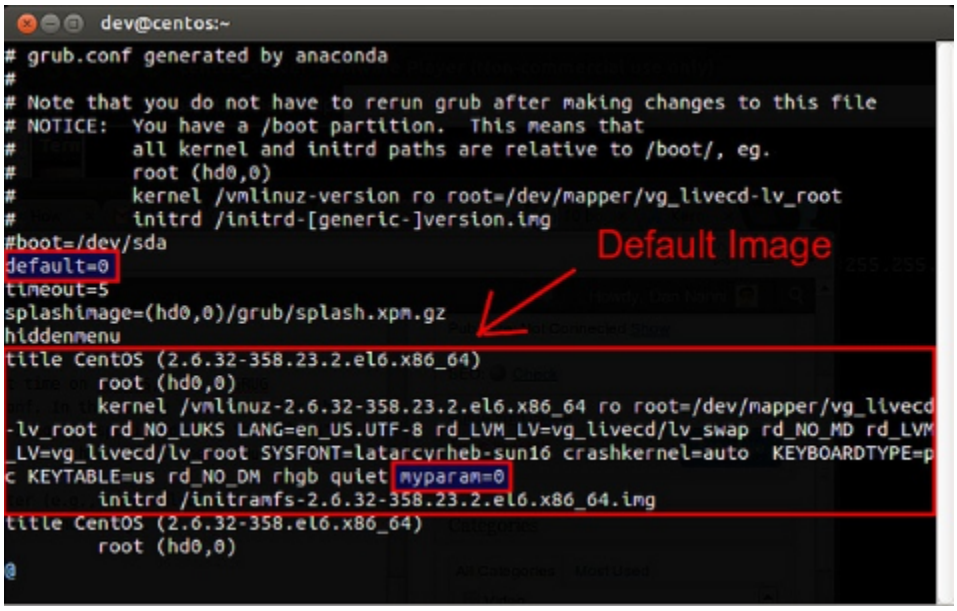
        ```
        $ sudo -e /etc/default/grub
        GRUB_CMDLINE_LINUX="...... intel_iommu=on"
        ```

     c. Then run the following command to generate the GRUB config file.

        ```
        $ sudo grub2-mkconfig -o /boot/grub2/grub.cfg
        ```

   - For CentOS
     a. Edit GRUB config template at `/boot/grub/grub.conf`.
     b. In the config file, look for the entry "default=N" at the top of the config file indicates which entry is the default image. On the next line, add a kernel parameter as "*name=value*" in *kernel /vmlinuz-* variable.

        ```
        kernel /vmlinuz-"...... intel_iommu=on"
        ```



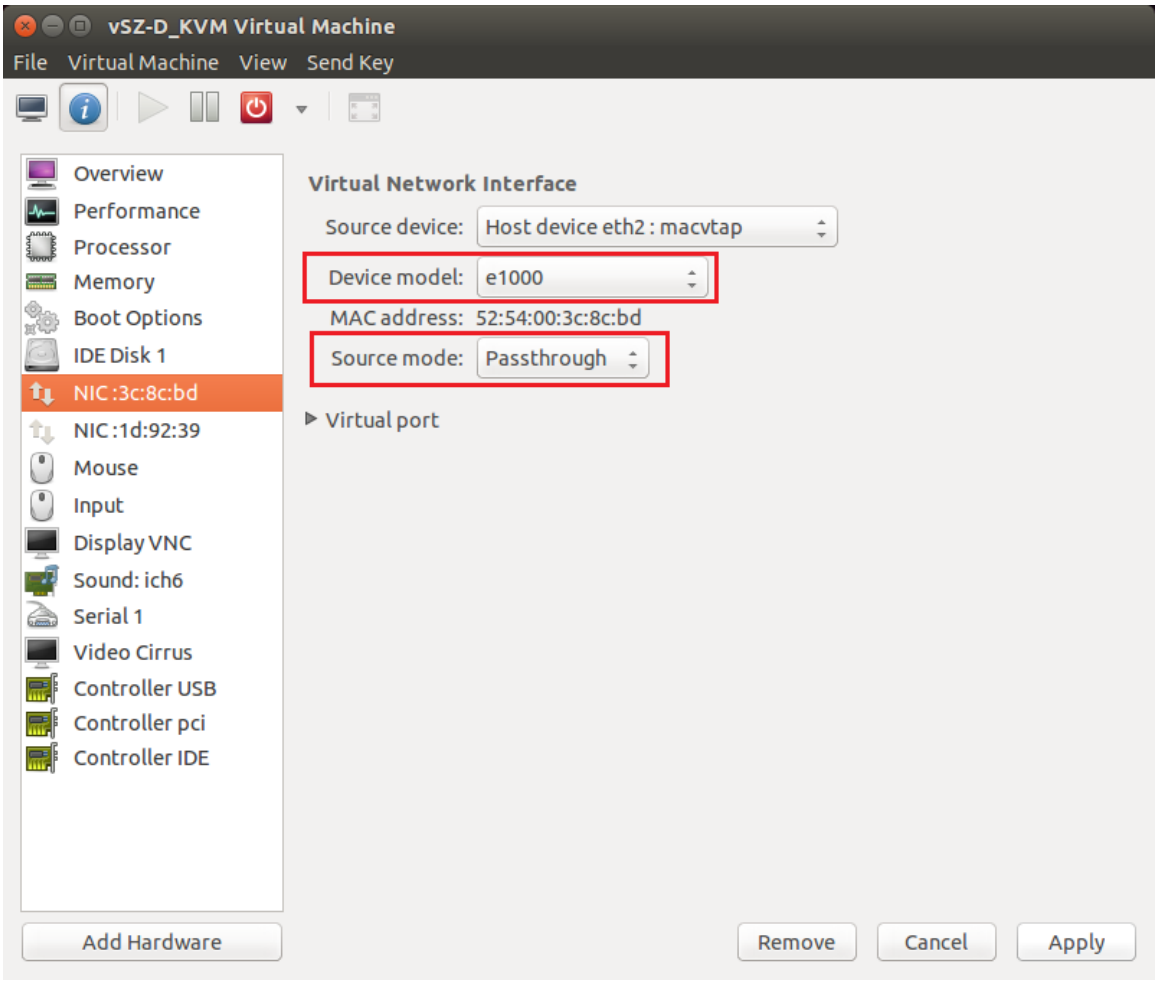
NIC Configuration in vSwitch Mode

NOTE

Configure only two ports for vSZ-D/.

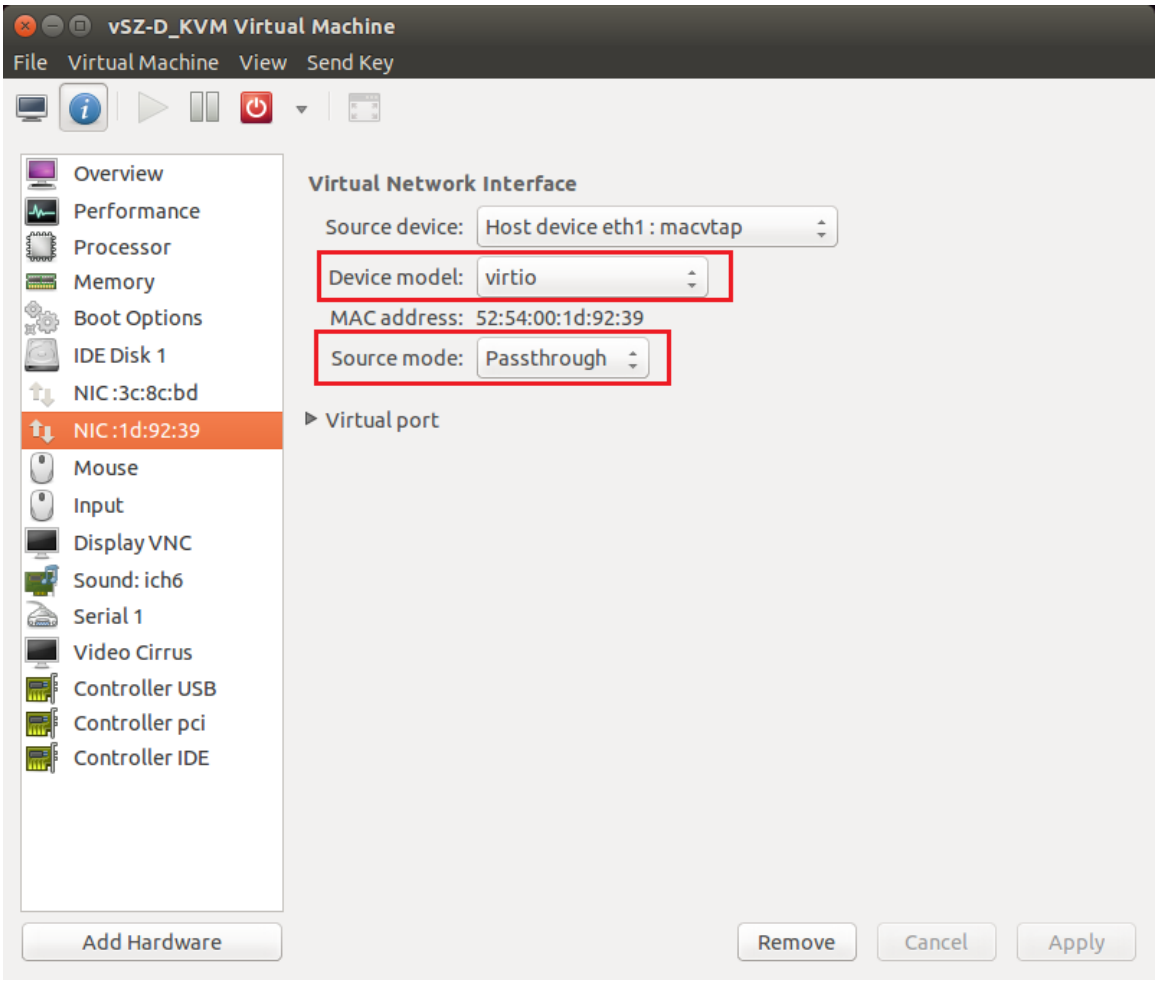
For the management interface, use the following settings:

- **Device model**: e1000
- **Source mode**: Either **Bridge** or **Passthrough** if you are using **macvtap** for the device type.



For the data interface, use the following settings:

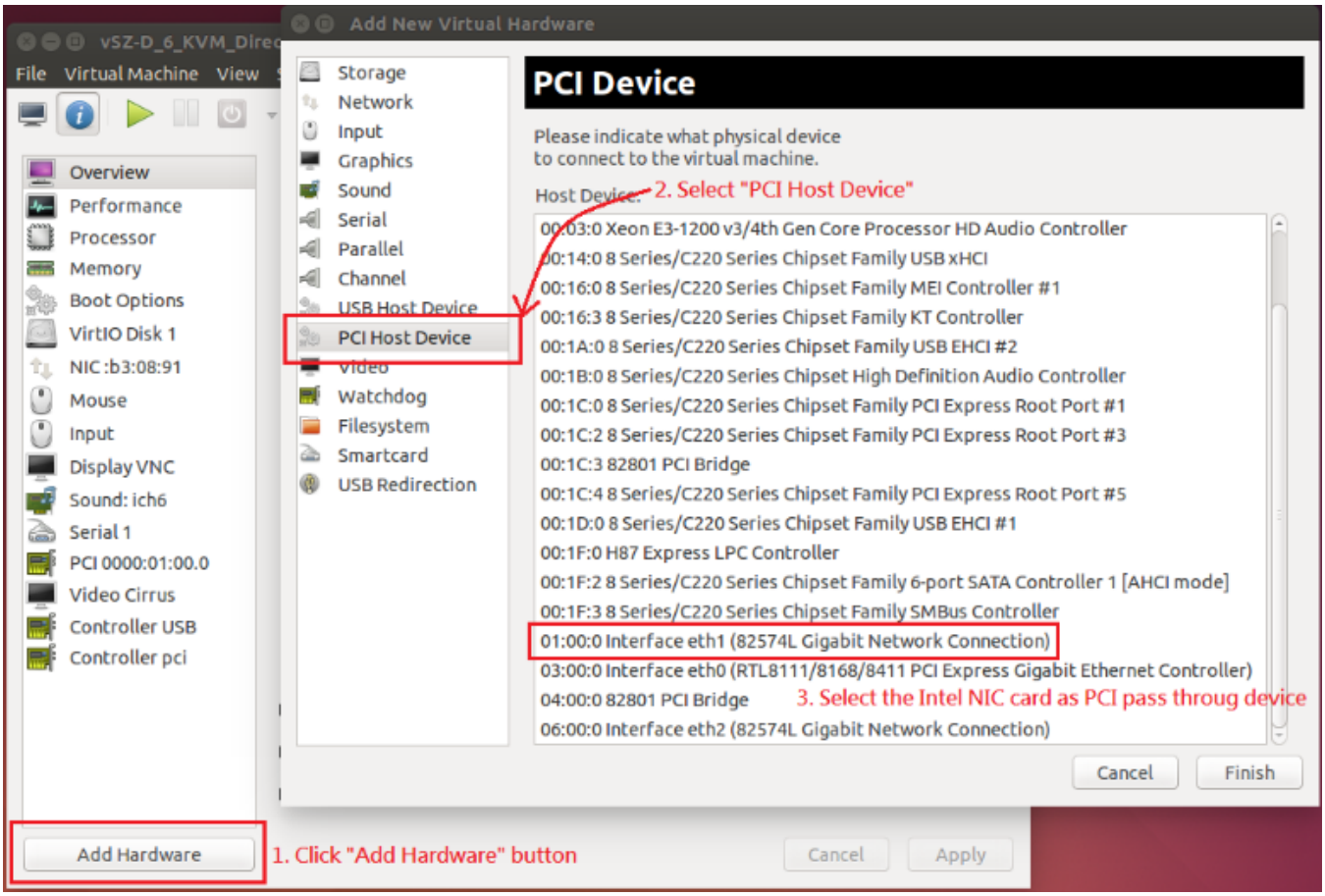
- **Device model**: e1000
- **Source mode**: **Passthrough** if you are using macvtap for the device type. Only the passthrough mode can allow UE traffic to pass through the VM NIC.



Adding a PCI Device to a VM on Virt-Manager

To assign a PCI device to a guest VM on virt-manager. :

1. From the VNC Viewer and click **Add Hardware** > **PCI Host Device**.
2. Choose a PCI device to assign from the PCI device list, and click **Finish**.



3. Power on the guest and the host PCI device would be visible in the guest VM.

NIC Card Setting

You must use only two ports.

	Management Interface	Data Interface
KVM w/ vSwitch	e1000	virtio
KVM w/ pci passthrough	e1000	1G: igb 10G:ixgbe
VMware w/ vSwitch	e1000 e1000e	VMXNET3
VMware w/ pci passthrough	e1000 e1000e	1G:igb 10G:ixgbe

Deployment of vSZ

- Deploy vSZ-D with 40GB NIC on ESXi Server..... 75
- Deploy vSZ-D with 40GB NIC on Linux Server..... 90

Deploy vSZ-D with 40GB NIC on ESXi Server

Deploy vSZ-D with 40GB NIC on ESXi Server

Hardware Requirement and Prerequisite

The following are the hardware and prerequisite for deploying vSZ-D on ESXi 6.7

Hardware Requirement

1. DELL Inc. PowerEdge R530
2. ESXi Server License 6.7
3. Broadcom NetXtreme BCM5720 Gigabit Ethernet NIC
4. Intel Ethernet XL710 for 40GbE QSFP+
5. CPU minimum 4 cores
6. vSphere ESXi Server 6.7 or later
7. 1 or 2 vNICs
8. 8 GB memory
9. 128 GB Hard disk

Prerequisite

- A hypervisor on ESXi to install vSZ-D. Recommended version is ESXi 6.7 and later.
- Download the vSZ-D package (.OVA file) from Ruckus support .
- The IP addresses, netmask, gateway, DNS, DHCP and NAT support for vSZ-D.
- Before you power on vSZ-D, ensure that the networking is configured on ESXi.
- Recommended to use static network addresses that are assigned to vSZ-D during setup.

  NOTE
  Due to different servers and NIC, the deployment procedure mentioned in this section is for reference.

Topology

The network topologies for vSZ-D deployment on ESXi 6.7 server.

The following are basic topologies for setting up vSZ-D. Based on your requirement you can choose any of the alternatives between one IP domain to three separate domains for deployment.

The below topology shows the different IP addresses for the domains.

FIGURE 29 Three different IP addresses setup

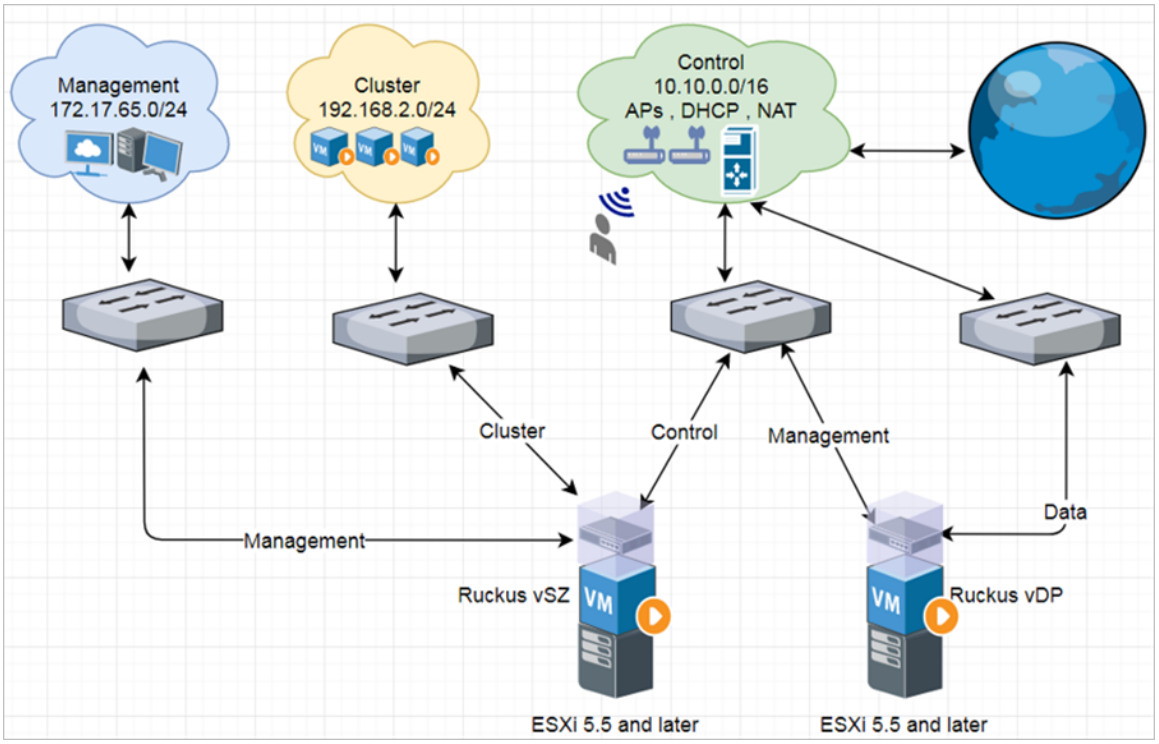
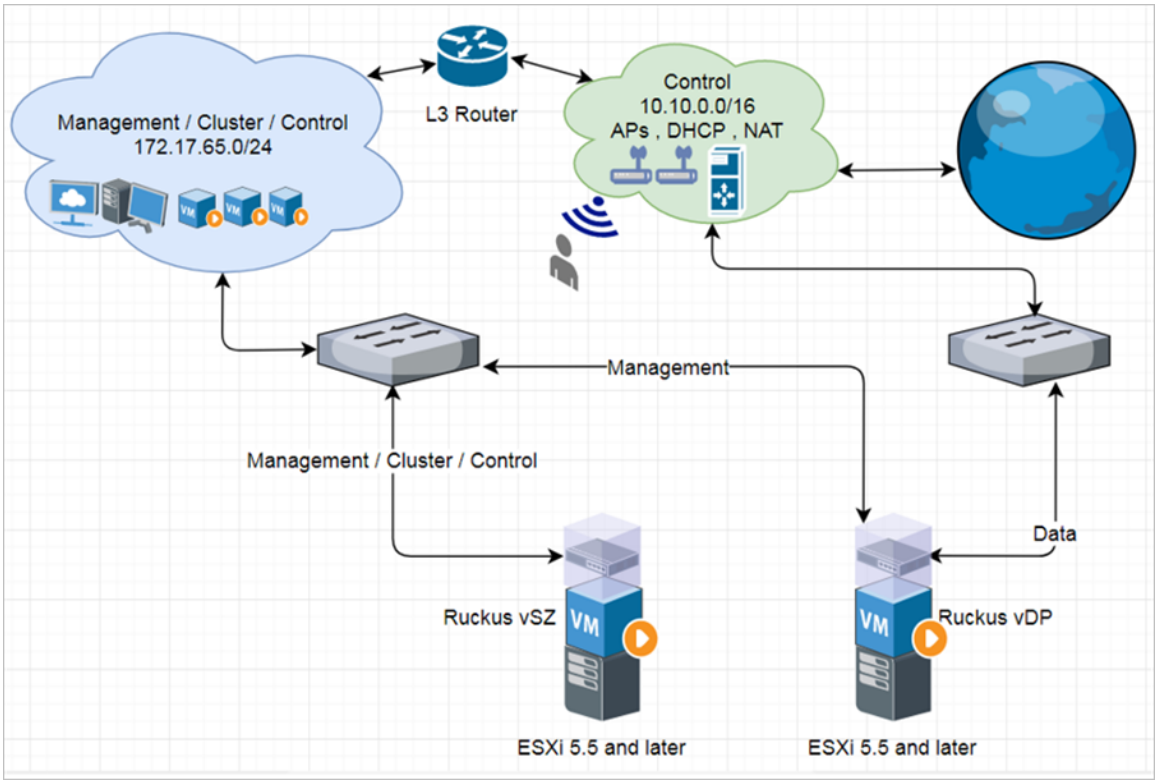
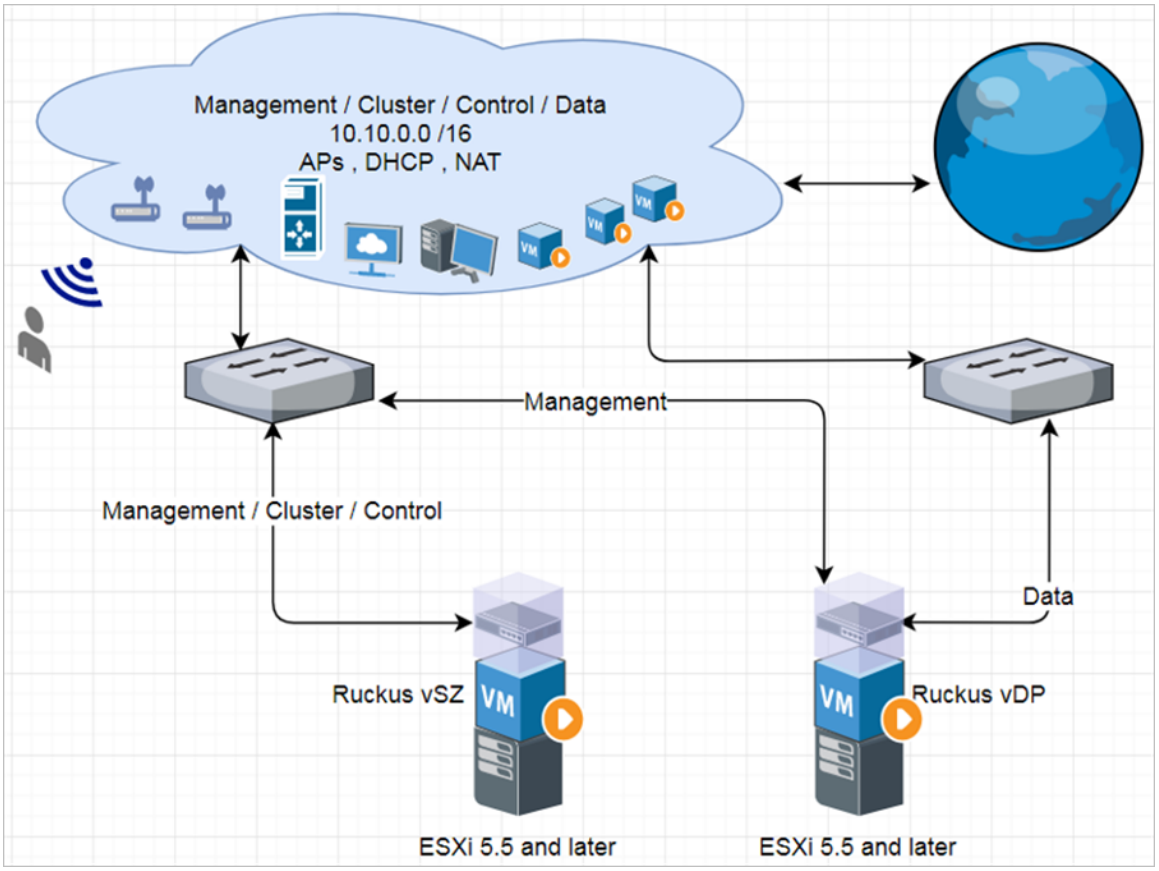


FIGURE 30 Two different domain IP addresses setup



The below topology shows the same IP addresses for the all the interfaces.

FIGURE 31 The same IP addresses setup



Deployment Procedure

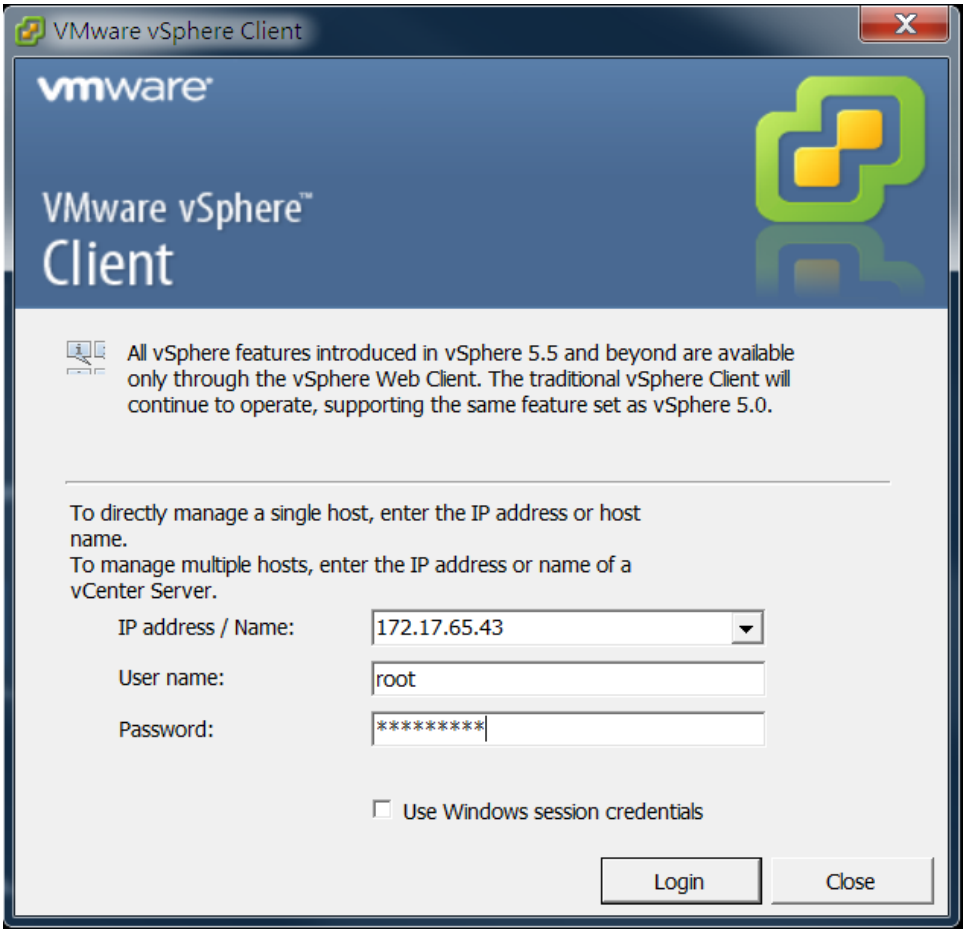
The following are basic instructions for setting up the controller on the ESXi server.

VMware ESXi 6.7 is installed and working.

For this deployment two different IP address domains are considered for controller interfaces. Refer to Topology on page 75

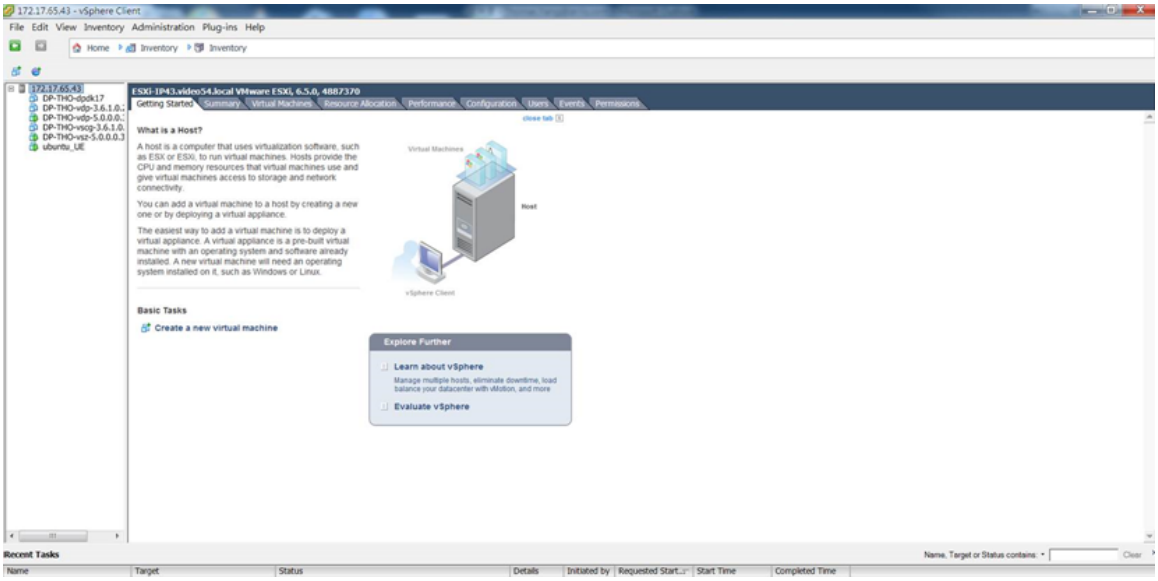
1. Login to the server through vSphere client tool as seen below.

FIGURE 32 Login to vSphere



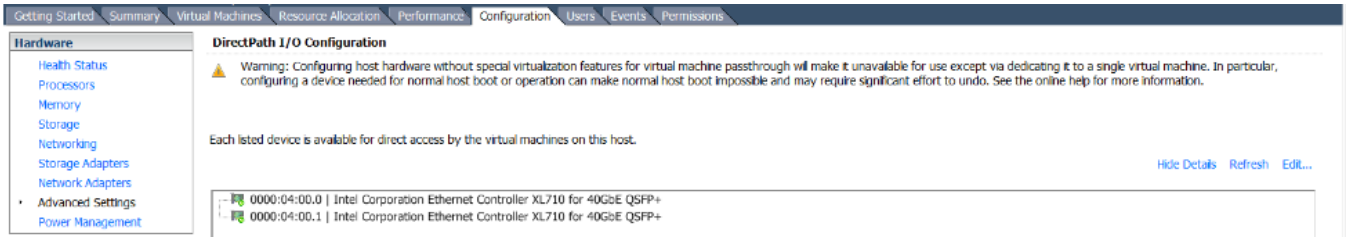
The vSphere Client management page appears as shown in the following figure.

FIGURE 33 vSphere Client management page



2. Navigate to **Configuration** > **Advanced Settings** > **Edit**.

   The **DirectPath I/O Configuration** page appears.

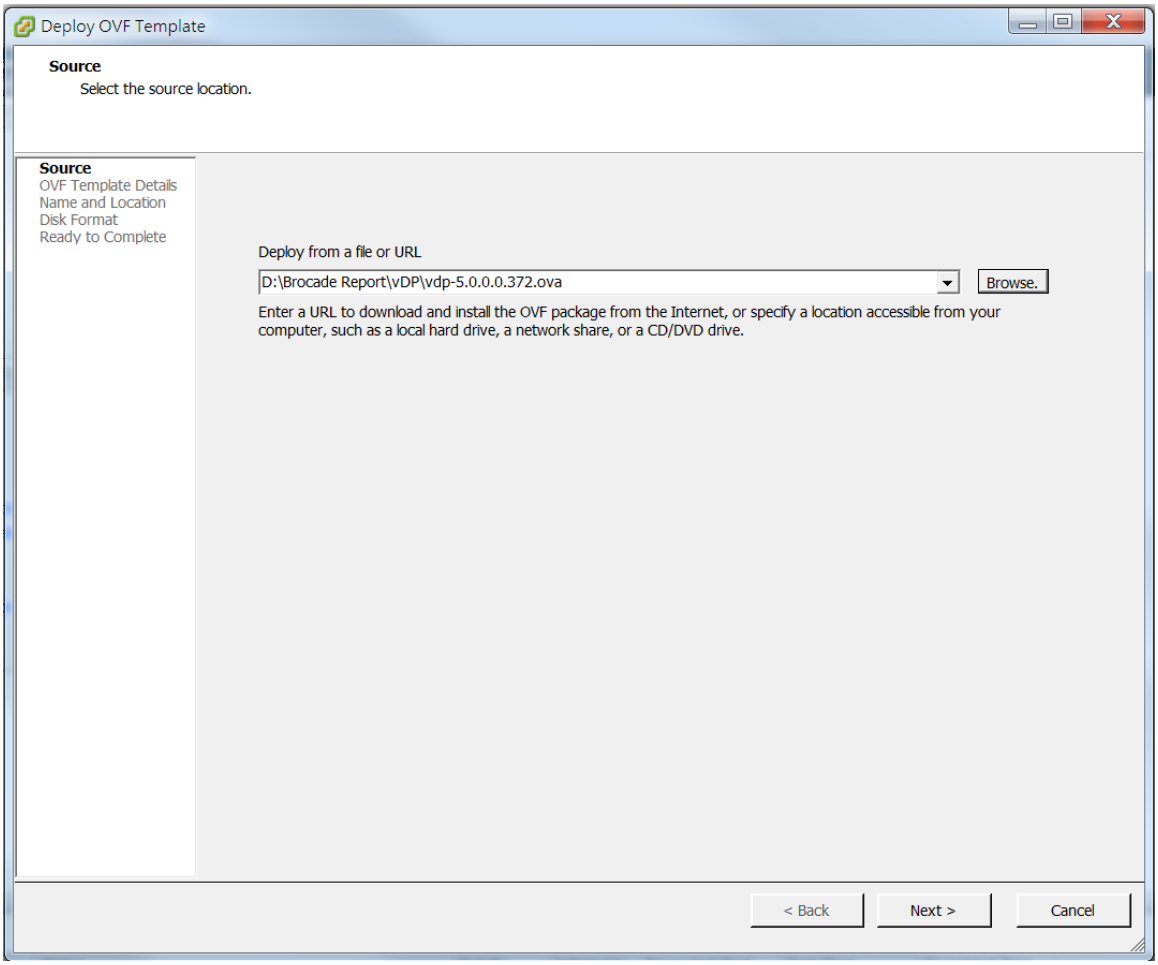


3. Select **XL710 40GbE QSFP+** ports and reboot vSphere server.

4. Download the controller (.ova file) from Ruckus support .

> **NOTE**
> You must deploy the controller directly from the .ova file. Copying an instance of the controller from another controller template might not function properly.

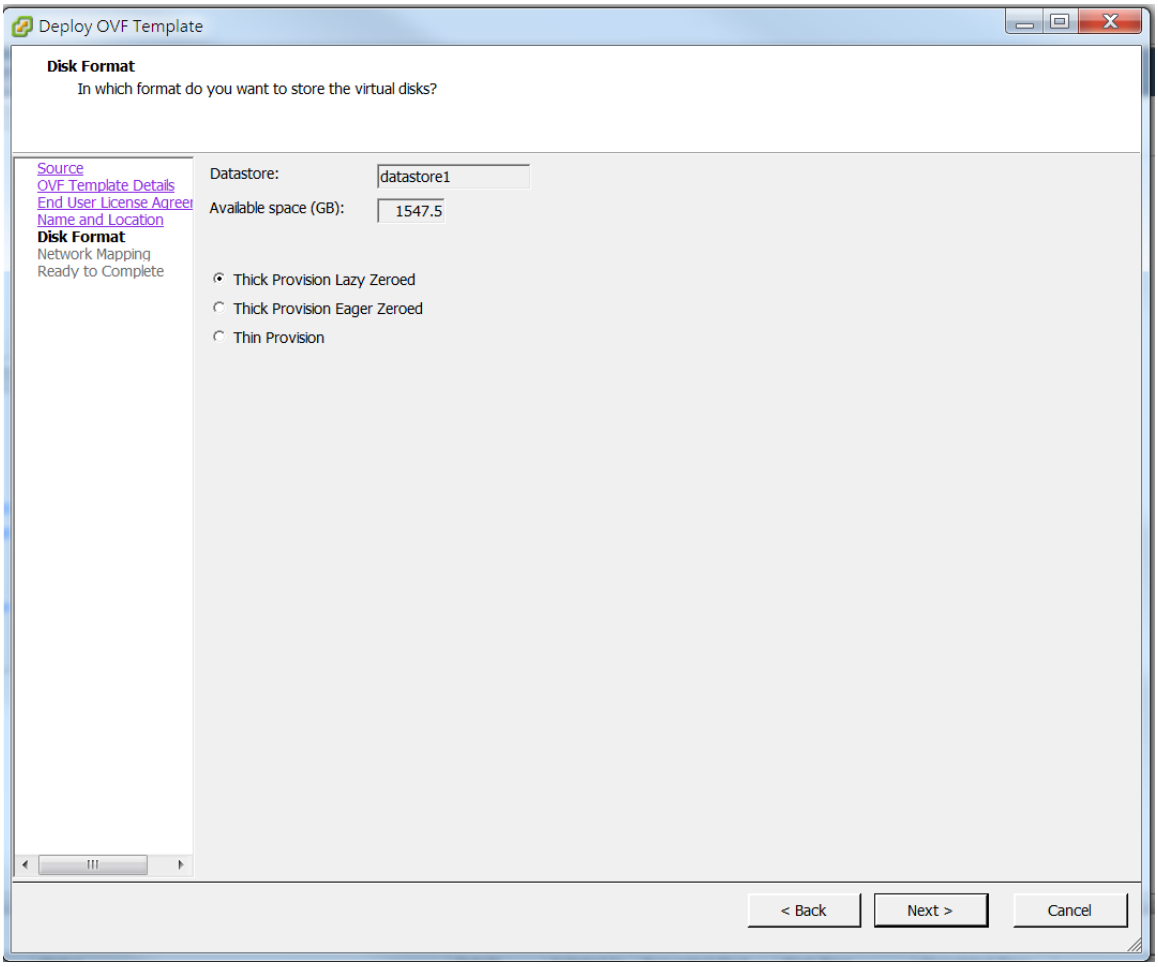
FIGURE 34 Deploy the file



5. Click **Browse**, to select the source location and upload the .ova file.
6. Click **Next.**

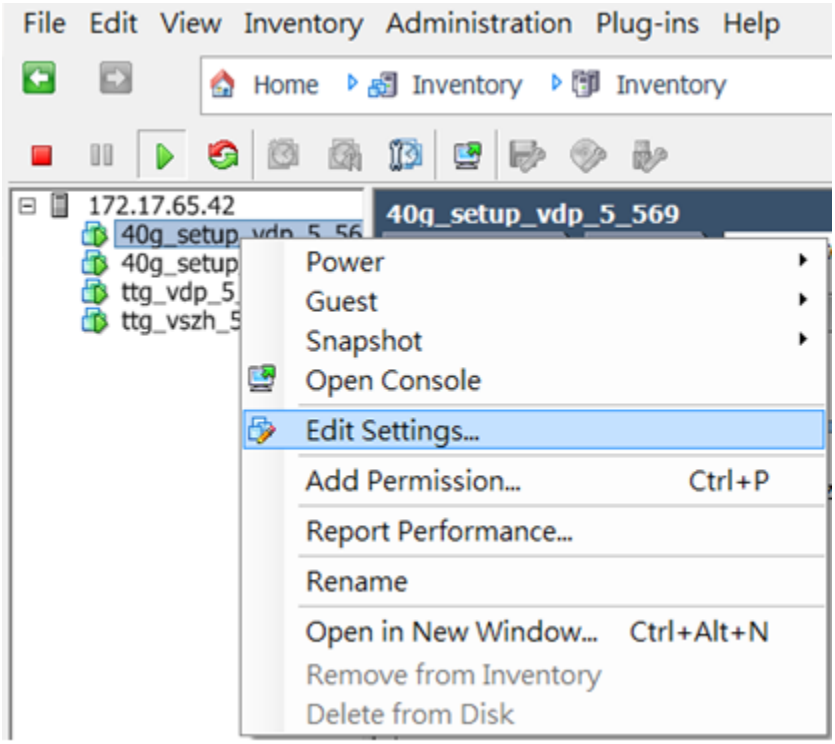
7. Enter the vSZ datastore name and choose the disk format as seen below.

FIGURE 35 Choose the disk format



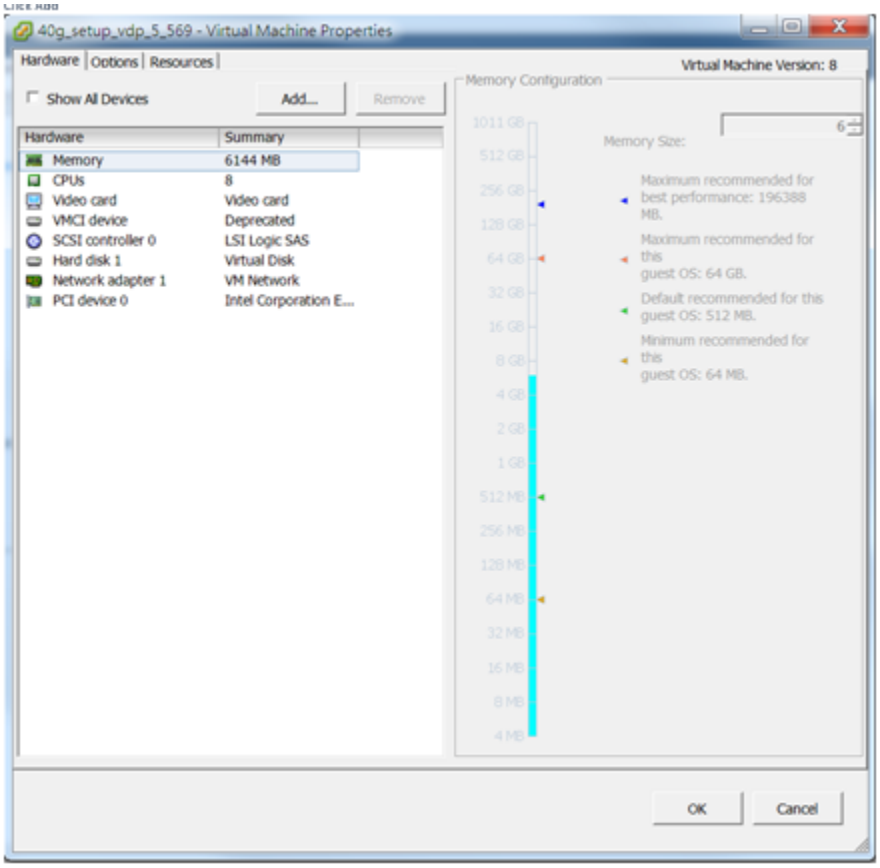
8. Click **Next.**

9. From the controller, right-click the VM and select **Edit Settings**.

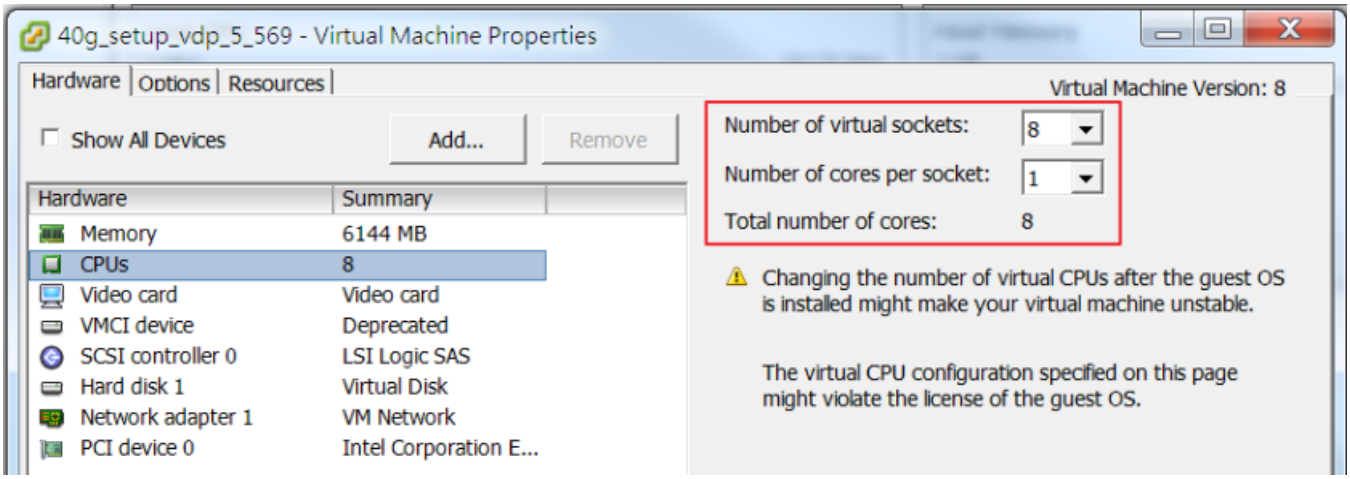


The Virtual Machine Properties dialog opens.

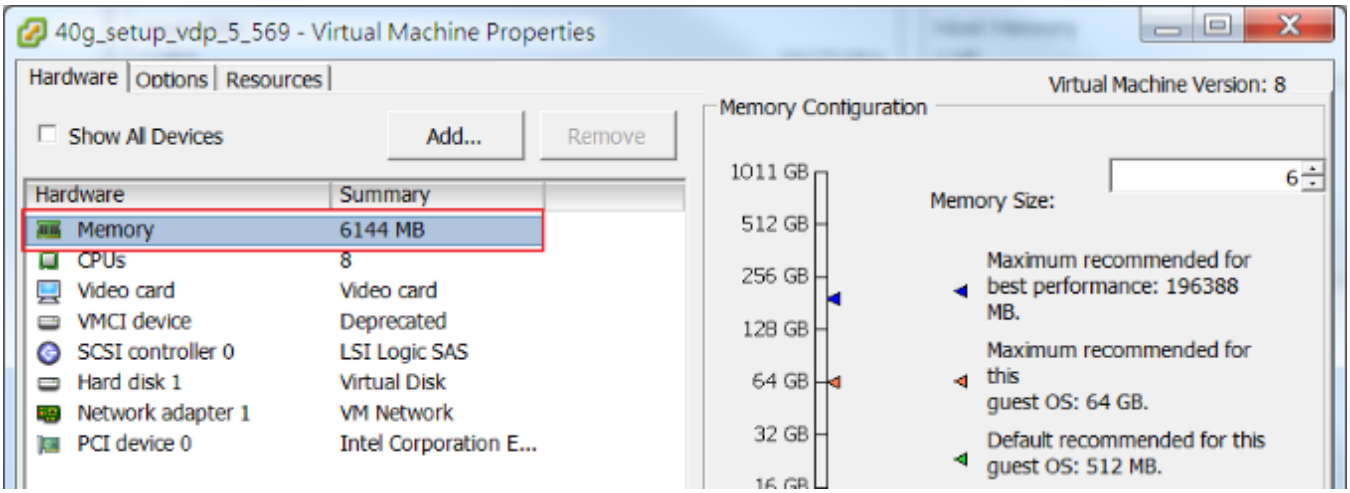
10. Select the destination network for each network source and click **Add** as shown in the following image.



11. For 40Gb throughput performance , select total number of CPU cores to **8**.



12. Select 6GB memory size.



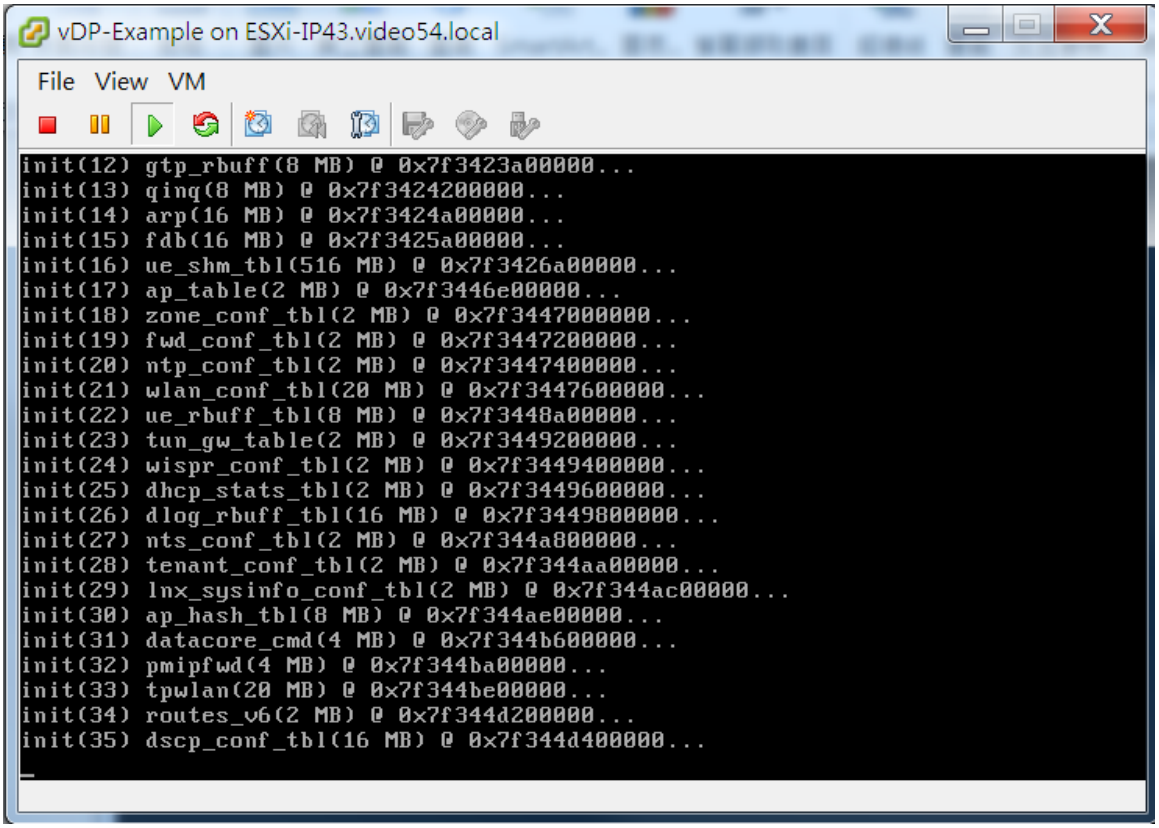
13. Click **OK** to start the deployment.
14. The deployment progress is displayed. On successful deployment, by default the controller now supports two network interfaces for management and data.

vSZ-D/SZ100-D/SZ144-D Connect to vSZ Using CLI

Follow the below procedures for vSZ-D/SZ100-D/SZ144-D to connect to vSZ.

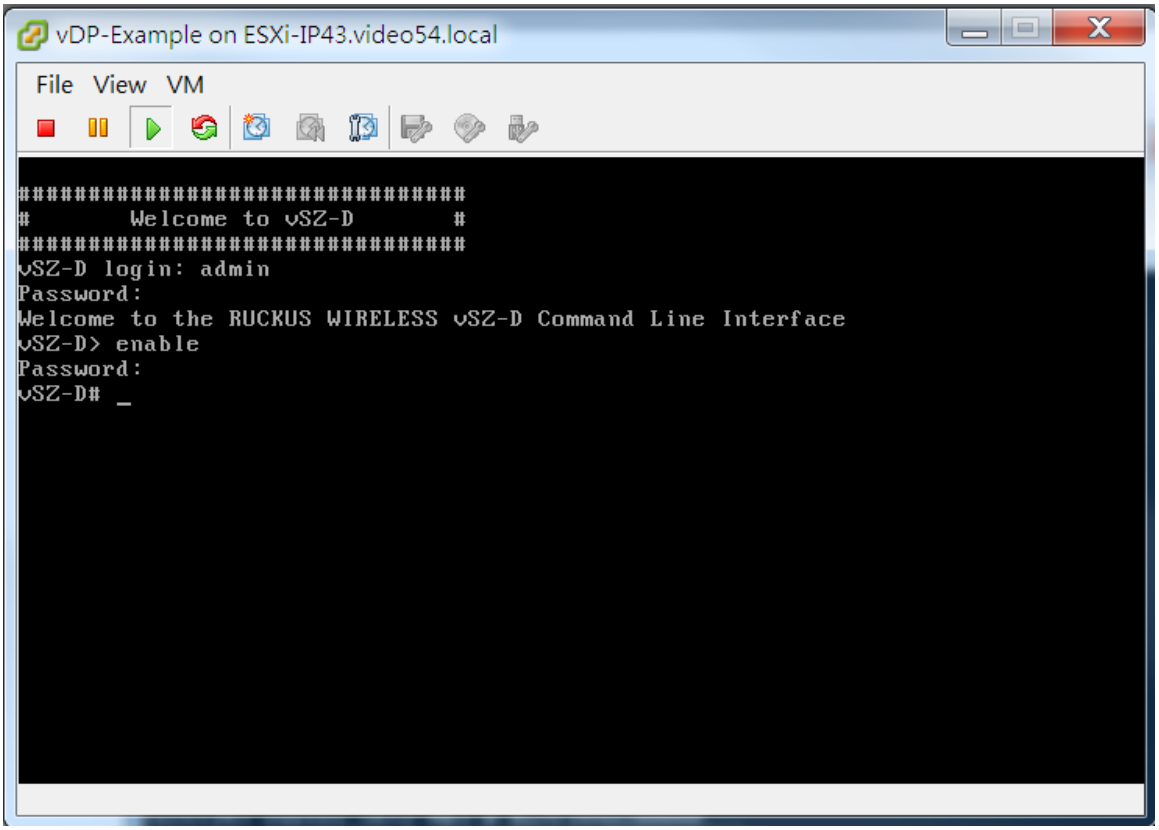
Open a CLI console window to run the deployed vSZ-D/SZ100-D/SZ144-D.

FIGURE 36 Run vSZ-D/SZ100-D/SZ144-D on the console



1. At the login prompt, login using **administrator** credentials of username and password. At the **>** prompt, enter the **enable (en)** command and the admin password to change the mode to Privileged-exec mode.

FIGURE 37 Login and Privileged mode



2. Run the **setup** command to configure the IP address for management and data interface. It is recommended to add a new host if you have multiple hosts for various configurations

FIGURE 38 Execute the setup command

3. Choose the IP address setup (IPv4 only or IPv4 and IPv6) for Management and Data interface by either selecting manual or DHCP. On defining the IP setup the process of vSZ-D/SZ100-D/SZ144-D connecting to vSZ controller starts.

FIGURE 39 Management interface

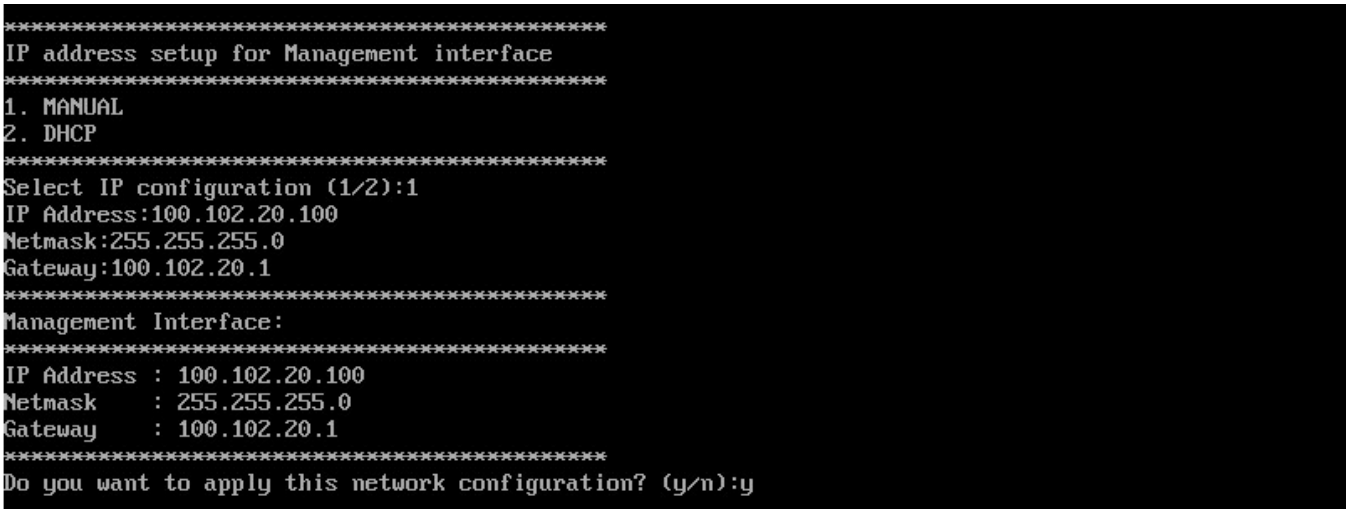


FIGURE 40 Data interface

4. Enter the DNS setting and select Enter to skip the NAT IP setting.

FIGURE 41 DNS setting

5. Enter vSZ control interface IP address. Follow the set of sequences as seen below for the vSZ-D/SZ100-D/SZ144-D to connect to vSZ controller. This changes the mode for vSZ-D/SZ100-D/SZ144-D as well as for vSZ.

FIGURE 42 vSZ control IP address

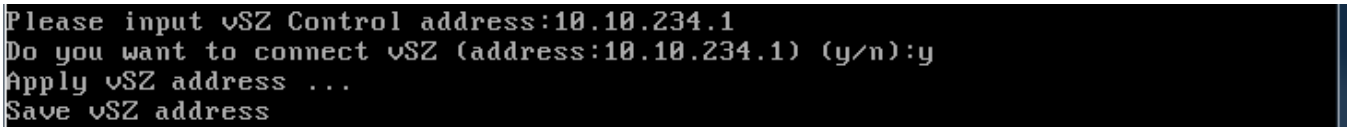
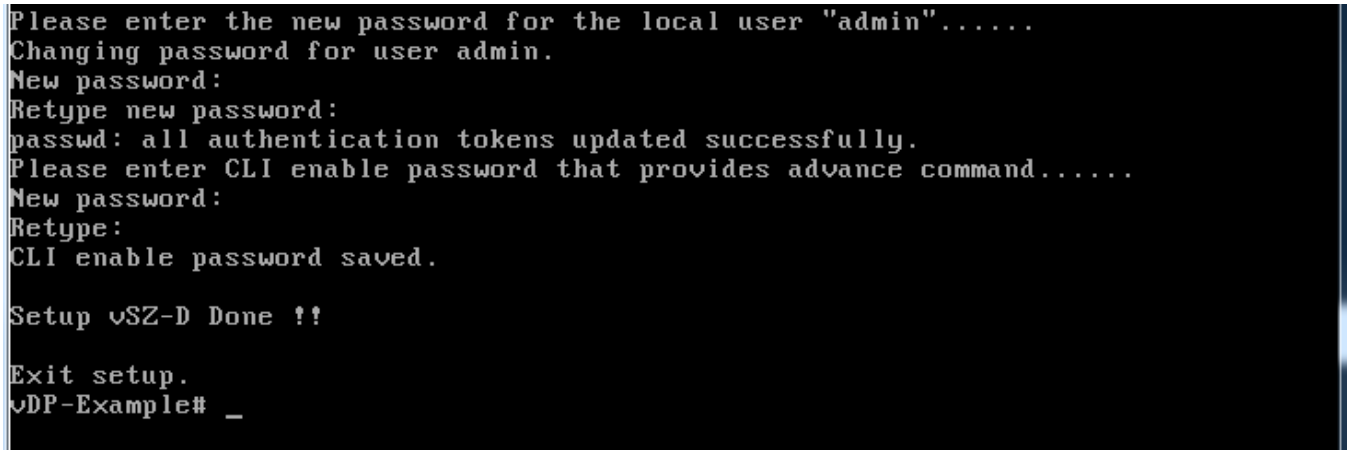


FIGURE 43 Connecting to vSZ

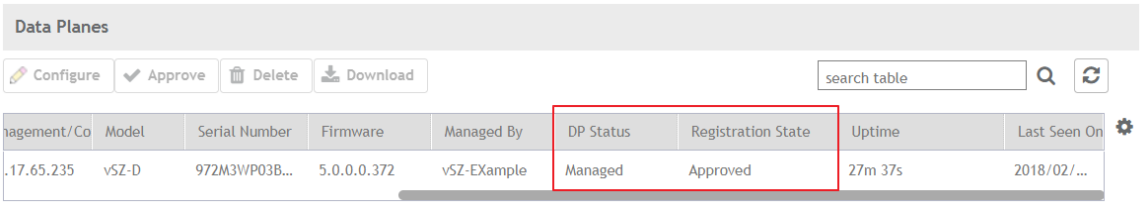


6. Exit from CLI console.

7. To view and approve the vSZ-D/SZ100-D/SZ144-D, login to the web interface. Navigate to **Clusters** > **Data planes**. Select the vSZ-D/SZ100-D/SZ144-D and click on **Approve.** On approval the status is greyed.

FIGURE 44 Approve the vSZ-D/SZ100-D/SZ144-D

FIGURE 45 Approved status



You have successfully added the vSZ-D/SZ100-D/SZ144-D image to the vSZ controller.

NOTE
Once the vSZ-D is registered and managed by the vSZ controller, the CLI login credentials will be the same as the vSZ superadmin. The CLI **enable password** remains the admin password set during vSZ-D configuration.

Deploy vSZ-D with 40GB NIC on Linux Server

Deploy vSZ-D with 40GB NIC on Linux Server

Hardware Requirement and Prerequisite

The following are the hardware and prerequisite for deploying vSZ-D on LINUX CentOS 7.

Hardware Requirement

1. DELL Inc. PowerEdge R320
2. Linux CentOS 7
3. Broadcom NetXtreme BCM5720 Gigabit Ethernet 2 Ports
4. Intel Ethernet 10G 2P X520

Prerequisite

- A Linux host enabled KVM which to install vSZ-D VM. Prefer CentOS 7 and later.
- Download the vSZ-D package (.qcow2 file) from Ruckus support .

- The IP addresses, netmask, gateway, DNS, DHCP and NAT support for vSZ-D.
- Two network interfaces to support vSZ-D.
- Before you power on vSZ-D, ensure that the networking is configured on LINUX.
- Recommended to use static network addresses that are assigned to vSZ-D during setup.
- Using CentOS 7, install KVM package with the **yum** command.

```
root@localhost ruckusvnc]# yum -y install qemu-kvm qemu-img virt-manager virt-viewer virt-install
libvirt libvirt-phthon libvirt-client
```

- Ensure KVM is active and running the following command

```
[root@localhost ruckusvnc]# systemctl status libvirtd
```

- Edit the following commands and file.

```
sudo yum install grub2-common

gedit /etc/default/grub
GRUB_TIMEOUT=5
GRUB_DISTRIBUTOR="$(sed 's, release .*$,,g' /etc/system-release)"
GRUB_DEFAULT=saved
GRUB_DISABLE_SUBMENU=true
GRUB_TERMINAL_OUTPUT="console"
GRUB_CMDLINE_LINUX="crashkernel=auto rd.lvm.lv=centos/root rd.lvm.lv=centos/swap rhgb quiet
intel_iommu=on"
GRUB_DISABLE_RECOVERY="true"

sudo grub2-mkconfig -o /boot/grub2/grub.cfg
```

- Reboot Linux host.

NOTE
Due to different servers and NIC, the deployment procedure mentioned in this section is for reference.

Topology

The network topologies for vSZ-D deployment on LINUX CentOS 7.

The following are basic topologies for setting up vSZ-D. Based on your requirement you can choose any of the alternatives between one IP domain to three separate domains for deployment.

The below topology shows the different IP addresses for the domains.

FIGURE 46 Three different IP addresses setup

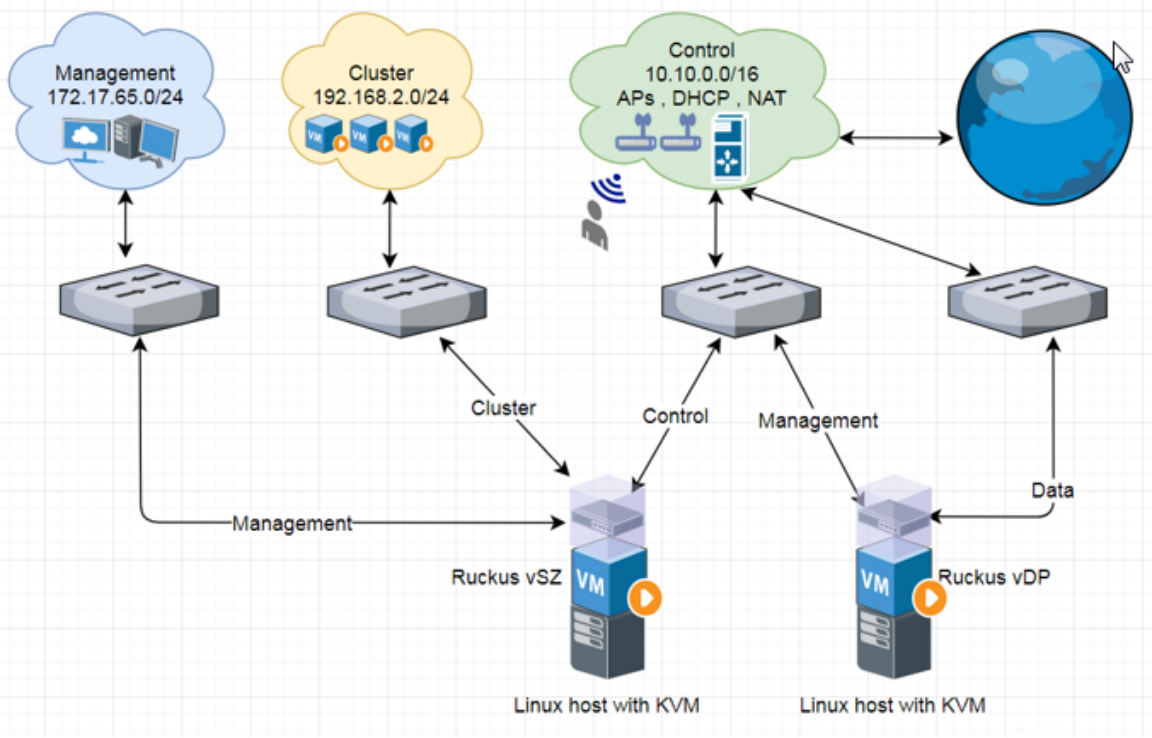
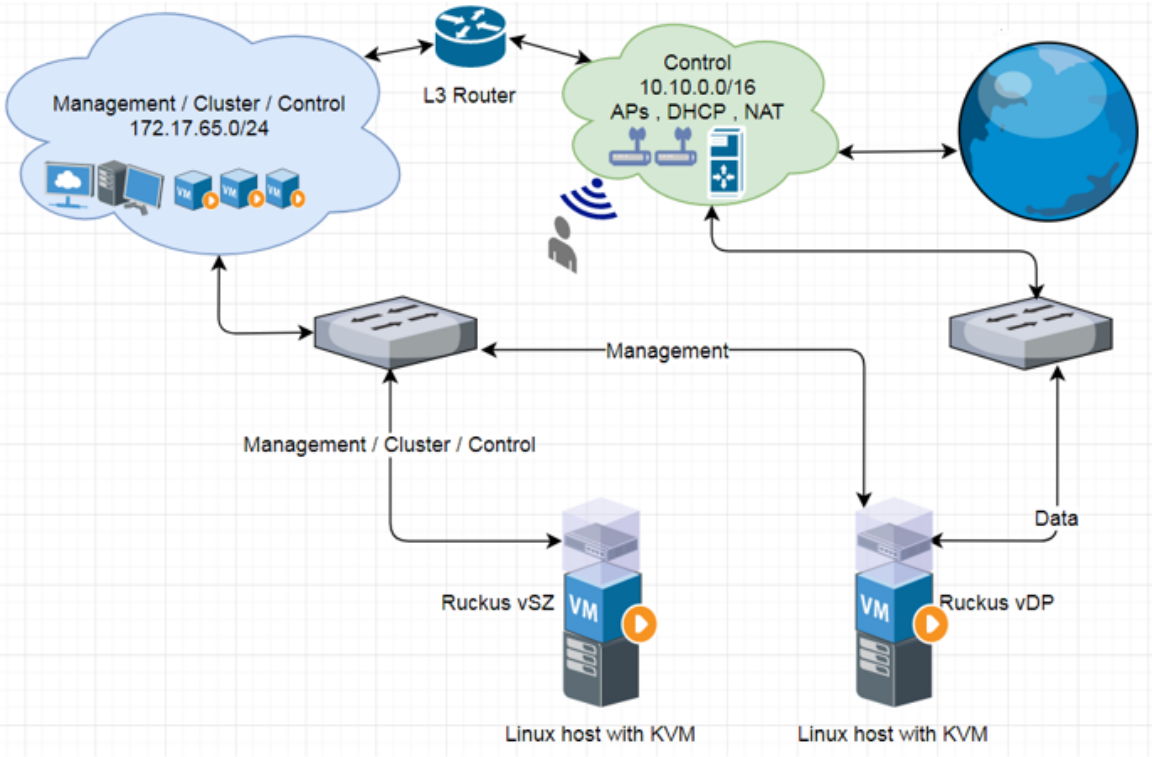
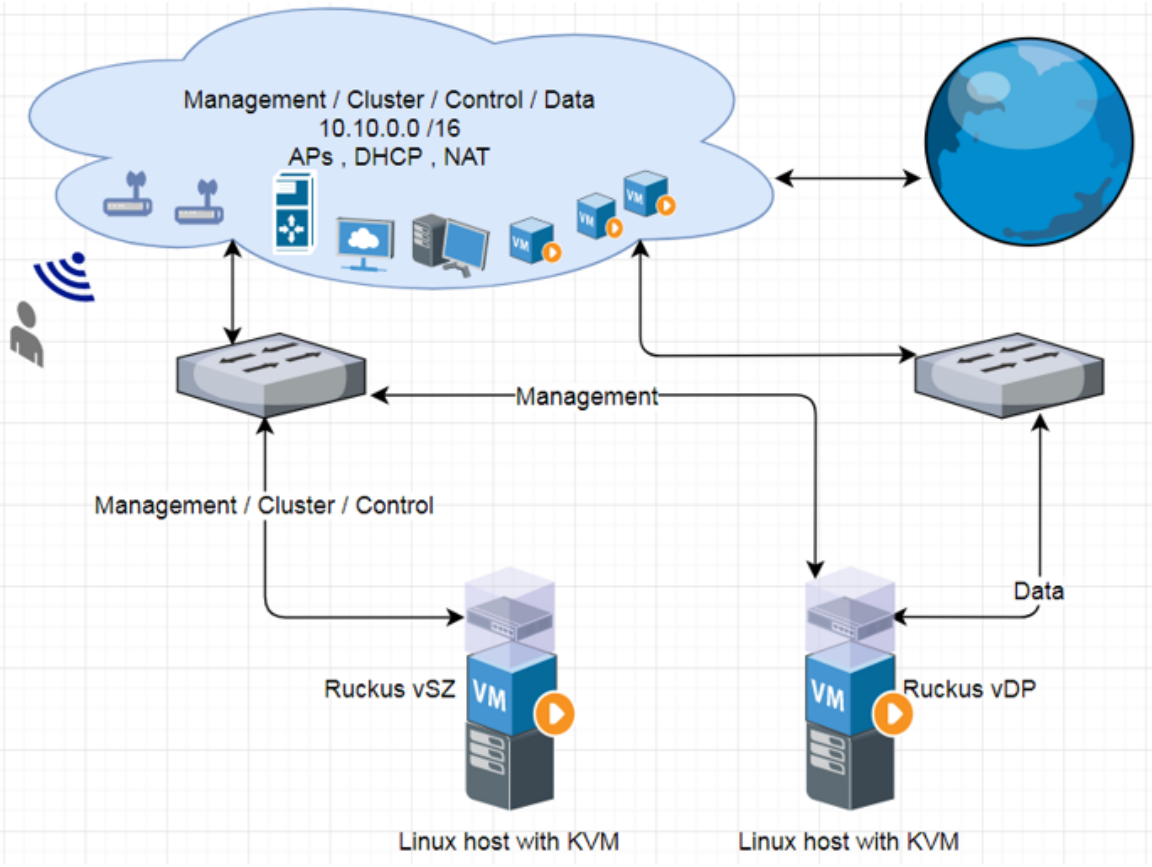


FIGURE 47 Two different domain IP addresses setup



The below topology shows the same IP addresses for the all the interfaces.

FIGURE 48 The same IP addresses setup



Deployment Procedure

The following are basic instructions for setting up vSZ-D on LINUX KVM.

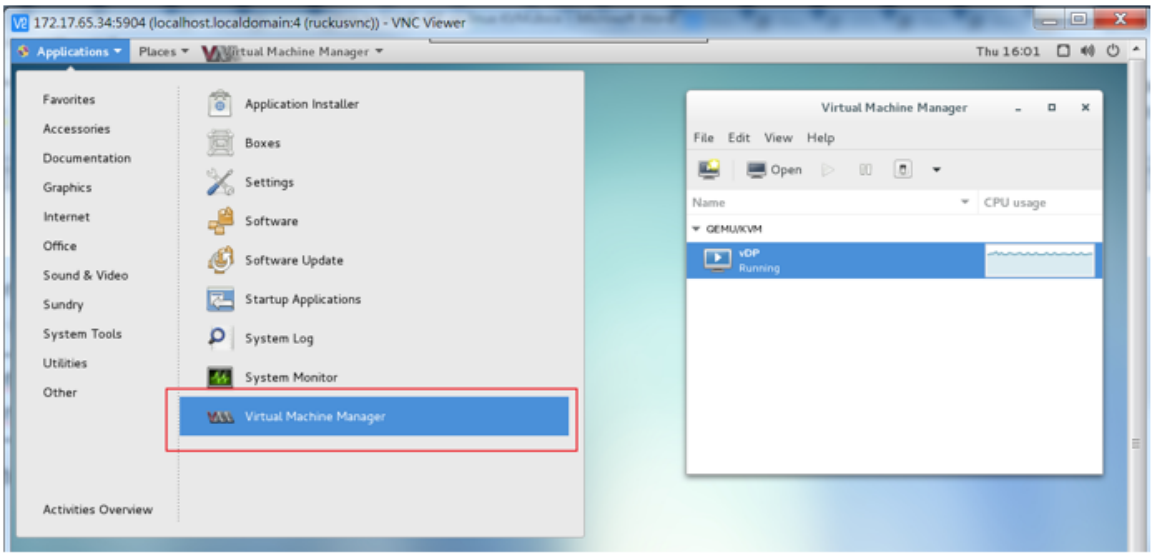
LINUX CentOS 7 KVM Package is installed and working.

For this deployment two different IP address domains are considered for Data Plane interfaces. Refer to Topology on page 91.

1. Download the Data Plane package (.qcow2 file) from Ruckus support .

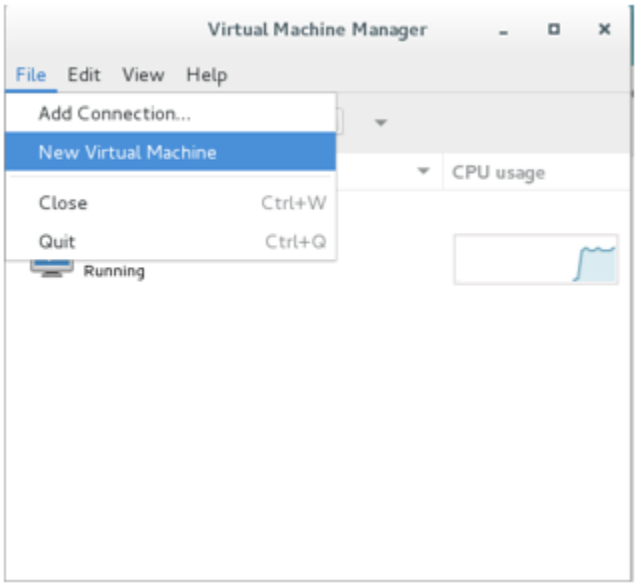
2. From the VNC Viewer, click **System Tools** > **Virtual Machine Manager** to open the Virtual Machine Manager tool. The Data Plane status must appear Running as shown in the following figure.

FIGURE 49 Virtual Machine Manager



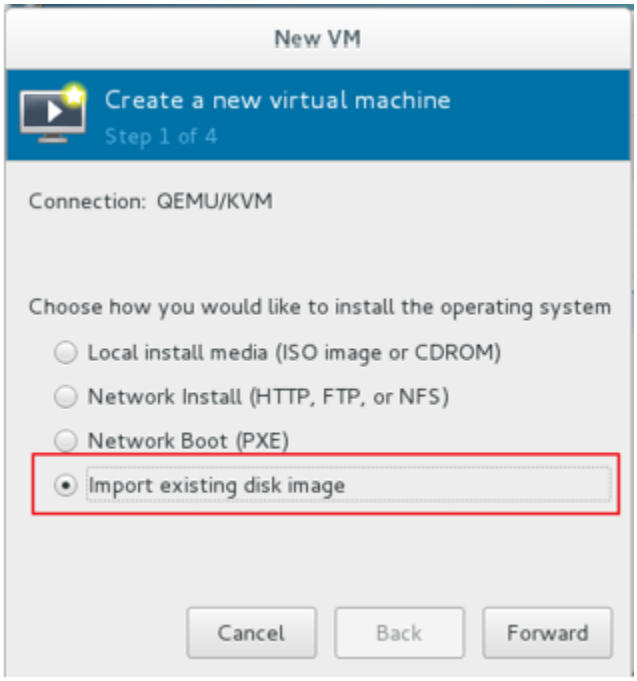
3. Create a new VM.
   a) Click **File** and select **New Virtual Machine** as shown in the following figure.

   FIGURE 50 Creating a Virtual Machine



   b) In the New VM dialog box, choose the disk format option as shown in the following figure.

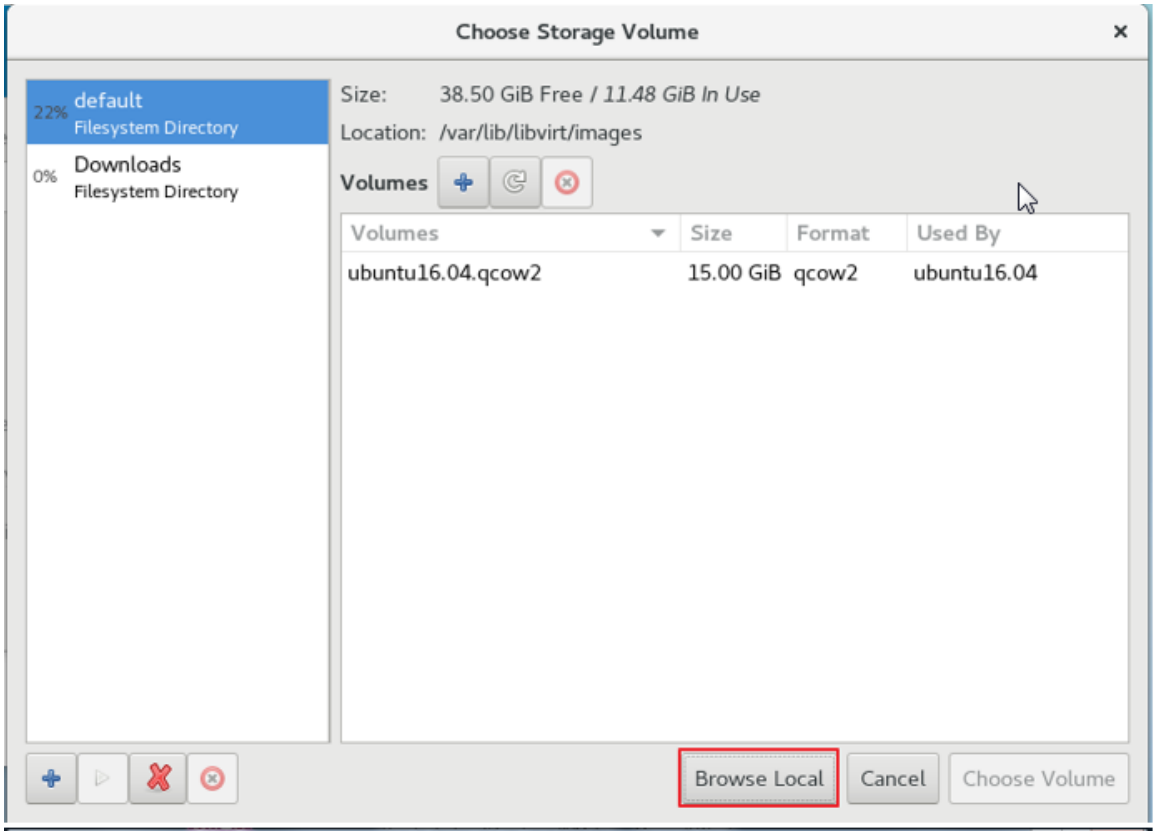
   FIGURE 51 Disk Format



c) Click **Forward**.

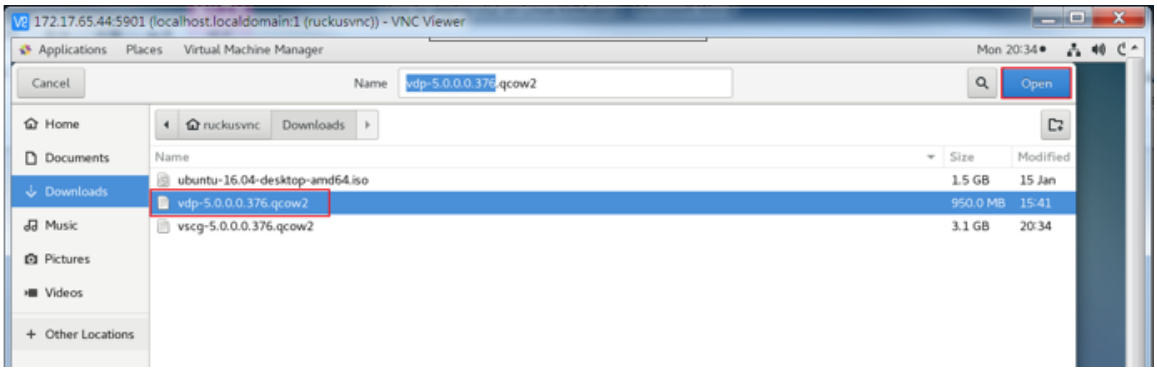
d) Choose destination storage path and storage volume. Click **Browse Local** as show in the following figure.

FIGURE 52 Storage Volume



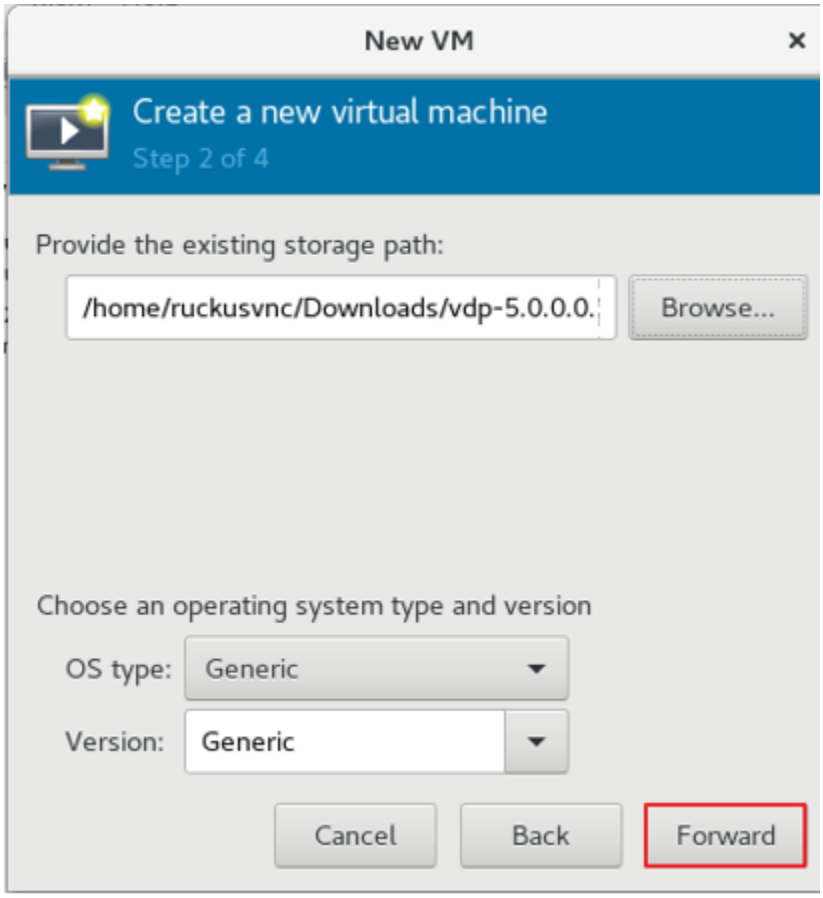
e) Select the Data Plane file and click **Open** as shown in the following figure.

FIGURE 53 Data Plane File



f) To select the storage path, click **Browse** as shown in the following figure.

FIGURE 54 Storage Path

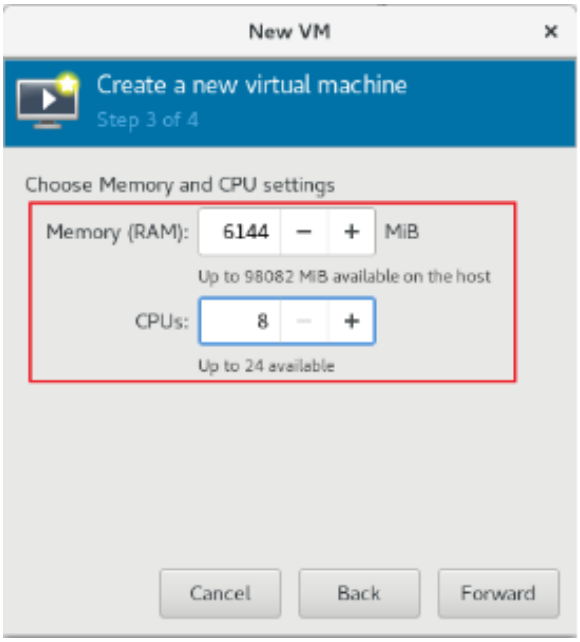


g) Click **Forward**.

h) Enter the **Memory (RAM)** and **CPUs** setting as shown in the following figure.

NOTE
Memory (RAM) must be 6GB and CPUs must be 8 cores.

FIGURE 55 Memory and CPU Settings

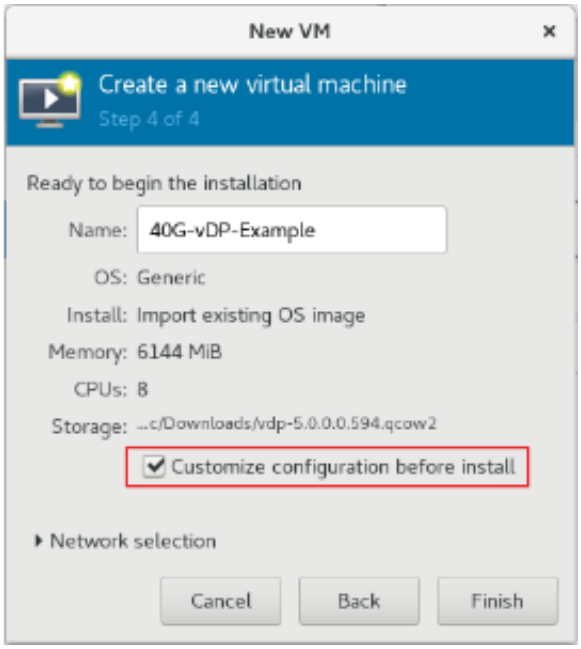


i) Click **Forward**.

j) To confirm the installation process, click **Finish** as shown in the following figure.

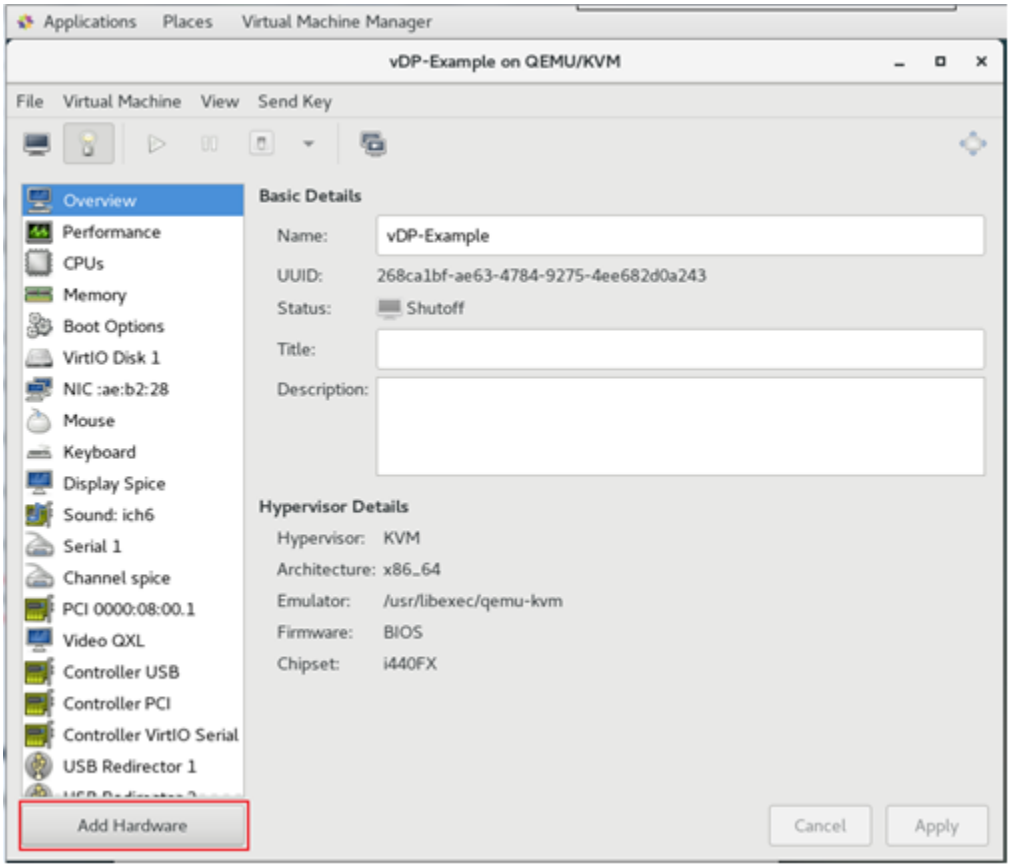
NOTE
The sequence for Network interfaces must first be Management and the Data.

FIGURE 56 Installation Confirmation



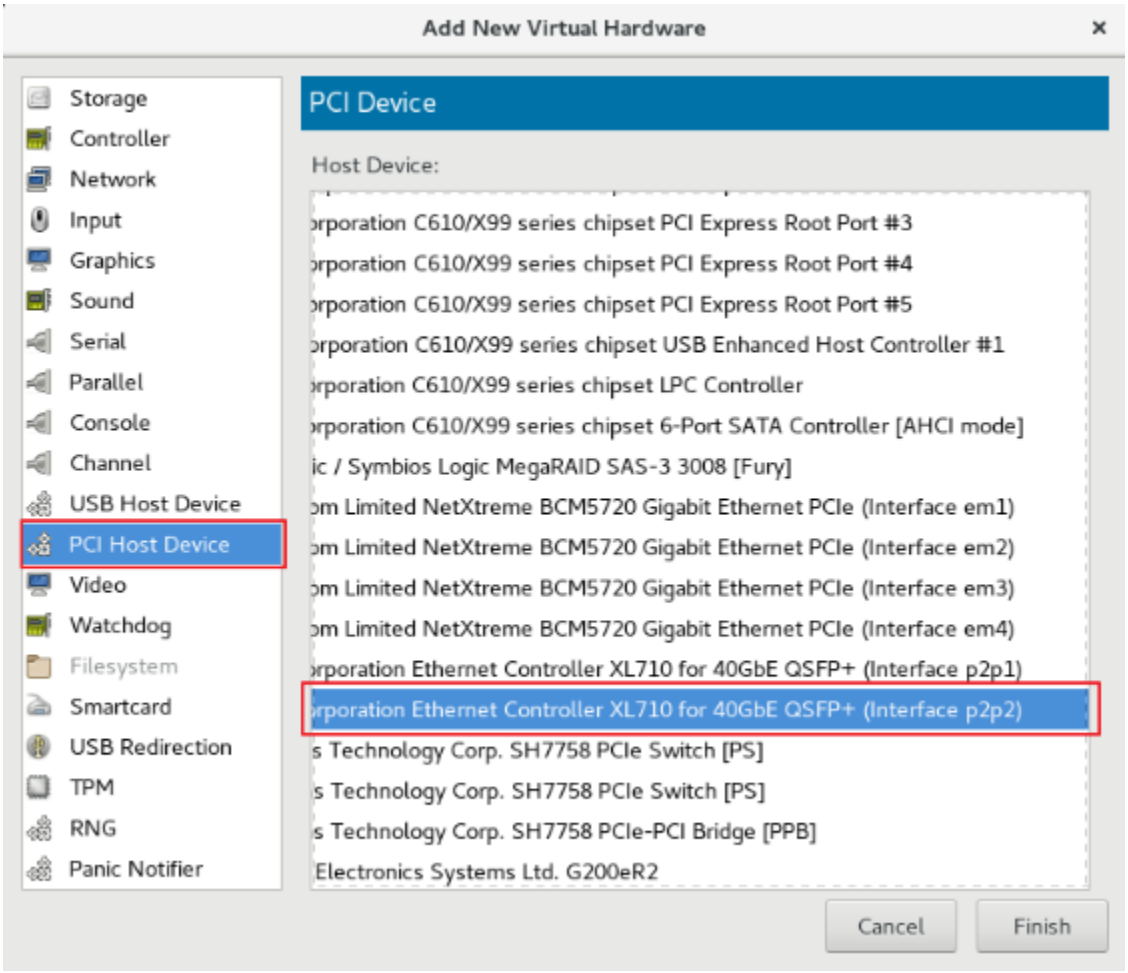
4. 4. Add another NIC as Data Plane needs two interfaces; Management and Data. From the VNC Viewer and click **Add Hardware** > **PCI Host Device** > **PCI Device** to add another NIC as shown in the following figure.

FIGURE 57 Adding NIC



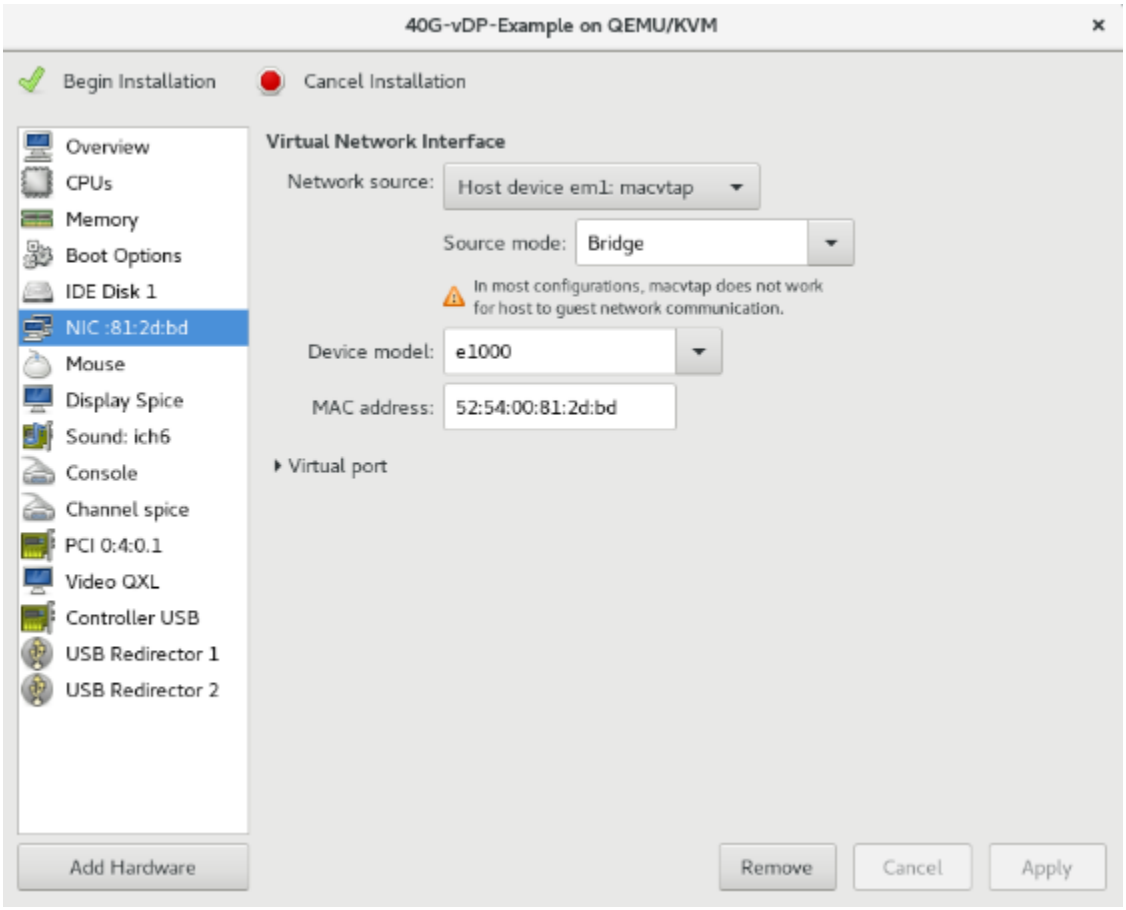
5. Select **PCI Host Device** > **PCI Device** and click **Finish** to add another NIC as shown in the following figure.

FIGURE 58 PCI Host Device



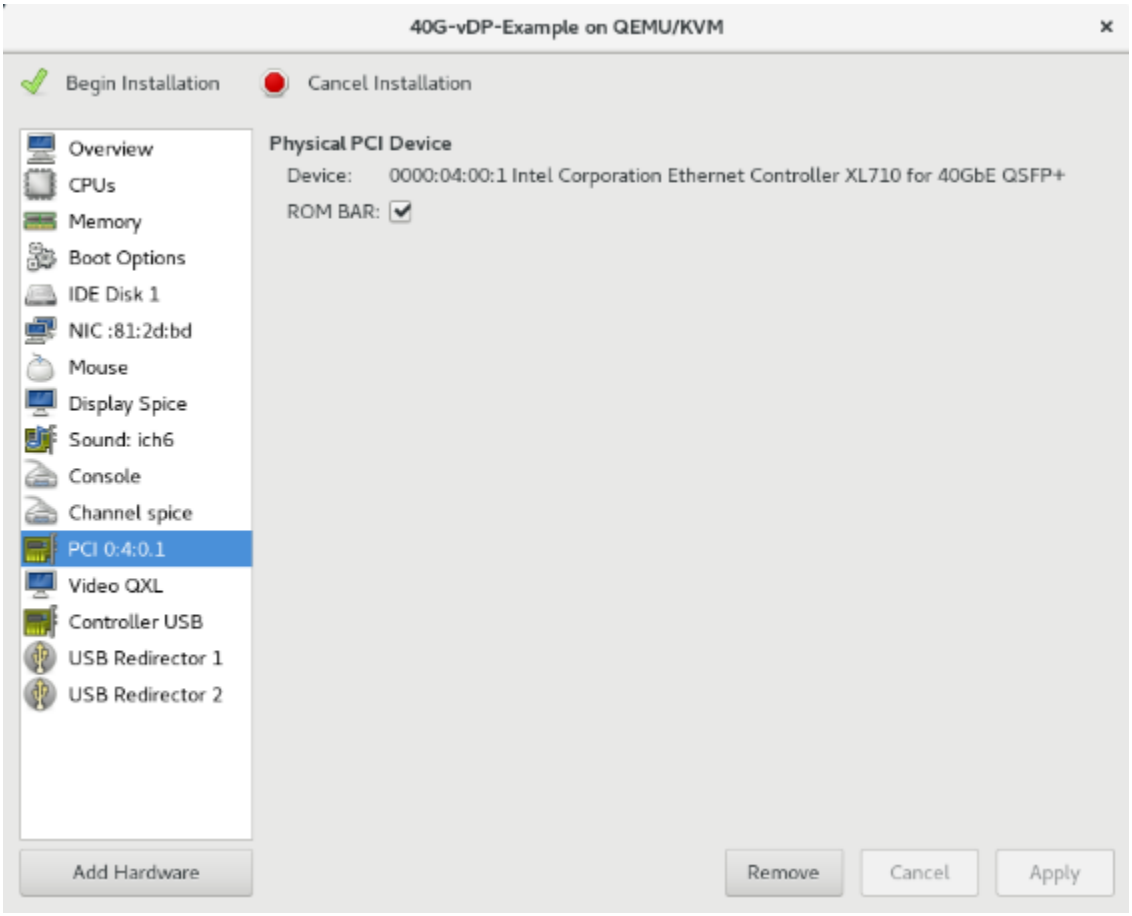
6. Select the NIC and choose the **Device model** to update the management interface associate as shown in the following figure.

FIGURE 59 Management Interface



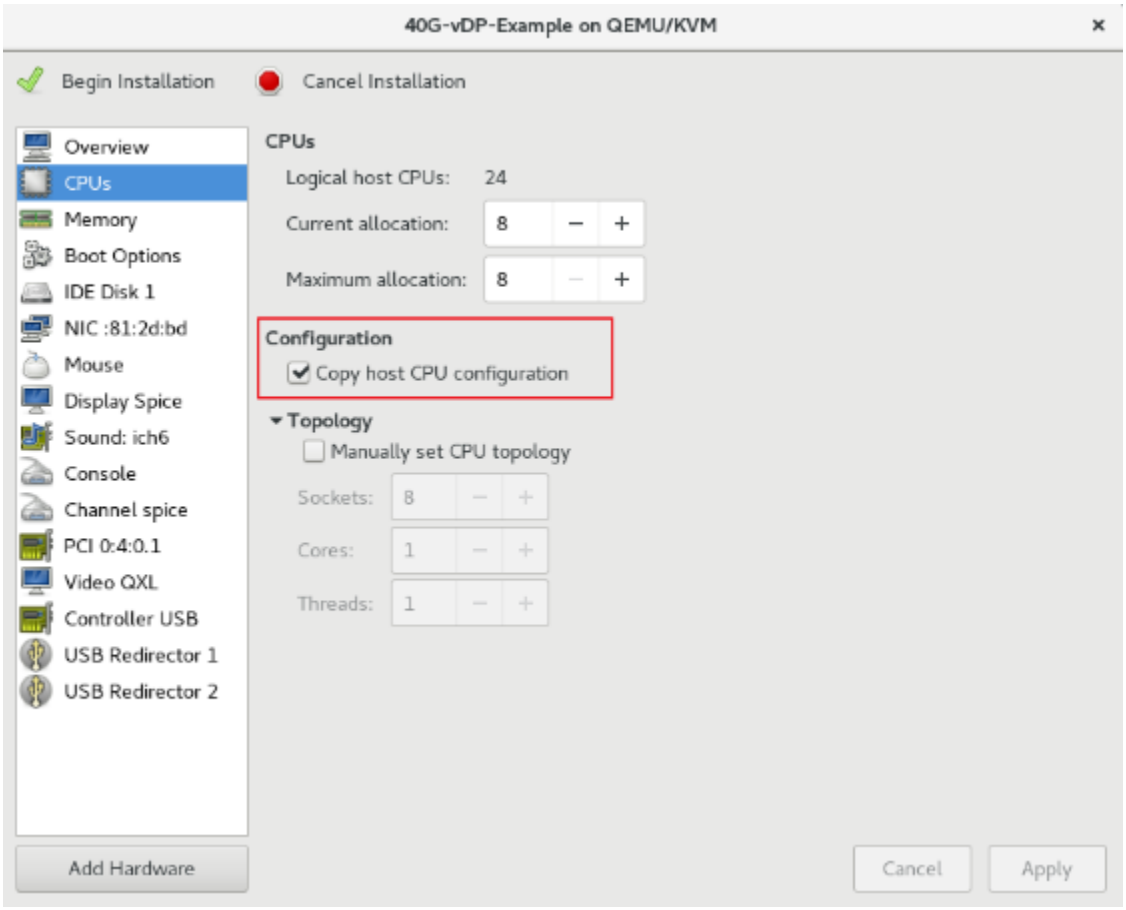
7. From PCI, select the **ROM BAR** check box to define the Data IP domain as shown in the following figure.

FIGURE 60 Data IP Domain



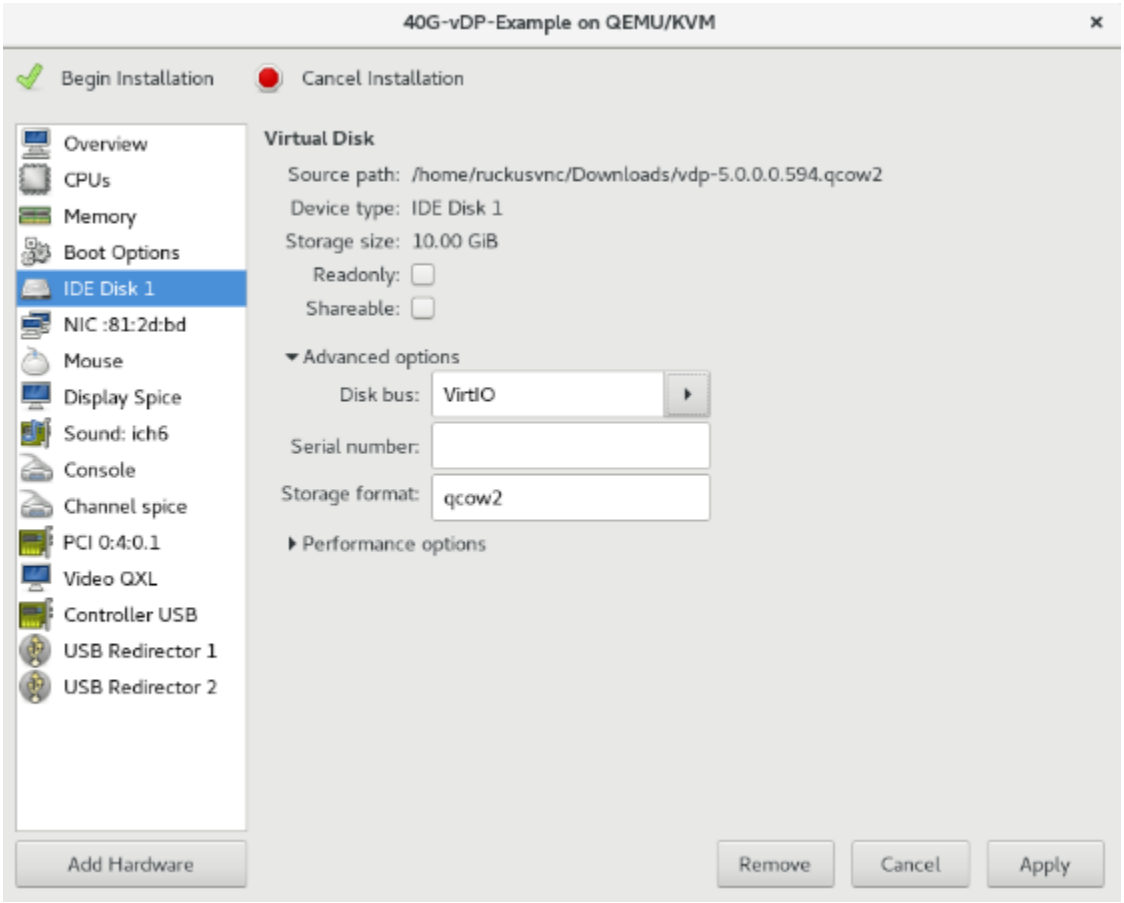
8. Define the CPU Configuration. Select the **Copy host CPU configuration** check box as shown in the following figure.

FIGURE 61 CPU Configuration



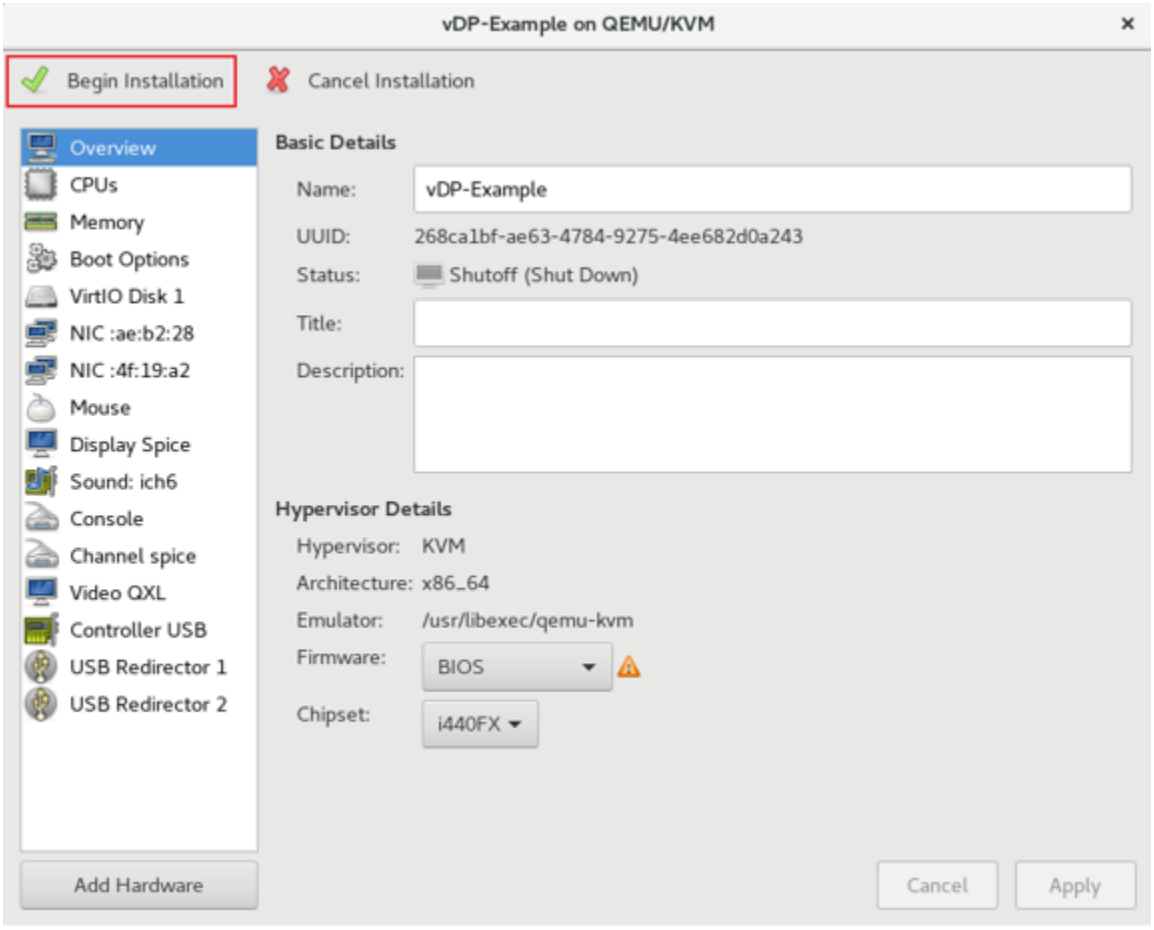
9. Define the IDE Disk Configuration. Choose the **Disk bus** option as shown in the following figure.

FIGURE 62 IDE Disk Configuration



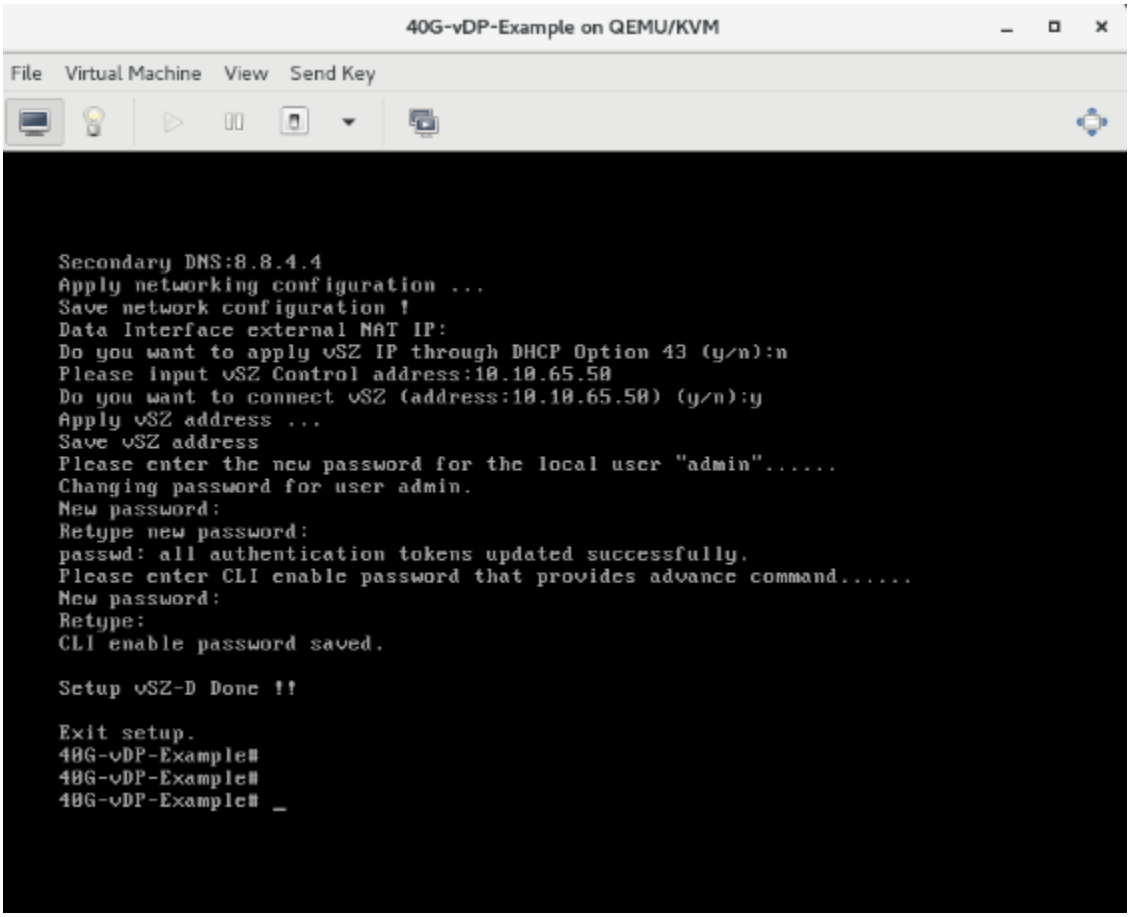
10. Select **Begin Installation** as shown in the following figure.

FIGURE 63 Begin Installation



11. The Data Plane setup is complete as shown in the following image.

FIGURE 64 Installation Complete

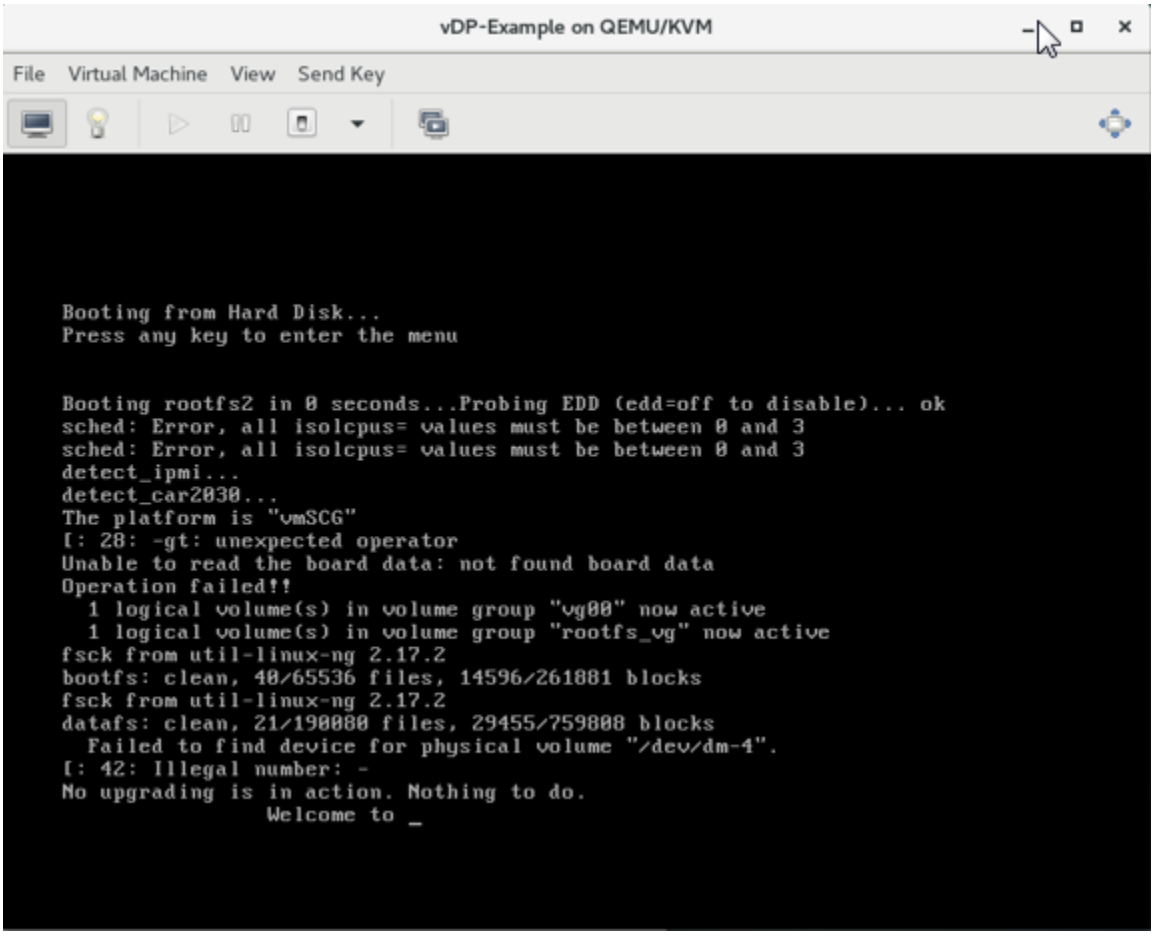


vSZ-D/SZ100-D/SZ144-D Connect to vSZ Using CLI

Follow the below procedures for vSZ-D/SZ100-D/SZ144-D to connect to vSZ.

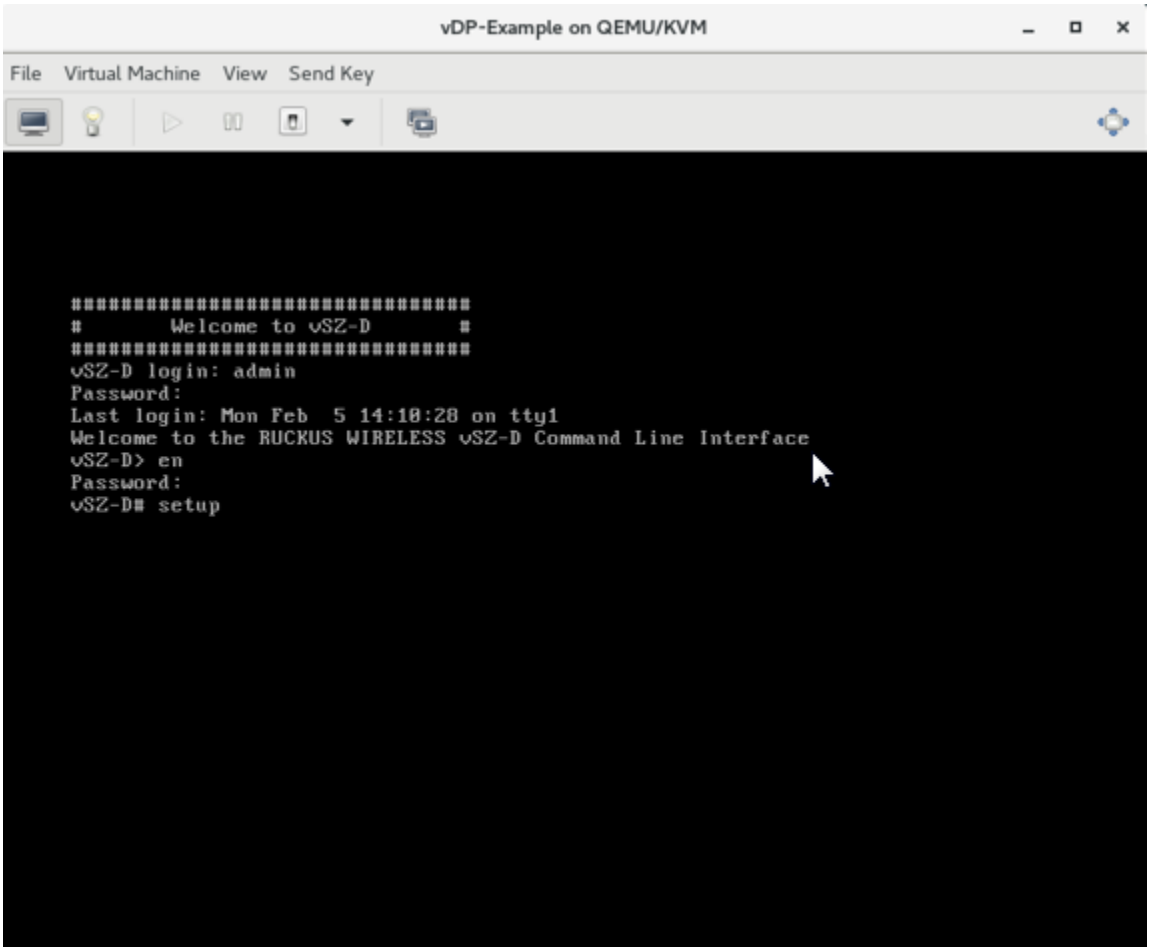
Open a CLI console window to run the deployed vSZ-D/SZ100-D/SZ144-D.

FIGURE 65 Run vSZ-D/SZ100-D/SZ144-D on the console



1. At the login prompt, login using **administrator** credentials of username and password. At the **>** prompt, enter the **enable (en)** command and the admin password to change the mode to Privileged-exec mode.

FIGURE 66 Login and Privileged mode



2. Run the **setup** command to configure the IP address for management and data interface. It is recommended to add a new host if you have multiple hosts for various configurations

FIGURE 67 Execute the setup command

3. Choose the IP address setup (IPv4 only or IPv4 and IPv6) for Management and Data interface by either selecting manual or DHCP. On defining the IP setup the process of vSZ-D/SZ100-D/SZ144-D connecting to vSZ controller starts.

   FIGURE 68 Management interface

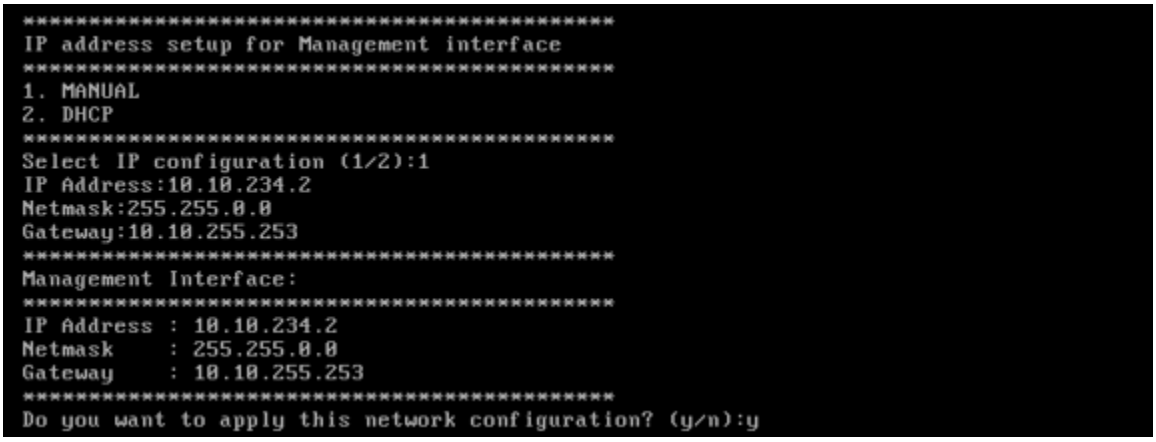
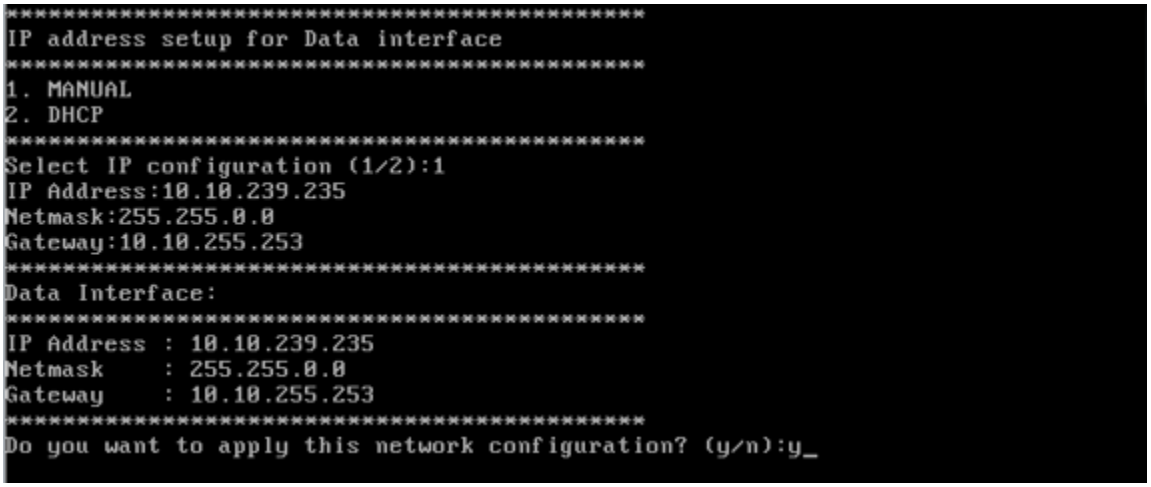


   FIGURE 69 Data interface



4. Enter the DNS setting and select Enter to skip the NAT IP setting.

   FIGURE 70 DNS setting

5. Enter vSZ control interface IP address. Follow the set of sequences as seen below for the vSZ-D/SZ100-D/SZ144-D to connect to vSZ controller. This changes the mode for vSZ-D/SZ100-D/SZ144-D as well as for vSZ.

FIGURE 71 vSZ control IP address

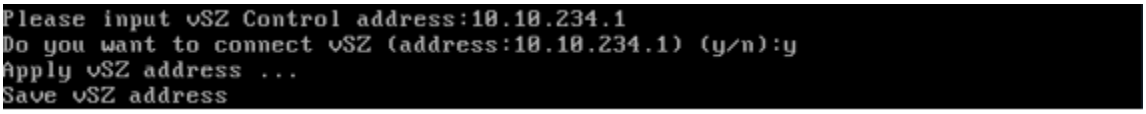
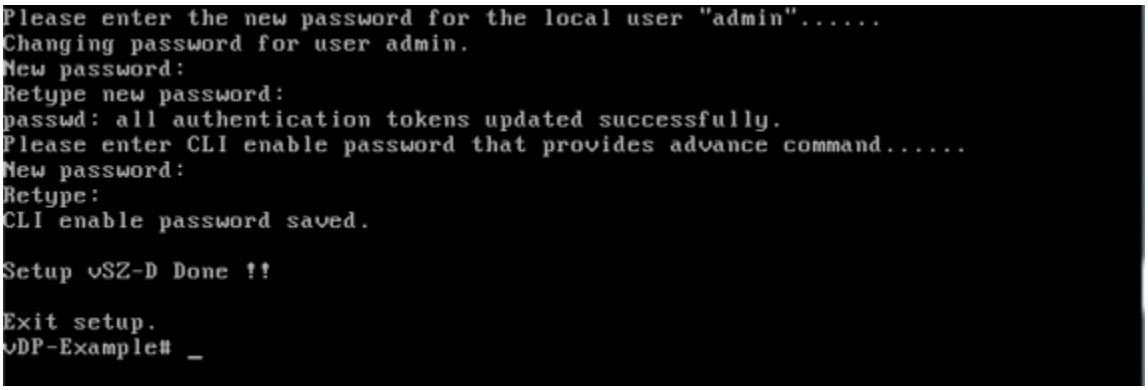


FIGURE 72 Connecting to vSZ

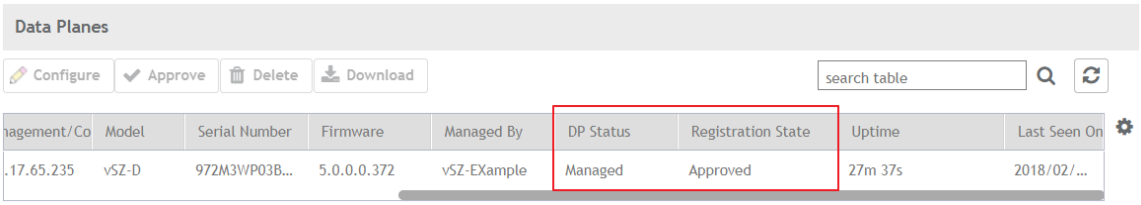


6. Exit from CLI console.

7. To view and approve the vSZ-D/SZ100-D/SZ144-D, login to the web interface. Navigate to **Clusters** > **Data planes**. Select the vSZ-D/SZ100-D/SZ144-D and click on **Approve.** On approval the status is greyed.

FIGURE 73 Approve the vSZ-D/SZ100-D/SZ144-D

FIGURE 74 Approved status



You have successfully added the vSZ-D/SZ100-D/SZ144-D image to the vSZ controller.

NOTE
Once the vSZ-D is registered and managed by the vSZ controller, the CLI login credentials will be the same as the vSZ superadmin. The CLI **enable password** remains the admin password set during vSZ-D configuration.

Upgrade Procedure

- Upgrade Procedure..... 113

Upgrade Procedure

Procedure for upgrading to a new vSZ-D/SZ100-D/SZ144-D version.

Controller and vSZ-D/SZ100-D/SZ144-D Firmware Compatibility Matrix

The below table indicates the compatibility matrix. In general, Ruckus supports N-2 vSZ-D/SZ100-D/SZ144-D releases with vSZ.

TABLE 10 Controller and vSZ-D/SZ100-D/SZ144-D Firmware Compatibility Matrix

vSZ	SZ144-D					SZ100-D Release							vSZ-D Release								
	6.1.1	**6.1.0**	**6.0.x**	**5.2.2**	**5.2.1**	**6.1.1**	**6.1.0**	**6.0.x**	**5.2.2**	**5.2.1**	**5.2.0**	**5.1.x**	**6.1.1**	**6.1.0**	**6.0.x**	**5.2.2**	**5.2.1**	**5.2.0**	**5.1.x**	**5.0.x**	**3.6.2**
6.1.1	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	No	No	No	No	Yes (*)
6.1.0	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No	No	No
6.0.x	No	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	No	No	No
5.2.2	No	No	No	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	No	Yes
5.2.1	No	No	No	No	Yes	No	No	No	No	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Yes	No	Yes
5.2.0	No	No	No	No	No	No	No	No	No	No	Yes	Yes	No	No	No	No	No	Yes	Yes	No	Yes
5.1.x	No	No	No	No	No	No	No	No	No	No	No	Yes	No	No	No	No	No	No	Yes	Yes	Yes
5.0.x	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes	Yes
3.6.2	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes

NOTE

Before starting this procedure, you should have already obtained a valid software upgrade file from Ruckus® Support or an authorized reseller.

NOTE

* - Additionally 3.6.2 GD in 6.1.1 LT for special requirements is supported. (In general, N-2 GD is only supported in GD release.)

NOTE

If you are upgrading both vSZ and vSZ-D/SZ100-D/SZ144-D, Ruckus® recommends upgrading vSZ first before vSZ-D/SZ100-D/SZ144-D.

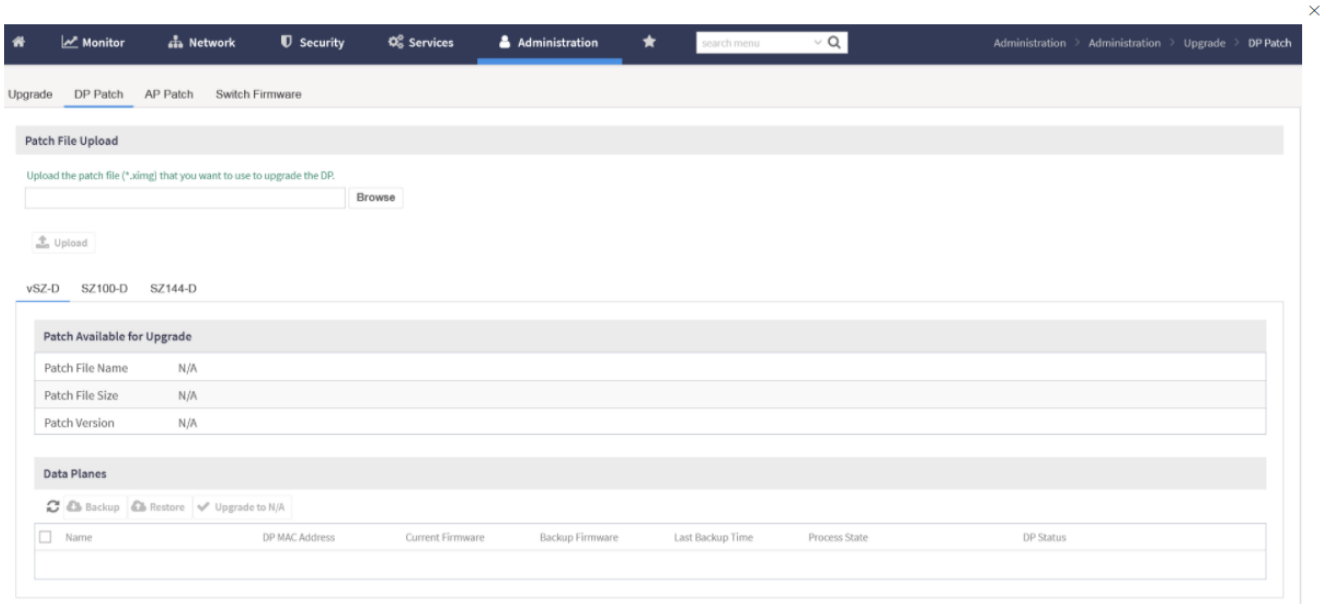
There is no order in upgrading the AP zone or vSZ-D/SZ100-D/SZ144-D. During the vSZ upgrade, all tunnels stay up except the main tunnel which moves to the vSZ. Once the upgrade procedure is completed, allow ten minutes for the vSZ-D/SZ100-D/SZ144-D to settle.

Upgrade to R5.0 does not support data migration (statistics, events, administrator logs). Existing system and network configuration is preserved. For further clarification, Contact Ruckus support.

Follow these steps to upgrade the vSZ-D/SZ100-D/SZ144-D version.

1. Copy the software upgrade file that you received from Ruckus® to the computer where you are accessing the controller web interface or to any location on the network that is accessible from the web interface.
2. Go to **Controller web interface** > **Administration** > **Upgrade**.

   FIGURE 75 Upgrade Section



3. Select the **DP Patch** tab. The **DP Patch** page appears.
4. In the **Patch File Upload** section, click the **Browse** button, and then browse to the location of the software upgrade file.

   The file name of the software upgrade file for:

   - vSZ-D is `vdp-{version}.ximg`
   - SZ100-D is `sz100d-installer_{version}.ximg`
   - SZ144-D is `sz144d-installer_{version}.ximg`
5. Click **Upload** to upload the software upgrade file.

   The controller automatically identifies the Type of DP (vSZ-D or SZ100-D or SZ144-D) and switches to the specific Tab page. Uploads the file to its database, and then performs file verification. After the file is verified, the **Patch Available for Upgrade** section is populated with information about the upgrade file.

   The following details are displayed:

   - **Patch File Name**: Displays the name of the patch file.
   - **Patch File Size**: Displays the size of the patch file.
   - **Patch Version**: Displays the version of the patch file.
6. In Data Planes, identify the data plane you want to upgrade, and then choose a patch file version **Upgrade to**.
7. Click Apply to apply the patch file version to the virtual data plane.

The following information about the virtual data plane is displayed after the patch file upgrade is completed.

- **Name**: Displays the name of the virtual data plane.
- **DP MAC Address**: Displays the MAC IP address of the data plane.
- **Current Firmware**: Displays the current version of the data plane that has been upgraded.
- **Backup Firmware**: Displays the backup version of the data plane.
- **Last Backup Time**: Displays the date and time of last backup.
- **Process State**: Displays the completion state of the patch file upgrade for the virtual data plane.
- **DP Status**: Displays the DP status.

You have successfully upgraded the data plane.

8. To verify if the upgrade is successful after a reboot:
   - Go to **Controller web interface** > **Administration** > **Upgrade** > **DP Patch** to view a confirmation message that the data plane firmware upgrade is complete.
   - Go to **Controller web interface** > **Network** > **Cluster** to view a confirmation message that the data plane is managed with an upgrade firmware version.

   NOTE
   To have a copy of the data plane firmware or move back to the older version, you can select the data plane from the list and click **Backup** or **Restore** respectively.

Data Plane Performance Recommendations

vSZ-D/SZ100-D/SZ144-D has been designed to induce minimal latency in user data aggregation and forwarding. The unique design of the vSZ-D/SZ100-D/SZ144-D software enables consistent packet performance with minimal throughput degradation as the number of tunnels or the number of clients' increase.

The fast path processing of the vSZ-D/SZ100-D/SZ144-D is engineered to scale to the underlying NIC capacity profiles whether be it 1G or 10G speeds. vSZ-D/SZ100-D/SZ144-D is designed to scale and handle data tunnels and data forwarding capabilities at high scale.

The following are some important observations and recommendations related to the vSZ-D/SZ100-D/SZ144-D performance:

- To obtain the best throughput, Ruckus recommends operating vSZ-D in directIO mode. This recommended mode of operation applies whether the hypervisor used is VMware or KVM.
- vSZ-D supports vSwitch mode of operation for added flexibility in deployments where vSZ-D may be co-located with other VMs for service chaining on the same underlying hardware. Note that the current observations are that in the vSwitch mode of operation, there is an induced performance impact in comparison with the directIO mode of operation. This may be due to the latency or performance bottleneck in virtIO and vSwitch sharing. This is still being researched at the Ruckus R&D Labs.
- There is an expected performance impact when enabling encryption (AES 128 bit and AES 256 bit) on the Ruckus GRE Tunnels. This is due to the overhead induced by the crypto processing on Ruckus AP and vSZ-D/SZ100-D/SZ144-D due to the associated overheads of encryption and decryption on a per packet basis. The vSZ-D/SZ100-D/SZ144-D software is designed to introduce minimal latency and overheads associated in packet processing. vSZ-D/SZ100-D/SZ144-D takes advantage of the underlying Intel chip's crypto module for packet encryption and decryption and the associated impact is primarily bounded at the hardware level.

For specific recommendations and calibrations that may be needed for your deployment, contact Ruckus.

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